Volume II

APPENDICES A – C

Wesley Gray
M.Ed. ELT
Rhodes University
# TABLE OF CONTENTS

## VOLUME II

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>i</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>1</td>
</tr>
<tr>
<td>LETTERS OF PERMISSION FOR THE PRELIMINARY STUDY</td>
<td>2</td>
</tr>
<tr>
<td>LETTERS OF PERMISSION FOR THE RESEARCH STUDY</td>
<td>5</td>
</tr>
<tr>
<td>EXAMPLES OF JOURNAL ENTRIES</td>
<td>10</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>14</td>
</tr>
<tr>
<td>TRANSCRIPT A</td>
<td>15</td>
</tr>
<tr>
<td>TRANSCRIPT B</td>
<td>35</td>
</tr>
<tr>
<td>TRANSCRIPT C</td>
<td>50</td>
</tr>
<tr>
<td>TRANSCRIPT D</td>
<td>65</td>
</tr>
<tr>
<td>TRANSCRIPT E</td>
<td>78</td>
</tr>
<tr>
<td>TRANSCRIPT F</td>
<td>93</td>
</tr>
<tr>
<td>TRANSCRIPT G</td>
<td>106</td>
</tr>
<tr>
<td>TRANSCRIPT H</td>
<td>115</td>
</tr>
<tr>
<td>TRANSCRIPT I</td>
<td>135</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>148</td>
</tr>
<tr>
<td>TRANSCRIPT J – THE ANALYSIS OF TRIADIC DIALOGUE 8A</td>
<td>149</td>
</tr>
<tr>
<td>TRANSCRIPT K – THE ANALYSIS OF TRIADIC DIALOGUE 1B</td>
<td>175</td>
</tr>
<tr>
<td>TRANSCRIPT L – THE ANALYSIS OF TRIADIC DIALOGUE 9F</td>
<td>215</td>
</tr>
<tr>
<td>TRANSCRIPT M – THE ANALYSIS OF TRIADIC DIALOGUE 4H</td>
<td>244</td>
</tr>
</tbody>
</table>
APPENDIX A

LETTERS OF PERMISSION

LETTERS OF THANKS

EXAMPLES FROM THE RESEARCH JOURNAL
LETTER OF PERMISSION GIVEN TO THE LEARNERS BEFORE THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +2746 622 8028

27 January 2006

Dear Learners

I am currently registered as a M.Ed. student in the Education Faculty at Rhodes University. My area of interest lies in the role that language plays in teaching and learning Science. Presently, I am at the initial stages of my research design and would be most appreciative if I could observe your class as part of my preliminary study.

Sincerely,

Wesley Gray
EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE PRINCIPALS AND TEACHERS BEFORE THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +27 46 622 8028
Cell: 078 126 4490

27 January 2006

Dear [name],

I am currently registered as a M.Ed. student in the Education Faculty at Rhodes University. My area of interest lies in the role that language plays in teaching and learning Science. Presently, I am at the initial stages of my research design and would be most appreciative if I could observe your Grade 10 and 11 Physical Science classes as part of my preliminary study.

Sincerely,

Wesley Gray
EXAMPLE OF A THANK YOU LETTER GIVEN TO THE TEACHERS AFTER THE PRELIMINARY STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: +27 46 603 8700
Fax: +2746 622 8028
Cell: 078 126 4490

10 February 2006

Dear [name]

Thank you for being so willing to open up your classes to me for observation and for the much valued insight that you provided.

It is much appreciated.

Best regards,

Wesley
EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE SCHOOL GOVERNING BODY BEFORE THE RESEARCH STUDY

To: The School Governing Body

Thank you for allowing me to conduct the preliminary study at your school during February, 2006. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/ her learners in grade 10 physical science. I have requested permission to do the study from the grade 10 physical science teacher, [name], who has since agreed to partake in the study. The study will entail the observation of ~3 consecutive lessons and if permitted these lessons will be video taped and transcribed.

I wish to assure [name], [name] and the learners that their anonymity will be maintained. As participation in this study is voluntary [name] and her learners may withdraw from the study at any point. During the study I will ask [name] for feedback on the conclusions drawn from the data. Furthermore, I will make the findings for the study available to the school, [name] and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)
EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE PRINCIPALS BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear [name]

Thank you for allowing me to conduct the preliminary study at your school during February, 2006. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/ her learners in grade 10 physical science. I have requested permission to do the study from the grade 10 physical science teacher, [name], who has since agreed to partake in the study. The study will entail the observation of ~3 consecutive lessons and if permitted these lessons will be video taped and transcribed.

I wish to assure [name], [name] and the learners that their anonymity will be maintained. As participation in this study is voluntary [name] and her learners may withdraw from the study at any point. During the study I will ask [name] for feedback on the conclusions drawn from the data. Furthermore, I will make the findings for the study available to the school, [name] and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)
EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE TEACHERS BEFORE THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear [name]

Thank you for being so willing to open up your classes to me for observation during the preliminary study. The proposal for the study has since been approved by the university and I would be most appreciative if I could begin the study during term 2 on the school calendar.

The purpose of this study is to understand the dialogue between a teacher and his/her learners in the grade 10 physical science classroom. The study will entail the observation of ~3 consecutive lessons. If permitted these lessons will be video taped and transcribed. I would appreciate it if at a later date a time could be arranged to obtain your much valued insight on the conclusions drawn from the data.

I wish to assure you that your anonymity, as well as the school’s and learners’ anonymity, will be maintained. As participation in this study is voluntary you may choose to withdraw from the study at any time. The findings for the study will gladly be made available to you, the school and other interested stakeholders.

Should you have any concerns or questions, please do not hesitate to contact me at 078 126 4490, or my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at Rhodes, on (046) 603 8386.

Sincerely

Wesley Gray
(Student number: 606G3296)
EXAMPLE OF A LETTER OF PERMISSION GIVEN TO THE PARENTS BEFORE
THE RESEARCH STUDY

Education Department
Rhodes University
P.O. Box 94
Grahamstown
6140
Tel: (046) 603 8700
Fax: (046) 622 8028

30 March 2006

Dear Parents

I am a M.Ed. student in the Education Faculty at Rhodes University who would like to
learn more about good teaching practice by observing [name] and her learners during
Physical Science. As I will need to video tape and transcribe the lessons in which your
son/daughter participates I would like to request permission from you to do so. I wish to
assure you that your son’s/daughter’s anonymity will be maintained. The findings from
this study will also gladly be made available to you upon request.

If you have any questions or concerns please feel free to contact me at 078 126 4490 or
my supervisors, Mrs. Sarah Murray and Mr. Ken Ngcoza, at the Faculty of Education at
Rhodes, on (046) 603 8700.

Sincerely

Wesley Gray
(Student number: 606G3296)

CONSENT FORM

We, _________________________, the parents of _________________________ permit
Wesley Gray (Student number: 606G3296) to observe, video tape and transcribe the
physical science lessons in which our son/daughter will be a participant. We understand
that our son’s/daughter’s anonymity will be maintained and that the findings of the study
will be made available to us upon request.

Signature: ___________________________ Date: ______________________________
EXAMPLE OF A LETTER OF PERMISSION TRANSLATED IN ISIXHOSA AND GIVEN TO THE PARENTS BEFORE THE RESEARCH STUDY

Mzali/mmelimzali ohloniphekileyo

Igama lam ndingu Wesley Gray. Ndifunda izifundo zeMEd apha eRhodes University, izifundo ke ezimalungu nophuhliso lwezemfundo nokuhlohlwa kwezeNzululwazi ezikololweni ngenjongo zokuphuhlisa ikamva labantwan bethu eMzantsi Afrika. Ngxhebe, umnqweno wam ke kukufunda ngokuphangalelelo ngendlela zokufundisa ezeNzululwazi ngokuthi ndibonele utishala onamava kunene umnumzana uMaselwa oxele nga Nathaniel Nyaluza xa ehlohla abafundi bakhe.


Ozithobileyo

Wesley Gray
(Inombolo yokuba ngumfundis: 606G3296)

______________________________
Umsayino

______________________________
Umhla

______________________________

ISIQINISEKISO

Mna

Mzali/mmelimzali


Umsayino ________________________ Umhla ________________________
EXAMPLES OF JOURNAL ENTRIES

Date: 18/4/2006

The teacher in conversation said that in implementing a new she focused on developing skills (drawing graphs etc.). She stated that a number of the learners wanted to go and do B.Comms etc. and that by teaching the learners these skills they would be better prepared for doing such (being able to apply these skills in the real world out there).

Date: 20/04/2006

The teacher expressed, in conversation, that self-assessment was not particularly constructive (the learners were inclined to give one another high marks without much thought).

She expressed further that she was not happy that the learners' portfolios were kept in the office where the learners did not have access to them. She said that the learners had very little time to look at the work...
The learners were required to pronounce the terms correctly 'Li/thum' as opposed to 'Li/i/thum'.

The names of the elements and terms for the periodic table were taught. These terms 's-block...alkali metals... etc. were taught but not explained.

Attention was drawn to the correct spelling of the terms.

At the end of the lesson the teacher expressed that it was not the most interesting introduction to chemistry but that few of the learners had a strong chemistry background and that therefore it was necessary to go over the periodic table as such.
[name] said that the science/maths/English teachers were the most fortunate in receiving assistance from the department in the implementation of SIE.

He remarked that the learners were not used to being asked questions. He stated that the learners were seldom asked questions in their other classes. He said that he had received a complaint from learners that he was not teaching them but asking too many questions. He remarked that the learners just wanted to be given the knowledge.

Date: 12/04/2006

[name] remarked that Grahamstown is a rural town and the learners are not exposed to science. He remarked that the terms in the textbook, such as "pot on the stove," are misleading to the students who perhaps come from a farm and are used to a cast iron pot standing on three legs.
The school is 'separate' from the township (physically surrounded by a barbed wire fence). The worldview in the science class is 'separate' from the township worldview.

By exposing these learners to the science worldview, though a bridge is being made for these learners from the township worldview to a new and different worldview (where these learners may hold multiple worldviews where the science worldview may be an additional worldview). By being able to solve, for example a physics problem, these learners are 'linked' to other scientists (these learners know of other scientists out there - they are able to do things scientists do); they are able to achieve something (however irrelevant to the everyday world) if they are able to leave the everyday world behind and escape to a new world; they are able to learn literacies that would not be learnt in the everyday world.
APPENDIX B

TRANSCRIPTS A – I
**ACTIVITY TYPE: ‘review’ [1]; ‘microgenre’ ‘IRF’ [3]**

**FIELD [2]:**
Displacement – definition(s) and units

1.1A T we looked at displacement and what and time yesterday we discussed what
1.2A displacement and we said what’s displacement it’s a change in position in a
1.3A given direction I gave many examples of how a displacement so many
1.4A ways of changing ones displacement the second one I said is yes
1.5A L a straight line direction
1.6A T no I didn’t say that a straight line distance distance instead of direction
1.7A how can I get a [unclear] direction straight line distance between two
1.8A positions or two points or lastly I said or lastly I said displacement is yes it
1.9A is


2.1A T you were absent from my class [name] you must wait behind you must
2.2A wait behind

**ACTIVITY TYPE: ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]**

**FIELD [2]:**
Displacement – definition(s) and units

1.10A T yes now we have displacement is a straight line distance between two
1.11A points or two positions in a given direction or it is the shortest the shortest
1.12A distance between two points

**ACTIVITY TYPE: ‘demonstration’ [1]**

**FIELD [2]:**
Displacement – definition

3.1A T now I said I like the first one displacement is a change in position in a
3.2A given direction okay here I change I’m in this position I move to another
3.3A position okay I’ve made a displacement I’ve made a displace I’ve displaced
myself I was in that place now I’m in another place now I could have come this place I could have come to this place in many ways I show you I said I move this way right across this way right across this way I still come here right ne but ne but that is what what have I done to move this way I still have gone a a long distance of that is the actual what the actual path to move from one position to this one but if I were to go there directly I move from there or I move from here to here I’ve just changed my position in a straight line that’s what I said it’s a straight line distance between two points that is displacement

**ACTIVITY TYPE:** ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]

**FIELD [2]:**

**Displacement – definition(s) and units**

<table>
<thead>
<tr>
<th>1.13A</th>
<th>T</th>
<th>now we said the units of displacement are what what are the units of displacement yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.14A</td>
<td>L</td>
<td>the meter</td>
</tr>
<tr>
<td>1.15A</td>
<td>T</td>
<td>the meter which means displacement and meters have something in common displacement is really a straight line distance it is distance</td>
</tr>
</tbody>
</table>

**ACTIVITY TYPE:** ‘review’ [1]; ‘microgenre’ ‘IRF’ [3]

**FIELD [2]:**

**Speed/ velocity – equation and units**

**Speed/ velocity – definition**

<table>
<thead>
<tr>
<th>4.1A</th>
<th>T</th>
<th>now when you displace yourself from somewhere to somewhere you really do what you really walk a certain distance okay you accept that</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2A</td>
<td>L</td>
<td>yes</td>
</tr>
<tr>
<td>4.3A</td>
<td>T</td>
<td>and therefore and therefore we said for displacement to happen there must be we said that a period a time when you take distance and divide it by time what do we get</td>
</tr>
<tr>
<td>4.5A</td>
<td>Ls</td>
<td>speed</td>
</tr>
<tr>
<td>4.6A</td>
<td>T</td>
<td>we got what</td>
</tr>
<tr>
<td>4.7A</td>
<td>Ls</td>
<td>speed</td>
</tr>
<tr>
<td>4.8A</td>
<td>T</td>
<td>speed</td>
</tr>
<tr>
<td>4.9A</td>
<td>Ls</td>
<td>speed</td>
</tr>
</tbody>
</table>
I agree with you I agree with you and so then we actually said when we take when we uh so we said speed equals distance divided by time the total distance moved divided by the total time taken to complete that distance and we said here the units are what [code-switches] are meters divide by seconds that’s units are what are meters divided by seconds or meter per second [chalkboard (1)] now similarly even in the case of what of displacement you can actually have what displacement divided by what by time and the units are also what meter divided by second or meter per second [chalkboard (2)] what is displacement divided by time who knows this mm who can tell me uh we know distance divided by time is speed but what is change in position divided by time who knows yes [name]
it’s the velocity it’s velocity good [name] velocity okay so you say velocity uh velocity [chalkboard (3)] what is velocity what is velocity yes boy velocity is a speed with direction velocity is a speed with direction okay very good he says he says velocity is speed in a given direction [chalkboard (4)] who else has something to say who says velocity is speed in a given direction or a speed with direction uh now remember he said now later we defined what remember we said when we define speed how do we define speed we said speed is the rate of distance we said speed is the rate of the rate of the rate of distance the rate of distance the rate of distance what is the speed what is velocity what is velocity what is velocity what is the velocity c’mon [code-switches] yes [name] velocity is the rate of displacement velocity is the rate of
Ls  displacement
T  displacement it’s easy speed is the rate of what of
Ls  distance
T  distance therefore velocity is the rate of displacement okay, good, okay
good so we now so we now have a new a new unit we now have a new unit
here now notice how this [code-switches]

ACTIVITY TYPE: ‘copying notes’ [1]
FIELD [2]:
Displacement – definition(s)
Velocity – definition, equation and units
5.1A  T  now okay let’s write this thing down now ne all of us okay lets’ consolidate
5.2A  here ne and write our notes down here right now [code-switches] stop work
5.4A  we look at what so we first write down this one date [code-switches]
5.5A  please ne we said displacement is a change in position in a given direction
5.6A  but that is what we said about displacement are we alright or we said
5.7A  displacement is straight line distance between two places or two points
5.8A  okay again we said displacement is the shortest distance between two
5.9A  points uhh displacement is the shortest distance between two points
5.10A  displacement is the shortest distance between two points [chalkboard (5)]
5.11A  are you happy are you comfortable
5.12A  Ls  yes
5.13A  T  are you sure that you understand this but I said I like what I said that I like
5.14A  the first one ne I said I like the first one because you’ll understand later ne
5.15A  they are all correct ja they are all correct then we said we now came to
5.16A  velocity sorry eone [sic] etwo [sic] velocity is the rate of what of
5.17A  Ls  [a number of learners talk at the same time]
5.18A  T  change in position the rate of change in position and we’ve got one word
5.19A  [code-switches] for the change in position and the word is
5.20A  L  displacement

18
displacement [chalkboard (5)] good so instead of saying change your
positioning I say displace yourself okay so it is the rate of change in
position or or displacement the units are meter so v equals sorry velocity
equals uh displacement divide by time time taken to do the displacement
okay are you happy now

are we happy okay now I’ve said in science we like to economize with the
writing it means we like to write in a short way an easy short way I haven’t
shown you that right I haven’t shown you that but before I do that let’s
switch off all the the so here we have velocity have meter divided by
second is the same as what as meter per second or meter dot per second
[chalkboard (5)] am I right yes the same units as what as speed but
remember speed has no direction ne velocity has direction why because
displacement has what direction displacement has direction so velocity
must also have what direction displacement happens in a given direction
are we happy

yes

ACTIVITY TYPE: ‘interruption’ [1] [interruption/ language] – ‘how to ask for help’

I know that we like to say yes no child likes to say no I can’t understand
why if you can’t understand please say no and start saying why and where
you don’t understand okay don’t just say yes no don’t be a [unclear] [code-
switches] uh
let’s look at the last part now do you understand that from the seven base
units you can make other what other units right let’s have a look at the at
the other one

ACTIVITY TYPE: ‘interruption’ [1] – cleaning the chalkboard

okay who wants to clean the board for me please who wants to clean the
board for me
[a learner cleans the chalkboard]
### Force

8.1A  T  let’s now brainstorm again here when you move when something moves or when you move or we say when something is in motion what makes things to move what makes things to move uh when you if you begin to move something must be happening what makes things to move

8.5A  yes

8.6A  L  force

8.7A  T  a force ne a force makes things to move

### Force

9.1A  T  okay okay okay okay okay a force makes things to move I’m going to force this wall to move I’m going to force this thing to move but you said a force can make things to move but you had it wrong there is something you don’t understand you don’t understand about what about

9.5A  yes

9.6A  L  force of gravity

9.7A  T  force of gravity okay okay so you mean things move because of force of gravity

### Gravitational force

10.1A  T  now I would like you to as from today don’t speak of the force of something okay don’t speak of the force of something because things don’t have what

10.2A  force

10.3A  Ls  force

10.4A  T  force but as but things always exert a force you I can I can
I can exert force on this table—it doesn’t mean that I have force. Listen very carefully. I don’t possess force. I don’t have force. But I know a force is acting on me and I can also exert a force. I can exert it means I can act. I can exert a force. I can make a force to act on something. I can make a force to act on something but I don’t have force. So don’t speak of the force of gravity. I know older people like ourselves and older folks speak of what force of gravity okay but I don’t like it. I’m happier you know to say gravitational force or the force exerted by gravity. Okay that becomes more scientific. The force exerted by gravity or gravitational force.

**ACTIVITY TYPE:** ‘microgenre’ ‘IRF’ cont. [3]

**FIELD [2]:**

**Force [chalkboard (7)]**

- okay now okay what can force do give me things that force can do yes
- it can change the direction
- it can change okay force let’s have a look at that force [code-switches]
- force can change what
- direction
- yes I agree anybody else yes
- it can take an object from one place to another place
- it can move an object okay it can can can displace an object it can make an object move from one place to another place do you agree
- yes
- do you agree yes yes force you know can do that okay now okay force can move an object from eh from one place okay to another it means it can it can cause things to to change positions okay another one [name]
- it can make a standing object start moving
- it can cause motion yes yes [code-switches] it can make things it can move
because you know I was here I can now move from here to here so I started

to move yes another one yes

it can stop moving things

it can stop moving things okay I agree it can force can can stop moving

objects it can make things if things are moving it can make them stop yes

another one yes

it can change the shape of an object

it can change the shape of an object it can stop moving things okay I agree it can force can make things to

another one yes

it can change the shape of an object

it can change the shape of an object very good very good it can change you

know the shape can change the shape of an object yes

ACTIVITY TYPE: ‘demonstration’ [1]

FIELD [2]:

Force

T [code-switches] or if you do what or if you take okay I can even take the

I can take uh a piece of here is rubber I can force I can change the shape

I can change the shape oh no I even broke it there okay that’s what’s force

now my main interest now on force here is this one it can make things to

move from one place to another place

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]

FIELD [2]:

Force

now remember it can makes things to move from one place to another

place and you said it can also start it can it can make things to start

moving

ACTIVITY TYPE: ‘interruption’ [1] [interruption/ language] – stationary and at rest

FIELD [2]:

Stationary and at rest

okay what is the speed of something that is stationary [code-

switches] it is stationary I say this car is stationary what do I really mean it

is
Standing it is not moving okay don’t say it is standing that’s literal translation [code-switches] don’t say it was [code-switches] no now it is not moving it is stationary it is now I you know I cannot say if I you know to stand up from you know from your seat I can’t say please be stationary I can’t say that I will say please stand up I but if something is stationary we say it is in one in one [a number of learners talk at the same time] in one position or we say it is at who knows it is at he is relaxed he’s relaxed oh okay over there yes he’s at rest or he’s resting [code-switches] very good he’s at rest he’s resting so I know now that the two words at rest stationary notice you spell it stationary not stationery with e the e means what stationery means what something to write on you know ball point pens you know books you know so careful there stationary and what and rest position rest position [chalkboard (8)] it means it is in one place it is in one place okay do you understand that yes good now she said force can make things to move from rest now if something moves from rest okay what is the speed of something that is at rest mm ja ja yes uh it is stationary are you sure zero
it is zero good anybody else so the speed of something at rest is always what is zero so okay so stationary speed equal to zero [chalkboard (9)]
speed equal to zero now if the speed is equal to zero what is the force acting on the object uh [unclear]
if the object does not have any speed what force is acting on the object hey
it’s standing sir
okay listen carefully if the speed of the object is zero what force is acting on the object anybody yes
no force
no force is actually is actually acting there no force good if speed is zero so we say the force here equals zero [chalkboard (10)] because no speed

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]

now when the object when a force arrives on the object and the force is exerted on the object the object begins to like myself if somebody pushes me I was stationary now somebody comes and pushes me I begin to move when you move what is changing from nought to somewhere

speed
it is your speed so once I begin to move so moving from rest the speed changes from zero to somewhere [chalkboard (11)] it changes from zero to let’s say two okay [code-switches] when the car is at rest when a car is at rest what is the speed of the car it is zero
13.11A  T    zero
13.12A  T    where do you see that the speed of the car is zero in the
13.13A  Ls   speedometer
13.14A  T    in the speedometer so so you always so so what is actually rested on the
13.15A  Ls   speedometer of the car [unclear] so the pointer the needle of the
13.16A  T    speedometer will be at zero but once it begins to move the car will do what
13.17A  T    sorry the needle of the speedometer will begin to move from zero to let’s
13.18A  T    say to what
13.19A  Ls   to twenty
13.20A  T    okay to twenty let’s say to you know to twenty meters per second am I
13.21A  T    right here [unclear] you know to twenty meters per second
13.22A  Ls   you are wrong sir
13.23A  T    uh
13.24A  Ls   you are wrong sir
13.25A  T    I am wrong it should be what
13.26A  Ls   kilometers per hour
13.27A  T    kilometers per hour good the speedometer of the car does does not register
13.28A  T    meters per second we speak of meters per second because we want to use
13.29A  T    standard international units meter and second right so we can’t have
13.30A  T    kilometers per hour k p h or simply kilometers per hour now this means
13.31A  T    kilometers per hour k p h or here right kilometers per hour how many
13.32A  T    kilometers it has traveled in one hour the speed of the car [chalkboard (12)]
13.33A  T    now I want one word I want one [unclear] how do you change the speed of
13.34A  T    the car from zero to twenty I’m in the car now grrr vroom
13.35A  Ls   [unclear]
13.36A  T    I do what
13.37A  Ls   [unclear]
13.38A  T    I engage the car into a gear do you all understand that
13.39A  Ls   yes
13.40A  T    you engage the car into a gear and then do what
13.41A  Ls   press the accelerator
you press the accelerator so when you change the speed of a car from zero to twenty what do you do to the car you accelerate the car can you see now change [sic] in speed has got something to do with what acceleration we now have a look at what at acceleration [chalkboard (13)] ne [code-switches] are you sure good ne are you sure are you comfortable yes are you happy yes

everybody just looks and says I’m happy mm I’ll see when when when we’re writing the actual test

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]
FIELD [2]:
Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]
so change in speed has something to do with what with acceleration now we also spoke of what of velocity we also spoke of what of velocity and we said velocity is what define velocity velocity is the rate of displacement or the rate of displacement
ACTIVITY TYPE: ‘interruption’ [1] [interruption/ language] – ‘a change in displacement’
FIELD [2]: Rate of displacement [sic]
15.1A T never say change in displacement right I know books are say that they are
15.2A wrong you see you you can’t change a change in position because the word
15.3A displacement itself it means what change in position so I can’t say dis
15.4A velocity is is the change is the rate of change of displacement it is just the
15.5A rate of what of change of position or if you want to put it in a nicer way
15.6A you say the rate of what of
15.7A Ls displacement
15.8A T displacement are you happy there
15.9A Ls yes

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]
FIELD [2]: Acceleration
Speed - a change in speed and a speedometer
Velocity and a velometer [sic]
13.67A T good now if you speak of velocity where would you see the velocity of a
13.68A car in a car where would you read it you read the speedometer sorry the
13.69A speed of a car the speedometer where would you read the velocity of the
13.70A car where would you read the velocity of a car a car keeps on changing
13.71A what position it keeps on making what displacements where would you
13.72A read what the velocity of the car uh the speed you read on a speedometer
13.73A the velocity
13.74A L a velometer [sic]
13.75A T uh
13.76A L a velometer
a velometer uh anybody else anybody else she says a velometer or better a velo a velocimeter [sic] perhaps velocity speedometer a velocimeter there is nothing like what like a velocimeter so cars don’t have what velocimeter they only have speedometers okay yes the velocity is the speed remember he said velocity is speed with what with direction so if a car is moving towards the north for a for a particular instant for a particular time I would say the velocity of the car is twenty meters per second to the north it actually means that the speed of the car the car is speeding towards the north the car is speeding towards the north or the car is speeding towards the east or the car is speeding towards the south but I use just one word I say the velocity of the car but in science science people are very lazy people but they think a lot uh so acceleration therefore is what okay give me a definition of acceleration okay acceleration happens in a given what you always change speed in a given time yes you must have time to change [unclear] grr gearbox ne vroom now the time you press on your accelerator ne vroom the car is moving it is changing speed but simultaneously the time also goes on so the change in speed happens a change in what in time so the speed now changes in time or the velocity changes in time the speed in a given direction or simply the velocity is changing in time what can give me a definition of acceleration the velocity is changing in time that means simply the car is accelerating give me a definition of veloc sorry of acceleration hey [code-switches] yes try try try try yes boy
no how do you define it how do you explain it you see you know we said speed we said when we speak of speed there must be steps completed and there must be time to complete that steps and we said how do we explain it you know speed you know to people we said okay speed is the rate of what of eh speed is the rate of

\[ speed = \frac{distance}{time} \]

distance this thing tells me that speed we said that [unclear] if you forget distance this means speed is the rate of distance [chalkboard (14)] that’s the complete explanation to people when I talk about it [unclear] that’s the next thing that I do I write down that one and I goes to mathematics I say which one counts now as speed you always divide what the distance by time now we have just said here acceleration [chalkboard (15)] has got something to do with what uh acceleration has got something to do with what with

\[ acceleration = \frac{change in speed}{time} \]

speed

\[\text{Ls} \]

no we never said that we said acceleration has got something to do with what with eh we are getting lost here acceleration has got something to do with what with eh [teacher points to chalkboard (12)] [code-switches] yes acceleration has got something to do with what with yes eh we all know with what yes

\[\text{L} \]

no it’s here it’s here [teacher points to chalkboard (12)] it’s here yes

\[\text{L} \]

it has something to do with speed changes

\[\text{T} \]

with speed changes not just the speed a change in speed [code-switches] acceleration once you speak of acceleration the speed must change from nought to somewhere or from or from twenty to you know to to forty
[chalkboard (16)] there is a change in you know the speed then you speak of what of acceleration you can’t just speak of acceleration when there is no change in what in speed if a car moves or is running or or is speeding at one twenty kilometers per hour all the way from P E to Grahamstown what is the acceleration of the car okay [code-switches] from from here [code-switches] ne I travel the same speed to to the the junction at [name] road what is my acceleration I travel from here to [name] street vroom [code-switches] u50 [sic] [code-switches] what is my acceleration eh uh yes [unclear] [learner shakes head] what is my acceleration you don’t have acceleration I don’t have it the car does not accelerate now in mathematics and science when you say you have now you have no [code-switches] eh [code-switches] [unclear] no in science or mathematics when you say you have this means you don’t have it [code-switches] eh he zero zero I don’t have acceleration so yes I don’t have speed it’s zero I don’t have force it’s zero.

ACTIVITY TYPE: ‘lecture’ [1] [lecture/ admonition and exhortation]

16.50A  
T people please please please please be here next week otherwise

17.2A if you don’t turn up here next week

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]

FIELD [2]:
Acceleration – definition and equation
Acceleration - units

16.59A  
T [unclear] so you now know that acceleration has something to do with

16.60A  
what with

16.61A  
Ls speed changes

16.62A  
T changes change actually it’s change in what in velocity and this change in velocity happens in a given time [chalkboard (17)] what is how can we define acceleration how can we define acceleration yes

\[acceleration = \frac{\text{change in velocity}}{\text{time}}\]
acceleration is speed changes

no eh people [code-switches] he he mm speed equals distance divide by time [chalkboard (14)] that’s mathematical when I talk it now speed is rate of distance hey [code-switches] yes now [name]

acceleration is an increase in speed

accelerations is speed equals distance divide by time [chalkboard (14)] that’s mathematical when I talk it now speed is rate of distance hey [code-switches] yes now [name]

acceleration is the rate of change in velocity

that’s all yes right acceleration is the rate of change of velocity

ACTIVITY TYPE: ‘lecture’ [1] [lecture/ admonition and exhortation] – ‘attitude towards science’

people you have got to be here you have got to be here you have got to be here you look at things easy look at things easy man don’t let your brain dare say ooh it’s tough ooh it’s tough now ooh no no no I find it very easy for you know for you [code-switches]

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]

FIELD [2]:

Acceleration – definition and equation

Acceleration - units

an example you know speed mathematically speed equals distance over time [chalkboard (14)] but let’s talk it now now this means speed is the rate of distance oh velocity displacement time say it in in in words [chalkboard (18)] now velocity is the rate of displacement that’s all don’t make things difficult for yourself eh [code-switches] hey so we now have this word now acceleration right is the rate of change in velocity [chalkboard (19)] that’s the word here change in velocity that’s the important thing there must be a change if there is no change in the
velocity or in the speed there is no acceleration do you understand

yes

do you understand now

yes

ACTIVITY TYPE: ‘lecture’ [1] [lecture/ admonition and exhortation] – ‘attitude towards science’
[code-switches] you get into [code-switches] everyday you get into your fathers’ cars everyday or your moms’ cars everyday you don’t look at these things you don’t look at these things you see cars moving all the time you don’t think of these things and you come and say science is tough it is not tough it is not tough but it is how you look at it that makes things to be tough now I’m here to guide you to show you that it’s not tough it’s not tough as long as you understand basic things

ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]
FIELD [2]: Acceleration – definition and equation

Acceleration - units

let’s now look at the units here right so we said acceleration equals change in velocity do this first divide by time ne good now what are the units of what of velocity eh what do you think are the units for velocity units for velocity or units for speed

yes

meters per second

meters per second so it’s meter divide by second that’s how we [code-switches] ne divide by what the units for time

second

second what is the answer there what is the answer there mm what is the answer there mm what is the answer if I divide meter per second by second

ACTIVITY TYPE: (‘groupwork’ [1]) – terminated due to insufficient time

FIELD [2]:

\[
\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}
\]
**Acceleration – units**

20.1A T [chalkboard (20)] quickly quickly come together in your desks and work out the answer and work out the answer meter mm the answer [code-switches]

20.2A T quickly come together in your desks and work out the answer meter mm the answer

20.3A T switches

**ACTIVITY TYPE: ‘microgenre’ ‘IRF’ cont. [3]**

**FIELD [2]:**

**Acceleration – definition and equation**

**Acceleration - units**

16.99A T meter per second divide by second meter per second divide by second

16.100A T meter per second divide by second simplify this this becomes what meter divide by second multiplied by uh

16.102A T one over s

16.103A T one over

16.104A T s

16.105A T one over s and this becomes what

16.106A T m

16.107A T m divide by

16.108A T s squared

16.109A T by s squared so units are meter per second squared which is the same as

16.110A T what as same as meter multiplied or dot s what

16.111A T minus one

16.112A T minus one ne

16.113A T yes

16.114A T you see ma you see they say minus one because they used what it’s minus

16.115A T what look eh it’s minus two mm it’s now minus two so again you see that

16.116A T we have combined two units from the base units with what with this one

**ACTIVITY TYPE: ‘microgenre’ ‘IRF’ [3]**

**FIELD [2]:**

**Force – equation and units**

21.1A T [chalkboard (21)] can we quickly before you go to the next period quickly check now force now force just just briefly when a force look at this when
a force acts on a certain mass when a force acts on a certain mass what would the force make on the mass it would make the mass to move if something moves it changes what

$L_s$ speed

$L_s$ accelerates

$L_s$ meter per second squared

meter per second squared this is meter per second squared there you have it now you have kilogram dot meter per second squared can you see now you have combined base units for mass base units for [code-switches] for distance base units for time to produce another unit and this is what now a kilogram multiplied by meter per second or mass times acceleration unit yes

$L$ newton

very good [name] the newton can you see you have now combined many or more than two units from the base units to produce a new unit go to your next class

\[ \text{Force} = \text{mass} \times \text{acceleration} \]

\[ = \text{kg} \times \text{m/s}^2 \]

\[ = \text{kg.m/s}^2 \]

\[ = \text{newton (N)} \]
ACTIVITY TYPE: ‘review’ [1]; ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – ‘calculation’/ ‘drawing and measurement’ (scale drawing)

1.1B T what type of vector addition did we do the first type of addition now we we
1.2B T said vectors can act how can vectors act number one in which in which way
1.3B L can vectors act
1.4B L1 in a certain direction
1.5B T no no okay yes yes let the whole class hear what you are saying
1.6B L1 I’m saying that I’m saying that they can act in the same direction
1.7B T vectors can act in the same direction do you all agree now if vec yes
1.8B L vectors can act in an opposite direction
1.9B T okay fine we are coming there ne right vectors can act on the op in the same
1.10B L direction now we said if they’re acting in the same direction what is the
1.11B L angle between the vectors yes [name]
1.12B L it's zero sir
1.13B T the angle between the vectors is zero okay so we said if if vectors are
1.14B T acting in the same direction we we now I think I made something like this
1.15B T I said okay the vectors I’m having a vector of what of eight newtons six
newtons now they act in the same direction same direction and the angle
between them is what is
**Ls** zero
**T** zero now when they act on the same in the same direction we said we can
get the resultant we can get resultant of of these two vectors in tw two
ways now there are two ways in which we can get the resultant now the
first one please the first one how can we get the resultant

**ACTIVITY TYPE:** ‘interruption’ [1] [interruption/ language] – ‘resultant of a vector’

**FIELD [2]: Resultant of a vector**

2.1B **T** oh by the way what is the resultant if I think of that you know the word
2.2B resultant of a vector what do we mean by that the resultant of a vector what
2.3B do we mean by that [code-switches] the resultant of vec [code-switches]
2.4B I’m telling you yes
2.5B **L** it is an answer of a vector
2.6B **T** it is an answer of a vector what do you mean by that yes
2.7B **L2** a vector is
2.8B **T** a resultant resultant
2.9B **L2** it is a vector sum
2.10B **T** it is a vector sum yes
2.11B **L2** that are all taken away
2.12B **T** the resultant is the vector sum of all vectors acting together say that all of
2.13B us
2.14B **Ls** the resultant is the vector sum of all vectors acting together
2.15B **T** all vectors act taken together
2.16B and thereafter I said again you can also put it this way the resultant the
2.17B resultant is a single vector it is a single vector which has the same
2.18B **Ls** effect as all vectors taken together

**ACTIVITY TYPE:** ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – ‘calculation’/ ‘drawing and measurement’ (scale drawing)

1.23B T for an example we said remember we said you can have a vector of what
1.24B of let’s say eight newtons east that’s a vector of eight newtons east
1.25B followed by another a vector of what of of of let let’s say uhm uh again
1.26B what let’s say six newtons east [chalkboard (1)] right so these are two
1.27B vectors acting here but instead of having two vectors acting one after the
1.28B other you can have one vector which would be equal to what yes
1.29B L which would be equal to fourteen newtons
1.30B T which would equal to fourteen newtons is that all
1.31B L east
1.32B T east because remember when you speak of a vector you can’t just say four
1.33B newtons you must tell me the
1.34B Ls direction
1.35B T direction if the answer is rea okay okay so so here we can have one single
1.36B vector we can now have here one single vector we can now have here one
1.37B single vector of fourteen newtons east so this is then the resultant it is the
1.38B resultant of what of this vector and this vector they form the resultant this
1.39B vector form one vector [chalkboard (2)]


FIELD [2]:
Magnitude and total resultant vector

3.1B T now if you say only fourteen newtons what does that imply you say the
3.2B answer is fourteen newtons what what could it be the question [code-
3.3B switches] if the answer is fourteen newtons what could have been the
3.4B question
3.5B L [unclear]
3.6B T no, I don’t think so any any now here the answer here the resultant is
fourteen newtons east now if the answer was only fourteen newtons what is fourteen newtons only [chalkboard (3)] don’t just howl at me [name] try try think what is fourteen newtons only aye yes [name]

the magnitude it’s only the magnitude so be very careful when you answer questions you must listen to the question if the question wants magnitude then this is correct [chalkboard (4)] but if it wants the total resultant vector you must give the magnitude and direction [chalkboard (5)] otherwise I told you in science we hate naked numbers [chalkboard (5)] otherwise I told you in

a ten meters per second squared or four meters per second speed and acceleration ten meters per second squared or two meters per second squared you can’t just give what a number okay are you happy

the magnitude

same direction angle between vector = 0°

same direction angle between vector = 0°
now I want you in your groups again I want you in your groups to work in your groups to look at [unclear] our first problem here was an athlete now read it please for me
an athlete runs eight kilometers east he rests and runs a further six kilometers east find the resultant displacement

ACTIVITY TYPE: ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Problem 1 – vectors acting in the same direction
Method 1 and 2 for solving problem 1 and 2 – ‘calculation’/ ‘drawing and measurement’ (scale drawing)

Okay fine so we look at what we look at the displacement now at then we said there are two ways in which we can get the resultant there are two ways in which we can get the resultant give me two ways in which one can get the resultant of those two vectors uh we know this we’ve discussed this but give me two ways in which the resultant of what of eight newtons east and six newtons east can be found [chalkboard (7)] and the first method the first method [code-switches] yes [name] we can get it by calculation we can get it by calculation yes we can get it by calculation simple calculation we can get it by calculation [chalk board (8)] yes which is here very easy because of the same thing you know direction so it will be you know the displacement will be the displacement would be equal to what eight newtons plus what six newtons and this will be fourteen newtons east that’s by calculation now the next one am I teaching only two people here yes by drawing by drawing what do you mean by that yes by drawing but what do you mean by that we discussed these things [code-switches] I swear I don’t go along with learners who don’t study who don’t go to their work the first
method yes I agree by calculation we can get at our displacement by calculating by adding by calculating yes [name] the answer is 1.65B by measurement 
1.67B by measurement yes by measurement and you measure something and you do what you measure and 
1.69B draw 
1.70B and draw yes very good so we can get the very same displacement by by drawing and measurement and measurement [chalkboard (9)] now when you do a measurement what must you first find if you want to make a drawing in science then we speak of what of drawing [code-switches] yes

scale drawing

scale drawing so we use what a scale drawing I use scale drawing scale drawing and what scale drawing and what and measurement now [unclear] and measurement remember we did it we measured what 80mm and right plus what plus 60mm and the total was what was one hundred and forty

80mm = 8km E  60mm = 6km E

ACTIVITY TYPE: ‘copying notes’ [1] [copying a problem]
FIELD [2]:
Problem 2 – vectors acting in opposite directions
5.1B now let’s have a second type of what of vector addition let’s have a second type of what of vector addition the problem is now an athlete the problem now is what here is now our problem you know [code-switches] an athlete right I hope you are writing this in your notebooks an athlete runs for eight kilometers east rests an athlete sorry runs eight kilometers east rests turns back and runs 6km west find the displacement of the athlete [chalkboard (11)]

An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.
ACTIVITY TYPE: ‘groupwork’ [1]
FIELD [2]:
Problem 2 – vectors acting in opposite directions
4.6B T I’m going to give you how many minutes what ten minutes remember there are two ways of getting the resultant find the resultant displacement I should say that now find the resultant displacement okay find the displacement find the resultant displacement right okay in each group in each group you work as a group to find out what is the resultant and now remember there are two ways of finding the resultant displacement you have the calculation part and the measurement and drawing you use a scale drawing what was the scale for the you know the last example scale drawing what was the scale for the you know the last example
4.14B L ten millimeters equals one kilometer
4.15B T you use the same scale
4.16B T right I’m going to give you ten minutes [code-switches] don’t just sit there ne you know one person you know can can be drawing others discuss around him or her
4.19B Ls [group work]
4.20B T [code-switches] please call me okay once you’ve finished please call me
4.21B we said use the same scale for scale drawing uh 10mm represents what
4.23B L one kilometer
4.24B L one kilometer [chalkboard (12)]
4.26B T you must show everything your scale your scale how you got your answer you know you know for the scale I was just seeing the drawing only how you got to your answer
4.29B T five minutes left [code-switches]
4.30B T let's have a look at this one
4.31B T let's have a look at that one there
right only three groups have done something that are good
okay you have tried but there is no complete answer

ACTIVITY TYPE: ‘review’ [1]; ‘microgenre’ ‘IRF’ [3]

FIELD [2]:
Problem 2 – drawing and measurement

7.1B T remember okay now what is happening here an athlete runs for eight
7.2B kilometers east rests turns back and runs for six kilometers west find the
7.3B displacement of the athlete now first I must ask myself is displacement a
7.4B vector or a scalar answer is
7.5B L a vector
7.6B T it's a vector number two

ACTIVITY TYPE: ‘interruption’ [1] [interruption/ language] – displacement
FIELD [2]:
Displacement

8.1B T by the way what is meant by displacement what is meant by the term
8.2B displacement yes
8.3B L it's a change in position
8.4B T it's a change in position it's a change in position right you must say that
8.5B right it is a change in position

ACTIVITY TYPE: ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Problem 2 – drawing and measurement

7.7B T so here I must find the change the actual final position of this person after
7.8B he ran eight kilometers east rested turned back and ran a further six
7.9B kilometers west finally where is he when you compare him with his
7.10B starting point so I told you I said there are two ways in which one can get
7.11B the answer here now first one is what is by is by what by by calculation
7.12B okay actually I think I must write down the other way round now
7.13B the first one is by measurement measurement and what and drawing

An athlete runs for 8km E, rests, turns back and runs 6km W. Find the displacement of the athlete.
For scale drawing 10mm : 1km

(13)

\[ \text{km} \times \frac{10\text{ mm}}{1\text{ km}} = 80\text{ mm} \]
you can get the answer here by doing an actual vector diagram right measurement and drawing now whenever do a measurement and drawing you have to show a scale I’ve given you the scale there you must use this because you can’t draw eight kilometers on your exercise book and you can’t draw what six kilometers ugh but if you draw a scale you can fit this in so I must first have my scale there scale right uh one kilometer equals ten millimeters therefore eight kilometers equals ten millimeters multiplied by eight kilometers divide by one kilometer and so you can see these cancel off and you have eighty millimeters [chalkboard (14)] so for eight kilometers I’ll draw what eighty millimeters so automatically even u six kilometers will then equal to 60 millimeters so I’ll draw I’m doing this one I’m doing this one measurement and drawing [chalkboard (13)] then I said I said whenever you are going to draw a vector you must listen whenever you draw a vector you must have a point a frame of what a frame of reference [code-switches] there must be a frame of reference so I’ll start drawing from here I have my point there I’ll start drawing from here I’ll start drawing from there [chalkboard (15)] right and I know this is in what direction a vertical line drawn on a piece of paper means this part means what direction

L_s north
T north and this one
L_s south
T and here I tell you I only see east and what and
L_s west
T west [chalkboard (13)] so I know this is in a straight straight line right because east and west lie in the same straight line so I just draw a line I told you a line perpendicular to this line I just draw my line [chalkboard (15)] I showed you that did I not do that

ACTIVITY TYPE: ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]

FIELD [2]: Problem 2 – drawing and measurement

7.43B  |  Ls  yes
7.44B  |  T  yes [code-switches] and then I must take

9.1B  |  T  I’ve only seen one group doing
9.2B  |  T  this thing [the teacher takes the protractor] only one group doing this
9.3B  |  T  thing that one [code-switches] nothing I’ve only seen one group doing this
9.4B  |  T  thing taking the real measurement it’s a measurement and drawing

FIELD [2]:
Problem 2 – drawing and measurement

7.45B  |  T  I’ve made my drawing I’ve drawn a line I’m going to measure now eighty
7.46B  |  T  millimeters so I take my ruler I measure eighty millimeters okay in my
7.47B  |  T  case here that’s what eighty millimeters right [chalkboard (16)] this is
7.48B  |  T  actually what eighty millimeters or because this is eighty millimeters it
7.49B  |  T  represents what
7.50B  |  Ls  eight kilometers
7.51B  |  T  eight kilometers east that’s what actually eight kilometers perpendicular
7.52B  |  T  right [code-switches] that’s eight millimeters [code-switches] sorry eighty
7.53B  |  T  millimeters in here so far as my board is [unclear] concerned right [code-
7.54B  |  T  switches] should I make it longer so that everyone can see [code-
7.55B  |  T  switches] sorry eighty millimeters right eighty millimeters that’s eighty
7.56B  |  T  that’s actually eighty millimeters east [chalkboard (17)] but I know the
7.57B  |  T  line is exactly eighty millimeters now this man is now here he is displaced
7.58B  |  T  he was here originally he was here originally finally now he is
7.59B  |  T  here he is now here he rests he’s now here now I’m told he turns back
7.60B  |  T  [unclear] are right six kilometers so he runs back again another six so
7.61B  |  T  he’s about here now he’s somewhere here he runs back again I measure
7.62B  |  T  what sixty millimeters right from here there it is it starts here again yes it
7.63B  |  T  starts from here sorry it starts from here he’s now here so finally he’s here
[chalkboard (17)] now I said to you you can take a vector to any position provided you do what I said you can take a vector to any position provided you do what if I walk eight kilometers this way

ACTIVITY TYPE: ‘demonstration’ [1] [role play]
FIELD [2]:
Vectors
10.1B T okay let’s see one two three four I’ve walked four meters from there in this direction is this any different from this one I’m now here I was there
10.2B one two three four in the same direction so I can take any vector to another position provided I do what I can take any vector look I was here
10.3B one two three four right I do the same thing I’m now here same vector is now here you see what I mean one two three four same direction so I can take a vector from any position to another position provided I do what
10.4B yes [name]
10.5B L you keep the same direction
10.6B T I keep the same direction and two and two yes [name] and provided I keep the same direction number two [name]
10.7B L you walk the same distance
10.8B T you walk the same what distance [code-switches] what are you saying because now I hate you know the word you know distance you know you know of vectors you know distance is a scalar although I know
10.9B L [unclear]
10.10B T provided I keep the same direction or and yo I don’t change what [code-switches] one two three four one two three four same direction and same
10.11B T same magnitude

ACTIVITY TYPE: ‘review’ cont. [1]; ‘microgenre’ ‘IRF’ [3]
FIELD [2]:
Problem 2 – drawing and measurement
same magnitude you can take a vector to any position provided you keep you keep the same magnitude and the same direction so I can take that vector of six newtons because I know it is right here that six is right here on the same straight line but because of this knowledge I have about vectors I can take it away from there is my vector that’s the same vector that’s now six kilometers west yes same vector now where is the person now he’s here now this persons now here he’s here same [unclear] what is his displacement what is his final position from starting point here was here initially after all the movements after all the running he finds himself here so that’s the displacement of the actual displacement is now here the displacement the actual displacement that’s my displacement that’s my displacement displacement [chalkboard (18)] is in which direction this part is a remainder of what vector yes of eight kilometers of the vector eight kilometers that is going to the east and I write it down now displacement sorry okay resultant displacement [chalkboard (18)] or displacement yes equals what this is two kilometers two kilometers east how did I find that how did I find this you know what you get two kilometers how did I find my two kilometers yes you minused sir you see I didn’t do any calculation here you see now I said there are two methods I’m still dra you know dra doing the measurement and drawing [chalkboard (13)] yes how did I yes you measure it sir you measure that line you measure this line you measure the displacement you measure it after measuring it go to your ruler again and you’ll find how many millimeters how many [name] it’s twenty millimeters

![Diagram](image-url)

Resultant displacement =

\[
\text{Resultant displacement} = 2\text{km}
\]

\[
10\text{mm} = 1\text{km}
\]

\[
2\text{km} = \frac{1\text{km} \times 20\text{mm}}{10\text{mm}} = 2\text{km}
\]
twenty millimeters so then I go to my scalar I must show that here I must show that on my on actually let me remove this thing first [chalkboard (19)] you show that and say look this scale is so some now ten millimeters equals one kilometer therefore twenty milliliters will equal to two kilometers am I right yes how do you get the two kilometers you actually said one kilometer times twenty millimeter divide by ten millimeters then you have what these cancel here and you have and you have you know ten into twenty uh two it’s two [chalkboard (19)] that’s why I wrote that down there you know two kilometers and for the person who wants to give you marks he sees everything how you got it by that you know only by measurement only by measurement and


there was only one group which actually did that that group there good

ACTIVITY TYPE: ‘teacher monologue’ [1]

FIELD [2]: Problem 2 – calculation

now the second method is by calculation we said that the second method is by calculation [chalkboard(20)] you can help with this calculation how
to do our calculation it’s very easy we have what one so our displacement our displacement will be equal to [chalkboard (21)] we take the direction to the east as positive we take the direction to the east as positive that’s what you do with your axis [chalkboard (22)] if you move you know towards you know from here to here it’s positive if you move from here to the start it’s what it’s negative if you move downwards it’s what it’s negative you move upwards it’s positive you actually take any of these as what as being if I take this direction as what as positive therefore I would say six sorry eight kilometers plus what plus I’m adding my vectors [unclear] the resultant plus then this one is now come back therefore
I take the opposite way as what as negative so I have what six kilometers and the answer will actually be two kilometers now what direction must I choose now here east and west what east and west which one the resultant the resultant of two vectors or three vectors the resultant of two vectors I’m going to stop there the resultant of two vectors will always take the direction of the bigger vector okay the bigger vector is what is eight kilometers so I would say it’s what oh sorry I forgot something here I should have said here ne eight kilometers east plus minus six kilometers west right and therefore right the whole thing becomes you know for those who [unclear] eight kilometers east minus six kilometers west answer becomes what two kilometers two kilometers the direction of of the bigger vector east that’s my calculation that’s my calculation are you happy now yes

ACTIVITY TYPE: ‘classroom business’ [1]

t [code-switches] also also tomorrow the school might break early I’m warning you now I’m not going early [code-switches] I’m not I’m warning you tomorrow the school might break early because it’s it’s day four and it’s a short what the start of a short what short holiday it’s the start of a short holiday or the start of a long weekend I because we are a bit behind in our work we’ll still be here you’ll hear from me okay yes sir are you happy yes sir good tomorrow we’ll start from here

ACTIVITY TYPE: ‘teacher summary’ [1] and assigning homework
now before you know we finish off what in what other way can we write this thing these two vectors are acting in which way [chalkboard (19)] yes boy in opposite directions they are acting in opposite directions but still in the same what straight line those two vectors are acting in opposite directions so we have now done addition of vectors in one in the same straight line (a) one (a) when they act in the same direction one (b) when they act in opposite directions still in the same straight line and our next problem because I would like you to now go home and try two right for tomorrow and and we’ll discuss it I want you to go and find out the displacement of the very same athlete he runs eight kilometers east he rests turns not back now turns and runs six kilometers north and stops find the displacement [chalkboard (24)] both by measurement and by calculation for tomorrow okay that’s homework now this athlete now runs six kilometers east turns and runs six kilometers north and stops find his resultant displacement it means find how far is he from where he was originally his change in position find his change in position okay we break

(24)

An athlete runs for 8km E, rests, turns and runs 6km N and stops. Find the displacement of the athlete. For scale drawing 10mm : 1km

(1) Measurement and drawing
(2) Calculation
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/[1]
- TEXT 2: Halliday, 1994/[2]
- TEXT 3: Wells, 1999/[3]
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: ‘classroom business’ [1]; ‘review’ [1]

1.1C T what did I want uh what did I want you to do actually I think I gave you
1.2C some work to do I said find out about something what was it who
1.3C remembers yes
1.4C L you wanted you want us to find displacement sir when a athlete runs for
1.5C eight kilometers east and then six kilometers north get the angle between the
1.6C compass [unclear]
1.7C T is he correct I said a person um yes yes an athlete does what
1.8C L [unclear]
1.9C T listen to yourselves a person runs what
1.10C L eight kilometers east
1.11C T eight kilometers

ACTIVITY TYPE: ‘interruption’ [1] – cleaning the chalkboard

2.1C T please clean the board for me


1.13C T a person runs eight kilometers east yes and then
1.14C L six kilometers north
1.15C T six kilometers north I don’t think I said that because okay okay because if if
1.16C T if the problem was a person runs eight kilometers east changes direction and
1.17C then what runs six kilometers north how would the drawing look like how
1.18C would the the drawing look like
1.19C L a right angle
1.20C T you would have a right angle between the two vectors right you would have
1.21C a right angle between the two vectors therefore the problem would not have
1.22C been like that what was the problem yes read it again
1.23C L [unclear] an athlete runs for eight kilometers east rests turns and runs six
1.24C kilometers north and stops [unclear]
1.25C T no I don’t think that I said that yes
1.26C L I think that you said an athlete runs for eight kilometers east and six
1.27C kilometers at one hundred and twenty degrees
1.28C T that’s it

**ACTIVITY TYPE:** ‘interruption’ [1]; ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD** [2] (Right-angled triangles; the magnitude of the resultant displacement):

**Methods:** a scale drawing and measurement; calculation

**The theorem of Pythagoras:** \( R^2 = x^2 + y^2 \)

**Formula/Tan rule:** \( \tan \theta = \frac{x}{y} \)

**[Formula/Cosine rule:** \( R^2 = P^2 + Q^2 - 2PQ \cos \theta \)]

**Keywords:** ‘resultant displacement’; ‘right-angled triangles’; ‘hypoteneuse’; ‘x axis’; ‘y axis’; ‘symbol’; ‘ratio’

3.1C T yes that is the first problem that you actually had that you know east
3.2C earlier the first problem we we dealt with was a person runs eight kilometers
3.3C eight kilometers east then this person runs changes direction and runs what
3.4C six kilometers north [chalkboard (1)] we finished that one we finished that
3.5C one we finished that one right do you remember

---

![Diagram](attachment:triangle.png)

R = \sqrt{8^2 + 6^2}
we finished that one and how did we do it we said for the displ now there are two ways in which you can find the resultant displacement there are two ways your resultant [chalkboard (2)] give me the first method you can use to find the resultant there [name] a scale drawing and measurement you can use a scale drawing you can use a scale drawing and measurement and the second one calculation and and and and what kind of calculation do we use here what information or what else do we have here remember the angle here is what is ninety [chalkboard (3)] now remember we said here we went to mathematics and we said to get this line right now we said r squared equals p squared plus q squared minus two p q cosine theta am I right that’s what we actually you know said and therefore r squared and therefore sorry so now our p squared is what is is eight that’s what we actually you know said and therefore r squared and therefore eight is eight squared plus six squared minus two what two what times eight times what six times six and times what cosine what cosine ninety degrees yes that’s what we actually we said and we found out what we found out that this becomes what sixty four am I right plus what plus thirty six and this becomes what minus what eight times six what ninety six ninety six times what and the cosine of what of ninety you must is
look at these the cosine of zero [chalkboard (4)] so so is actually zero so this whole thing so this whole thing this whole thing [chalkboard (5)] is what becomes zero so the only thing left what is this and this so in the case of what of ninety degrees if this angle is ninety degrees then this whole part [chalkboard (5)] becomes zero that’s why only this part is left then we said r squared then becomes what p squared plus what plus q squared but we said oh in this case we can use what this is the same as what as the theorem of what of

3.36C

\[ L = \text{Pythagoras} \]

3.37C

\[ T \]

Pythagoras if this is p and this is what q and this is r but the square on the hypotenuse equals the sum of the two squares of the other two sums if you add this square here plus this square here if you add this square and this square you will get the total sum of the bigger what of the bigger square in [chalkboard (6)] right and then we said let’s make things easier for ourselves here and then replace what with p with what we said now r squared and then now actually the case of p it will be what who remembers a symbol here yes

3.40C

\[ L \]

\[ x^2 \]

3.41C

\[ T \]

x squared why x squared why do we choose x as a symbol here I told you we actually did this yes yes

3.44C

\[ L \]

[unclear]

3.45C

\[ T \]

because the p lies along the x axis in our mathematics that’s x and the y vertical line in our mathematics is normally called what the y axis that’s therefore this becomes y squared and that’s why we kept this what as another method [chalkboard (7)] this is only applicable when when yes that formula or the usage or the use of Pythagoras is only valid or applicable when when when the angle between two vectors is what is remember this thing comes from that formula so this formula works for all triangles but when we come to this triangle here this formula works for all triangles ne all
triangles for all triangles [chalkboard (8)] but when the triangle is a right
angle triangle like this one [chalkboard (6)] then the whole thing
becomes short and it becomes like [chalkboard (7)] [code-switches]

**ACTIVITY TYPE:** ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Obtuse-angled triangles; calculation):**

**Methods:** scale drawing and measurement; calculation

- **Formula/ The cosine rule:** \( R^2 = P^2 + Q^2 - 2PQ \cos \theta \)
- **Formula/ The sine rule:** \( \frac{b}{\sin B} = \frac{a}{\sin A} = \frac{c}{\sin C} \)

**Key utterances/ definitions:** ‘it [the cosine rule] works for all triangles’; ‘in science you can’t have naked numbers’; ‘a vector is a physical quantity that has both magnitude and direction’

4.1C  T then I think I gave you now different work to check what when the angle
4.2C  this is six kilometers right and what and one fifty degrees and this is eight
4.3C  kilometers and what and ninety degrees am I right yes then you have your a
4.4C  resultant is line drawn from there to there am I right yes [code-switches]
4.5C  that’s your resultant [chalkboard (9)] right how did you get this line
4.6C  what is the [unclear] there [code-switch- the switches]

**ACTIVITY TYPE:** ‘interruption’ [1]; ‘collecting homework’ [1]

5.1C  T can I get the work now can I get the work now

**ACTIVITY TYPE:** ‘review’ [1] cont.; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Obtuse-angled triangles; calculation)**

4.7C  T let’s see whether you are right ne
4.8C  [code-switches] let’s see let’s see now ne [code-switches] now again there
4.9C  are always two ways there are always two ways there are always two ways
to get what to get the answer as far as resultant is concerned and you will

\[
R^2 = P^2 + Q^2 - 2PQ \cos \theta \quad \text{all triangles}
\]

\[
= (8)^2 + (6)^2 - (2 \times 8 \times 6) \times \cos 90^\circ
\]

\[
= 64 + 36 - 96 \times 0
\]
write measurement or by calculation scale drawing and measurement and
calculation right [code-switches] let’s see if we do it by calculation I’ll first
begin with what with calculation now in science remember whenever you
are going to do a calculation in science you’ve got to draw a little sketch to
show where you [unclear] right for instance if you just make a calculation I
won’t know where it comes from yes so for the calculation part there I have
my drawing notice that my drawing need not be in a particular scale now do
you understand

when you are going to do a calculation there is no need for you to draw a be
scale drawing or to make a scale drawing you just draw a diagram but
[code-switches] so my one fifty is somewhere there and then you have that
you have that that’s your resultant that would be your resultant that would
your resultant that would be the resultant so I’ve got eight kilometers at
ninety degrees and I’ve got six kilometers right at one fifty degrees

[chalkboard (10)] are you happy are you happy

then in this case we know this angle here is what is one fifty look I put all I
insert all the given information in my drawing right I know my angle
actually starts from there so I say now I want that one so I want here but
squared equals p squared plus q squared minus two p q cosine theta that’s
the formula it’s the formula for you to [unclear] okay are you happy

then we have what is my p I’ve got my eight squared plus my
six
six squared minus yes two what two what
eight
eight times what
times six times what cosine one fifty degrees this is what this is sixty four
am I right this is thirty six six minus what
ninety six minus what ninety six times what cosine of what of one fifty is what ne minus zero point eight six six minus zero point eight six six because a minus times a minus becomes what a plus are you correct minus becomes what yes answer becomes what [unclear] total answer here one eighty three point one four one eighty three are you correct here is she correct yes one eighty three one eighty three point one four point one four okay we’ll leave it at what at one eighty three and then we look at what and therefore r equals what the square root of what of one eighty three and the answer is thirteen point five what thirteen point five thirteen point five is that the answer what is the answer yes that is the answer are you sure check the direction are you sure I am very sorry [code-switches] is that the answer there yes
that is not the answer because in science you can’t have naked numbers

you are right so answer is

ten point five kilometers

ten point five kilometers [chalkboard (11)] but I’m dealing here with a vector now can I what is a vector what is a

yes [code-switches] what is a vector [code-switches] yes

it is a physical quantity which has direct magnitude and direction

it is a physical quantity which has both magnitude and direction in our answer here what do we only have now yes

magnitude

we only have here the magnitude of this resultant we only have the only

magnitude of this resultant and the question does not want the magnitude it wants what the total resultant which means we must still get what the
direction alright so we go on how do we get our direction how do we get our
direction we want this in our drawing we want that thing [chalkboard (12)]

that part our direction right we want that part but for us to get that part we

must get this angle here which I will call alpha or a [chalkboard (12)] alright I can call [code-switches] a because before I get that I must get a I must

now use another rule which rule is that one eh anybody yes what do we call this rule first who knows eh yes what do you call this rule in mathematics [chalkboard (11)] it is eh what

the cosine rule

the cosine rule it’s the cosine rule [chalkboard (13)] it is the cosine rule it works for all triangles it works for all triangles right now to get the angle now what rule do we have to use we can use the tan rule why can we use here why can we say tan rule tan theta now why can’t we get tan theta equals something or x over y why why can’t I use this ratio here why [code-switches]

6.1C T for two weeks you were playing

FIELD [2] (Obtuse-angled triangles; calculation)

4.98C T why why can’t I use this one or when do we use that rule or that ratio tan
4.99C theta when do we use that ratio tan theta yes [name]
4.100C L when the triangle is a right angle
4.101C T when the triangle is a right angle we only use this one when we have a
4.102C triangle to get this angle [chalkboard (14)] to get what the y or the x tan
4.103C theta here tan of this angle here equals the opposite y over x and you can get
4.104C this angle we can’t use this one here now [chalkboard (14)] why can’t
4.105C you use that one here now to get that angle eh
4.106C L that triangle is not a right angle triangle
4.107C T up up
4.108C L that triangle is not a right angle triangle
4.109C T the triangle the triangle we have here is not a right angle triangle so you can
4.111C use yes c’mon speak speak [name]
4.112C L sin [sic] theta
4.113C T no you can’t use sine theta sine theta sine theta is also applicable here
4.114C [chalkboard (14)] which rule do we use here [code-switches] yes to get this
4.115C line here I used a rule the cosine rule I could say cosine theta the cosine rule
4.116C [code-switches] to get the angle here ne I cannot use the ratio I cannot use
4.117C the ratio I can’t use the ratio I must use a rule which is a piece I’ve used in
4.118C mathematics right now this rule I mean how do we [unclear] it ne you know
4.119C the angle how do you do it anybody

ACTIVITY TYPE: ‘boardwork’ [1]; ‘going over boardwork’ [1]

7.1C T [name] come and show us what you have done to get the angle ne to get
7.2C direction where do you get the three from now I can see one fifty on the
7.3C board I know the thirteen comma five [unclear] you know from the resultant
7.4C [chalkboard (15)] and the three [chalkboard (16)] eh now now okay okay
7.5C okay just stand aside you can stand by the board if you want to now if sine

\[ R^2 = P^2 + Q^2 - 2PQ\cos\theta \]  
\[ R = \sqrt{183} \]

\[ R = 13.5km \]
<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.6C</td>
<td>C</td>
<td>one fifty okay don’t [code-switches] I don’t think we have a sine one fifty</td>
</tr>
<tr>
<td>7.7C</td>
<td>C</td>
<td>there I don’t think we have a sine one fifty there no you know on the board I</td>
</tr>
<tr>
<td>7.8C</td>
<td>C</td>
<td>don’t think so I don’t think we’ve got a sine one fifty on the board yes boy</td>
</tr>
<tr>
<td>7.9C</td>
<td>L</td>
<td>[unclear]</td>
</tr>
<tr>
<td>7.10C</td>
<td>T</td>
<td>sine one fifty degrees [chalkboard (17)]</td>
</tr>
</tbody>
</table>

**ACTIVITY TYPE:** ‘interruption’ [1]; ‘review’ [1]

**FIELD [2]** (The definition of the Multiplicative Inverse):
The definition of the Multiplicative Inverse: \(a \times \left(\frac{1}{a}\right) = 1\)

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.120C</td>
<td>T</td>
<td>now in mathematics if you have got two over x equals two over x it is as</td>
</tr>
<tr>
<td>4.121C</td>
<td>C</td>
<td>much as writing the same thing here as what which is the simplest way of</td>
</tr>
<tr>
<td>4.122C</td>
<td>C</td>
<td>writing this thing if it was two divide by something divide by two divide by</td>
</tr>
<tr>
<td>4.123C</td>
<td>C</td>
<td>something x [code-switches] it is the same thing it is the same thing as</td>
</tr>
<tr>
<td>4.124C</td>
<td>C</td>
<td>writing what yes [code-switches] yes</td>
</tr>
<tr>
<td>4.125C</td>
<td>L</td>
<td>one equals one</td>
</tr>
<tr>
<td>4.126C</td>
<td>T</td>
<td>two divide by x equals two divide by x I said a simple way of writing this is</td>
</tr>
<tr>
<td>4.127C</td>
<td>C</td>
<td>thing down is just writing what [code-switches] two just equals two [code-</td>
</tr>
<tr>
<td>4.128C</td>
<td>C</td>
<td>switches] two equals two [chalkboard (18)]</td>
</tr>
</tbody>
</table>

**ACTIVITY TYPE:** ‘review’ [1] cont.; ‘IRF’ ‘microgenre’ [3]

**FIELD [2]** (Obtuse-angled triangles; calculation)

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.129C</td>
<td>T</td>
<td>now if you look at these things sine one fifty degrees over what thirteen</td>
</tr>
<tr>
<td>4.130C</td>
<td>C</td>
<td>point five equals [code-switches] therefore usine [sic] one fifty degrees</td>
</tr>
<tr>
<td>4.131C</td>
<td>C</td>
<td>equals sine theta [chalkboard (19)]</td>
</tr>
</tbody>
</table>

**ACTIVITY TYPE:** ‘interruption’ [1] – teacher admonition

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1C</td>
<td>T</td>
<td>you played for three two weeks whilst I was away [code-switches] that thing</td>
</tr>
<tr>
<td>8.2C</td>
<td>C</td>
<td>wrong help her out [code-switches]</td>
</tr>
</tbody>
</table>

**ACTIVITY TYPE:** ‘review’ [1] cont.; ‘IRF’ ‘microgenre’ [3]

**FIELD [2]** (Obtuse-angled triangles; calculation)

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.121C</td>
<td>C</td>
<td>writing this thing if it was two divide by something divide by two divide by</td>
</tr>
<tr>
<td>4.122C</td>
<td>C</td>
<td>something x [code-switches] it is the same thing it is the same thing as</td>
</tr>
<tr>
<td>4.123C</td>
<td>C</td>
<td>writing what yes [code-switches] yes</td>
</tr>
<tr>
<td>4.124C</td>
<td>C</td>
<td>writing what yes [code-switches] yes</td>
</tr>
<tr>
<td>4.125C</td>
<td>L</td>
<td>one equals one</td>
</tr>
<tr>
<td>4.126C</td>
<td>T</td>
<td>two divide by x equals two divide by x I said a simple way of writing this is</td>
</tr>
<tr>
<td>4.127C</td>
<td>C</td>
<td>thing down is just writing what [code-switches] two just equals two [code-</td>
</tr>
<tr>
<td>4.128C</td>
<td>C</td>
<td>switches] two equals two [chalkboard (18)]</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\sin 150^\circ &= \frac{\sin \theta}{3} \\
\sin 150^\circ &= \frac{\sin \theta}{3} \\
\sin 150^\circ &= \frac{\sin \theta}{3} \\
2 &= \frac{2}{x} \\
2 &= \frac{2}{x} \\
2 &= \frac{2}{x} \\
\end{align*}
\]
yes sine one fifty degrees over what equals what can you go now right sit

when I introduced you to this thing I said when you have a right angle
triangle like this one [chalkboard (20)] and you have what four and three
you remember and angle here is what ninety degrees what is there what is
this one r equals what yes

r equals five
five r equals five [code-switches] then I said if I want the angle now this is
ninety and we said if we want this angle if we want this angle right this
angle if we make it theta we can say we can use a trig ratio we can say tan
theta equals y y axis equals y over x which is the same as what as three
divide by four which is the same as what as zero point seven five
[chalkboard (20)] do you remember now do you remember now
then we now said then we get now now I said theta therefore theta will then
be equal to tan to the power of minus one zero point seven five and the

answer was what answer was

thirty seven degrees
thirty seven degrees thirty seven degrees this angle this angle here we know
[chalkboard (22)] let say this side is what is a this side is what is
now thirty seven degrees [chalkboard (20)] that’s how we [unclear]
but in this case we don’t have a right angle here [chalkboard (12)] so we
can’t use that formula for the trigonometrical ratio tan theta we can’t use
this one now we can’t use this one

now then I said this one for this one [chalkboard (12)]
now we use the sine rule [chalkboard (21)] we now use the sine rule what
9.3C does the sine rule say what does the sine rule say now if you take any
triangle let us just take any triangle just if you take any triangle a b c let say
this side is what is a this side is what is c small c and this one is small b
right then the sine rule says b sorry b over sine b equals a over sine a equals
c over sine c you can invert the whole thing if you want that is the sine rule

\[
\frac{b}{\sin B} = \frac{a}{\sin A} = \frac{c}{\sin C}
\]

FIELD [2] (Obtuse-angled triangles; calculation)

10.1C now I can use now now since this rule can be used for all triangles I can also
10.2C use it now for this one [chalkboard (12)] how do we do it here now we’ve
10.3C got this line is opposite to that angle which I call a this line is opposite to
10.4C that one this angle [code-switches] this angle is opposite to this line and this
10.5C angle is opposite to this line you see that technically you see now if I want
10.6C to get that one r over sine one fifty equals equals [code-switches] six over
10.7C sine a equals eight over no no no one fifty eight over sine [code-switches]
10.8C eight over sine b same thing here [chalkboard (22)] right same thing
10.9C therefore now I can take any any two I can make any two here ne I can take
10.10C this one [code-switches] I can remove that actually [unclear] or remove this
10.11C and come here and say okay \(\sin r\) [code-switches] \(\sin 150\) sine what one fifty degrees
10.12C over r now r is what r is thirteen comma five thirteen comma five equals I
10.13C want this one and I know that [unclear] equals sine a over what over six now
10.14C solve you know for what sine a solve for sine a I’ve given
10.15C you now the clue solve for sine a [chalkboard (23)]

FIELD [2] (Obtuse-angled triangles; calculation – angle)
11.1C [the learners solve the problem]

FIELD [2] (Obtuse-angled triangles; calculation)
4.156C T sine a yes sine a okay sine a [code-switches] sine okay sine a will be equal
4.157C to okay let’s make it simpler sine a times thirteen comma five equals what
4.158C equals what yes
4.159C L sine one fifty degrees times six
4.160C T sine one fifty degrees times six that’s the equation therefore I can now say
4.161C therefore sine a must therefore be equal to [code-switches] yes
4.162C L [unclear]
4.163C T sine one fifty degrees times what
4.164C L six
4.165C T times six divide by
4.166C L thirteen point five
4.167C T thirteen point five right that’s what we get then yes now we go and find fifty
4.168C one fifty yes find one fifty


12.1C T I can see people don’t have calculators I can see people don’t have
12.2C calculators I can see people don’t have calculators and I had a strong
12.3C warning on those calculators


**FIELD [2] (Obtuse-angled triangles; calculation)**

4.169C T sine one fifty is nought point five zero point five times six divide by thirteen
4.170C point five answer is answer is yes zero point five times six divide by thirteen
4.171C point five
4.172C L .1 zero point two two two
4.173C T [name]
4.174C L .1 zero point two two two
4.175C T zero point two two two two okay zero point two two we’ll leave it at
4.176C two two decimal places zero point two two are you sure that sine oh point
4.177C [unclear] good so I now know that that this is equal so sine a equals zero
4.178C two two that means the size of this part [chalkboard (12)] is zero point two
4.179C two the ratio is that part but what do I really want I want what I want a the
4.180C actual angle and the angle is

\[
\frac{\sin 150^\circ}{13.5} = \frac{\sin a}{6}
\]

\[
\sin a = \frac{\sin 150^\circ \times 6}{13.5}
\]

\[
\sin a = 0.22
\]

\[
a = \sin^{-1}0.22
\]

\[
a = 12.7^\circ
\]

\[
a = 13^\circ
\]

Direction = 90 – 13

\[
= 77^\circ
\]

Displacement = 13.5km at 77°
**ACTIVITY TYPE: ‘interruption’ [1]; ‘review’ [1] – tan rule**

13.1C T how do you get it how do you get it how do you get it how do you get it how do you get it
13.2C how did we tan theta equals y over x which is three over four this becomes
13.3C zero point seven five so tan theta equals zero point seven
13.4C five therefore theta equals what [code-switches] the inverse of tan the
13.5C inverse of tan zero point seven five that’s how you get the angle itself
13.6C [chalkboard (25)]


**FIELD [2] (Obtuse-angled triangles; calculation)**

4.181C T [code-switches] yes
4.182C L [unclear]
4.183C T you get the inverse on sine yes sine inverse minus one [code-switches] zero
4.184C point two two the answer is
4.185C L twelve point seven
4.186C T what
4.187C L twelve point seven
4.188C T twelve point seven twelve point seven degrees that’s about thirteen degrees
4.189C that’s about thirteen degrees okay I’ll accept that ne that’s about thirteen
4.190C degrees okay but it’s actually that one so we now know that the angle there
4.191C ne is about what thirteen degrees about thirteen degrees about thirteen
4.192C degrees [chalkboard (26)] [chalkboard (23)] what is this angle there
4.193C L [unclear]
4.194C T so I now know that my direction [code-switches] my direction will be equal
4.195C to ninety minus what thirteen and the answer is what is
4.196C L seventy seven
4.197C T seventy seven [chalkboard (23)]


14.1C T it’s very funny it’s very funny [code-switches]
so I now now the total displacement here so my final answer now right now displacement will be displacement will be thirteen point five kilometers at seventy seven degrees that’s the actual answer now final answer now that’s the final answer [chalkboard (23)] that’s the final answer [code-switches] can I have these please do you have any questions now do if you have any questions do you have any questions do you have any questions do you understand what I have done here do you understand what I have done on the board the only way for you to have grasped it ne is to go home and repeat all the steps I have done until you are sure you understand

$$\tan \theta = \frac{y}{x}$$

$$\tan \theta = 0.75$$

$$\theta = \tan^{-1} 0.75$$

$$R = \sqrt{6^2 + 8^2} \approx 10$$
ACTIVITY TYPE: ‘interruption’ [1] – cleaning the chalkboard
1.1D T okay clean the board for me

ACTIVITY TYPE: ‘interruption’ [1]
2.1D T we are going very very slow we are going very slow we are going very slow

ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘measurement and drawing’)

Example: An athlete runs 8km E, rests and runs back for 6km W

3.1D T the first example we made was an athlete runs eight kilometers east rests
3.2D runs a further eight kilometers [unclear] [code-switches] addition of two or
3.3D more vectors okay it’s up to b now okay [code-switches] let’s first finish off
3.4D all what we have been discussing let’s first finish off all what we have
3.5D discussing right now we look at b we now look at b in this case we want to
3.6D add displacements we want to add displacements acting in the same straight
3.7D line we want to add displacements acting in the same straight line but in
3.8D opposite directions so we’re going to have eh displacements ehm in the
3.9D same straight line same straight line opposite directions these things are now
3.10D going to be acting in opposite directions [chalkboard (1)] do you follow me
3.11D Ls yes
3.12D T right ne the first type of displacement was in the same straight line but these
acting in the same direction [code-switches] right now let’s have a look at
now example here let us have a look at an example here an athlete an athlete
runs again eight kilometers east an athlete runs eight kilometers east right
comma rests and runs back uh for let say okay six kilometers that means
west he runs back because he would be running towards [chalkboard (1)]
now if it if it was moving east if the athlete was moving moving east eight
kilometers east he rests he runs back now again what ehm what six
kilometers east [code-switches] now how [code-switches] I said there are
two ways in which one can add vectors [chalkboard (2)] now first one first
method of adding vectors yes [name]

L scale
T scale what yes [name] yes
L scale drawing
T we actually use a scale drawing by measurement and drawing by scale is
measurement and drawing that’s the first way of adding our vectors by
measurement and drawing now in this case we can also have do this by
measurement and drawing so we can first have a scale our scale I said our
what now give me a scale here [code-switches]
L one kilometer equals ten millimeters
T what
L one kilometer equals ten millimeters
T one kilometer one kilometer equals what
L ten millimeters
T ten [code-switches]
L millimeters
T millimeters that’s our scale right that is our scale ten milli you know you
know one kilometer equals ten millimeters so now there now if our
scale is is like that therefore eh eight kilometers will be equal to what
L eighty millimeters
T what
Ls eighty millimeters
T eighty millimeters and what six kilometers will be equal to
Ls sixty millimeters
T sixty millimeters yes that’s right [chalkboard (3)]

ACTIVITY TYPE: ‘do now’ [1]
FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘measurement and drawing’)

right now I’m going to eighty millimeters to the east I’m going to give you five minutes you know allow you now to draw eighty millimeters towards the east [code-switches] you know to do that no less than that three minutes [code-switches] I’ve shown you how to draw to make measurements with your pair of compasses your pencils must be sharp [code-switches]

FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘measurement and drawing’)

now we are told the person rests the person rests an athlete running rests sorry rests and runs back for six kilometers now of course if he runs back it means he’s going towards the west

ACTIVITY TYPE: ‘interruption’ [1]; ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (‘rule’):
‘rule’: ‘a vector can be changed to another place as long as the magnitude stays the same and the direction’

now there is a certain thing I told you about vectors which includes magnitude and direction what did I say yes you said a vector is a physical quantity no I didn’t say that that is a definition of or it is when I explained what a one vector is but I told you something about what about about the position of a vector and the magnitude of a vector I told you something about the
magnitude of a vector and the position of a vector [code-switches] I told you something about what about I even made examples here I said if I move this two three four places I’m moving this way the same thing is the same even if I move here one two three four remember you remember I did that

ACTIVITY TYPE: ‘interruption’ [1]; ‘demonstration’ [1]
FIELD [2] (‘rule’)

6.1D  T  yes I was in this position one two three four but even if

ACTIVITY TYPE: ‘interruption’ [1]; ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (‘rule’)

5.13D  L  a vector can be changed to another place
5.14D  T  a vector can be changed to another place yes as long as you do what yes
5.15D  L1  [unclear]
5.16D  T  as long as yes
5.17D  L1  the magnitude stays the same
5.18D  T  the magnitude stays the same and two things
5.19D  L1  the direction
5.20D  T  and the direction stays the same

FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘measurement and drawing’)

3.50D  T  so so this person runs eight kilometers east
3.51D  T  he is now here he runs back [code-switches] right here six kilometers but I can take that vector backwards away from there [code-switches] right and therefore draw what and come here [code-switches] then draw exactly what
3.54D  T  six millimeters sorry sixty millimeters eh in this direction [code-switches]
3.55D  T  this is eight kilometers sorry what this is six kilometers ne what west
3.56D  T  [chalkboard (4)] right I’ve taken you see this person did this thing this
person ran eighty eight kilometers towards the east eight kilometers east
he is here now right the person is here now he rests here that’s why you
say he rests then turns back you know he turns back he runs back again for
what for six kilometers ten twenty twenty forty fifty sixty alright he runs
back again what six he is now here again he is now here so he he ran back
he is now here he was here first he ran there he came back there he is now
here [chalkboard (5)] what is his change in position that means what is his
displacement what is his change in position yes
(5)

ACTIVITY TYPE: ‘interruption’ [1]; ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (‘rule’)

so here remember this thing that you can move a vector to another position
provided you do not do not change what the change what you’ve had it
change what [code-switches] you can take a vector to another position
provided you do not change what the change what you’ve had it
change what eh [code-switches] you can take a vector to any position as
long as you don’t change what

so I’ve taken now that vector see that I’ve taken now [code-switches] I’ve
not changed what the direction it’s still backwards I’ve not changed what so

FIELD [2] (Resultant of two successive displacements; in the same straight line;
opposite direction; ‘measurement and drawing’)
the magnitude and the resultant my resultant is now here [code-switches] the
resultant is now here so [unclear] in the first vector the part that is left is
now this one so this is two kilometers west [chalkboard (7)] that is the
magnitude sorry the resultant displacement

**ACTIVITY TYPE: ‘interruption’ [1] – the learner corrects the teacher**

7.1D T yes boy
7.2D L [unclear] two kilometers east
7.3D T what sorry oops sorry two kilometers east very good very good very good
two kilometers east two kilometers east two kilometers east [chalkboard (8)]


**FIELD [2] (Resultant of two successive displacements; in the same straight line;
opposite direction; ‘measurement and drawing’)**

3.74D T now we have made or we have found the resultant using a drawing using a
drawing ne any questions any que do you understand that now do you
3.76D understand [code-switches] ne

**ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]**

**FIELD [2] (Resultant of two successive displacements; in the same straight line;
opposite direction; ‘calculation’)**

8.1D I said you can also get the same answer using what a
8.2D L a calculation
8.3D T a what ne
8.4D L a calculation
8.5D T a calculation [code-switches] why now you can still get the same answer
8.6D using what a calculation so the first one there we use what a scale drawing
now the second part we now use a calculation so my calculation my
calculation the resultant displacement or displacement displacement equals
8.7D how do you do it [code-switches] do the calculation your answer will be
8.9D what your answer must be what
8.10D L [unclear]
8.12D T your answer must be two kilometers west how do you get that
9.1D  T  you can’t tell me to add you know to get resultant there now eight plus six
9.2D  [unclear] a calculator [code-switches] one plus one I need a calculator
9.3D  [code-switches] three plus four a calculator aye aye aye

FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘calculation’)
8.13D  T  yes
8.14D  L  minus six
8.15D  T  you know why do you minus now we spoke of vector addition I never spoke
8.16D  of minusing vectors how do we get it how do we get it how do we get the
8.17D  how how do we get the the two kilometers east yes
8.18D  L  eight kilometers plus negative six

10.1D  T  [code-switches] you never get enter my class having funny things on you
10.2D  know on your ears [code-switches]

FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘calculation’)
8.19D  T  now how do we get the answer
8.20D  L  eight plus negative six
8.21D  T  you you you you add okay so it’s eight kilometers east plus right do
8.22D  why do we put a negative sign here why do we put a negative sign here why
8.23D  we put a negative sign here why do we put a negative sign we say minus six
8.24D  kilometers why do we say know do that why do we use a negative I’m
8.25D  adding yes I’m adding quite correct addition of vectors eight kilometers east
8.26D  plus but I put a minus sign here why why yes
8.27D  L  because the direction is not the same
8.28D  T  because the direction yes of of this vector is not the same as that one now
8.29D  how would you describe you know you know the direction of these two
8.30D  vectors how do these two vectors act as far as direction is concerned how do
those two vectors eight and six act in as far as direction is concerned yes
they act in opposite directions
they act in opposite directions if one goes positive the other one must go the what negative so answer here is what is two kilometers east [chalkboard (9)]

**ACTIVITY TYPE: ‘teacher monologue’ [1]**

**FIELD [2] (The direction of vectors):**
‘the direction of vectors’: ‘positive direction’; ‘negative direction’

**FIELD [2] (Resultant of two successive displacements; in the same straight line; opposite direction; ‘calculation’)**

now notice now notice that notice that if I chose if I chose the direction towards east as what as I could also have said displacement minus eight kilometers alright plus what plus two kilometers yes answer is what is minus two kilometers which actually means what two kilometers east now this minus means that it is moving in the opposite direction to this one [code-switches] [chalkboard (10)] but don’t worry too much about this one so far just get to know that one it depends whether you chose this one as positive direction or this one as the negative direction but so far I’m choosing it for you that this side is positive this side is what is negative [code-switches] your axis in mathematics this side goes where positive this side goes where negative and this side goes what negative and that side goes what positive [chalkboard (11)] that’s why otherwise later you’ll know that you can have any direction yes


Displacement = 8km E + (– 6km) = 2km E

Displacement = – 8km E + 6km = – 2km

2km E

---

now yes when you look at vectors when you look at vectors acting in the
same straight line the angle between the vectors can be what or what if if if
two vectors act in the same direction what would be the angle between them
we’ve got two vectors here they act in the same direction what what is the
angle between them you know you know the two vectors
It is zero if the vectors act in opposite directions what is the angle between
the vectors
one eighty
one eighty

ACTIVITY TYPE: ‘teacher monologue’ [1]
FIELD [2] (Force)
notice that but we’ll explain that better when we deal with force as a
vector you can have a force acting on one object or two forces acting on one
object will be in the same direction or have two forces acting on the same
object but in opposite directions [code-switches]
yes

ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant
displacement; ‘measurement and drawing’)
good now we now look at c we now look at c we now look at c still addition
of what of vectors we now look at what at c displacements in directions in
different directions let’s say that in different directions displacements sorry
in different directions displacements in different directions now the
direction in which is when we have a person running from here a person
runs eight kilometers to the
east
east changes direction runs six kilometers what to the
north
north that’s two displacements where the direction sorry the angle between
the two vectors one displacement another displacement the angle between
them is what is 90º

ninety degrees right so that the angle between the displacements is what is
ninety degrees so let’s make it again in the form of a problem we want to
solve the problem now an athlete again an athlete runs eight kilometers east
comma changes direction and runs six kilometers north [chalkboard (12)]
now remember when he runs eight kilometers east what is the direction or
what is the direction of east in terms of degrees yes
ninety degrees
ninety degrees [code-switches] what is the direction of north in terms of
degrees yes boy
zero degrees
telephone [unclear] do you know [unclear]

ACTIVITY TYPE: ‘interrupt’ [1], ‘IRF’ ‘microgenre’
FIELD [2] (‘the everyday’ - the school)

why is the school built this way not the doors and the windows face north
and south why why why yes
because towards the east sir to face the light
to face the light
yes
but the light comes but the sun comes from east [code-switches] what do
you think made the planning of the buildings face north just just to prevent
what too much sunlight getting into the classroom imagine in summer time

Displacements in different directions
so that the angle between the
displacements is 90º
An athlete runs 8km E,
changes direction
and runs 6km N

Displacements in different directions
so that the angle between the
displacements is 90º
An athlete runs 8km E, (0 º)
changes direction
and runs 6km N (90 º)
[code-switches] the whole sunlight gets through the windows direct rays not afternoon the sun you know the sun west the sun rays you know strong rays coming inside we need light but we don’t need what the direct rays

ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘measurement and drawing’)

14.9D T [code-switches] the whole sunlight gets through the windows direct rays not afternoon the sun you know the sun west the sun rays you know strong rays coming inside we need light but we don’t need what the direct rays

14.10D Scale: 1km = 10mm

14.11D (14)  Scale: 1km = 10mm

14.12D \[\therefore \] 8km = 80mm

14.13D 6km = 60mm

ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘measurement and drawing’)

13.32D T scale again [code-switches] one kilometer equals what ten millimeters that is

13.33D our scale that is our scale quickly do it quickly so we now know that eight

13.34D kilometers so therefore eight kilometers equals eighty millimeters and and

13.35D what six kilometers equals sixty millimeters [chalkboard (14)] [code-switches]

13.36D ACTIVITY TYPE: ‘do now’ [1]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘measurement and drawing’)

15.1D T faster faster faster …some of you don’t want to think some of you don’t

15.2D want to think because you always start with the the direction you know

15.3D towards the east [code-switches] you want all the time someone must think

15.4D for you it doesn’t go like that it doesn’t go like that there must be a time

15.5D when you have to think for yourselves use your brain [code-switches]…you

15.6D can’t draw a thick line like this…finished

ACTIVITY TYPE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘measurement and drawing’)

13.37D T [unclear] you can’t just draw a vector and you don’t know you know the

13.38D length then of course this person was eight kilometers east he then then

13.39D changes direction I showed you how to make sure that this is right this is six

13.40D kilometers north now the displacement the change in position displacement

13.41D means what change in position remember that hey what is the change from

13.42D here to there how long is is the line how long is the line [code-switches]

13.43D Ls ten kilometers
13.44D  T  [code-switches]
13.45D  Ls  ten kilometers
13.46D  T  when you use your ruler how long is the line
13.47D  Ls  ten kilometers
13.48D  T  ten millimeters
13.49D  L  one hundred millimeters
13.50D  T  one hundred millimeters which is equal to [code-switches] according to our
13.51D  scale according to our scale so this is one hundred millimeters which of
13.52D  course according to our scale is what is ten kilometers ten kilometers how
13.53D  did you get ten kilometers how did you get it how did you get you know you
13.54D  know ten kilometers [chalkboard (15)] mm
13.55D  Ls  by calculation sir
13.56D  T  no you only measured what the line and you found out the line the length of
13.57D  line is what is hundred millimeters how did you change the hundred
13.58D  millimeters you know to get ten kilometers
13.59D  L  because according to the scale one kilometer is ten millimeters
13.60D  T  then
13.61D  L  so then definitely one hundred millimeters is ten kilometers
13.62D  T  so you must look at your scale and say ten millimeters equals one kilometer
13.63D  [code-switches] therefore one hundred millimeters so ask yourself if ten
13.64D  kilometers sorry ten millimeters equals ten kilometers will a hundred
13.65D  millimeters be less or will it be more [code-switches]
13.66D  Ls  [Xhosa]
13.67D  T  [code-switches] it will be big so if you in mathematics if you want to get a
13.68D  T  big number always multiply by the big number right one hundred
13.69D  millimeters multiplied by one kilometer divide by the small millimeters
13.70D  there you can see this cancels there your answer will be in kilometers and
13.71D  also again there you have ten [code-switches] [chalkboard (16)] alright and
13.72D  then so so so here we have displacement equals ten kilometers is that answer
13.73D  correct yes
13.74D  L  it is not correct
why or it is not complete why because there is no direction okay how do you get the direction how do you get the direction yes how do you get the direction you know over there yes the tan rule what the tan rule the tan rule yes the sine rule the sine rule yes use a protractor very good we are doing measurement here we are doing measurement here we are doing the first one here we are doing it by measurement how can I make some calculations now we are doing it here by measurement so we use what a protractor a protractor and measure angle from from the north so we say that displacement equals ten kilometers at fifty three degrees that’s my measurement that’s my measurement [chalkboard (15)] that’s my measurement

ACTIVITY TYPE: assigning homework
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’) [ the learners are required to do the calculation part of the question for homework]
ACTIVITY STRUCTURE: ‘classroom business’ [1]
1.1E  T  who’s absent these two girls
1.2E  Ls  [names]

ACTIVITY STRUCTURE: ‘going over the homework’ [1]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’)
2.1E  T  um let’s see now we are still busy with what with calculation when an that
2.2E  athlete running eight kilometers to the east and then turning and running a
2.3E  further six kilometers to the north and then I said go home and and finish up
2.4E  one how do you do it so how do you do that one how do you do that one
2.5E  anybody

ACTIVITY STRUCTURE: ‘going over the homework’ [1]; ‘boardwork’ [1]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’)
2.6E  T  who would like to come and show us anybody who would like to come and
2.7E  show us how that one was done anybody who would like to come and show
2.8E  us hey anybody who would like to come and show us how that one

ACTIVITY STRUCTURE: ‘interruption’ – teacher admonition
3.1E [code-switches] can I leave you then uh can I leave you [code-switches]
ACTIVITY STRUCTURE: ‘going over the homework’[1]; ‘boardwork’ [1] cont.

FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’)

2.9E L1 we first did it by scale drawing our scale was or my scale was one kilometer
2.10E [chalkboard (1)]
ACTIVITY STRUCTURE: ‘interruption’ [1] one; ‘going over boardwork’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’)

4.1E T can you stop there is he correct eh
4.2E L no sir he is not
4.3E T why
4.4E L because the scale was ten millimeters [unclear]
4.5E T is he correct to do a scale drawing yes
4.6E L no sir
4.7E T why
4.8E L we want to do a calculation
4.9E T because we
4.10E L we want to do a calculation
4.11E T we want to find the answer by doing a calculation so there is no need to do
4.12E what
4.13E Ls a scale drawing
4.14E T a scale drawing I said that to you I said that to you [code-switches]

5.1E T next time for these people don’t talk I won’t come to your class [code-switches]
5.2E
I need what a drawing that depicts exactly how the person ran

so you know you remove that but I said for any calculation you must do
what but for any calculation you must do what [code-switches] yes

you must have a drawing

you must have a drawing I said for any calculation you must have a drawing

you must have a drawing and the drawing did they tell you what what must

be you know you know how do you know do we need to

have a scale drawing do we need to have a scale drawing

when we do a calculation in a problem in physical science do we need to do
a scale drawing yes

yes sir
eh
yes sir

because you can’t you can’t draw eight kilometers in your book

look look look look [code-switches] I said to you [code-switches] when
you do [code-switches] in a science problem it’s either you do it one scale
drawing scale drawing then here you have a scale which you say something
something is equal to something then you draw that drawing according to
the scale you have drawn then I said number two you can still get the same
answer here if you have an answer here you still have the same answer here
by making a calculation by making a calculation in the case of a calculation
I said there is no need for a scale drawing no need for a scale drawing
but there must be a drawing there must be a drawing the drawing need
not be a scale drawing that’s why [code-switches] I said here is a small
[code-switches] a small drawing the drawing need not be a scale drawing it
will help you to solve the problem mathematically but you look at the
drawing and you solve it mathematically so I don’t need any scale drawing
there but I need what a drawing that depicts exactly how the person ran

ACTIVITY STRUCTURE: ‘going over the homework’[1]; ‘boardwork’ [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant
displacement; ‘calculation’)
2.11E  L1  the person ran eight kilometers east
2.12E  T  yes you know there is my ruler
2.13E  L1  he ran six kilometers north [chalkboard (3)]

ACTIVITY STRUCTURE: ‘interruption’[1] two; ‘going over boardwork’ [1]; ‘IRF’
‘microgenre’ [3]
FIELD [2]:
Key utterance: ‘your drawing must actually depict at least be close to what is actually
happening’
7.1E  T  before you go further do you think that’s a very nice drawing
7.2E  L  no sir
7.3E  T  why
7.4E  L  because [unclear] have no direction
[code-switches] okay but okay fine yes
because the vectors look like they are equal
the vectors look like they are equal the vectors look like they are equal you
know your drawing must actually depict at least be close to what is actually
happening that’s better now eight kilometers east what longer than what six
kilometers [chalkboard (4)]

ACTIVITY STRUCTURE: ‘going over the homework’[1]; ‘boardwork’ [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant
displacement; ‘calculation’)
we used the theorem of Pythagoras $r = x + x^2 + y^2$
[schalkboard (5)]

ACTIVITY STRUCTURE: ‘interruption’ [1] three; ‘going over boardwork’ [1]; ‘IRF’
‘microgenre’ [3]
FIELD [2]:
The theorem of Pythagoras: $R^2 = x^2 + y^2$

[code-switches] [the teacher leaves the classroom to talk to a learner from
another class]

ACTIVITY STRUCTURE: ‘going over the homework’[1]; ‘boardwork’ [1] cont.
FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant
displacement; ‘calculation’)
eight kilometers squared plus six squared equals is equal to now we’ve got
the magnitude we want the direction so we say $\tan \theta = \frac{6}{8}$
eight is equal to zero point seven five is equal to theta is equal to tangent is

\[ 8 = \frac{6}{8} = 0.75 \]

\[ \theta = \tan^{-1} 0.75 = 37^\circ \]

degrees [chalkboard (6)]

[the teacher returns to the classroom]

\[ R^2 = x^2 + y^2 \]

\[ R = \sqrt{100} = 10\text{km} \]

\[ R = (8)^2 + (6)^2 = 64 + 36 = 100 \]

\[ \tan \theta = \frac{6}{8} \]

\[ \theta = \tan^{-1} 0.75 = 37^\circ \]

direction = \( 90^\circ - 75^\circ \)

\[ R = \sqrt{100} = 10\text{km} \]

\[ R = (8)^2 + (6)^2 = 64 + 36 = 100 \]

\[ \tan \theta = \frac{6}{8} \]

\[ \theta = \tan^{-1} 0.75 = 37^\circ \]

direction = \( 90^\circ - 75^\circ \)

\[ R = \sqrt{100} = 10\text{km} \]

\[ R = (8)^2 + (6)^2 = 64 + 36 = 100 \]

\[ \tan \theta = \frac{6}{8} \]

\[ \theta = \tan^{-1} 0.75 = 37^\circ \]

direction = \( 90^\circ - 75^\circ \)

\[ R = \sqrt{100} = 10\text{km} \]

\[ R = (8)^2 + (6)^2 = 64 + 36 = 100 \]

\[ \tan \theta = \frac{6}{8} \]

\[ \theta = \tan^{-1} 0.75 = 37^\circ \]

direction = \( 90^\circ - 75^\circ \)

\[ R = \sqrt{100} = 10\text{km} \]
seven from ninety why do we subtract thirty seven from ninety why yes

to get that angle which angle yes [unclear] to get what why do we subtract thirty seven from ninety yes to get the value of theta but we already eh he but we already calculated the value of theta thirty seven degrees why do we subtract the thirty seven degrees from ninety yes because we want that angle there okay what name the angle [unclear] theta thirty seven degrees why then show us go to the board and show us [Xhosa] you see yes [code-switches] [Xhosa] yes why


FIELD [2] (Right-angled triangles; the magnitude and direction of the resultant displacement; ‘calculation’)

I never said that we never said that why do subtract the thirty seven from ninety theta here theta here we know is thirty seven degrees why do we subtract this thirty seven from ninety


it’s May it’s May it’s May month and we are struggling getting through that that thing
there why you know why do we subtract thirty seven from ninety what is
the magnitude of the resultant of eight kilometers and six kilometers what is
the magnitude of the resultant of eight kilometers and six kilometers what is
the magnitude of the resultant of ten eight kilometers and six kilometers
ten kilometers
it is ten kilometers that is that is only the magnitude now what is what else
is missing in this magnitude because the resultant vector there ne is is is
having a magnitude of what of ten kilometers what is missing now in this
ten kilometers
direction
it is direction how do we get direction yes
ninety degrees minus thirty seven degrees
why do we do that how do we measure direction how do we measure
direction how did I show you
you take your protractor sir
yoh we always measure our direction from the north we always measure
from the north how this is east this is west we always measure from the
north whether you calculate it or use a protractor any hey [code-switches]
we now know that this angle ne [code-switches] now what do call the
direction that moves this way clockwise of a vector what word did we use
when we measured the angle from nought degrees clockwise what word did
we use to indicate the angle that we measured from north to you know if
you go clockwise yes
opposite direction
[code-switches]
opposite direction
opposite direction what’s that yes
the bearing
the bearing we used the bearing we measured from here we we found out the vector I say it had a bearing of what [code-switches] it’s a bearing of what of fifty three degrees this vector hey that vector hey that vector [code-switches] a resultant has a bearing of what of fifty three degrees we meas we subtract this thirty seven degrees from this ninety to get the bearing [code-switches] that is ninety that’s ninety that’s why to get the direction the bearing and that is why there ne we say the displacement is what now once I say displacement it means the total vector is what is one hundred kilometers at a bearing of [code-switches] at fifty three degrees [chalkboard (8)/(9)]

ACTIVITY STRUCTURE: ‘lecture’ [1]

[chalkboard (8)/(9)]

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Vectors):
Vector (definition): ‘a vector is a physical quantity which has magnitude and direction’
Magnitude
Keywords: size, unit
Direction
Keywords/ phrases: ‘four cardinal points of a compass’; ‘clockwise’/ ‘anticlockwise’; ‘lies on a bearing of 60°’ / ‘lies at 60°’/ ‘Boat N 60° E’; ‘to bisect’; ‘point of reference’/ ‘frame of reference’

what is a vector
a vector is a physical quantity which has magnitude and direction

...
what yes
[unclear]
magnitude only is what how now give me an example of a magnitude give me an example of a magnitude only a vector is magnitude is any quantity any quantity which has magnitude and direction but magnitude alone can be what give me an example of anything with magnitude only yes scalar okay okay now I’m not asking scalars here ne I’m saying how else can you write magnitude two things two things must be there to make the word you know the word magnitude two things must be there to make the word magnitude is made up of what two things magnitude is made up of two things what and what [name] size and unit [code-switches]
size plus unit ten size unit ten kilometers so [code-switches]
speaking of magnitude but once I now include direction direction let’s now begin where now this one then I have what the north the east the south and the west those are the four cardinal points of a compass the four cardinal points of a compass
is that difficult is that thing [unclear] hey [chalkboard (10)]
so then I go now if I speak of magnitude only there is no direction here if I speak of what of magnitude but once I now include direction direction let’s now begin where now this one then I have what the north the east the south and the west those are the four cardinal points of a compass the four cardinal points of a compass
this I dealt with [code-switches] February
ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Vectors)
12.30E T  four cardinal points of a compass now this is north direction [code-switches]
12.31E now in terms of degrees for our compass what is nought sorry north
12.32E Ls  zero degrees
12.33E T  zero degrees and east
12.34E Ls  ninety degrees
12.35E T  ninety degrees and south
12.36E Ls  one eighty degrees
12.37E T  and west
12.38E Ls  two seventy degrees [chalkboard (11)]
12.39E T  we always measure clockwise in science to get the [unclear]

ACTIVITY STRUCTURE: ‘review’ [1]; ‘teacher monologue’ [1]
FIELD [2]
Key utterance: ‘move this way…anticlockwise in mathematics’
15.1E T  but in mathematics you can still have the very same four cardinal points but
15.2E in mathematics we like to do it this way [code-switches] in trigonometry we
15.3E move from here and say our starting point is here therefore it is now zero
15.4E and move up this side so our points move this way north and this way means
15.5E anticlockwise in mathematics but it will still nought even there nought
15.6E it’s where I start I start from here it’s my point of reference it’s my frame of
15.7E reference take a note of these things a person is actually four steps to the
15.8E right and five steps in front [code-switches] [chalkboard (12)]
15.9E Ls  yes

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Vectors)
12.40E T  then we went on now from here and said how do you draw a vector or
12.41E direction we said okay let’s have a look at this one now this is east this is
north this is south this is west now if you have a vector if you have a person or a a boat here [code-switches] there is a boat at point a [chalkboard (11)]

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (‘the everyday’ – ‘in the news’)

now [unclear] the one in P E now I’m sure have you heard of that boat

yes

which one [code-switches]

[Xhosa]

there is a boat almost what south east of what of Port Elizabeth it’s crew members all drowned [code-switches] there it’s all science in your news eh direction south east of Port Elizabeth yes that’s where it is now here is your direction south east of Port Elizabeth yes that’s where it is now here is your [code-switches] north east west south so the boat is somewhere here it’s almost what south east [chalkboard (13)] so direction is important

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Vectors)

now we then said if we had a boat placed at that point there you measure from here and say okay ne boat let’s say sixty degrees here ne [chalkboard (14)] so the boat lies the boat lies at or on a bearing of sixty degrees that’s what we said that’s what we said if the boat lies here now on its bearing [unclear]

ninety degrees

ne

ninety degrees

on a bearing of what of

ninety degrees

T [code-switches] if the boat is now here it’s lying where now
one eighty degrees

on a bearing of what of

one eighty degrees

now if the boat if the boat lies in between [chalkboard (16)] if the boat lies
now in between what east and what and north what is what is this angle if
this line is a line bisecting do you know the word bisecting uh you did
mathematics in grade nine to bisect what do you mean to bisect do you
know

yes to have two sections

yes okay okay to bisect to have two sections to have two sections that in this
case when you speak of a particular bisector that means this line joins this
other line that angle is what is ninety degrees that’s what you did in
mathematics when we use mathematics [chalkboard (15)] here now if if if
this vector is a line bisecting this angle then this side is what forty five
degrees and this side is then what fourty five degrees [code-switches] now
this lies on a bearing of what of

forty five degrees

[chalkboard (16)] [code-switches] now sometimes we lose
out or we neglect what the bearing and we say it lies at sixty degrees lies at
forty five degrees and then we say eh this is ten kilometers at forty five from
degrees [chalkboard (16)] you know once it’s like this we have measured
the north clockwise forty five degrees let’s say there is a boat here and here
you have got fifty degrees

what is the bearing of the boat what is the bearing of the boat what is the
bearing of the boat [code-switches] you must measure from where [code-
switches] you take the bearing you know when you measure the bearing of a
vector from where do you measure

from the north

from the north from the north you measure from the north and you move in

which direction

clockwise

in a
clockwise

why do say then that this boat lies at direction thirty degrees yes

one fifty degrees

one

one hundred and fifty degrees

how do you get that

because from north to east it’s ninety degrees

from north to east it’s ninety degrees

plus sixty degrees

plus sixty you know you know degrees if you subtract thirty

from ninety you get what sixty here so total from north to there is one fifty

degrees [chalkboard (16)] that is what we meant by what a vector a

vector has magnitude and what direction then [code-switches] take the

direction as points in a compass what a bearing [chalkboard (10)] and we

said bearing is the one that we normally use although there are other

methods frame of reference and I have shown you that bearing of what of

sixty degrees I’ve shown you that a bearing [code-switches] of sixty degrees

a bearing the bearing from here is sixty degrees that point there that’s north

it’s east it’s south it’s west the point the boat there is the boat [code-

switches] the boat lies [chalkboard (17)] where is our frame of reference

where is our frame of reference [code-switches]

ACTIVITY STRUCTURE: ‘interruption’ – teacher admonition
I’m only teaching one person because this girl and this girl are not here.

**ACTIVITY STRUCTURE:** ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Vectors)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.1E</td>
<td>T</td>
<td>I’m only teaching one person because this girl and this girl are not here</td>
</tr>
<tr>
<td>12.121E</td>
<td>T</td>
<td>yes</td>
</tr>
<tr>
<td>12.122E</td>
<td>L</td>
<td>the frame of reference is north</td>
</tr>
<tr>
<td>12.123E</td>
<td>T</td>
<td>it’s north so I put down my north in this case I put down my north and then</td>
</tr>
<tr>
<td>12.124E</td>
<td></td>
<td>what do I have to do now yes</td>
</tr>
<tr>
<td>12.125E</td>
<td>L</td>
<td>sixty degrees</td>
</tr>
<tr>
<td>12.126E</td>
<td>T</td>
<td>you move sixty degrees yes</td>
</tr>
<tr>
<td>12.127E</td>
<td>L</td>
<td>east</td>
</tr>
<tr>
<td>12.128E</td>
<td>T</td>
<td>you know why east why you have moved [code-switches] you have</td>
</tr>
<tr>
<td>12.129E</td>
<td></td>
<td>moved you have moved sixty degrees to the east to the east that is another</td>
</tr>
<tr>
<td>12.130E</td>
<td></td>
<td>way of what of expressing that [chalkboard (17)] but [code-switches] north</td>
</tr>
<tr>
<td>12.131E</td>
<td></td>
<td>sixty degrees east east [code-swiches] at sixty degrees I know you have</td>
</tr>
<tr>
<td>12.132E</td>
<td></td>
<td>already measured from what</td>
</tr>
<tr>
<td>12.133E</td>
<td>Ls</td>
<td>north</td>
</tr>
<tr>
<td>12.134E</td>
<td>T</td>
<td>from north and you have moved towards the east</td>
</tr>
</tbody>
</table>
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Lemke, 1993/ [1]
- TEXT 3: Wells, 1999/ [3]
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

ACTIVITY TYPE: ‘testing’ [1]
FIELD [2]:
Symbol for the physical quantity and unit – force, weight, velocity, distance, displacement, mass, acceleration due to gravity, work, time, power
1.1F T symbol for the physical quantity symbol for the unit number one is force
1.2F force weight velocity distance or displacement distance or displacement
1.3F where is your jotter don’t waste full scap it costs money mass mass
1.4F acceleration acceleration acceleration due to gravity acceleration due to
1.5F gravity work work time number nine is time two four six eight nine nine
1.6F number ten power any more

ACTIVITY TYPE: ‘classroom business’ [1]
2.1F T okay files here tomorrow one two three four
2.2F Ls [unclear]
2.3F T actually that you’re right that is fair I started [unclear]
2.4F Ls yes
2.5F T you four files tomorrow
2.6F Ls [unclear]

ACTIVITY TYPE: ‘lecture’ [1]
3.1F T ladies keep your files properly all the time it shouldn’t be you should be
3.2F able to produce it any time and I can tell you that it does not have to have
3.3F what you’re working on at present because that should be in your
traveling file that you bring to school with all your other subjects

<table>
<thead>
<tr>
<th>ACTIVITY TYPE: 'going over the test dialogue' [1]; ‘IRF’ ‘microgenre’ [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1F T</td>
</tr>
<tr>
<td>4.2F L</td>
</tr>
<tr>
<td>4.3F T</td>
</tr>
<tr>
<td>4.4F L</td>
</tr>
<tr>
<td>4.5F T</td>
</tr>
<tr>
<td>4.6F L</td>
</tr>
<tr>
<td>4.7F T</td>
</tr>
<tr>
<td>4.8F L</td>
</tr>
<tr>
<td>4.9F T</td>
</tr>
<tr>
<td>4.10F L</td>
</tr>
<tr>
<td>4.11F T</td>
</tr>
<tr>
<td>4.12F L</td>
</tr>
<tr>
<td>4.13F T</td>
</tr>
<tr>
<td>4.14F L</td>
</tr>
<tr>
<td>4.15F T</td>
</tr>
<tr>
<td>4.16F L</td>
</tr>
<tr>
<td>4.17F T</td>
</tr>
<tr>
<td>4.18F</td>
</tr>
<tr>
<td>4.19F</td>
</tr>
<tr>
<td>4.20F</td>
</tr>
<tr>
<td>4.21F L</td>
</tr>
<tr>
<td>4.22F L</td>
</tr>
<tr>
<td>4.23F T</td>
</tr>
<tr>
<td>4.24F L</td>
</tr>
<tr>
<td>4.25F T</td>
</tr>
<tr>
<td>4.26F</td>
</tr>
<tr>
<td>4.27F</td>
</tr>
</tbody>
</table>
small g remember \( w = m \cdot g \) it’s the \( g \) um so number what is it \( 6 \) is \( g \) and \( m \) to the minus two okay um work yours

capital \( w \) capital \( j \)

capital \( w \) capital \( j \) is good well done uh time

small \( t \) small \( s \)

small \( t \) small \( s \) is good well done power

capital \( p \) capital \( w \)

well done count out of twenty twenty well done you two nineteen that’s
good eighteen still good seventeen sixteen less than sixteen are you happy

now

yes

talk to me about the ones you got wrong if you’re not happy okay

ACTIVITY TYPE: ‘going over the homework’ [1]; ‘groupwork’ [1]

FIELD [2];

S.I. Units

Force diagrams

Equations:

\[ W = m \cdot g \]

\[ F_{\text{res}} = m \cdot a \]

\[ F_g = m \cdot a_g \]

okay take out your worksheets from last night girls right now listen aye

let’s have you listening I’m still waiting for some ladies right in your
groups your same groups remember fours so swing round so you’re in your
groups this is not practical so you only need four and wait wait wait till I
tell you what you’ve got to do you then look at your answers now I’m not
giving you the answers you’re going to look at the answers and see for
example that these four all have three each one if they don’t agree
between them they’ve got to sort out amongst each other which answer
they think is correct and why I’ll give you a few minutes to do that when
you’ve done that then I’ll go through just to check that all of us have got
the correct answers right swing round into your groups

ACTIVITY TYPE: ‘going over the homework’ [1]; ‘IRF’ microgenre’ [3]
FIELD [2]:
S.I. Units
force diagrams
Equations:
\[ W = m \cdot g \]
\[ F_{\text{res}} = m \cdot a \]
\[ F_{\text{g}} = m \cdot a_{\text{g}} \]

right ladies let’s swing round into your own seats again and let’s go
through the answers come that group
um zero point zero zero one k gs
how many zero comma how many zeros
two zeros I got
nought nought one correct keep going because we’re only on number one
that group
zero point zero two five k gs
correct
zero point four eight five k gs
correct
one comma nought three eight k gs
correct please note that you must have those k gs on your answers keep
going next group
thirty newtons
correct
one hundred and fifty newtons
T  correct

L  one thousand two hundred and fifty newtons

T  correct

L  nought comma three eight newtons

T  nought comma three eight newtons is correct well done number three

L  sixty newtons

T  six o newtons correct

L  three hundred and fifty newtons

T  correct [name]

L  um nought comma four nought newtons

T  correct

L  fourty seven newtons

T  correct number four we’re on

L  zero comma five kilograms

T  correct

L  two comma eight kilograms

T  correct at the back

L  thirty two kilograms

T  correct

L  zero comma zero zero one kilograms

T  how come you’ve suddenly gone back there

L  she’s in our group and [name] is not here

T  oh okay alright right number five have you done one

L  eighteen newtons

T  eighteen newtons is good number six a

L  a stays the same

T  the mass is unchanged is everybody happy

Ls yes

T  okay the weight [name]
6.47F L um it decreases
6.48F T the weight decreases everybody alright
6.49F Ls yes
6.50F T because your acceleration due to gravity that little g that we know is ten m
6.51F L it decreases
6.52F T decreases well done okay onto number seven
6.53F L four m s to the minus two
6.54F T four m s to the minus two is good um number eight
6.55F Ls [unclear]
6.56F L2 [unclear]
6.57F T uh how have you numbered yours one two three four five six seven nine
6.58F L2 [unclear]
6.59F T next time check that you’ve got it what is it
6.60F L two k gs
6.60F T two k gs is good

**ACTIVITY TYPE:** ‘boardwork’ [1]; ‘going over boardwork’ [1]

**FIELD [2]:**

**Force diagrams**

7.1F T right number nine are you going on the board please nine
7.2F a nine b on the board you can do nine c you haven’t done one in this
7.3F group yet you’re doing nine c on the board and we’re back again you’re
doing nine d on the board please put a b c d right along and I have seen
7.5F some of these ladies that are not labeled without labels they are going to
7.6F be wrong you have got to have an arrow approximately the right length
7.7F and a label you don’t have to label the ones that are already there just the
7.8F ones that you’ve selected [chalkboard (1)] right let’s go through if you
7.9F look at ‘a’ what you were given was the force of the girl on the object and
7.10F the force of the earth on the object you were told these objects are
7.11F stationary which means there must be no resultant force so first of all you
7.12F know that you must balance the force of the earth and you must balance

(1)
the force of the girl pulling the object right what balances the force of the earth is the force of the surface on the object and what balances her pulling is the friction between the object and the surface so it’s the force of friction okay everybody happy there

arrows should look approximately the same size they must have arrowheads on and they must be labeled okay look at ‘b’ what you were given for ‘b’ was the force of the earth on the object in other words the weight of the object it wasn’t being pulled by a girl it is stationary so you do not need any horizontal forces to balance the force of the earth is the force of the surface so these good who put horizontal forces into ‘b’ you didn’t need them okay um ‘c’ the two horizontals were in now do you need the verticals

yes because the earth is there the earth is pulling down on this object so the force of the earth on the object the force of the surface on the object balancing the force of the earth and then the last one you were given the force of the surface and you were given the friction remember what we said about friction it acts in the opposite direction to the motion so something must have been pulling it this way so she’s called it the force of the girl on the object which is quite fine if you want to put a force of a motor vehicle or a force of a boy or whatever that’s also fine and then to balance the force of the surface you must balance the force of the earth the weight of the object okay well done all those ladies that’s good
ok last one um who did we get up to who hasn’t done one on the board in that back group one two three on the board did you do one no okay ‘a’ ‘b’ ‘c’ no she’s doing ‘a’ [name]’s doing ‘a’ you’re doing ‘b’ she’s doing ‘c’ rub theirs off and put ‘a’ ‘b’ or ‘c’ [name] rub that bit off there please put your letters ladies ‘a’ ‘b’ or ‘c’ [chalkboard (2)] listening to the girls at the board this one probably caused more problems than any of the others right let’s talk about it while they’re drawing the object has got to be accelerating to the right so first of all the vertical forces don’t go away so there is the force of the earth on the object and the force of the surface on the object right they’re there then it’s accelerating to the right so there must be a force of something pulling it to the right the force of the girl pulling it or whatever to the right then there’s likely to be some friction to the left but it’s accelerating right so there must be a resultant force to the right so the right hand side must be longer than the left hand side get it that’s looking good [name] now you need your verticals right look at ‘c’ look at ‘c’ it’s finished stationary on the table the weight is still there the force of the earth on the object is still there and the force of the surface to balance that weight is still there and nothing to the right so there is no resultant force so it is stationary on the table so ‘c’ is good um right let’s talk about ‘b’ ‘b’ was going to the left now here’s where the catch comes in it was going at a constant velocity that means there is no resultant force so if it’s going at constant velocity it’s almost like it’s stationary in terms of the forces so this force should be the same length as the force of friction [chalkboard (3)] the force of the girl pulling the object has got to be the same length as the friction right the verticals are still there so the verticals are good now it’s constant velocity ladies you are in a car you...
are on a motorway going to Port Elizabeth and you are sitting there at a hundred and twenty kilometers per hour constant velocity going in a straight line towards Port Elizabeth there is the force of the engine driving the car forwards and there is the force friction between the tyres and the tar and the friction in the engine there’s a lot of friction going in the opposite direction the friction is balancing the force of the engine driving the car forwards only when you want to break the speed limit and go from a hundred and twenty to a hundred and forty do you have to press the accelerator and make the forward force bigger than the frictional force backwards and then you are accelerating not going constant velocity at there is a resultant force so very important stationary or constant velocity no resultant force maybe write that somewhere near number ten stationary or constant velocity no resultant force it doesn’t mean there’s no force there are forces there’s no resultant force they are balanced

L they are balanced forces well done right then let’s look at ‘a’ the object is accelerating to the right so something is pulling it to the right so she’s got a girl pulling the object to the right okay her verticals are balanced please remember to make sure your forces touch so make them touch the object okay and try and make them the same length hers are more or less the same length right so her verticals are fine her horizontal it’s going to the right accelerating so there’s got to be a resultant force to the right so she’s put her friction quite correct it’s to the left this arrow must be shorter than that arrow to indicate that there is a resultant force to the right everybody happy with that

Ls yes

T yes

Ls yes

T right put your homework away you may now put it into your files at home
ACTIVITY TYPE: ‘IRF’ ‘microgenre’ [3]
FIELD [2]:
Formula:
\[ E_k + E_p = \text{mechanical } E \]
Key terms/ utterances:
- ‘gravitational potential energy’; ‘potential energy’; ‘stored energy’
- ‘kinetic energy’; ‘energy due to movement’
- ‘mechanical energy’
- ‘energy is transferred’; ‘transformed’; ‘changed from one form into another’

right the last thing we are going to talk about in the mechanics section it’s getting quite hot in here today right the last little bit that we do in the mechanics section is a little bit more than you did last year about energy hopefully last year you learnt several different forms of energy did you yes maybe not last year maybe grade eight yes okay grade seven eight nine it doesn’t matter the different forms of energy things like heat energy and sound energy and light energy and electrical energy chemical energy right the two we are going to talk about cause this is a mechanics section the two we are going to talk about is potential energy and kinetic energy right now let’s be more specific we are going to talk about gravitational potential energy now remember you are doing your own notes for your own sakes so subheading would be energy and then we are going to talk about gravitational potential energy remember some of you put your notes into rough and then put them into no neat others of you go straight into neat it’s up to you some people write nothing they know it already that’s not a problem if you know it already they’re your notes you are learning to keep notes one of your skills right
can anybody remember another similar name for potential energy

L3 still energy

T say that loudly what was it

L3 still energy

T not still it begins with an s though s t

Ls stored energy

T stored energy

L3 oh yes

T right now you can get stored in terms of things like a spring all of you

think of a spring when a spring is pushed in tight it’s got the potential to

Ls expand

T expand and spring out hasn’t it right you lot have all got the potential to

pass matric to develop your grey cells to do well in life you’ve all got the

potential it doesn’t mean you’re all going to that’s up to each and

everyone one of you hopefully each and everyone of you are going to but

you’ve got the potential right now gravitational potential energy you can
define it as energy due to height specifically so like the energy in a spring

wouldn’t come under gravitational potential energy okay gravitational

potential energy is energy due to height the other way of talking of

potential energy when you were in grade nine is position sometimes you

may have used that word energy due to position but what we’re going to

think of this year is energy due to height cause it’s got the gravity bit in

um where’s that okay here’s her eraser is it moving

Ls no

T what sort of energy did it have up there

Ls potential energy

T gravitational potential energy

Ls oh

T okay you can just call it potential energy but bear in the back of your minds

that it’s gravitational potential energy energy due to height so it’s got the

potential to do what
to fall down alright water at the top of a waterfall has (gravitational) potential energy alright anything that is at a height compared to something else alright has got potential energy okay now what about the second one we’re going to [unclear] which is kinetic energy kinetic energy is what sort of energy [unclear] energy due to movement right as soon as there’s movement there is kinetic energy and then together what are gravitational potential energy and kinetic energy called (yoh gravitational potential kinetic energy) some strange names coming out of here today kinetic energy and potential energy together make mechanical energy [chalkboard (4)] right let’s think again about the water at the top of a waterfall and it’s going to fall down you can’t lose or gain energy it gets transferred some books say transformed some books say changed I don’t mind which word you use it can get changed from one form to another so for the water for the waterfall or her eraser it started with potential energy what in the end changed into kinetic energy it got faster and faster as it went down okay there was movement and there was more and more movement alright mechanical energy at the top let’s think about the mechanical energy at the top was it [unclear] kinetic or potential the top don’t put your eraser away we’re using this eraser alright at the top here is it moving no
so the mechanical energy is all potential halfway down so it’s going from there to the desk halfway down half will be kinetic and half will be potential

potential and at the bottom now it’s got no potential it’s not going to fall any further all the mechanical energy is kinetic energy

kinetic energy the table is going to stop it think of examples tonight please I’m going to ask you for examples tomorrow off you go ladies
ACTIVITY TYPE: ‘testing’ [1]
FIELD [2]:  

**Force diagram**

**Weight**

**The force of the earth**

1.1G  T  number one I want a force diagram for this stapler which I am pushing towards the south 
1.2G  T  force diagram for that stapler and I am pushing it towards the south it’s not moving it’s not moving look at it one two three 
1.3G  T  four files tomorrow hey don’t forget your arrows and your labels number two 
1.4G  T  what is the weight of a two kilogram object what is the weight of a two kilogram object what is one word for the force of the earth on an object one word for the force of the earth on an object one word for the force of the earth on an object four the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.5G  T  you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.6G  T  object one word for the force of the earth on an object one word for the force of the earth on an object four the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.7G  T  force of the earth on an object number four the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.8G  T  you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.9G  T  object one word for the force of the earth on an object one word for the force of the earth on an object four the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 
1.10G T  object one word for the force of the earth on an object one word for the force of the earth on an object four the force of the earth acts on you does it pull you or does it push you the force of the earth acts on you does it pull you or does it push you 

**ACTIVITY TYPE: ‘going over the test dialogue’ [1]; ‘IRF’ ‘microgenre’ [3]**

2.1G  T  right let’s start here today [chalkboard (1)]
2.2G  Ls  [unclear]
2.3G  T  hey here here here let’s go tell me one force that you’ve got
um the arrow goes up [chalkboard (2)]
and what have you labeled it
um force of the surface
force of the surface on the object well done okay one mark you’ve got to
have an arrow you’ve got to have labeled force of the surface on the
object another force you’ve got
of approximately the same size please and labeled
force of the earth on the object
force of the earth on the object well done another one
arrow to the left
force of friction well done [chalkboard (4)] and
arrow to the right
approximately the same size please [chalkboard (5)]
force of [name]
[name] force of [name] on stapler or whatever force of person on object I
was pushing that way hey
yes
but what if you drew your arrow on the back
if you did this right question [chalkboard (6)] if you did this that’s alright
it’s same thing hey okay then your friction your friction you could have
done your friction like that [chalkboard (7)] or you could have done your
friction like that [chalkboard (8)] it doesn’t matter hey okay either’s good
it is exactly the same thing remember there’s lots of alternatives which
mean exactly the same thing in science okay so there’s four marks there
ladies right um next one two k gs force of the earth on a two k g body
twenty
twenty newtons how did she do that she said w equals m g w equals two
times ten which equals twenty then she thought about her units twenty
newtons to make your answer even better twenty newtons down but

you don’t have to do that at the moment twenty newtons one mark another

word for the force of the earth

gravity

no because we would have to say force of gravity remember I said to you
don’t ever just say gravity either say force of gravity or acceleration due
to gravity and you haven’t told me in saying gravity whether you mean
you mean force of gravity or whether you mean acceleration due to
gravity and I said one word so I’m not going to take gravity it’s kind of
it’s partially alright there but it’s not good enough next [name]

L

weight

T

weight’s good weight is what I was looking for force of gravity is right
but it’s not one word okay weight is um [name] the earth does what to you
it pulls you

L

the earth so so don’t do that to show me it pulls you down yes the earth
pulls on you it does not push you up I can’t tell you how many times I’ve
seen exam papers with arrows pointing up for the force of the earth which
is obviously not you know if I drop my pen what does it do it goes down
the earth pulls on it right four five six seven it’s out of seven add it up
hands up seven well done six good five four less than four were you
asleep yesterday are you awake today do you understand

ACTIVITY TYPE: ‘review’ [1]
FIELD [2]:
Formula:
\[ E_k + E_p = \text{mechanical } E \]
Key terms/utterances:
- ‘kinetic energy is energy due to movement’
- ‘gravitational potential energy is energy due to height’
- ‘if energy does not get lost potential energy changes into kinetic energy when
something falls from a height’
right we were talking about mechanical energy yesterday and we basically said mechanical energy is the total together of your potential energy and your kinetic energy \( E_{\text{mechanical}} \) and we said kinetic energy was energy due to movement and we said potential energy you’re talking about gravitational potential energy and that is energy due to height now if energy does not get lost when something falls from a height and no energy is lost then your potential energy changes into kinetic energy

\[ E_k + E_p = E_{\text{mechanical}} \]

so I’ve got a nice transparency here that I found sometime ago in a book I used to be in charge of diving and I always liked this part of the book it is an American book hence they call it P E and K E instead E subscript p and E subscript k obviously it’s the same thing okay and there is somebody diving right and there is what they are diving into it was very nice because I used to have the diving captain was nearly always in the class so [unclear] in Matric that was doing this because this remember you’ve got change in syllabus and you’re doing a simplified version of what used to be done in Matric here and it always happened to be done in diving season and so it was a very nice thing there is the person diving into a bucket and I always used to have to tell the diving captain that it would knock some brains into him
right let’s have a look at it what sort of energy is a person got at the top got potential
potential energy and they say the potential energy is ten thousand joules
and the kinetic energy the person is not yet moving is nought is everybody
happy with the units for energy joules okay work and energy both have
the same units joules because energy is the ability to do work right then
the person dives at the bottom he’s no longer got any height so he’s
potential energy is now nought and all his potential energy has changed
into kinetic energy now we come to halfway there’s halfway halfway
down he loses height basically because it is halfway down and it is in
proportion to the distance of the ten thousand joules five thousand of
those joules are potential energy that changes into kinetic energy so now
that person has five thousand joules of potential energy and five thousand
of kinetic if we look only a quarter of the way down think about a quarter
and three quarters of ten thousand a quarter is two thousand five hundred
three quarters is seven thousand five hundred everybody happy there now
where you have to be careful with this is you must think is it above
halfway or is it below halfway the moment we’re looking above halfway
above halfway the potential energy must be bigger than the kinetic energy
cause he’s still high up this person is still high up so of those three
quarters is the potential one quarter is kinetic everybody happy with how
it’s divided up then we go down we’ve now got three quarters of the way
down if you look there the division in terms of the distance is still three
quarters and one quarter so in terms of the energy it is three quarters and
one quarter so it’s your seven thousand five hundred and your two
thousand five hundred again but now look at the difference this time he’s
nearer the bottom so the big bit the three quarters is kinetic energy and the
one quarter is potential energy everybody happy there so it’s divided in
proportion to the distance remembering that the biggest portion you’ve
got to make a decision is it kinetic or is it potential if it’s above halfway

<table>
<thead>
<tr>
<th></th>
<th>PE (J)</th>
<th>KE (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7500</td>
<td>2500</td>
</tr>
<tr>
<td>1</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>2</td>
<td>2500</td>
<td>7500</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>10000</td>
</tr>
</tbody>
</table>

(10)
the biggest portion will be potential if it’s below halfway the biggest portion will be kinetic now let’s look at the mechanical energy hands up those who can tell me what the mechanical energy is at the top ten thousand aye where’s your hand [name] ten thousand everybody happy yes how did she find that she said potential plus kinetic is ten thousand plus nought makes ten thousand joules okay what is the mechanical energy sleepy head at the back the mechanical energy at the bottom at like right at the bottom right at the bottom here ten thousand everybody happy yes right now go halfway uh at the back right on the in the middle there uh ten thousand joules ten thousand joules everybody happy mechanical energy is still ten thousand joules right let’s go three quarters of the way down what is the mechanical energy ten thousand everybody happy

**ACTIVITY TYPE:** ‘IRF’ ‘microgenre’ [3]

**FIELD [2]:**
- Units for energy
- Formula:
  \[ E_k + E_p = \text{mechanical } E \]
Key terms/ utterances:
- ‘kinetic energy is energy due to movement’
- ‘gravitational potential energy is energy due to height’
- ‘if energy does not get lost potential energy changes into kinetic energy when something falls from a height’

right a brick falls off a scaffolding here is the ground and it’s going for forty five metres here’s the brick it’s going to fall the brick has three hundred joules of mechanical energy okay three hundred joules of mechanical energy [chalkboard (11)] now we’re going to do a whole lot of questions um let’s go to the back corner what’s the mechanical energy at the bottom everybody try hey you can write it in your jotters if you want whilst she’s busy thinking

three hundred joules if you are unhappy and don’t see where somebody is getting their answer from please say so loudly so that we can sort out the problem what is the potential energy at the top

three hundred joules next lady coming down that row what is the kinetic energy at the top

nought joules everybody happy I’m going to call these positions A and B [chalkboard (12)] next lady at A what is the mechanical energy

nought joules everybody sorry good question oh they’re fifteen alright right what did I asked you mechanical energy at A [chalkboard (13)]

three hundred joules is good everybody alright

[unclear]
mechanical energy at A not kinetic or potential mechanical the total can
the total change

no

no she didn’t actually for that bit need to ask me the question about the
heights but obviously to do the rest of it we need to know those heights
alright next lady the potential energy at A
two hundred joules
two hundred joules is good everybody alright

[a number of learners talking at the same time]

no no two thirds it’s divided the distance is divided into thirds right so it
has fallen one third of the way its fallen fifteen metres that’s one third
fifteen over forty five is one third okay it’s fallen one third of the way so
your looking at two thirds and one third the big bit is potential so the two
thirds of three hundred is potential okay one third is going to be kinetic
next lady who’s turn is it what’s the kinetic energy of A
one hundred

one hundred joules [unclear] okay let’s go to B mechanical energy of B
three hundred joules
three hundred joules kinetic energy at B
two hundred joules
two hundred joules well done and the potential energy at B

a hundred joules
a hundred joules and at the bottom the mechanical energy
three hundred joules
three hundred joules and kinetic energy [name]

[unclear]

no at the bottom
at the bottom it’s three hundred joules
three hundred joules everybody happy and [name] the potential energy at
the bottom
At the bottom it’s zero. Correct everybody.

**ACTIVITY TYPE: ‘groupwork’**

Alright okay what you’ve got to do now you go into your same groups. Again now you’re doing an assessment task this assessment task is a little bit different you’ve got to devise a question okay on kinetic energy, potential energy and mechanical energy alright the whole thing alright the whole concept okay you’ve got to make up a question worth ten marks it can have like four parts it can have three parts however you like but your group has got to make up a question with a situation you can’t have a diver or a brick because I’ve used the diver and the brick okay you’ve got to make up a situation alright and you’ve got to make up a question that’s going to be worth ten marks in your group and then you’ve got to put that question onto a piece of paper obviously with the answers either underneath or clearly in pencil as against pen or something and you hand it in cause it’s it’s an assessment task alright so swing round into your groups.
**TEXTS USED IN THIS ANALYSIS:**

- TEXT 1: Lemke, 1993/ [1]
- TEXT 3: Wells, 1999/ [3]
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

**ACTIVITY STRUCTURE:** ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Systems in equilibrium – apparatus (1))**

<table>
<thead>
<tr>
<th>Time</th>
<th>Role</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1H</td>
<td>T</td>
<td>[code-switches] good now where were we discussing the last time in my class almost three weeks ago two weeks ago am I right</td>
</tr>
<tr>
<td>1.2H</td>
<td>T</td>
<td>[code-switches] tell me what [code-switches] good let’s start</td>
</tr>
</tbody>
</table>

**ACTIVITY STRUCTURE:** ‘interruption’ – cleaning the chalkboard

<table>
<thead>
<tr>
<th>Time</th>
<th>Role</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1H</td>
<td>T</td>
<td>go clean the board for me please</td>
</tr>
</tbody>
</table>

**ACTIVITY STRUCTURE:** ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Systems in equilibrium – apparatus (1))**

<table>
<thead>
<tr>
<th>Time</th>
<th>Role</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4H</td>
<td>T</td>
<td>let’s see what [unclear] systems in equilibrium systems in equilibrium I think we looked at this</td>
</tr>
<tr>
<td>1.5H</td>
<td>T</td>
<td>systems in equilibrium</td>
</tr>
</tbody>
</table>

[the teacher and a learner set up apparatus (1)]

**ACTIVITY STRUCTURE:** ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD [2] (Systems in equilibrium – apparatus (1))**

**Equation(s):**

\[
F = mg \\
R = F_1 - F_2
\]
1.6H T so that’s approximately level okay now we were discussing something like that there I think I think initially we had something like this no initially I think we had something like this we had something like that and and we had a pulley here sorry we something like that and we had here and we had we had seventy grams and seventy grams eh and and we said the whole thing remains at rest right because I’ve got two the two systems or the whole system is in equilibrium the whole system is in equilibrium I think it’s where we stopped writing things right ne [chalkboard (2)]

1.14H Ls yes

1.15H T and then we removed this one we removed sorry no no you know we kept that one there and we added here what another what another eighty and immediately we saw that the system was no longer were

1.18H Ls in equilibrium

1.19H T in equilibrium the system was no longer in equilibrium the system began to do what to

1.21H Ls accelerate

1.22H T to accelerate which side towards where the bigger mass which is of course here now what makes things to accelerate it is a it is a resultant force so

1.25H T before we got there we first got the force here we said now the force here is what is m g and we said zero point seven zero point seven kilograms

1.27H Ls zero point zero seven
zero point zero seven sorry zero point zero seven kilograms multiplied by ten and we have zero point seven newtons so we have here zero point seven newtons and of course here automatically is what

zero point eight newtons
zero point eight newtons and of course here the resultant is what is $f_1$ minus $f_2$ which is $f_1$ zero point eight minus zero point seven and this becomes zero point one newtons so the resultant is what zero point one newtons and whole thing begins to accelerate towards this side we’ve got a this side a this side we’ve got a now the whole system has the same acceleration the whole system has the same what

acceleration
acceleration [chalkboard (2)] and then we said but how can we keep that thing again [unclear] how can we make it again to be at rest now we added another what another mass piece here we’ve now added another mass piece here and the whole thing changed and became like this the whole thing changed and became like that the whole thing changed and became like this and then we had something like this here we had something like this here so uh sorry seventy grams eighty grams and one hundred which is one newton and of course zero point eight newtons and zero point seven newtons are we alright [chalkboard (3)]

and we and we this this point this point here is where I have forces acting on one point so at this point here at this point here I’ve got forces acting on one point how many forces are acting on that point [apparatus (1)]

three forces
three forces what is their magnitude three forces are acting are acting on on that point now give me the magnitude of those forces yes eh give me the magnitude I’ve got three forces acting on on this point here give me the magnitude of of those forces acting at that point eh yes eh he yes

$F = mg = 0.07 \times 10$

$= 0.7N$

$R = f_1 - f_2$

$= 0.8 - 0.7$

$= 0.1N$

3.1H  
Eh he three weeks of playing

ACTIVITY STRUCTURE: ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Systems in equilibrium – apparatus (1))

1.57H  T  yes
1.58H  L  the zero point seven newton force the one point zero newton force
1.59H  T  yes
1.60H  L  and the zero point eight newton force
1.61H  T  so there are three forces there zero point seven newtons [code-switches]
1.62H  L  zero point seven newtons one newton and what and
1.63H  Ls  zero point eight newtons
1.64H  T  zero point eight newtons you know are actually acting there you’ve got three
1.65H  L  forces acting there and I’ve got zero point seven newtons zero point eight
1.66H  and
1.67H  Ls  one newton
1.68H  T  one newton acting there

ACTIVITY STRUCTURE: ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Systems in equilibrium – a force diagram):
Key terms/utterances:
- ‘experiment’; ‘pair of compasses’
- ‘balanced’; ‘at rest’; ‘accelerated’
- ‘the whole thing [system] shifted’; ‘the whole system would collapse’
- ‘magnitude’; ‘direction’
- ‘resultant’; ‘force acting downwards’; ‘force acting upwards’
- ‘the diagonal of this rectangle’

4.1H  T  alright now what we then did here was to find the resultant now now we
4.2H  then drew something like that we had something like this [code-switches] in
4.3H  our experiment [code-switches]
4.4H  Ls  yes
4.5H  T  right in our experiment we had something like that we had something like
that we had something like that then you made your experiment and then you said there's a force this side a force this side and a force here I've got one newton zero point eight newtons zero point seven the point is acting here and we then wanted to find what the resultant of these two forces and of course it was quite easy because you used what you used your pair of what of your your pair of what of compasses Ls T compasses to get that there and of course again here to get it there I hope I'll be right here then we joined the two then we joined the two I'm lucky not very we joined the two and we found out that the resultant is like that and then I asked you a few questions so this is the resultant of this force and this force mm this line is the resultant of these forces now if this sorry if this is the resul if this line the diagonal of this rectangle is the resultant of these two forces what do you find you actually found that its magnitude is equal to what [chalkboard (4)] yes boy to the one newton force acting downwards L to the one newton force acting downwards T to the one newton force acting downwards we found that it is almost equal here we found out that this force here is also that force there the resultant of these two forces is one newton but these two forces these two forces of eight and seven were balanced by this force remember these two forces they accelerated and needed a a force to balance those force not to accelerate which force balanced them yes 4.28H the one newton force 4.29H the one newton force was used to balance what the resul sorry these two forces but these two forces had a resultant this way so this force is a force that does what that balances what 4.32H [unclear] 4.33H no zero point eight and zero point seven have a resultant of one newton [code-switches] right now these two forces when we did not have this force downwards here this accelerated this way we then put in another force here
to do what

4.37H L to balance the two forces
4.38H T to balance the two forces so this is a force that does what that
4.39H L balances
4.40H T that balances these two forces [apparatus (1)] it is a force that balances we
4.41H actually put a force here of what of of a hundred grams equal one newton
4.42H [chalkboard (5)] and it became it the whole of thing shifted and became like
4.43H this it it made this thing come to rest [chalkboard (3)] it actually made the
4.44H resultant to do what it made the resultant do what yes
4.45H L it made it zero
4.46H T I agree you are quite correct once something is at rest the resultant is
4.47H Ls zero
4.48H T zero the resultant force acting on that thing is zero now now can you give
4.49H can you define this force the force acting downward [apparatus (1)] is a
4.50H force that does what [name]
4.51H L that balances
4.52H T that balances
4.53H L all forces
4.54H T all forces acting at this point now we think there is a point here ne now we
4.55H think you know there is a point here [code-switches] there is a point here
4.56H and I’ve got two forces acting on this point but now suddenly I have now
4.57H [code-switches] this force balances the forces acting on that point
4.58H [chalkboard (5)] why because this force acts in this direction [chalkboard
4.59H (4)] and this one acts in that direction if this force was not here [chalkboard
4.60H (6)] sorry if this force was not there what would be what do you think would
4.61H actually happen yes
4.62H L the whole system would collapse
4.63H T the whole system would collapse [code-switches] right so so this force is a
4.64H force that balances that balances the two forces so this force we found out is
4.65H equal to what
to the resultant force so this force so a force that balances other forces a force that balances other forces must be equal to what to the resultant force to the resultant force so here this force balances the other forces it balances them right it balances them but this force is the resultant now these two forces are equal [chalkboard (4)] now we want to use a special name here to to give you know this force that balances other forces who knows act activity structure: ‘interruption’ – teacher admonition

am I teaching three people here am I teaching three people here it’s very easy for me to say you know get out of here and run back [code-switches]

activity structure: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
field [2] (systems in equilibrium – a force diagram):
key definition/ ‘conditions’:
the equilibrant: ‘the equilibrant is always equal to the resultant force’ and ‘it [the equilibrant] acts in the same straight line as the resultant…but in the opposite direction’

yes [code-switches] yes yes eh he this force is equal to this force let’s now form a new word you know for this force yes equilibrant it’s the equilibrant yes so this is called the equilibrant [chalkboard (4)] it is a force that balances other forces what do we know about a force that balances other forces is that [code-switches] is equal to what to the resultant to the resultant of those two forces what is the second condition of the
equilibrant what is the second thing about you know about the equilibrant
eh one condition is that the equilibrant is always equal to the resultant force

number two [name]

it acts in the same straight line as the resultant

[vector diagram]
it acts in the same straight line as the resultant very good yes

but in the opposite direction

but in the opposite direction very good boy very good in the opposite
direction that’s what the equilibrant is now now now [unclear]

ACTIVITY STRUCTURE: ‘interruption’ [1] – cleaning the chalkboard
clean the board for me please you know this side [unclear]

I’m not teaching only three people [code-switches]

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘micorgenre’ [3]

FIELD [2] (Systems in equilibrium – a vector diagram):
‘Rule’: ‘you can take any vector and put it into the other position as long as you…
don’t change it’s magnitude and direction’

right now earlier I said something about vectors I said something about take
a vector who remembers I said something about direction or position of a
vector do you remember [name]
you said yes you can take any vector and put it into the other position as
long as long as you don’t change it’s direction

very good boy very good you can take any vector and put it into the other
position as long as you keep two things [unclear] what are they

you don’t change it’s magnitude and direction

you don’t change what its direction and

its magnitude

its magnitude

ACTIVITY STRUCTURE: ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Systems in equilibrium – a vector diagram):
A closed figure

8.12H T I’m going to use that knowledge I’m going to take this vector I’m going to
take this vector approximately same direction same direction I’m going to
take this vector [code-switches] this vector approximately direction the
8.15H same yes I’m going to take this vector this one direction I don’t change they
8.16H form what [chalkboard (4, 7)]
8.17H Ls a triangle
8.18H T they form a
8.19H Ls triangle
8.20H T or now what do you call this [chalkboard (8)] I don’t want its name it’s a
8.21H [code-switches] it’s a four sided figure is it open or closed
8.22H Ls closed
8.23H T it’s closed you know I have what a closed figure I don’t want you to say it’s
8.24H a triangle yes I agree it’s a triangle but I want you to get used to what what’s
8.25H the word a closed figure but in this case the closed figure is what is a
8.26H triangle you can have different closed figures like this one it’s also a closed
8.27H figure but not a triangle [chalkboard (8)] right now okay so I’ll call this
8.28H vector force number one I’ll call this one force number two I’ll call this one
8.29H force number three do you follow me do you follow me force one equals
8.30H you know the magnitude zero point seven force two zero point eight force
8.31H Ls yes
8.32H

ACTIVITY STRUCTURE: ‘interruption’ [1]; ‘review’ [1]; ‘IRF’ ‘microgenre’ [3]

FIELD [2] (Systems in equilibrium – apparatus (1)):
Equilibriant(s)

9.1H T right now what is before we come here before we come here how many
equilibrants do you see here how many equilibrants do you see there only
yes [chalkboard (4)]
one
are you sure one yes okay let’s go back now how many equilibrants here
[apparatus (1)] yes how many yes yes how many
[unclear]
why do you say that
[unclear]
this force yes
[Xhosa]
why do you say that
because it they make the object to balance look they balance the object
they balance you know the object now actually what I’m trying to say is that
this point here because we have found out that this point remains at rest so
anyone of those forces balances any other two yes let’s check now [code-
switches] take this one now off and we put this one [unclear] yes you
have a new way of the forces now [apparatus (1)] and the system does not
fall it’s again the system is in equilibrium alright I can take another one now
and I can move it the other way round the other way round now this side
[code-switches] this side now [unclear] there even if I take any one of them
still remains at rest [code-switches] the system is at
rest
rest so any one of those two forces or three forces is the equilibrant of any
other two forces so I’ve got how many equilibrants here
three
I’ve got three equilibrants zero point eight is the equilibrant of what
and what
zero point seven
zero point seven and
and one and zero point seven is the equilibrant of zero point eight and one and one good very good

**ACTIVITY STRUCTURE:** ‘review’ cont. [1]; ‘IRF’ ‘microgenre’ [3]

**FIELD** [2] (Systems in equilibrium — a force diagram):

Resultant (the magnitude and the direction of the resultant):

- **10.1H** \( T \) now fine now I’m going to call this \( f \) one \( f \) one I’m going to call this \( f \) two
- **10.2H** \( T \) I’m going to call this \( f \) three [chalkboard (4)] what is the resultant what is the resultant of \( f \) one and \( f \) two what is the resultant of \( f \) one of \( f \) one and \( f \) two yes
- **10.3H** \( L \) two yes
- **10.4H** \( L \) zero point seven
- **10.5H** \( T \) what is the resultant of zero point sorry of \( f \) one and \( f \) two the resultant yes
- **10.6H** \( L \) it will be one newton
- **10.7H** \( T \) I don’t know now there are no numbers what is the resultant of \( f \) one and \( f \) two two what is the equilibrant of \( f \) one and \( f \) two
- **10.8H** \( Ls \) \( f \) three
- **10.9H** \( T \) it is
- **10.10H** \( Ls \) \( f \) three
- **10.11H** \( T \) f three this equilibrant I know [code-switches] about the equilibrant it acts
- **10.12H** \( Ls \) \( f \) three
- **10.13H** \( T \) where yes
- **10.14H** \( L \) in the opposite direction
- **10.15H** \( T \) and in the
- **10.16H** \( L \) same straight line
- **10.17H** \( T \) in the same straight line keeping that in mind if \( f \) three is the equilibrant of \( f \) two and \( f \) one therefore what is therefore the resultant of \( f \) one and \( f \) two yes
f three

eh but we have said f three is the equilibrant of f one and f two so f three so

f three can’t be the resultant of f one and f two but f one and f two are the or

f is are are so what f three is the equilibrant of f one and f two what is the

resultant of f one and f two

I think it’s the [unclear]

are you sure are you sure yes [name] try

I think it’s [unclear]

are you sure

yes

I think it is the other force that acts in the opposite direction to f three

give that now put that mathematically put what you are saying in words

mathematically I said keeping in mind that the resultant is equal to the

equilibrant it acts in the same straight line but in the opposite direction what

is the resultant of f two and f one you must put on your thinking caps [code-
switches] yoh what is the resultant of f one and f two we know that the

equilibrant of f one and f two is f three but we know something about f

three but one is equal in magnitude [code-switches]

the resultant

to the resultant [code-switches] the resultant is always acting in the

opposite direction [code-switches]

equilibrant

to the equilibrant [code-switches] what

is the resultant of f one and f two [code-switches] f one and f two the

resultant put what you are saying opposite in mathematics [code-switches]

yes

minus f three

[code-switches] it’s minus f three once you say minus f three I know you are
saying to me it’s equal in magnitude and acts in the opposite direction it’s
simple I now know now I can take this thing I have three forces there I have
three forces there we made an experiment we found out all about these
things the only force that we see there is minus f three right but we
constructed it to be there right so I can remove this force vector even if it is
now there I know that the resultant of what of f one and f two is

\[ \mathbf{L}_s \] minus f three

\[ \mathbf{T} \] minus f three if I if I left you know my equilibrant there the resultant of f
one and f two is what is

\[ \mathbf{L}_s \] minus f three

\[ \mathbf{T} \] minus f three [code-switches]

**ACTIVITY STRUCTURE:** ‘review’ [1]; ‘teacher monologue’ [1]

**FIELD** [2]:

**Key definitions:**

- **Force diagram:** ‘represent[s] the actual direction of the forces originally’
- **Vector diagram:** ‘a diagram that results from taking the vectors from a force diagram rearranging them till they form...a closed figure’

when I draw it like a this let me draw it represent the actual direction of the
forces originally it’s called a force force diagram [chalkboard (4)] that’s a
force diagram of [code-switches] of this situation [apparatus (1)] it’s a force
diagram I have a force diagram of this situation [code-switches] I’ve got that
force I’ve got that force I’ve got that you can draw a diagram of that [code-
switches] now you can also be required to draw a vector diagram
[chalkboard (7)] we now know the vector difference between a vector
diagram and a force diagram uh a vector diagram will be a diagram that
results from taking the vectors from a force diagram rearrange them till they
form what a closed figure then we have a diagram

**ACTIVITY STRUCTURE:** ‘review’ cont. [1]; ‘IRF’ microgenre’ [3]
FIELD [2] (Systems in equilibrium – a force diagram and a vector diagram):
Resultant(s)
Equilibrant(s)

12.1H  T  right now what is the resultant of what is the resultant of f what is the
12.2H  resultant of f one and f two answer is f one and f two the resultant is what is
12.3H  what is the resultant of f one and f two what is the resultant of f one and f
12.4H  two [code-switches] it is minus f three it is minus f three what is the
12.5H  resultant of f two and f three
12.6H  Ls  minus f one
12.7H  T  minus
12.8H  Ls  f one
12.9H  T  what is the resultant of f three and f one
12.10H Ls  minus f two
12.11H T  minus
12.12H Ls  f two
12.13H T  minus f two what is the equilibrant of f two and f three
12.14H Ls  f one
12.15H T  it is
12.16H Ls  f one
12.17H T  f one so any one of these is the equilibrant so as they are here they are all
12.18H equilibrants to get the resultant is opposite [code-switches] right now let’s
12.19H take a look at how these can be arranged

ACTIVITY STRUCTURE: ‘IRF’ ‘micorgenre’ [3] (largely monologic)
FIELD [2] (‘the everyday’ – ‘mirrors’; ‘pictures’)

13.1H  T  where do you get such things you get such things you know from other
13.2H  things you know where you know in nature and in our homes where do you
13.3H  normally get forces acting like this uh [code-switches] is there anything at
your home that you think it will have forces acting in this way eh there are so there are so many but you don’t observe these things yes [code-switches] yes [code-switches] yes

**ACTIVITY STRUCTURE:** ‘boardwork’ [1]; ‘going over boardwork’ [1]

**FIELD** [2];

**Key terms/utterances:**
- ‘picture’; ‘in equilibrium’; ‘at rest’; ‘hanging’
- ‘a force acting on this picture’
- ‘a force diagram’; ‘a free body diagram’

let’s take this one can you draw a force diagram of the forces acting here who can do this a picture is hanging on a wall twine there twine there it’s hanging twine there twine there it’s also hanging can you draw a force diagram of this picture that way now is this picture in equilibrium yes because it’s at rest because it is resting because it’s stuck there it’s actually [unclear] right now now who can draw the forces acting on this picture anybody [code-switches] [chalkboard (10)] can you explain to us there which forces are acting this way which forces are acting this way in this picture this way [unclear] in the picture here in the picture in the picture no no no no in the picture in the picture the forces are acting on that picture [code-switches] anybody help her please there are three forces acting on that picture [code-switches]
[Xhosa]
draw that force diagram [code-switches] and [name] has actually drawn the
dpicture that way there now when we draw something [code-switches] like
that then we say we have drawn what
a free body diagram
a free body diagram of this thing [name] says there is a picture right right
and he says there is a force acting on this picture this way there is a force
acting on this picture this way there is a force acting on this picture this way
I can’t I can’t understand next anybody else anybody else

what makes this picture to face downwards to hang downwards what force
is acting on the picture so that it actually hangs downwards what force is
acting on this thing hangs downward
gravitation
[code-switches] gravitational force [code-switches] so now I’ve got a force
acting downwards here ne this way so if I’ve got a force acting this way
[chalkboard (9)] [code-switches] please I’ve got a force acting downwards
here I’ve got a force acting downward that’s why the picture by the way is
actually hanging it’s hanging downwards gravitational force and then I’ve
got what you also have a force coming from this [unclear] this way [code-
switches] you also have a force coming from this [unclear] this way
[chalkboard (11)] [code-switches]
this is not in the textbook it’s there around you all the time [code-switches] (12)

FIELD [2] (‘the everyday’ –‘mirrors’; ‘pictures’):
Key terms/ utterances:
- ‘the system must be in equilibrium’; ‘those three forces are in equilibrium’
- ‘force diagram’; ‘vector diagram’; ‘a closed figure’

once I can draw the force diagram once I can draw the force diagram I then (12)
go onto the vector diagram here is the force downwards here is this one yes
then this one yes it forms a closed figure [chalkboard (12)] therefore that
system must be in equilibrium [code-switches] they form a closed figure we
know that the forces are in equilibrium those three forces are in equilibrium
those three forces are you know in equilibrium do you understand now

ACTIVITY STRUCTURE: ‘IRF’ ‘microgenre’ [3] (largely monologic)
FIELD [2] (‘the everyday’ – ‘block and tackle’; ‘the engine of a car’):
Key terms/ utterances:
- ‘force’; ‘gravity’; ‘gravitational force’
- ‘the forces are in equilibrium’
- ‘arrow’; ‘a free body diagram’; ‘a closed figure’; ‘a vector diagram’

we have another situation here [code-switches] situations like this like um
have you ever heard of the word block and tackle block and tackle block and
tackle block and tackle do you know this thing

block and tackle is the thing they use or the combination of chains and
blocks and wood that they use to lift up the engine of a car from a car [code-
switches] here is the car there is the car okay that’s my a van you know I’m
going to you know remove the engine now they normally have something
like this [code-switches] and there is a chain here hanging and then they pull
out the engine of the car alright then now the engine of the car there’s the engine the engine of the car now here that they pull it away from here alright they pull it this way so I’ve got the force [code-switches] in which direction must the arrow face the force is coming from here [code-switches] the direction of the arrow here [chalkboard (13)]

upwards

coming from here [unclear] now as the engine is being pulled sideways which are the forces which are actually acting on it so this thing now once it is pulled like this [code-switches] the whole thing changes eh engine [code-switches] gravity now this is the pulling force which other forces are is actually acting on the engine which other forces are actually acting on the engine [name]

gravitational force

which other forces are actually acting on the engine on the engine as you see it there [code-switches] I pull it away I pull it away what are the other forces which are actually acting on the engine [code-switches] yes

gravitational force

you know gravitational force [chalkboard (13)] yoh aye aye aye aye aye aye aye aye aye then again we made what we now made a [code-switches] a free body diagram [chalkboard (14)] right now these forces in equilibrium these forces in equilibrium now we check we take this force downwards we take that one we take this one mm they form a closed figure these three forces are in equilibrium once you take three forces acting at a point and the three forces make a closed figure

vector diagram force diagram once they make a sorry once they make a closed figure [chalkboard (15)] then the forces are in e equilibrium
15.39H T equilibrium do you understand now
15.40H Ls yes
**ACTIVITY STRUCTURE:** ‘IRF’ ‘microgenre’ [3]
FIELD [2] (‘the everyday’ – ‘advertisement boards’)

16.1H T yoh aye aye aye yoh let’s now check again here’s a building
16.2H [chalkboard (16)] where do you normally see things like those mm
16.3H L1 town
16.4H T town very good [unclear] where
16.5H L1 around Edgars
16.6H T shops around Edgars yes there around Edgars I’m very glad that you know
16.7H that it is around Edgars you know around town there now somewhere
16.8H around Edgars
**ACTIVITY STRUCTURE:** ‘review’; ‘teacher monologue’ [1]
FIELD [2] (‘the everyday’ – ‘advertisement boards’):

**Key terms/ utterances:**
- ‘force’; ‘weight’ (‘weight will always be there as long as something is hanging’);
  ‘gravitational force’
- ‘the system is in equilibrium’
- ‘a free body diagram’; ‘a force diagram’; ‘a closed figure’

17.1H T you’ve got you actually have this advertisement boards [unclear] a wire like
17.2H that there this is actually hanging something like that [unclear] and this
17.3H thing is actually hanging it is hanging [code-switches] you have to
17.4H calculate those things [code-switches] how many forces around here acting
17.5H here there is a force acting here [code-switches] yes there is also a force
17.6H acting downwards here weight and there is also a force pushing towards this
17.7H thing that way [code-switches] there is a force pushing this way now I can
17.8H take this thing to make a free body diagram I’ve got this the weight weight
17.9H will always be there as long as something is hanging gravitational force then
you’ve got this force is acting in this direction yes this one is acting that way (16) [chalkboard (17)] that’s a force diagram then if this force diagram when you rearrange the forces and redraw them and they form [code-switches] a closed figure then the system is in equilibrium yes it is equilibrium why because [code-switches] are you happy now Ls yes T that’s the end of the period
I said go and design an experiment how must we do it to find out what would happen to the equilibrant when you change you know the [unclear] I said go and design design an activity to investigate how the equilibrant change...
ACTIVITY STRUCTURE: ‘interruption’ [1]; ‘review’ [1]; ‘do now’ [1]
FIELD [2] (Problem):
Equation:
\[ F = mg \]
Key terms/ utterances:
- ‘weight’
- ‘the force which the earth exerts on the falling object’
- ‘freefall acceleration’
- ‘it [the object] is falling freely’

3.1I okay now if we take a mass okay number one what is the weight of a mass
3.2I of one kilogram [code-switches] sorry five hundred grams I’ve got five
3.3I hundred grams here [code-switches] if I’m going to let this thing fall what is
3.4I the force which the earth exerts on the falling object five hundred grams it
3.5I won’t just come in the head you sit down you write down and use the
3.6I correct formula there [code-switches] and show me how you got the answer
3.7I I’ve got a mass of five hundred grams I’ve got a mass of five hundred grams
3.8I it falls right what is the force which or with which the earth exerts on the
3.9I object to cause it to fall
3.10I
3.11I [the teacher walks around the classroom and checks]
3.12I
3.13I T you must be finished by now good [code-switches] so others got it answer
3.14I answer is five newtons right good [code-switches]

ACTIVITY STRUCTURE: ‘interruption’ – teacher admonition
4.1I T what do you really want I really don’t know what you really want I really
4.2I don’t know what you really want

ACTIVITY STRUCTURE: ‘interruption’ cont. [1]; ‘review’ [1]; ‘teacher-student
duolog’ [1]
FIELD [2] (Problem)
tell us [name] how do you get the answer
five hundred grams
five hundred grams five hundred grams yes
you change the five hundred grams to zero point five kilograms
why
because I change five hundred grams to kilograms
you first change the five hundred grams to kilograms which of course which
is of course five hundred grams has the same value as what as how many
kilograms if I divide this by a thousand
a grade eleven child I can’t understand why using a calculator ne that
doesn’t know that if I divide five hundred by one thousand the answer is
what is zero point five kilograms I can’t believe it I can’t believe that a
grade eleven child doing mathematics cannot divide five hundred by what
by by one thousand
ACTIVITY STRUCTURE: ‘interruption’ cont. [1]; ‘review’ [1]
FIELD [2] (Problem)
to you change this to kilograms so we now know the mass [code-switches]
in kilograms then we want the force exerted by the earth now of course the
force will be equal to the mass of the object multiplied by freefall
acceleration because it is falling freely right therefore and this is what this is
zero point five kilograms multiplied by ten meters per second squared which
would of course be five newtons
I cannot understand it I can’t understand it why [unclear] [code-switches] who do not know how to change grams into kilograms I really
don’t understand it I’m telling you I cannot believe it
ACTIVITY STRUCTURE: ‘interruption’ cont. [1]; ‘review’ [1]
FIELD [2] (Problem)
now we are able to get this the mass sorry the weight of the object by calculation [chalkboard (2)]

ACTIVITY STRUCTURE: ‘teacher monologue’ cont. [1]  
FIELD [2] (A spring balance)
A spring balance: ‘a little gadget’; ‘a spring’; ‘numbers’; ‘zero’; ‘ten’; ‘pointer’; ‘hook’; ‘scale’

[2.5I] I’ve got here a spring balance inside here it is a little gadget
[2.6I] here inside it has a spring inside it has a spring that’s the little gadget [code-switches]
[2.7I] it has things like this it has numbers here and the numbers go down to ten it’s zero here and it has a pointer there of course it’s like that
[2.9I] and it has a hook there you hang it you know you know on this hook
[2.10I] anything you hang it there and the reading will actually be on this scale
[2.11I] but [code-switches][chalkboard (3)]

ACTIVITY STRUCTURE: ‘labwork’ [1]; ‘groupwork’ [1]
FIELD [2]
Key terms/ utterances:
- ‘a spring balance’; ‘a mass piece’
- ‘the reading’

right now I’m going to give each table one you join here you join there
there’s some more here now take a mass piece of a mass piece of one kg a mass piece of okay I’m going to put this one here ne a mass piece of what of one hundred grams can you weigh the mass sorry you know weigh that mass and see the reading on the what on the spring balance have a mass piece after finishing you know give the mass piece you know to the others you know you know to the other groups secondly secondly everybody must see [code-switches]

[the learners weigh the mass pieces using the spring balances]
ACTIVITY STRUCTURE: ‘review’ [1]; ‘labwork’ [1]; ‘IRF’ ‘microgenre’ [1]
FIELD [2]
Key terms/utterances:
- ‘the reading’; ‘the expected reading’; ‘the real answer’; ‘there is nothing wrong with those answers’
- ‘the difference in weights’; ‘similar’; ‘the reason’
- ‘well adjusted’; ‘well balanced’; ‘the pointer is not at zero’
- ‘friction’; ‘what makes it difficult for things to move over one another’; ‘what makes it so…difficult for things to grind over one another on the surface of the earth’;
  ‘friction is always there’
- ‘elasticity’

8.1I T now the mass of the mass of five hundred grams what is the
8.2I reading on the spring balance what is the reading on the spring balance yes
8.3I L one kilogram
8.4I T it is it is in your case what
8.5I L one kilogram
8.6I T it is one kilogram so the reading on the on the spring balance is what is
8.7I L ten newtons
8.8I T ten newtons this one
8.9I L four point one
8.10I T what
8.11I L four point one
8.12I T four point one four point one why do you think the reading you know the
8.13I reading is actually four point one it’s why because it’s similar to that one
8.14I okay okay I must first adjust it okay borrow that one reading here reading
8.15I here
8.16I L four point nine
8.17I T four point nine newtons now why do you think it it is only four point nine
newtons it should have been what
five newtons

why do you think that it was four point nine newtons because why do you think it was now they got five you know you know ten there ne and there they got five they now got five there ne but but here you know same mass here five hundred grams same mass there ne but they got five there ne and here you got what here you get what four point nine what do you think is the reason for the difference you know in weights [code-switches] now what makes this difference two things two things uh what [code-switches] yes

so it could be the whole thing is not well adjusted right so I’m going to adjust it for you good the pointer was not at zero good right so that’s why it was what something like what point sorry nine point in this case what was the [code-switches] the pointer is not at zero sir how do you know that how do you know that the pointer is at zero the real pointer there is at zero what is the reason why I cannot get the the real answer here of what of of five newtons anybody now anybody anybody can you can you can think hard now all of us why in some cases in this spring balances the reading is not the same as others others got what nine point nine others got what five others got four point nine and there’s nothing wrong with those answers why [code-switches] what makes it difficult for things to move over one another what makes it so you know difficult for things to grind over one another on the surface of the earth yes friction [unclear] there is friction there might be friction here here let’s see so it’s holding this thing down friction is always there so in most cases you will get that you will not get the expected reading because but now but there must be a reason
friction in this case could be the reason number two it could be that our
spring balance is not well what well balanced right no there not well bal but
in this case it is well balanced but I said it is well well balanced yes it is well
balanced but here that’s about four point nine yes no problem because and
also there and also there what could be the reason friction yes friction and
balancing them the scale or also again what the elasticity [code-switches]

ACTIVITY STRUCTURE: ‘IRF’ ‘microgenre’ [3]
FIELD [2] (A spring balance)
Key terms/ utterances:
- ‘this spring will always be extended whenever a mass is put in the hook’
- ‘it’s called a spring balance…because the object doesn’t fall because it is balanced by
the spring’
- ‘the force…exerted by the surface of the earth…downwards’
- ‘the force coming from this spring…upwards’

so so here this is called a spring balance spring balance aye man aye aye this
is called a spring balance [chalkboard (3)] because inside there inside there
is a spring this spring will always be extended whenever a mass is put in the
hook here the spring you know becomes extended now it’s called a spring
balance why do we call it a spring balance what do you think is the reason
why we call this a spring yes boy
I think because there is a spring inside
eh
I think because there is a spring inside
so because inside there’s a spring so that’s called a spring balance so is ne
anything inside it has a spring so in the boot of a car there are springs there
so the boot of a car has got a spring balance why is this thing called a spring
balance why
because the object doesn’t [unclear]
the object doesn’t fall because
it is balanced by the spring
it is balanced by the spring look this mass piece this mass piece this mass piece if it was not [unclear] right this mass piece if it is if it is if it is not hooked here and I release it it will fall down but if I have it here reading is is five why the spring inside there ne acts in what direction the force acting on this thing acts in what direction [code-switches] exerted by the surface of the earth on this mass piece is in what direction
the resultant the equilibriant

why it’s called a spring balance because the spring inside here balances the gravitational force

- ‘it’s called a spring balance because the spring inside here balances…the gravitational force’
- ‘spring force’; ‘gravity’; ‘gravitational force’
- ‘mass piece’
- ‘at rest’; ‘in equilibrium’
- ‘the resultant’; ‘the equilibriant’

why it’s called a spring balance because the spring inside here balances what the gravitational force that is why it is called a spring balance now you
see here I’ve got two forces acting [unclear] I’ve got two forces acting two forces acting here they act on what on the mass piece here is the mass piece I’ve got a force coming from the spring spring force [code-switches] the gravity gravitational force the mass piece is now at rest [chalkboard (4)] so it is in equilibrium so any one of these two is the resultant okay so this is the resultant you know equilibrant of this one this is the equilibrant of that one the system is in equilibrium

ACTIVITY STRUCTURE: ‘groupwork’ [1]
FIELD [2] (Activity – three spring balances)

now now I want you now to think in your groups I want you now to think in your groups how you would use three spring balances to keep on changing what to get the resultant and use the spring balances to get the resultant and the equilibrant and on the same piece of paper you make a drawing to show that if you open up the spring balance or if you change the angle between the spring balances something also happens to the what to the equilibrant

[the learners start to do the activity in their groups]

ACTIVITY STRUCTURE: ‘IRF’ ‘microgenre’ [3]
FIELD [2] (Two spring balances)
- ‘two spring balances’
- ‘the force exerted by this spring balance on this one is equal to the force exerted by this spring balance on this one’
- ‘difference’; ‘different directions’
by the way before we start suppose I have these two spring balances right
both of them are well yes you know zero nought nought and let them pull
one another what do you think would be the reading on both of them I pull
you know using the same force okay let’s have it like this two spring
balances there they are there they are facing one another now which one of
these two balances as they are now here which one of these will actually
change the reading [code-switches] people use your brains think this spring
balance is actually here [code-switches] right now nought nought right no
weights on them both no weights right no weights then I’m going to take
this one which one will now actually change this reading which one yes

L1 [unclear]

why

L1 [unclear]

T what’s that so the reading on this one will actually change why

L1 [unclear]

T it’s simple it will rest [code-switches] the weight of this one [code-
switches] the force of the gravitational force of so I have a reading there
zero point one [code-switches] simple simple simple thinking the weight of
this one if I hold them like this if I hold them like this and I pull them apart
or I I you know I only hold one and pull the other one reading on this one is
what reading on this one is what if you say it’s nought [code-switches]
nought [code-switches] it will have a certain value on one side it’s zero on
one side or it’s three on one side


ACTIVITY STRUCTURE: ‘IRF’ ‘microgenre’ cont. [3]

FIELD [2] (Two spring balances)

T if I do that and I just pull them together yes

L1 it will be the same reading
12.26 
T [code-switches] same reading
12.27 
L1 yes
12.28 
T right okay let us see if it is true what is the reading on yours [code-switches]
12.29 
L [unclear]
12.30 
T why now so if this spring balance exerts a force of two newtons on this one
12.31 
L1 this one does what
12.32 
T [code-switches]
12.33 
L1 it does the same
12.34 
T [code-switches]
12.35 
L1 it does the same
12.36 
T it does the same what
12.37 
L1 [unclear]
12.38 
T [code-switches] if this spring balance or if I exert or if the reading on this
12.39 
L spring balance is what is two the reading on this one is also two but I’m
12.40 
T only pulling this one I only pulling this one I’m not pulling this one I’m
12.41 
L pulling this one the reading is four the reading also here is four five also five
12.42 
T it’s because when the force exerted by this spring balance on this one is
12.43 
L equal to the force exerted by this spring balance on this one what is different
12.44 
L direction
12.45 
T direction another difference I’ve got two forces here ne two forces acting on
12.46 
L different directions and the other difference is what
12.47 
L the direction
12.48 
T we have you know we have said we have got two forces acting
12.49 
L here two forces are actually acting here these two forces act in the opposite
12.50 
T direction so [code-switches] number two where are these two forces acting
12.51 
L [unclear]
12.52 
T where not how are they acting what are these forces pulling at [code-
12.53 
L switches] spring balances are these forces the same as this thing are they
12.54 
T pulling on the same thing are they pulling on the same thing are these two
ACTIVITY STRUCTURE: ‘demonstration’ [1]
FIELD [2] (Two spring balances)
Key terms/utterances:
- ‘difference’; ‘these are two forces [are] not acting on the same object so in this case we can’t speak...of equilibrium’

it’s like me and you [code-switches] now I am pulling him and he is also
these are two forces not acting on the same object so in this case we can’t
speak of what of equilibrium be very careful be very careful of how you
speak when I speak of equilibrium the forces acting there in that system
must be acting on one object in this case I don’t have two forces [code-
switches] two forces acting on the same object he is pulling me I am pulling
him but [code-switches] but I can pull him and I pulling him but if I pull
him he is still pulling me he is still pulling me but we are moving so the
system is not in equilibrium although there are two forces acting in opposite
directions [code-switches]

ACTIVITY STRUCTURE: ‘interruption’ [1]
I know that learners like to say yes because yes is the shortest answer yes
yes

ACTIVITY STRUCTURE: ‘groupwork’ cont. [1]
now go on now quickly my students think of a way of using three spring
balances to show you the resultant and also the equilibrant right and after
that you can use the very same three spring balances to show that when you change the angle between two what two spring balances something else happens to what you know to the equilibrant make a start a nice drawing a rough drawing [code-switches] in science you never discuss without drawings you never solve problems without making a drawing to have a picture of what was happening
APPENDIX C

TRANSCRIPTS J – M:

THE ANALYSIS OF TRIADIC DIALOGUE 8A – 4H
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)  
Projection; Modality; Concession

TAXANOMIC RELATIONS (EXPERIENTIAL)  
Class to member; Wholes to parts; Equivalence and Contrast

THEME (TEXTUAL)  
The Theme-Rheme boundary is shown by #. [4]

PERIODICITY AND SERIAL EXPANSION (TEXTUAL)  
macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings
<table>
<thead>
<tr>
<th></th>
<th>PEDAGOGIC DISCOURSE</th>
<th>REGULATIVE REGISTER METAFUNCTIONS</th>
<th>INSTRUCTIONAL REGISTER METAFUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>let’s # now, brainstorm again here</td>
<td>INTERPERSONAL</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>J2</td>
<td>when YOU # move…</td>
<td>POSITIVE POLARITY</td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td>J3</td>
<td>when..SOMETHING # moves</td>
<td></td>
<td>QUESTION (expressed by typical</td>
</tr>
<tr>
<td>J4</td>
<td>or when YOU # move…</td>
<td></td>
<td>clause Mood interrogative)</td>
</tr>
<tr>
<td>J5</td>
<td>OR we # say</td>
<td></td>
<td>- ‘what makes things to move?’</td>
</tr>
<tr>
<td>J6</td>
<td>when SOMETHING # is in MOTION</td>
<td></td>
<td>[J7]; ‘what makes things to move?’</td>
</tr>
<tr>
<td>J7</td>
<td>&gt;what # makes things to move?&lt;…</td>
<td>EXPERIMENTAL</td>
<td>[J8]; ‘what makes things to move?’</td>
</tr>
<tr>
<td>J9</td>
<td>&gt;what # makes things to move?&lt;…</td>
<td></td>
<td>MODALIZATION</td>
</tr>
<tr>
<td>J10</td>
<td>uh?</td>
<td></td>
<td>- ‘something must be happening’</td>
</tr>
<tr>
<td>J11</td>
<td>[code-switches]</td>
<td></td>
<td>[J14] (finite: modal) [3] (degree</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of modalization: high) [4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EXPERIMENTAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘something’¹ [J6]; ‘things’² [J15]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>‘motion’ [J6]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EQUIVALENCE AND CONTRAST</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘when something moves’ [J3];</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>‘when something is in motion’ [J6]</td>
</tr>
</tbody>
</table>

¹ something (x10)
² things (x20)
| J12 | when you # .. |
| J13 | if you # begin to move |
| J14 | something # must be happening |
| J15 | what what # makes things to move?.. repetition 2 |
| J16 | yes? |

**LOGICAL**

CONJUNCTION
1) external conjunction:
- ‘or’ [J5] (conjunction type: ‘addition’; ‘alternative’)

**TEXTUAL**

CONJUNCTION
1) circumstances:
- ‘now’ [J1]

REFERENCE
1) first person pl.
- ‘let’s now brainstorm again here’ [J1]
- ‘or we say’ [J5]

**METADISCUSSION**

(parallel environments) [5]
- ‘when you move’ [J2]; ‘when something moves’ [J3] (parallel environments) [5]

**LOGICAL**

CONJUNCTION
1) external conjunction:
- ‘when’ [J2]; ‘when’ [J3]; ‘when’ [J4]; ‘when’ [J6]; ‘when’ [J12] (conjunction type: ‘time’; ‘simultaneous’) [6]
- ‘or’ [J4] (conjunction type: ‘addition’; ‘alternative’)
- ‘**or we say** when something is in motion’ [J5; J6]

<table>
<thead>
<tr>
<th>J17</th>
<th>L</th>
<th>force</th>
<th>EXPERIENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>J18</td>
<td>T</td>
<td>a FORCE</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>J19</td>
<td></td>
<td>ne?</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>J20</td>
<td></td>
<td>a FORCE # makes things to move, repetition 3</td>
<td>MODALIZATION</td>
</tr>
<tr>
<td>J21</td>
<td></td>
<td>(okay, okay, okay, okay, okay, okay, okay, okay, okay, okay)</td>
<td></td>
</tr>
<tr>
<td>J22</td>
<td></td>
<td>a FORCE # makes things to move... repetition 3</td>
<td></td>
</tr>
<tr>
<td>J23</td>
<td></td>
<td>I # ’m going to FORCE this wall to move</td>
<td></td>
</tr>
<tr>
<td>J24</td>
<td></td>
<td>I # ’m going to FORCE</td>
<td></td>
</tr>
<tr>
<td>J25</td>
<td></td>
<td>[The teacher knocks three times against the wall with his hand] this thing to move...</td>
<td></td>
</tr>
<tr>
<td>J26</td>
<td></td>
<td>‘<strong>but you # said</strong>’</td>
<td></td>
</tr>
</tbody>
</table>


- ‘**but you said**’ [J25] (Pr: verbal)
- ‘you don’t understand’ [J28]; ‘you don’t understand about what? about?’ [J28] (Pr: cognition)

- ‘**there is something you don’t understand you don’t understand about what? about?**’ [J28] (‘individual response’) [7]


- ‘I’m going to force this wall to move’ [J23]; ‘I’m going to force this
| J26 | a FORCE # can make things to move... | thing to move' [J24] (parallel environments) [5] |
| J27 | but you # had it WRONG.. | TEXTUAL |
| J28 | “there # is something you # don’t understand”.. “you # don’t understand about WHAT? about?” | CONJUNCTION 1) internal conjunction: - ‘okay’; ‘okay’; ‘okay’; ‘okay’; ‘okay’ [J21] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6] |
| J29 | yes? | REFERENCE 1) reference: - ‘but you said’ a force can make things to move’ [J25-J26] |
| J30 | L | force of gravity | EXPERIENTIAL |
| J31 | T | “FORCE of GRAVITY” | KEY LEXICAL ITEMS - ‘force of gravity’ [J30] |
| J32 | (okay, okay, so you # mean | INTERPERSONAL |
| J33 | things # move because of force of gravity?... | SPEECH FUNCTION COMMAND (expressed by typical clause Mood imperative) - ‘don’t speak’ of the force of something’ [J35] - ‘okay don’t speak’ of the force of something’ [J36] |
| J34 | now..I # would like you to..as from today.. | INTERPERSONAL |
J35 | don’t speak # of the force of something repetition 4

J36 | okay don’t speak # of the force OF something repetition 4

J37 | because?..

J38 | THINGS # don’t have what?...

**MODULATION**
- ‘now I would like you to as from today’ [J34] (finite: modulated) [3]
  (degree of modulation: median) [4]

**EXPERIENTIAL**

**PROCESSES**
- ‘okay okay so you mean things move because of force of gravity’ [J32-J33] (Pr: cognition)
- ‘I would like you as from today’ [J34] (Pr: affection)
- ‘don’t speak of’ [J35]; ‘okay don’t speak of’ [J36] (Pr: behavioural)

**LOGOGENESIS**
- ‘now I would like you to as from today don’t speak of the force of gravity’ [J34-J35]

**EXPERIENTIAL**

**EQUIVALENCE AND CONTRAST**
- ‘don’t speak of the force of something’ [J35]; ‘so don’t speak of’ [J64] (parallel environments) [5]

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
1) circumstances:
- ‘today’ [J34]
2) internal conjunction:

REFERENCE
1) first person sing.
- ‘now I would like you to as from today’ [J34]

METADISCOURSE
- ‘don’t speak of the force of something’ [J35]
- ‘okay don’t speak of the force of something’ [J36]

| J39 | Ls | force
[...]
[a couple of learners respond] |

| J40 | T  | force...

| J41 | but as but things # always EXERT..a force...

| J42 | you # .. |

| J43 | I can, I can, I can, I # can EXERT |

INTERPERSONAL
- SPEECH FUNCTION
  COMMAND (expressed by typical clause Mood imperative)
  - ‘listen to that very carefully’ [J48]
  - ‘so don’t speak of the force of gravity’ [J64]

INTERPERSONAL
- MODALIZATION [6]
  - but as but things always exert a force’ [J41]

NEGATION [6]
- ‘I don’t possess force I don’t possess force I don’t have force’
**APPRAISAL [6]**
1.1) attitudinal lexis:
- ‘I’m happier you know to say’ [J68]

1.2) attitude (judgement – criticize; direct; personal):
- ‘I know older people like ourselves and older folks speak of what force of gravity’ [J65; J66]

**CONCESSION [6]**
- ‘but’ [J52]; ‘but’ [J67]
  (conjunction type: ‘consequence’; ‘cause’; ‘concessive’) [6]

**EXPERIMENTAL**

**KEY LEXICAL ITEMS**
- ‘table’ [J44]; ‘gravitational force’ [J69]; ‘the force exerted by gravity’ [J69]

**EQUIVALENCE AND CONTRAST**
- ‘I don’t possess force’ [J50]; ‘I don’t have force’ [J51] (parallel environments) [5]
| J59 | I # can EXERT a force on SOMETHING else |
| J60 | it # means |
| J61 | >I # can make a force to ACT on something< repetition 7 |
| J62 | >I # can make a force to ACT on something< repetition 7 |
| J63 | >but I # don’t have force< repetition 6 |
| J64 | so don’t speak # of..the force of gra:vity |
| J65 | I know # |
| J66 | older people like ourselves and older folks # speak of what force of gravity… |
| J67 | okay but I # don’t like it |
| J68 | I # ’m happier you know to say…\textsc{gravitational} force OR..the force \textsc{exerted} by? |

**verbal**

**LOGICAL**

**CONJUNCTION**

1) external conjunction:
- ‘and’ [J54] (conjunction type: ‘addition’; ‘addition’) [6]
- ‘so’ [J64] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘and’ [J66] (conjunction type: ‘addition’; ‘addition’) [6]

**TEXTUAL**

**CONJUNCTION**

1) internal conjunction:

**REFERENCE**

1) first person sing.
- ‘I know older people like ourselves and older folks speak of what force of gravity’ [J65; J66]
- ‘okay but I don’t like it’ [J67]
- ‘I’m happier you know to say \textsc{gravitational} force or the force exerted by gravity’ [J68]

2) reference:
- ‘I know older people like’
ourselves and older folks speak of what force of gravity’ [J65; J66]

METADISCOURSE
- ‘so don’t speak of the force of gravity’ [J64]
- ‘I’m happier you know to say gravitational force or the force exerted by gravity’ [J68-J69]

<table>
<thead>
<tr>
<th>J69</th>
<th>Ls</th>
<th>gravity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>J70</td>
<td>T</td>
<td>gravity</td>
</tr>
<tr>
<td>J71</td>
<td></td>
<td>okay &gt;that # becomes more scientific&lt; repetition 8</td>
</tr>
<tr>
<td>J72</td>
<td></td>
<td>&gt;that # becomes more more scientific&lt; repetition 8</td>
</tr>
<tr>
<td>J73</td>
<td></td>
<td>the force exerted by gravity or GRAVITAL TIONAL force</td>
</tr>
<tr>
<td>J74</td>
<td></td>
<td>okay now..okay what # can FORCE do?</td>
</tr>
<tr>
<td>J75</td>
<td></td>
<td>give # me things that force can do..</td>
</tr>
<tr>
<td>J76</td>
<td></td>
<td>yes?</td>
</tr>
</tbody>
</table>

INTERPERSONAL

SPEECH FUNCTION
-

COMMAND (expressed by typical clause Mood imperative)
- ‘give me things that force can do’ [J75]
  (‘individual extended response unassisted’) [7]

APPRaisal [6]
1.1) Attitude (appreciation - positive):
- ‘okay that [term] becomes more scientific’ [J71]
- ‘that becomes more more scientific’ [J72]
1.2) Graduation (Quantity)
- ‘okay that [term] becomes more

INTERPERSONAL

SPEECH FUNCTION
- QUESTION (expressed by typical clause Mood interrogative)
- ‘what can force do?’ [J73]  
  (‘individual extended response unassisted’) [7]

MODALIZATION
- ‘what can force do?’ [J73]; ‘give me things that force can do’ [J74]
EXPERIENTIAL

PROCESSES
- 'okay that becomes more scientific' [J71]; 'that becomes more more scientific' [J72] (Pr: intensive)

METADISCOURSE
- 'okay that [term] becomes more scientific' [J71]
- 'that [term] becomes more more scientific' [J72]

LOGICAL

CONJUNCTION
1) external conjunction:
- 'or' [J72] (conjunction type: 'addition'; 'alternation') [6]
<table>
<thead>
<tr>
<th>J77</th>
<th>L</th>
<th>it # can CHANGE the direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODALIZATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘it can change the direction’ [J77]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘direction’ [J77]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TEXTUAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>THIRD PERSON SING.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘it can change the direction’ [J77]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J78</th>
<th>T</th>
<th>it # can change</th>
</tr>
</thead>
<tbody>
<tr>
<td>J79</td>
<td></td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PROCESSES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘let’s have a look at’ [J80]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Pr: cognition)</td>
</tr>
<tr>
<td>J80</td>
<td></td>
<td><strong>TEXTUAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) internal conjunction:</td>
</tr>
<tr>
<td>J81</td>
<td></td>
<td><strong>TEXTUAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) text reference:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘let’s have a look at’ [the following statement to be written on the chalkboard]’ [J80]</td>
</tr>
</tbody>
</table>

<p>| J82 | [code-switches] |
| J83 | force # …can change? what? |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>J84</strong></td>
<td>Ls</td>
<td>direction</td>
<td>- ‘let’s have a look at that’ [J80]</td>
</tr>
<tr>
<td><strong>J85</strong></td>
<td>T</td>
<td>direction</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[chalkboard]</td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td><strong>J86</strong></td>
<td></td>
<td>[code-switches]</td>
<td>Offer</td>
</tr>
<tr>
<td><strong>J87</strong></td>
<td></td>
<td>yes I # agree</td>
<td>- ‘anybody else?’ [J88]</td>
</tr>
<tr>
<td><strong>J88</strong></td>
<td></td>
<td>anybody else?</td>
<td>(‘individual extended response unassisted’) [7]</td>
</tr>
<tr>
<td><strong>J89</strong></td>
<td></td>
<td>yes?</td>
<td>TEXTUAL</td>
</tr>
<tr>
<td><strong>J90</strong></td>
<td>L</td>
<td>it # can TAKE an object from one place to another place</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MODALIZATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘it can take an object from one place to another place’ [J90]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>J91</strong></td>
<td><strong>T</strong></td>
<td>it # can MOVE an object</td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td><strong>J92</strong></td>
<td><strong>okay</strong> it # can, can, can, can DISPLACE an object</td>
<td>SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative)</td>
<td></td>
</tr>
<tr>
<td><strong>J93</strong></td>
<td>it # can MAKE an object move from ONE place to? ANOTHER place</td>
<td>- ‘<strong>do you agree?</strong>’ [J94]</td>
<td></td>
</tr>
<tr>
<td><strong>J94</strong></td>
<td><strong>do you # agree?</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**KEY LEXICAL ITEMS**
- ‘object’³ [J90]; ‘place’⁴ [J90]

**TEXTUAL**

**REFERENCE**
1) third person sing.
- ‘it can take an object from one place to another place’ [J90]
2) comparative:
- ‘it can take an object from one place to another place’ [J90]

³ object (x15)
⁴ place (x5)
<table>
<thead>
<tr>
<th>J95</th>
<th>Ls</th>
<th>(yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J96</td>
<td>T</td>
<td>do you # agree?</td>
</tr>
<tr>
<td>J97</td>
<td></td>
<td>yes, yes, force # you know can do that okay..</td>
</tr>
<tr>
<td>J98</td>
<td></td>
<td>now okay force # ...can...uh move an object..from..eh..from one place okay to another</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[chalkboard]</td>
</tr>
<tr>
<td>J99</td>
<td></td>
<td>it # means</td>
</tr>
<tr>
<td>J100</td>
<td></td>
<td>it # can..it can cause things to..to change positions...</td>
</tr>
<tr>
<td>J101</td>
<td></td>
<td>okay?..</td>
</tr>
</tbody>
</table>

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:

**REFERENCE**
1) second person pl.
- ‘do you agree?’ [J94]

**INTERPERSONAL**

**SPEECH FUNCTION**
**QUESTION** (expressed by typical clause Mood interrogative)
- ‘do you agree?’ [J96]

**SPEECH FUNCTION**
**OFFER**
- ‘another one’ [J102] ('individual extended response unassisted') [7]

**INTERPERSONAL**

**MODALIZATION**
- ‘force...can do that’ [J97]
- ‘it can cause things to...change positions’ [J100]

**MONOGLOSSIA** [6]
- ‘it means it can it can cause things to to change positions’ [J101-J102]

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘positions’ [J100]
<table>
<thead>
<tr>
<th>J102</th>
<th>J103</th>
<th>TEXTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>CONJUNCTION</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) internal conjunction:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>REFERENCE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) comparative:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘<strong>another one</strong>’ [J102]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J104</th>
<th>L</th>
<th>INTERPERSONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘it can make a standing object start moving’ [J104]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘a standing object’ [J104]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J104</th>
<th>L</th>
<th>TEXTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>REFERENCE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) third person sing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘it can make a standing object start moving’ [J104]</td>
</tr>
<tr>
<td>J105</td>
<td>T</td>
<td>it # can CAUSE motion..</td>
</tr>
<tr>
<td>------</td>
<td>---</td>
<td>-------------------------</td>
</tr>
<tr>
<td>J106</td>
<td></td>
<td>yes, yes,</td>
</tr>
<tr>
<td>J107</td>
<td></td>
<td>[code-switches]</td>
</tr>
<tr>
<td>J108</td>
<td></td>
<td>it # can make things</td>
</tr>
<tr>
<td>J109</td>
<td></td>
<td>it # can move</td>
</tr>
<tr>
<td>J110</td>
<td></td>
<td>because you know I # was HERE</td>
</tr>
<tr>
<td>J111</td>
<td></td>
<td>I # can now move from HERE to HERE</td>
</tr>
<tr>
<td>J112</td>
<td></td>
<td>so I # started to move</td>
</tr>
<tr>
<td>J113</td>
<td></td>
<td>yes, another one?</td>
</tr>
<tr>
<td>J114</td>
<td></td>
<td>yes?</td>
</tr>
<tr>
<td>J115</td>
<td>L</td>
<td>it # can STOP moving things</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**SPEECH FUNCTION OFFER**
- ‘yes another one’ [J113] (‘individual extended response unassisted’) [7]

**INTERPERSONAL**

**MODALIZATION**
- ‘it can cause motion’ [J105]
- ‘because you know I was here I can now move from here to here’ [J110-J111]

**LOGICAL**

**CONJUNCTION**
1) external conjunction:

**TEXTUAL**

**REFERENCE**
1) comparative:
- ‘yes another one’ [J113]

**TEXTUAL**

**CONJUNCTION**
1) circumstances:
- ‘now’ [J111]

**REFERENCE**
1) location in space:
- ‘because you know I was here I can now move from here to here’ [J110; J111]
<table>
<thead>
<tr>
<th>J116</th>
<th>T</th>
<th>&gt;it # can STOP moving things&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>J117</td>
<td>okay I # agree..</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>J118</td>
<td>it # can..force can...can stop...moving...objects</td>
<td></td>
</tr>
<tr>
<td>J119</td>
<td>[chalkboard]</td>
<td></td>
</tr>
<tr>
<td>J120</td>
<td>if things # are moving</td>
<td></td>
</tr>
<tr>
<td>J121</td>
<td>it # can make them stop</td>
<td></td>
</tr>
<tr>
<td>J122</td>
<td>yes, another one?</td>
<td></td>
</tr>
<tr>
<td>J123</td>
<td>yes?</td>
<td></td>
</tr>
<tr>
<td>J124</td>
<td>L</td>
<td>it # can CHANGE the SHAPE of an object</td>
</tr>
</tbody>
</table>

**MODALIZATION**
- ‘it can stop moving things’ [J115]

**TEXTUAL**

**REFERENCE**
1) third person sing.
- ‘it can stop moving things’ [J115]

**INTERPERSONAL**

**SPEECH FUNCTION OFFER**
- ‘yes another one’ [J122] (‘individual extended response unassisted’) [7]

**CONJUNCTION**
1) internal conjunction:

**REFERENCE**
1) comparative:
- ‘yes another one’ [J122]

**INTERPERSONAL**

**MODALIZATION**
- ‘if things are moving it can make them stop’ [J119-J121]
| J125 T | **it # can CHANGE the SHAPE of an object** |
| J126 | **very good..very good..** |
| J127 | **it # can change you know the shape can change...the shape...of an object yes** |
| [chalkboard] |
| J128 | ([code-switches]) |
| J129 | **(or..if you # do what?)** |
| J130 | **or if you # ..take..** |
| J131 | **okay I # can even take the..** |
| J132 | **I # can take uh a piece of..** |
| J133 | **here # is RUBBER** |

**INTERPERSONAL**

- 'it can change the shape of an object’ [J124]

**APPRAISAL [6]**
1.1) attitude (appreciation – positive)
- ‘**very good very good** [answer]’ [J126]
1.2) graduation (force; intensifiers)
- ‘**very good very good** [answer]’ [J126]
2) attitudinal lexis:
- ‘**now my main interest now on force here is this one [this statement]’** [J140]

**CONTINUATIVES [6]**
- ‘**okay I can even take the’** [J131]

- **INTERPERSONAL**

**MODALIZATION**
- ‘I can change the shape’ [J135]

**CONTINUATIVES [6]**
- ‘oh no I even broke it there’ [J137]

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
<table>
<thead>
<tr>
<th>J134</th>
<th>I # can FORCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>J135</td>
<td>I # can CHANGE the SHAPE repetition 9</td>
</tr>
<tr>
<td>J136</td>
<td>I # can CHANGE the SHAPE repetition 9</td>
</tr>
<tr>
<td>J137</td>
<td>oh no I # even broke it there)</td>
</tr>
<tr>
<td>J138</td>
<td>okay?</td>
</tr>
<tr>
<td>J139</td>
<td>that # ’s what’s force</td>
</tr>
<tr>
<td>J140</td>
<td>now..my MAIN interest now on force here # is THIS one…</td>
</tr>
<tr>
<td>J141</td>
<td>it can make things to move from one place to another place</td>
</tr>
<tr>
<td>J142</td>
<td>now remember #</td>
</tr>
<tr>
<td>J143</td>
<td>it # can make things to move from one place to another place..</td>
</tr>
<tr>
<td>J144</td>
<td>and you # said..</td>
</tr>
<tr>
<td>J145</td>
<td>it # can also &gt;START&lt;...</td>
</tr>
<tr>
<td>J146</td>
<td>it # can it can make things..to &gt;START&lt;..moving</td>
</tr>
</tbody>
</table>

- ‘now my main interest now on force is this one’ [J140] (Pr: intensive)
- ‘now remember’ [J142] (Pr: cognition)
- ‘and you said’ [J144] (Pr: verbal)

**LOGICAL**

**CONJUNCTION**

1) external conjunction:
- ‘and’ [J144] (conjunction type: ‘addition’; ‘addition’) [6]
- ‘or’ [J129]; ‘or’ [J130] (conjunction type: ‘addition’; ‘alternation’) [6]
- ‘if’ [J129]; ‘if’ [J130] (conjunction type: ‘consequence’; ‘condition’) [6]

**TEXTUAL**

**CONJUNCTION**

1) circumstances:
- ‘now’ [J140]
2) internal conjunction:
- ‘okay’ [J131]; ‘now’ [J140]; ‘now’ [J142]; ‘okay’ [J147] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

**REFERENCE**

- ‘shape’ [J125]; ‘rubber’ [J133]

- ‘here is rubber’ [J133]
| J147 | okay | 1) text reference:  
- ‘now my main interest now on force here is this one [this statement]’ [J140]  
METADISCOURSE  
- ‘now my main interest now on force here is this one [statement written on the chalkboard]’ [J140] |
| J148 T | now..she # said.. |  
INTERPERSONAL  
SPEECH FUNCTION  
QUESTION (expressed by typical clause Mood interrogative)  
- ‘what is the speed of something that is at rest?’ [J151]  
(‘individual response’) [7] |
| J149 | force # can make things to move from REST.. |  
EXPERIENTIAL  
PROCESSES  
- ‘now she said’ [J148] (Pr: verbal) |
| J150 | now if something # moves from REST… |  
EXPERIENTIAL  
KEY LEXICAL ITEMS  
- ‘rest’ [J151]; ‘speed’ [J151] |
| J151 | okay...what # is the SPEED of something that is at REST?... |  
LOGICAL  
CONJUNCTION  
1) external conjunction:  
- ‘if’ [J150] (conjunction type: ‘consequence’; ‘condition’) [6] |
<p>| J152 | mm ja ja... |<br />
| J153 | yes? |<br />
| J154 | uh? |</p>
<table>
<thead>
<tr>
<th>J155</th>
<th>L</th>
<th>it # is stationary</th>
</tr>
</thead>
<tbody>
<tr>
<td>J156</td>
<td>T</td>
<td>are you # sure?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFFER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘are you sure?’ [J156]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(‘individual response’) [7]</td>
</tr>
<tr>
<td>J157</td>
<td>L</td>
<td>zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘zero’ [J157]</td>
</tr>
</tbody>
</table>
it # is zero

**good**

**anybody else?...**

> so the SPEED of something at rest # is always what? is ZERO<

**okay...** STATIONARY...SPEED... equal to zero...

[chalkboard (11)]

SPEED [is] # equal to ZERO..

**now** if the SPEED is # equal to ZERO..

what # is the force ACTING on the object?

uh?

**SPEECH FUNCTION**

**OFFER**

- ‘**anybody else’** [J160]

**APPRaisal**

1) attitude (appreciation – positive)

- **good** [answer]’ [J159]

**LOGICAL**

**CONJUNCTION**

1) external conjunction:

- ‘so’ [J161]; ‘so’ [J162]; ‘so’ [J162] (conjunction type: ‘consequence’; ‘cause’) [6]

- ‘if’ [J164] (conjunction type: ‘consequence’; ‘condition’) [6]

**INTERPERSONAL**

**SPEECH FUNCTION**

**QUESTION** (expressed by typical clause Mood interrogative)

- ‘what is the force acting on the object?’ [J165] (**individual response**) [7]

**MODALIZATION** [6]

- ‘so the speed of something at rest is always what is zero’ [J161]

**REFERENCE**
| J167 | L | [unclear] |
| J168 | T | if if the object # does not have any SPEED.. |
| J169 | T | what FORCE # is acting on the object?.. |
| J170 | T | hey? |
| J171 | L | it # ’s standing sir |
| J172 | T | ‘okay..listen # carefully’.. |
| J173 | T | if the SPEED of the object is # ..ZERO |
| J174 | T | what FORCE # is acting on the object?.. |
| J175 | T | anybody? |

1) comparative:
- ‘anybody else’ [J160]  

**INTERPERSONAL**  
SPEECH FUNCTION  
QUESTION (expressed by typical clause Mood interrogative)  
- ‘if the object does not have any speed what force is acting on the object?’ [J168-169]  
(‘individual response’) [7]  

**LOGICAL**  
CONJUNCTION  
1) external conjunction:  
- ‘if’ [J168]; ‘if’ [J168] (conjunction type: ‘consequence’; ‘condition’) [6]  

**INTERPERSONAL**  
SPEECH FUNCTION  
COMMAND (expressed by typical clause Mood imperative)  
- ‘okay listen carefully’ [J172]  

**INTERPERSONAL**  
SPEECH FUNCTION  
QUESTION (expressed by typical clause Mood interrogative)  
- ‘if the speed of the object is zero what force is acting on the object?’
| J176 | yes? | SPEECH FUNCTION
OFFER
- ‘anybody?’ [J175]
(‘individual response’) [7] |
| J177 | L    | no force |
| J178 | T    | >no force # is actually is actually acting there<.. |
| J179 |      | no force # .. |

| J172 |  | EXPERIENTIAL
PROCESSES
- ‘okay listen carefully’ [J172] (Pr: behavioural) |


| J173 |  | LOGICAL
CONJUNCTION
1) external conjunction:

| J174 |  | TEXTUAL
CONJUNCTION
1) internal conjunction:

| J178 |  | INTERPERSONAL
APPRAISAL
1.1) attitude (appreciation – positive) |
<table>
<thead>
<tr>
<th>J180</th>
<th>good.</th>
<th>- ‘<strong>good</strong> [answer]’ [J180]</th>
</tr>
</thead>
<tbody>
<tr>
<td>J181</td>
<td>if..speed is # zero</td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td>J182</td>
<td><strong>so.. we # say</strong></td>
<td><strong>PROCESSES</strong></td>
</tr>
<tr>
<td>J183</td>
<td>the force here # ..equals..zero</td>
<td>- ‘<strong>so we say</strong>’ [J182] (Pr: verbal)</td>
</tr>
<tr>
<td></td>
<td>[chalkboard (12)]</td>
<td><strong>LOGICAL</strong></td>
</tr>
<tr>
<td>J184</td>
<td>because [there # is] no speed</td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) external conjunction:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TEXTUAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) first person pl.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘<strong>so we say</strong>’ [J182]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>LOGICAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) external conjunction:</td>
</tr>
</tbody>
</table>
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

**HETEROGLOSSIA (INTERPERSONAL)**

Projection; Modality; Concession

**TAXANOMIC RELATIONS (EXPERIENTIAL)**

Class to member; Wholes to parts; Equivalence and Contrast

**THEME (TEXTUAL)**

The Theme-Rheme boundary is shown by #. [4]

**PERIODICITY AND SERIAL EXPANSION (TEXTUAL)**

macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings
<table>
<thead>
<tr>
<th></th>
<th>PEDAGOGIC DISCOURSE</th>
<th>REGULATIVE REGISTER</th>
<th>INSTRUCTIONAL REGISTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>T</td>
<td>INTERPERSONAL</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>K2</td>
<td>the FIRST type of addition</td>
<td>POSITIVE POLARITY</td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td>K3</td>
<td>now we we # said</td>
<td>SPEECH FUNCTION</td>
<td>QUESTION (expressed by typical clause Mood interrogative)</td>
</tr>
<tr>
<td>K4</td>
<td>vectors # can ACT..</td>
<td>QUESTION (expressed by typical clause Mood interrogative)</td>
<td>- ‘how can vectors act?’ [K5]</td>
</tr>
<tr>
<td>K5</td>
<td>HOW # can vectors act?..</td>
<td>- ‘in which…way can vectors act?’ [K7] (‘individual response’) [7]</td>
<td></td>
</tr>
<tr>
<td>K6</td>
<td>number one..</td>
<td>MODALIZATION</td>
<td>vectors can act’ [K4]; ‘how can vectors act?’ [K5]; ‘in which in which way can vectors act?’ [K7]</td>
</tr>
<tr>
<td>K7</td>
<td>in which..in which # WAY can vectors ACT?</td>
<td>EXPERIENTIAL</td>
<td>(finite: modal) [3] (degree of modalization: low) [4]</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**TEXTUAL**

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘the first type of [vector] addition’ [K2]
- ‘what type of vector addition did we do?’ [K1] (Pr: material)
- ‘now we we said’ [K3] (Pr: verbal)

**PROCESSES**
- ‘what type of vector addition did we do?’ [K1] (Pr: material)
- ‘now we we said’ [K3] (Pr: verbal)
<table>
<thead>
<tr>
<th>K8</th>
<th>L1</th>
<th>in a certain direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>K9</td>
<td>T</td>
<td>no no okay YES?..YES?..</td>
</tr>
<tr>
<td></td>
<td></td>
<td>let the whole class.. # HEAR what you are saying</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**SPEECH FUNCTION**

COMMAND (expressed by the typical clause Mood imperative)
- ‘let the whole class hear what you are saying’ [K10] (=raise your voice) (‘individual extended response unassisted’) [7]
**EXPERIENTIAL**

**PROCESSES**
- ‘let the whole class hear’ [K10] (Pr: perception)
- ‘what you are saying’ [K10] (Pr: verbal)

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:

**REFERENCE**
1) second person sing.
- let the whole class hear what you are saying’ [K10]

**METADISCOURSE**
- ‘let the whole class hear what you are saying’ [K10]

<table>
<thead>
<tr>
<th>K11</th>
<th>L₁</th>
<th>I # ‘m saying that..</th>
</tr>
</thead>
<tbody>
<tr>
<td>K12</td>
<td></td>
<td>I # ‘m saying</td>
</tr>
<tr>
<td>K13</td>
<td></td>
<td>that they # can ACT in the same direction</td>
</tr>
</tbody>
</table>
| K14 |    | INTERPERSONAL MODALIZATION
- ‘I’m saying that they can act in the same direction’ [K13; K14] (finite: modal) [3] (degree of modalization: low) [4] |
<table>
<thead>
<tr>
<th>K15</th>
<th>T</th>
<th>EXPERIENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘same direction’ [K14]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) first person sing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘I’m saying’ [K11]; ‘I’m saying’ [K13]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) comparative:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘I’m saying that they can act in the same direction’ [K13; K14]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QUESTION (expressed by typical clause Mood interrogative)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘do you all agree?’ [K16]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODALIZATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘vectors can act in the same direction’ [K15] (finite: modal) [3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(degree of modalization: low) [4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) second person pl.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘do you all agree?’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REPETITION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘act/ ing in the same direction’ repetition1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>K17</td>
<td>Ls</td>
<td>yes</td>
</tr>
<tr>
<td>K18</td>
<td>T</td>
<td>yes</td>
</tr>
<tr>
<td>K19</td>
<td></td>
<td>now if vec-</td>
</tr>
<tr>
<td>K20</td>
<td></td>
<td>yes?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) internal conjunction:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K21</td>
<td>L</td>
<td>vectors # can act in an OPPOSITE direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K22</td>
<td>T</td>
<td>okay FINE..</td>
</tr>
<tr>
<td>-----</td>
<td>---</td>
<td>-------------</td>
</tr>
<tr>
<td>K23</td>
<td></td>
<td>we # are coming there</td>
</tr>
<tr>
<td>K24</td>
<td></td>
<td>ne?</td>
</tr>
<tr>
<td>K25</td>
<td></td>
<td>right vectors # can act on the op- in the same direction repetition1</td>
</tr>
<tr>
<td>K26</td>
<td></td>
<td>now we # said</td>
</tr>
<tr>
<td>K27</td>
<td></td>
<td>if they # ’re ACTING in the same direction repetition1 ...</td>
</tr>
<tr>
<td>K28</td>
<td></td>
<td>what # is the ANGLE between the vectors repetition2?..</td>
</tr>
</tbody>
</table>
| K29 |   | yes [name]?

**TEXTUAL**

**REFERENCE**

1) comparative:  
- ‘vectors can act in an opposite direction’ [K21]

**INTERPERSONAL**

**SPEECH FUNCTION**

QUESTION (expressed by typical clause Mood interrogative)
- ‘if they’re acting in the same direction what is the angle between the vectors?’ [K27; K28]  
(‘individual response’) [7]

**EXPERIENTIAL**

**PROCESSES**

- ‘now we said’ [K26] (Pr: verbal)

**INTERPERSONAL**

**MODALIZATION**


**EXPERIENTIAL**

**KEY LEXICAL ITEMS**

- ‘angle’ [K28]

**LOGICAL**

**CONJUNCTION**

1) external conjunction:  
- ‘if’ [K27] (conjunction type: ‘consequence’; ‘condition’) [6]
**CONJUNCTION**
1) internal conjunction:

**REFERENCE**
1) reference:
- ‘**now we said** if they’re acting in the same direction what is the angle between the vectors’ [K26-K28]

**REPEITION**
- ‘the angle between the vectors/ them’ repetition2

| K30 | L | it ’s zero sir |
| K31 | T | the ANGLE between the vectors repetition2 # is ZERO.. |
| K32 |   | **OKAY...so we # said..** |
| K33 |   | if if vectors # are acting in the same direction repetition1 |
| K34 |   | WE,..WE,.. |
| K35 |   | **now I # think** |
| K36 |   | I # made something like THIS,.. |

**EXPERIENTIAL**
- ‘zero’ [K30]

**KEY LEXICAL ITEMS**
- ‘zero’ [K30]

**INTERPERSONAL**

**DEMANDING INFORMATION** [4]
- ‘and the angle between them is what is’ [K43] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

**MODALIZATION**
- ‘I think’ (Modal Adjunct) (degree of modalization: median)
<table>
<thead>
<tr>
<th>K37</th>
<th>I said</th>
<th>EXPERIENTIAL PROCESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OKAY...the vectors..</td>
<td>- ‘okay so we said’ [K32]; ‘I said’ [K37] (Pr: verbal)</td>
</tr>
<tr>
<td>K39</td>
<td>’m having a vector of what of EIGHT,...newtons..</td>
<td>- ‘I made something like this’ [K36] (Pr: material)</td>
</tr>
<tr>
<td>K40</td>
<td>SIX, newtons</td>
<td>LOGICAL CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td>[chalkboard (1)]</td>
<td>1) external conjunction:</td>
</tr>
<tr>
<td>K41</td>
<td>now they ACT in the SAME direction,..</td>
<td>- ‘so’ [K32] (conjunction type: ‘consequence’; ‘cause’) [6]</td>
</tr>
<tr>
<td>K42</td>
<td>same direction,</td>
<td>- ‘and’ [K43] (conjunction type: ‘addition’; ‘addition’) [6]</td>
</tr>
<tr>
<td>K43</td>
<td>and the ANGLE between them is what? is?</td>
<td>TEXTUAL CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) internal conjunction:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘okay’ [K32]; ‘now’ [K35]; ‘okay’ [K38] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) exophoric:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘I made something like this’ [K36]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) reference:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘okay so we said’ [K32]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>K44</strong></td>
<td>Ls</td>
<td><em>zero</em></td>
</tr>
<tr>
<td><strong>K45</strong></td>
<td></td>
<td>[a number of learners talk at the same time]</td>
</tr>
<tr>
<td><strong>K46</strong></td>
<td>T</td>
<td><strong>ZERO</strong></td>
</tr>
<tr>
<td><strong>K47</strong></td>
<td></td>
<td><em>now...when</em> they # ACT on the SAME..&lt;repetition1&gt; in the SAME direction&lt;repetition1&gt;…</td>
</tr>
<tr>
<td><strong>K48</strong></td>
<td></td>
<td><em>we # said</em></td>
</tr>
<tr>
<td><strong>K49</strong></td>
<td></td>
<td><em>we # can..GET the</em> &lt;RESULTANT&gt;&lt;repetition3&gt;..</td>
</tr>
<tr>
<td><strong>K50</strong></td>
<td></td>
<td><em>we # can GET the</em> &lt;RESULTANT&gt;&lt;repetition3&gt; of of these two vectors..in tw- two ways</td>
</tr>
<tr>
<td><strong>K51</strong></td>
<td></td>
<td><em>now there # are TWO ways in which we can get the resultant</em> &lt;repetition3&gt;..</td>
</tr>
<tr>
<td><strong>K52</strong></td>
<td></td>
<td><em>now the FIRST one please&lt;…</em></td>
</tr>
<tr>
<td><strong>K53</strong></td>
<td></td>
<td><em>‘the first one’…</em></td>
</tr>
<tr>
<td><strong>K54</strong></td>
<td></td>
<td><em>HOW # can we get the resultant</em> &lt;repetition2&gt;?..</td>
</tr>
</tbody>
</table>

- ‘I said’ [K37]  

**INTERPERSONAL**  

**SPEECH FUNCTION**  
**COMMAND**  
- ‘*now the first one please’ [K52] (=please give me the first one)  
- ‘*the first one’ [K53] (=give me the first one)  

**SPEECH FUNCTION**  
**QUESTION**  
- ‘*how can we get the resultant?’ [K54]  

**MODALIZATION**  
- ‘*we can get the resultant’ [K49];  
- ‘*we can get the resultant of of these two vectors in tw- two ways’ [K50];  
- ‘*now there are two ways in which we can get the resultant’ [K51];  
- ‘*how can we get the resultant?’ [K54] (finite: modal) [3] (degree of modalization: low) [4]
<table>
<thead>
<tr>
<th>EXPERIENTIAL</th>
<th>EXPERIENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY LEXICAL ITEMS</td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td>- ‘two ways in which we can get’ the resultant’ [K51]</td>
<td>- ‘resultant’ [K49]</td>
</tr>
<tr>
<td>PROCESSES</td>
<td>PROCESSES</td>
</tr>
<tr>
<td>- ‘we said’ [K48] (Pr: verbal)</td>
<td>- ‘we said’ [K48]</td>
</tr>
<tr>
<td>- ‘we can get the resultant’ [K49] (Pr: material)</td>
<td></td>
</tr>
<tr>
<td>LOGICAL</td>
<td>LOGICAL</td>
</tr>
<tr>
<td>CONJUNCTION</td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td>1) external conjunction:</td>
<td>1) external conjunction:</td>
</tr>
<tr>
<td>TEXTUAL</td>
<td>TEXTUAL</td>
</tr>
<tr>
<td>CONJUNCTION</td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td>1) internal conjunction:</td>
<td>1) internal conjunction:</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>REFERENCES</td>
</tr>
<tr>
<td>1) reference</td>
<td>1) reference</td>
</tr>
<tr>
<td>- ‘we said’ [K48]</td>
<td>- ‘we said’ [K48]</td>
</tr>
<tr>
<td>REPETITION</td>
<td>REPETITION</td>
</tr>
<tr>
<td>- ‘get the resultant’ repetition³</td>
<td>- ‘get the resultant’ repetition³</td>
</tr>
<tr>
<td>K55</td>
<td>T</td>
</tr>
<tr>
<td>-----</td>
<td>---</td>
</tr>
<tr>
<td>K56</td>
<td></td>
</tr>
<tr>
<td>K57</td>
<td></td>
</tr>
<tr>
<td>K58</td>
<td></td>
</tr>
<tr>
<td>K59</td>
<td></td>
</tr>
<tr>
<td>K60</td>
<td>[code-switches]</td>
</tr>
<tr>
<td>K61</td>
<td></td>
</tr>
<tr>
<td>K62</td>
<td>[code-switches]</td>
</tr>
<tr>
<td>K63</td>
<td></td>
</tr>
<tr>
<td>K64</td>
<td></td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**SPEECH FUNCTION**

**QUESTION** (expressed by typical clause Mood interrogative)
- ‘oh by the way what is the resultant?’ [K55]
- ‘if I think of that you know the word resultant of a vector what do we mean by that?’ [K56; K57]
- ‘the resultant of a vector what do we mean by that?’ [K58; K59] (‘individual extended response unassisted’) [7]

**EXPERIENTIAL**

**PROCESSES**
- ‘if I think of that you know the word resultant of a vector’ [K56] (Pr: cognition)
- ‘what do we mean by that?’ [K57]; ‘what do we mean by that?’ [K59] (Pr: verbal)
- ‘I’m telling you’ [K63] (Pr: behavioural)

**CONJUNCTION**
1) external conjunction:
- ‘if’ [K56] (conjunction type: ‘consequence’; ‘condition’) [6]

**KEY LEXICAL ITEMS**
- ‘resultant’ [K55]
<table>
<thead>
<tr>
<th><strong>K65</strong></th>
<th><strong>L</strong></th>
<th>it # is an ANSWER of a vector</th>
<th><strong>EXPERIENTIAL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K66</strong></td>
<td><strong>T</strong></td>
<td>[code-switches]</td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
</tr>
<tr>
<td><strong>K67</strong></td>
<td><strong>L</strong></td>
<td>it # is an ANSWER of a vector</td>
<td></td>
</tr>
<tr>
<td><strong>K68</strong></td>
<td><strong>T</strong></td>
<td>it # is an ANSWER of a vector?...</td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td><strong>K69</strong></td>
<td></td>
<td><strong>what what # do you mean by</strong></td>
<td><strong>SPEECH FUNCTION</strong></td>
</tr>
</tbody>
</table>

**TEXTUAL**

CONJUNCTION
1) internal conjunction:
- ‘by the way’ (conjunction type: ‘addition’; ‘staging’; ‘sidetracking’) [6]

REPETITION
- ‘what do you/ we mean by that?’ repetition4

METADISCOURSE
- ‘what do we mean by that [term]?’ [K57]; ‘what do we mean by that [term]?’ [K59]

**TEXTUAL**

METADISCOURSE
- ‘if I think of that you know the word resultant of a vector’ [K56]
| K70 | that? repetition... | yes? | QUESTION (expressed by typical clause Mood interrogative)  
- ‘it is an answer of a vector what do you mean by that?’ [K68; K69]  
(‘individual extended response assisted’) [7]  
**EXPERIENTIAL**  
**PROCESSES**  
- ‘what what do you mean by that?’ [K69] (Pr: verbal)  
**TEXTUAL**  
**REFERENCE**  
1) second person sing.  
- ‘what what do you mean by that?’ [K69] |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>K71</td>
<td>L₂</td>
<td>a vector is</td>
<td></td>
</tr>
<tr>
<td>K72</td>
<td>T</td>
<td>a RESULTANT,..RESULTANT,</td>
<td></td>
</tr>
<tr>
<td>K73</td>
<td>L₂</td>
<td>it # is a vector sum</td>
<td></td>
</tr>
</tbody>
</table>
**EXPERIENTIAL**  
**KEY LEXICAL ITEMS**  
- ‘a vector sum’ [K73] |
<p>| K74 | T | it # is a VECTOR SUM.. |  |
| K75 | | yes? |  |</p>
<table>
<thead>
<tr>
<th>K76</th>
<th>L₂</th>
<th>that are all taken away</th>
</tr>
</thead>
<tbody>
<tr>
<td>K77</td>
<td>T</td>
<td>&lt;the RESULTANT # IS the VECTOR SUM of ALL vectors ACTING together&gt;</td>
</tr>
<tr>
<td>K78</td>
<td></td>
<td>say # THAT all of us</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPEECH FUNCTION COMMAND (expressed by the typical clause Mood imperative)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘say that all of us’ [K78]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PROCESSES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘say that all of us’ [K78] (Pr: verbal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) first person pl.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘say that all of us’ [K78]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘the vector sum of all vectors acting together’ [K77]</td>
</tr>
<tr>
<td>K79</td>
<td>L</td>
<td>&lt;the resultant # is the vector sum of all vectors acting together&gt;</td>
</tr>
<tr>
<td>K80</td>
<td>T</td>
<td>the RESULTANT...&lt;ALL vectors ACT taken together&gt;</td>
</tr>
<tr>
<td>K81</td>
<td>T</td>
<td>&quot;and thereafter I # said again you can also put it this way&quot;</td>
</tr>
<tr>
<td>-----</td>
<td>---</td>
<td>---------------</td>
</tr>
<tr>
<td>K82</td>
<td></td>
<td>the RESULTANT..the RESULTANT.. # IS a SINGLE vector..</td>
</tr>
<tr>
<td>K83</td>
<td></td>
<td>it # is a SINGLE vector..which has the SAME..EFFECT..as &lt;ALL vectors taken? together&gt;</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**MODALIZATION**
- ‘and thereafter I said again you can also put it this way’ [K81]

**CONTINUATIVES [6]**
- ‘and thereafter I said again you can also put it this way’ [K81]

**EXPERIENTIAL**

**PROCESSES**
- ‘and thereafter I said again’ [K81]; ‘you can also put it this way’ [K81] (Pr: verbal)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘and’ [K81] (conjunction type: ‘addition’; ‘addition’) [6]

**TEXTUAL**

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘a single vector which has the same effect as all vectors taken together’ [K83]
**REFERENCE**
1) first person sing.
- ‘and thereafter I said again you can also put it this way’ [K81]
2) reference:
- ‘and thereafter I said again you can also put it this way’ [K81]

**METADISCOURSE**
- ‘and thereafter I said you can also put it [the term resultant] this way’ [K81]

<table>
<thead>
<tr>
<th>K84</th>
<th>Ls</th>
<th>together</th>
</tr>
</thead>
<tbody>
<tr>
<td>K85</td>
<td>T</td>
<td>for an example,..</td>
</tr>
<tr>
<td>K86</td>
<td></td>
<td>we # said..remember,..</td>
</tr>
<tr>
<td>K87</td>
<td></td>
<td>we # said</td>
</tr>
<tr>
<td>K88</td>
<td></td>
<td>you # can have a VECTOR..of what, of...let’s say EIGHT newtons..EAST</td>
</tr>
<tr>
<td>K89</td>
<td></td>
<td>that # ’s a vector of EIGHT newtons EAST..followed by another, a vector of</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**MODALIZATION**
- ‘you can have a vector of what of let’s say eight newtons east’ [K88]

**CONTINUATIVES [6]**
- ‘that’s a vector of eight newtons east followed by another a vector of

**INTERPERSONAL**

**DEMANDING INFORMATION [4]**
- ‘but instead of having two vectors acting one after the other you can have one vector which would be equal to what’ [K91; K92]
  (‘individual response’) [7]

**MODALIZATION**
- ‘you can have one vector which
|   | what of, of, of, of let, let’s say uhm, uh, again, what let’s say SIX newtons, EAST [chalkboard (1)]  
K90 |   | what of of of let’s say uhm uh again what let’s say six newtons east’ [K89]  
K91 | right so these # are TWO vectors acting here..  
K92 | BUT instead of having TWO vectors...ACTING one after the other  
K93 | you # can have ONE vector..>which would be equal to what?...  
   |   | - ‘you can have one vector which would be equal to what?’ [K92] (finite: modal) [3] (degree of modalization: median) [4]  
   |   | CONCESSION [6]  
   |   | - ‘instead of’ [K91] (conjunction type: ‘comparison’; ‘concessive’)  
   | EXPERIENTIAL  
   | PROCESSES  
   | - ‘we said’ [K86]; ‘we said’ [K87]; ‘let’s say’ [K88]; ‘let’s say’ [K89] (Pr: verbal)  
   | - ‘remember’ [K86] (Pr: cognition)  
   | EXPERIENTIAL  
   | KEY LEXICAL ITEMS  
   | - ‘eight newtons east’ [K89]; ‘six newtons east’ [K89]; ‘two vectors’ [K90]; ‘one vector’ [K92]  
   | LOGICAL  
   | CONJUNCTION  
   | 1) external conjunction:  
   | - ‘so’ [K90] (conjunction type: ‘consequence’; ‘cause’) [6]  
   | TEXTUAL  
   | TEXTUAL
CONJUNCTION
1) internal conjunction:
- ‘right’ [K90] (conjunction type: addition; staging; framing) [6]

REFERENCE
1) reference:
- ‘we said’ [K86]; ‘we said’ [K87]

REFERENCE
1) exophoric:
- ‘that’s a vector of eight newtons east followed by another a vector of what of of of let’s say uhm uh again what let’s say six newtons east’ [K89]
- ‘right so these are two vectors acting here’ [K90]
2) location in space:
- ‘right so these are two vectors acting here’ [K90]
3) comparative:
- ‘that’s a vector of eight newtons east followed by another a vector of what of of of let’s say uhm uh again what let’s say six newtons east’ [K89]

K94 L which would be equal to fourteen newtons

INTERPERSONAL
MODALIZATION
- ‘which would be equal to fourteen newtons’ [K94] (finite: modal) [3]
(degree of modalization: median) [4]

EXPERIENTIAL
KEY LEXICAL ITEMS
- ‘fourteen newtons’ [K94]
| K95 | T | which would be equal to FOURTEEN newtons?.. |
| K96 | L | is that # all?.. |
| K97 | T | >EAST< |
| K98 | T | because remember.. # |
| K99 | T | when you # speak of a vector.. |
| K100 | T | you # CAN’T just say fourteen newtons.. |
| K101 | T | you # must tell me the? |
| K102 | T | you # must tell me the? |

**INTERPERSONAL**

SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - ‘is that all?’ [K96] (‘individual response’) [7]

**DEMANDING INFORMATION [4]** - ‘which would be equal to fourteen newtons’ [K95]

**MODALIZATION** - ‘which would be equal to fourteen newtons?’ [K95] (finite: modal) [3] (degree of modalization: median) [4]

**EXPERIENTIAL**

KEY LEXICAL ITEMS - ‘east’ [K98]

**INTERPERSONAL**


<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEGATION [6]</td>
<td>‘you can’t just say’ fourteen newtons’ [K101]</td>
</tr>
<tr>
<td>CONTINUATIVES [6]</td>
<td>‘you can’t just say’ fourteen newtons’ [K101]</td>
</tr>
<tr>
<td>EXPERIENTIAL</td>
<td></td>
</tr>
<tr>
<td>PROCESSES</td>
<td>‘because remember’ [K99] (Pr: cognition)</td>
</tr>
<tr>
<td></td>
<td>‘when you speak’ of a vector’ [K100]; ‘you must tell me the?’ [K102] (Pr: behavioural)</td>
</tr>
<tr>
<td>LOGICAL</td>
<td></td>
</tr>
<tr>
<td>CONJUNCTION</td>
<td>1) external conjunction:</td>
</tr>
<tr>
<td></td>
<td>‘when’ [K100] (conjunction type: ‘time’; ‘simultaneous’) [6]</td>
</tr>
<tr>
<td>TEXTUAL</td>
<td></td>
</tr>
<tr>
<td>REFERENCE</td>
<td>1) second person pl.</td>
</tr>
<tr>
<td>K103</td>
<td>L</td>
</tr>
<tr>
<td>------</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>K104</td>
<td>T</td>
</tr>
<tr>
<td>K105</td>
<td></td>
</tr>
<tr>
<td>K106</td>
<td></td>
</tr>
<tr>
<td>K107</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
we # can now have here ONE...single vector \textsuperscript{repetition5} of fourteen newtons east..

so THIS # is then the resultant..

it # is the resultant of what? of? THIS vector \textbf{and} THIS vector..

>they # form the resultant<..

this vector # form ONE vector

[chalkboard (2)]

LOGICAL

CONJUNCTION
1) external conjunction:
- ‘if’ [K105] (conjunction type: ‘consequence’; ‘condition’) [6]
- ‘so’ [K106]; ‘so’ [K106]; ‘so’ [K109] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘and’ [K110] (conjunction type: ‘addition’; ‘addition’) [6]

TEXTUAL

CONJUNCTION
1) internal conjunction:
- ‘\textbf{okay}’ [K106]; ‘\textbf{okay}’ [K106]
  (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

REFERENCE
1) exophoric:
- ‘so this is then the resultant’ [K109]
- ‘it is the resultant of what of this vector and this vector’ [K110]
- ‘this vector form one vector’ [K112]
2) location in space:
- ‘\textbf{okay okay} so so here we can have one single vector’ [K106]
FIELD [2]: Magnitude and total resultant vector

- ‘we can now have here one single vector’ [K107]
- ‘we can now have here one single vector of fourteen newtons east’ [K108]

REPETITION
- ‘one single vector’ repetition5

<table>
<thead>
<tr>
<th>K113</th>
<th>T</th>
<th>NOW..we # said</th>
</tr>
</thead>
<tbody>
<tr>
<td>K114</td>
<td></td>
<td>okay NOW if [unclear]</td>
</tr>
<tr>
<td>K115</td>
<td></td>
<td>now we # STOPPED here..</td>
</tr>
<tr>
<td>K116</td>
<td></td>
<td>we # said</td>
</tr>
<tr>
<td>K117</td>
<td></td>
<td>that you # can ADD vectors acting in the same direction repetition1</td>
</tr>
<tr>
<td>K118</td>
<td></td>
<td>so we # have..SAME...direction...</td>
</tr>
<tr>
<td>K119</td>
<td></td>
<td>and we # said here</td>
</tr>
<tr>
<td>K120</td>
<td></td>
<td>this # is the same as what? as?</td>
</tr>
</tbody>
</table>

INTERPERSONAL
MODALIZATION
- ‘we said that you can add vectors acting in the same direction’ [K116; K117] (finite: modal) [3] (degree of modalization: low) [4]

LOGICAL
CONJUNCTION
1) external conjunction:
- ‘if’ [K114] (conjunction type: ‘consequence’; ‘condition’) [6]
ANGLE...between...vectors, repetition2 # is what? equals zero..

right?..

zero degrees

okay?

[chalkboard (6)]

>the angle between the vectors repetition2 # is now equal to zero degrees<

EXPERIENTIAL
PROCESSSES
- ‘now we said’ [K113]; ‘we said’ [K116]; ‘and we said here’ [K119] (Pr: verbal)
- ‘that you can add’ vectors acting in the same direction’ [K117] (Pr: behavioural)

TEXTUAL
CONJUNCTION
1) internal conjunction:
- ‘now’ [K113]; ‘okay’[K114]; ‘now’ [K114]; ‘now’ [K115] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

REFERENCE
1) first person pl.
- ‘now we stopped here’ [K115]
2) location in space:
- ‘and we said here’ [K115]
3) reference:
- ‘we said’ [K113]; ‘we said’ [K116]; ‘we said’ [K119]

ACTIVITY TYPE: ‘review’ [1]; ‘groupwork’ [1] [groupwork/]

REFERENCE
1) exophoric:
- ‘this is the same as what as’ [K120]
**Preparation for Groupwork**

**Field [2]: Problem 1**

**K126**

Okay FINE...so we # look at WHAT? at the displacement

**K127**

now...and then we # said

**K128**

there # are TWO ways in which we can get the resultant ..

**K129**

there # are TWO ways in which we can get the resultant ..

**K130**

>give # me two ways in which one can get the resultant of those two vectors<..

**K131**

uh?..

**K132**

we # KNOW this...

**K133**

we # ’ve DISCUSSED this...

**K134**

BUT give # me TWO ways..in which the resultant of what? of EIGHT newtons, EAST AND SIX newtons, EAST can be found..

[chalkboard (7)]
>and the FIRST method,<repetition6 ..

>the FIRST method,<repetition6 ..

[code-switches]

YES [name]?

**which** the resultant of what of eight newtons east and six newtons east **can be found** [K134] (finite: modal) [3] (degree of modalization: low) [4]

CONCESSION [6]

EXPERIENTIAL

KEY LEXICAL ITEMS
- ‘**the first method**’ [K135]

PROCESSES
- ‘**okay fine so we look at what at the displacement**’ [K126]; ‘**we discussed this**’ [K133] (Pr: behavioural)
- ‘**now and then we said**’ [K127] (Pr: verbal)
- ‘**give me the two ways**’ [K129]; ‘**in which we can get** the resultant’ [K129]; ‘**but give me two ways in which** the resultant of what of eight newtons east and six newtons east **can be found**’ [K134] (Pr: material)
- ‘**we know this**’ [K132] (Pr: cognition)
LOGICAL

CONJUNCTION
1) external conjunction:
- ‘so’ [K126] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘then’ [K127] (conjunction type: ‘time’; ‘successive’) [6]

TEXTUAL

CONJUNCTION
1) internal conjunction:

REFERENCE
1) first person pl.
- ‘we know this’ [K132]
- ‘we’ve discussed this’ [K133]
2) first person sing.
- ‘but give me two ways in which the resultant of what of eight newtons east and six newtons east can be found’ [K134]
3) comparative:

TEXTUAL

REPETITION
- ‘the first method’ repetition6
<table>
<thead>
<tr>
<th>K139</th>
<th>L</th>
<th>we # can get it by calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘calculation’ [K139]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K140</th>
<th>T</th>
<th>we # can get it by calculation, $^{\text{repetition/}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K141</th>
<th></th>
<th>yes...we # can get it by calculation, $^{\text{repetition/}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K142</th>
<th></th>
<th>SIMPLE calculation...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K143</th>
<th></th>
<th>we # can get it by $&lt;$calculation$&gt;$, $^{\text{repetition/}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>yes...which is here VERY EASY...</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K144</th>
<th></th>
<th>because of the same thing &gt;you know direction&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K145</th>
<th></th>
<th>SO it # will be?...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K146</th>
<th></th>
<th>you know the displacement # will be?...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>K148</strong></td>
<td>the displacement WOULD be equal to what? EIGHT newtons, plus WHAT? plus? SIX newtons,</td>
<td>1.2) graduation (force; intensifiers)</td>
</tr>
<tr>
<td><strong>K149</strong></td>
<td>and this # will be FOURTEEN newtons, EAST</td>
<td>- ‘we can get it by calculation yes which is here very easy’ [K143]</td>
</tr>
<tr>
<td><strong>K150</strong></td>
<td>that # ’s by calculation..</td>
<td>MODALIZATION</td>
</tr>
<tr>
<td><strong>K151</strong></td>
<td>now the next one?…</td>
<td>- ‘we can get it by calculation’ [K140]; ‘yes we can get it by calculation’ [K141]; ‘we can get it by calculation yes which is here very easy’ [K143] (finite: modal) [3] (degree of modalization: low) [4]</td>
</tr>
<tr>
<td><strong>K152</strong></td>
<td>am I # teaching only two people here?..</td>
<td>CONTINUATIVES [6]</td>
</tr>
<tr>
<td></td>
<td>yes?</td>
<td>- ‘am I teaching only two people here?’ [K151]</td>
</tr>
</tbody>
</table>

**EXPERIENTIAL PROCESSES**
- ‘we can get it by calculation’ [K140] (Pr: material)
- ‘am I teaching only two people here?’ [K151] (Pr: behavioural)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘so’ [K145] (conjunction type:
<table>
<thead>
<tr>
<th>K153</th>
<th>L</th>
<th>by drawing</th>
<th>EXPERIENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- '[a] drawing' [K153]</td>
</tr>
<tr>
<td>K154</td>
<td>T</td>
<td>by drawing,</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>K155</td>
<td></td>
<td>what # do you mean by that ? repetition4</td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td>K156</td>
<td></td>
<td>yes by drawing..</td>
<td>QUESTION (expressed by typical clause Mood interrogative)</td>
</tr>
<tr>
<td>K157</td>
<td></td>
<td>but what # do you mean by that ? repetition4</td>
<td>- ‘what do you mean by that?’ [K155]</td>
</tr>
<tr>
<td>K158</td>
<td></td>
<td>&gt;we # DISCUSSED these things&lt;..</td>
<td>- ‘but what do you mean by that?’ [K157]</td>
</tr>
<tr>
<td>K159</td>
<td></td>
<td>[unclear]</td>
<td>DEMANDING INFORMATION [4]</td>
</tr>
</tbody>
</table>

**TEXTUAL**

**CONJUNCTION**

1) internal conjunction:

**REFERENCE**

- ‘am I teaching only two people here?’ [K151]

**TEXTUAL**

**REPEITION**

- ‘we can get it by calculation’ repetition7
I # SWEAR,

I # DON’T go along with learners who don’t study..you know who don’t go through their work..

the FIRST method repetition6.. # <<yes I agree>>[is] ..by calculation

we # can get at our displacement by calculating, by ADDING, by calculating...

“yes [name]”?

“the answer # is”?

- ‘the answer is’ [K165] (‘individual response’) [7]

APPRAISAL
1) attitudinal lexis:
- ‘I swear I don’t go along with learners who don’t study you know who don’t go through their work’ [K160; K161]

MODALIZATION
- ‘we can get at our displacement by calculating by adding by calculating’ [K163] (finite: modal) [3] (degree of modalization: low) [4]

NEGATION [6]
- ‘I swear I don’t go along with learners who don’t study you know who don’t go through their work’ [K160; K161]

CONCESSION [6]

EXPERIENTIAL

PROCESSES
- ‘what do you mean by that?’
‘but what do you mean by that?’ [K157]; ‘I swear’ [K160] (Pr: verbal)
- ‘we’ve discussed these things’ [K158]; ‘I don’t go along with learners who don’t study you know who don’t go through their work’ [K161]; ‘we can get at our displacement by calculating by adding by calculating’ [K163] (Pr: behavioural)
- ‘we can get at our displacement by calculating by adding by calculating’ [K163] (Pr: material)

REFERENCE
1) second person sing.
- ‘what do you mean by that?’ [K151]; ‘but what do you mean by that?’ [K157]
2) first person pl.
- ‘we discussed these things’
3) first person sing.
- ‘I swear I don’t go along with learners who don’t study you know who don’t go through their work’ [K160; K161]
- ‘the first method is yes I agree by calculation’ [K162]
4) possessive: 
- ‘I swear I don’t go along with learners who don’t study you know who don’t go through their work’ [K160; K161]

METADISCOURSE 
- ‘we discussed these things’ [K158]

<table>
<thead>
<tr>
<th>K166</th>
<th>L</th>
<th>by measurement</th>
</tr>
</thead>
</table>

EXPERIENTIAL

KEY LEXICAL ITEMS
- ‘measurement’ [K166]

<table>
<thead>
<tr>
<th>K167</th>
<th>T</th>
<th>by MEASUREMENT?..</th>
</tr>
</thead>
<tbody>
<tr>
<td>K168</td>
<td></td>
<td>yes? by MEASUREMENT and?..</td>
</tr>
<tr>
<td>K169</td>
<td></td>
<td>you # MEASURE something</td>
</tr>
<tr>
<td>K170</td>
<td></td>
<td>and you # do what?...</td>
</tr>
<tr>
<td>K171</td>
<td></td>
<td>you # measure</td>
</tr>
<tr>
<td>K172</td>
<td></td>
<td>and?</td>
</tr>
</tbody>
</table>

INTERPERSONAL

DEMANDING INFORMATION [4]
- ‘by measurement’ [K167]
- ‘yes by measurement and’ [K168]
- ‘and you do what’ [K170]

EXPERIENTIAL

PROCESSES
- ‘you measure something’ [K169]; ‘you measure’ [K171] (Pr: behavioural)
**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘**and**’ [K168]; ‘**and**’ [K170]; ‘**and**’ [K172] (conjunction type: ‘addition’; ‘addition’) [6]

<table>
<thead>
<tr>
<th>K173</th>
<th>L</th>
<th>draw</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>K174</th>
<th>T</th>
<th><strong>and # DRAW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>K175</td>
<td></td>
<td>yes, very good..</td>
</tr>
<tr>
<td>K176</td>
<td></td>
<td><strong>so we # can get</strong> the very SAME, displacement by...by <strong>drawing</strong>...<strong>and</strong> measurement..<strong>and</strong> measurement..</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[chalkboard (9)]</td>
</tr>
<tr>
<td>K177</td>
<td></td>
<td><strong>now when you # do a measurement</strong></td>
</tr>
<tr>
<td>K178</td>
<td></td>
<td><strong>what # must you first find?</strong>..</td>
</tr>
<tr>
<td>K179</td>
<td></td>
<td><strong>if you # want to make a DRAWING..in SCIENCE</strong></td>
</tr>
<tr>
<td>K180</td>
<td></td>
<td><strong>then we # speak of? what? of drawing?</strong></td>
</tr>
<tr>
<td>K181</td>
<td></td>
<td>[code-switches]</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**SPEECH FUNCTION**

**QUESTION (expressed by typical clause Mood interrogative)**
- ‘**now when you do a measurement what must you first find?**’ [K177; K178]

**DEMANDING INFORMATION** [4]
- ‘**if you want to make a drawing in science then we speak of what of drawing**’ [K179; K180] (‘individual response’) [7]

**APPRaisal**
1.1) attitude (appreciation – positive)
- ‘yes very good [answer]’ [K175]
1.2) graduation (force; intensifiers)
- ‘yes very good [answer]’ [K175]
<table>
<thead>
<tr>
<th>K182</th>
<th>yes?</th>
</tr>
</thead>
</table>

**MODALIZATION**
- "so we can get the very same displacement by by drawing and measurement and measurement’ [K176] (finite: modal) [3] (degree of modalization: low) [4]
- "now when you do a measurement what must you first find?" [K177; K178] (finite: modal) [3] (degree of modalization: high) [4]

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘a drawing in science’ [K179]

**PROCESSES**
- ‘and draw’ [K174]; ‘so we can get the very same displacement by by drawing and measurement and measurement’ [K176]; ‘then we speak of what of drawing’ [K180] (Pr: behavioural)
- ‘if you want to make a drawing in science’ [K179] (Pr: affection)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘**and**’ [K174]; ‘**and**’ [K176]; ‘**and**’ [K176] (conjunction type: ‘addition’; ‘addition’) [6]
- ‘**so**’ [K176] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘**when**’ [K177] (conjunction type: ‘time’; ‘simultaneous’) [6]
- ‘**if...then**’ [K179; K180] (conjunction type: ‘consequence’; ‘condition’) [6]

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:
- ‘**now**’ [K177] (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

**METADISCUSSION**
- ‘if you want to make a drawing in science then we speak of what of drawing’ [K179; K180]

**REFERENCE**
1) comparative:
- ‘**so we can get** the very same displacement **by drawing and measurement and measurement**’ [K176]

<table>
<thead>
<tr>
<th>L</th>
<th>scale drawing</th>
</tr>
</thead>
</table>

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘[a] scale drawing’ [K183]

| T | SCALE drawing.. |
| K185 | **so we use what?** a scale drawing.. |
| K186 | I # use scale drawing..SCALE drawing, **and what?** SCALE drawing, **and what?** and? measurement |
| K187 | now [unclear] |
| K188 | **and measurement** |
| K189 | remember # |
| K190 | we # did it |
| K191 | we # measured what? |
| K192 | EIGHTY,..millimeters **and?** right plus what? plus?..SIXTY, millimeters |
| K193 | and the TOTAL # was what? was? |

**EXPERIENTIAL**

**PROCESSES**
- ‘**remember**’ [K189] (Pr: cognition)
- ‘**we did it**’ [K190] (Pr: material)
- ‘**we measured what?**’ [K191] (Pr: behavioural)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘**so**’ [K185] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘**and**’ [K186]; ‘**and**’ [K186]; ‘**and**’ [K186]; ‘**and**’ [K188] (conjunction type: ‘addition’; ‘addition’) [6]

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:

**DEMANDING INFORMATION** [4]
- ‘and the total was what was’ [K193] (‘individual response’) [7]

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘eighty millimeters’ [K192]; ‘sixty millimeters’ [K192]; ‘total’ [K193]

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘**and**’ [K192]; ‘**and**’ [K193] (conjunction type: ‘addition’; ‘addition’) [6]
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K194</strong></td>
<td><strong>L</strong></td>
<td>one hundred and fourty</td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘one hundred and fourty’ [K194]</td>
<td></td>
</tr>
<tr>
<td><strong>K195</strong></td>
<td><strong>T</strong></td>
<td>was one hundred and fourty, millimeters which was equal to</td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td><strong>K196</strong></td>
<td></td>
<td>[code-switches]</td>
<td></td>
</tr>
<tr>
<td><strong>K197</strong></td>
<td></td>
<td>to fourteen?</td>
<td></td>
</tr>
<tr>
<td><strong>K198</strong></td>
<td><strong>Ls</strong></td>
<td>kilometers</td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘kilometers’ [K198]</td>
<td></td>
</tr>
<tr>
<td><strong>K199</strong></td>
<td><strong>T</strong></td>
<td>kilometers east</td>
<td><strong>EXPERIENTIAL</strong></td>
</tr>
<tr>
<td><strong>K200</strong></td>
<td></td>
<td>and THIS # was equal to, SIX kilometers..east</td>
<td><strong>PROCESSES</strong></td>
</tr>
<tr>
<td><strong>K201</strong></td>
<td></td>
<td>and THIS # was equal to, EIGHT kilometers..east</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>EXPERIENTIAL</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘that’s how we did it’ [K202] (Pr: material)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>KEY LEXICAL ITEMS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘six kilometers east’ [K200]; ‘eight kilometers east” [K201]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>LOGICAL</strong></td>
<td></td>
</tr>
<tr>
<td>K202</td>
<td>[chalkboard (10)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>that # ’s how we did it</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEXTUAL**

**REFERENCE**
1) first person pl.
- ‘that’s how we did it’ [K202]

**CONJUNCTION**
1) external conjunction:
- ‘and’ [K200]; ‘and’ [K201]

**TEXTUAL**

**REFERENCE**
1) exophoric reference:
- ‘and this was equal to six kilometers east’ [K200]
- ‘and this was equal to eight kilometers east’ [K201]
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)  
Projection; Modality; Concession

TAXANOMIC RELATIONS (EXPERIENTIAL)  
Class to member; Wholes to parts; Equivalence and Contrast

THEME (TEXTUAL)  
The Theme-Rheme boundary is shown by #. [4]

PERIODICITY AND SERIAL EXPANSION (TEXTUAL)  
macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings
<table>
<thead>
<tr>
<th>L1</th>
<th>PEDAGOGIC DISCOURSE</th>
<th>REGULATIVE REGISTER</th>
<th>INSTRUCTIONAL REGISTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>RIGHT</strong> the LAST thing we are going to <strong>TALK</strong> about... in the MECHANICS section #...</td>
<td>INTERPERSONAL</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>L2</td>
<td><em>(it’s getting quite hot in here today)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>[the teacher takes off her jacket] <strong>RIGHT</strong> the LAST little bit that we do in the mechanics section #... <em>is a little bit MORE than you did last year about.. ENERGY...</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td><strong>HOPEFULLY LAST YEAR # ..YOU learnt..SEVERAL</strong> different FORMS of ENERGY..</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L5</td>
<td>DID you?</td>
<td><strong>SPEECH FUNCTION</strong> QUESTION (expressed by typical clause Mood interrogative)</td>
<td></td>
</tr>
</tbody>
</table>

**KEY LEXICAL ITEMS**
- ‘mechanics’ [L1]; ‘energy’ [L3]

**TEXTUAL**
1) circumstances:
- ‘last year’ [L3]; ‘last year’ [L4]
2) internal conjunction:
- ‘right’ [L1]; ‘right’ [L3]
<table>
<thead>
<tr>
<th>L6</th>
<th>Ls</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>L7</td>
<td>T</td>
<td>maybe not LAST year..</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maybe..GRADE 8</td>
</tr>
<tr>
<td>L8</td>
<td></td>
<td><strong>INTERPERSONAL</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MODALIZATION</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘<strong>maybe not last year</strong>’ [L7] (Modal Adjunct)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘<strong>maybe grade 8</strong>’ [L8] (Modal Adjunct)</td>
</tr>
<tr>
<td>L9</td>
<td>Ls</td>
<td>yes</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td>[a number of the learners talk at the same time]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L10</th>
<th>T</th>
<th>okay..grade 7 8 9…</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>L11</th>
<th>it # doesn’t MATTER…</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>L12</th>
<th>the different FORMS of energy..things..like..&gt;HEAT energy, and SOUND energy, and LIGHT energy, and ELECTRICAL energy&lt;..CHEMICAL energy…</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>L13</th>
<th>RIGHT the TWO we are going to talk about [is] #.</th>
</tr>
</thead>
</table>

| L14 | <cause this # is a mechanics section>..

**Adjunct)**

**TEXTUAL**

**CONJUNCTION**

1) circumstances:
- ‘last year’[L7]; ‘grade 8’ [L8]

**REFERENCE**

1) comparative:
- ‘maybe not last year’ [L7]

**INTERPERSONAL**

**SPEECH FUNCTION COMMAND** (expressed by the non-typical clause Mood declarative)
- ‘now remember you are doing your own notes for your own sakes’ [L18; L19] (=take notes)
- ‘so subheading would be energy’ [L20] (=write the subheading energy)
- ‘remember some of you put your notes into rough and then put them into neat’ [L22-L24]; ‘others

**INTERPERSONAL**

**SPEECH FUNCTION QUESTION** (expressed by typical clause Mood interrogative)
- ‘right can anybody remember another similar name for potential energy?’ [L34] (‘individual response’)[7]
the TWO we are going to talk about #..is POTENTIAL energy..and KINETIC energy

RIGHT..NOW..let’s # be MORE specific..

we # are going to talk about..<gravitational potential energy>

now remember #

you # are doing your OWN notes, for your OWN sakes,..

so..SUBHEADING # would be ENERGY,

and then we # are going to talk about gravitational POTENTIAL energy…

REMEMBER #

some of you # put your notes into ROUGH

and then # put them into no- NEAT..

others of you # go straight into neat,..
| L26 | it’s up to YOU… |
| L27 | >some people # write NOTHING, |
| L28 | they # KNOW it already |
| L29 | that # ’s NOT a problem |
| L30 | if YOU # know it already |
| L31 | they # ’re YOUR notes |
| L32 | you # are learning to keep NOTES< |
| L33 | ONE of your skills… |
| L34 | RIGHT can anybody # remember another similar NAME for potential energy? |

EQUIVALENCE AND CONTRAST
- ‘they know it already’ [L28];
- ‘you know it already’ [L30] (parallel environments) [5]

CONJUNCTION
1) external conjunction:
- ‘then’ [L21]; ‘then’ [L24] (conjunction type: ‘time’; ‘successive’) [6]

LOGICAL

- ‘heat energy’ [L12]; ‘sound energy’ [L12]; ‘light energy’ [L12]; ‘electrical energy’ [L12]; ‘chemical energy’ [L12]; ‘potential energy’ [L12]; ‘kinetic energy’ [L12]; ‘gravitational potential energy’ [L17]
TEXTUAL

CONJUNCTION
1) circumstances:
- ‘grade 7’ [L10]; ‘[grade] 8’ [L10]; ‘[grade] 9’ [L10]
2) internal conjunction:
- ‘okay’ [L10]; ‘right’ [L13]; ‘right’ [L16]; ‘now’ [L16]; ‘now’ [L18]; ‘right’ [L35] (conjunction type: addition; staging; framing) [6]

REFERENCE
1) second person pl.
- ‘you are doing your own notes for your own sakes’ [L19]
- ‘remember some of you put your notes into rough and then put them into neat’ [L22-L24]
- ‘others of you go straight into neat’ [L25]
- ‘it’s up to you’ [L26]
- ‘that’s not a problem if you know it already’ [L29; L30]
- ‘you are learning to keep notes one of your skills’ [L32-L33]
2) possessive:
- ‘you are doing your own notes for your own sakes’ [L19]
- ‘remember some of you put your
notes into rough and then put them into neat” [L22-L24]
- ‘they’re your notes’ [L31]
- ‘you are learning to keep notes one of your skills’ [L32-L33]
3) comparative:
- ‘right can anybody remember another similar name for potential energy’ [L34]
- ‘remember some of you put your notes into rough’ [L22; L23]
- ‘some people write nothing’ [L27]

REPETITION
- ‘notes’ [L19]; ‘notes’ [L23]; ‘notes’ [L31]; ‘notes’ [L32] (lexical cohesion, repetition) [1]
- ‘your own notes’ [L19]; ‘your own sakes’ [L19]

METADISCUSSION
- ‘so subheading would be energy’ [L20]
- ‘and then we are going to talk about gravitational potential energy [heading]’ [L21]
- ‘right can anybody remember another similar name for potential energy’ [L34]
| L36 | T | **say # that loudly?** | LEARNER’S RESPONSE - ‘still energy’ [L35] |
| L37 | L | **still energy** | |
| L38 | T | **not still** | INTERPERSONAL |
| L40 | L | **s t?..** | |
| L41 | Ls | **stored energy** | EXPERIENTIAL |
| | | [a couple of learners call out ‘stored energy’] | |
| L42 | T | **STORED energy** | KEY LEXICAL ITEMS - ‘stored energy’ [L42] |
| L43 | L | **oh yes** | |
| L44 | T | **RIGHT..NOW..you # CAN get STORED in TERMS of things like..a SPRING** | INTERPERSONAL |
| L45 | **all of you** # think of a spring… |
| L46 | WHEN a SPRING # is PUSHED in TIGHT… |
| L47 | IT # ’s got the potential..TO? |

SPEECH FUNCTION
- COMMAND (expressed by the typical clause Mood imperative)
  - ‘**all of you** think of a spring’ [L45]
    - (‘an imperative consisting of a MOOD element of subject only’) [3]

DEMANDING INFORMATION [4]
- ‘it’s got the potential to’ [L47]
  - (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

MODALIZATION
- ‘right now you can get stored in terms of things like a spring’ [L44]

EXPERIENTIAL
- PROCESSES
  - ‘**all of you think of** a spring’ [L45]
    - (Pr: cognition)

EXPERIENTIAL
- KEY LEXICAL
  - ‘spring’ [L44]; ‘potential’ [L47]

LOGICAL
- CONJUNCTION
  - 1) external conjunction:

TEXTUAL
- CONJUNCTION
  - 1) internal conjunction:
    - ‘**right**’ [L44]; ‘**now**’ [L44]
      - (conjunction type: addition; staging;
[a couple of learners call out ‘expand’]

..expand

and # spring out

hasn’t it

RIGHT..YOU LOT # have ALL got the POTENTIAL...to pass matric..to develop your GREY cells..to do well..in LIFE

you # ’ve all got the potential...

it # doesn’t mean you’re all going to,,..

that # ’s UP to EACH and every ONE of you...

hopefully each and every one of you # ARE going to,..

BUT you # ’ve GOT the POTENTIAL...

right..NOW..<GRAVITATIONAL potential energy>..
you # can define it as <ENERGY due to HEIGHT> specifically

so like the energy in a SPRING #..wouldn’t come under <GRAVITATIONAL potential energy>..

okay gravitational potential energy # is <ENERGY due to HEIGHT>...

the other way of talking of potential energy when you were in grade 9 #
is...position

“sometimes you # may have used that word energy due to position”..

but what we’re going to think of THIS year # is ENERGY due to HEIGHT..

CAUSE it # ’s GOT the GRAVITY bit in...

um..WHERE # ’s that?

OKAY..here # ’s her ERASER...

is it # MOVING?

modulation: low) [4]
NEGATION [6]
- ‘it doesn’t mean you’re all going to’ [L54]
CONCESSION [6]
MONOGLOSSIA [6]
- ‘it doesn’t mean that you’re all going to’ [L54]

COLLOQUIAL/INFORMAL ENGLISH
- ‘so like the energy in a spring wouldn’t come under gravitational potential energy okay?’ [L60] (colloquial English)
- ‘but what we’re going to think of this year is energy due to height cause it’s got the gravity bit in’ [L64; L65] (informal English; colloquial English)

EXPERIENTIAL PROCESSES
- ‘the other way of talking of’

EXPERIENTIAL

KEY LEXICAL ITEMS
- ‘position’ [L62]; ‘height’ [L59];
- ‘we’re going to think of’ [L64] (Pr: cognition)

EQUIVALENCE AND CONTRAST
- ‘to pass matric’ [L52]; ‘to develop your grey cells’ [L52]; ‘to do well in life’ [L52] (parallel environments) [5]

LOGOGENESIS
- ‘the other way of talking of potential energy when you were in grade 9 is position’ [L62]

LOGICAL
CONJUNCTION
1) external conjunction:
- ‘so’ [L60] (conjunction type: ‘consequence’; ‘cause’) [6]
- ‘but’ [L64] (conjunction type: ‘comparison’; ‘contrast’) [6]

‘gravity’ [L65]; ‘eraser’ [L67]

LOGICAL
CONJUNCTION
1) external conjunction:
- ‘and’ [L50] (conjunction type: ‘addition’; ‘addition’) [6]
CONJUNCTION
1) circumstances:
- ‘grade 9’ [L62]; ‘this year’ [L64]
2) internal conjunction:
- ‘right’ [L52]; ‘right’ [L58]; ‘now’ [L58]; ‘okay’ [L61]; ‘okay’[L67]
(conjunction type: addition; staging; framing) [6]

REFERENCE
1) second person pl.
- ‘right you lot have all got the potential’ [L52]
- ‘you’ve got the potential’ [L53]
- ‘it doesn’t mean you’re all going to’ [L54]
- ‘that’s up to each and everyone of you’ [L55]
- ‘hopefully each and everyone of you are going to’ [L56]
- ‘but you’ve got the potential’ [L57]
2) comparative:
- ‘the other way of talking of potential energy when you were in grade 9 is position’ [L62]

REPETITION
- ‘you lot have all got the potential’

REFERENCE
1) exophoric:
- ‘okay here’s her eraser’ [L67]
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[L52]; ‘you’ve all got the potential’ [L53]; ‘you’ve got the potential’ [L57] - ‘each and every one of you’ [L55]; ‘each and every one of you’ [L56] METADISCOURSE - ‘you can define it as energy due to height specifically’ [L59] - ‘the other way of talking of potential energy when you were in grade 9 is position’ [L62] - ‘sometimes you may have used that word energy due to position’ [L63]</td>
<td></td>
</tr>
<tr>
<td>L69</td>
<td>Ls</td>
<td>no</td>
</tr>
<tr>
<td>L70</td>
<td>T</td>
<td>what # sort of ENERGY did it have up there? INTERPERSONAL SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - ‘what sort of energy did it have up there?’ [L70] (‘whole class response unprompted – one word answer to real question from teacher’) [7]</td>
</tr>
<tr>
<td>L71</td>
<td>Ls</td>
<td>potential energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>L72</td>
<td>T</td>
<td>GRAVITATIONAL potential energy</td>
</tr>
<tr>
<td>L73</td>
<td>Ls</td>
<td>oh</td>
</tr>
<tr>
<td>L74</td>
<td>T</td>
<td>okay..you # can just call it potential energy</td>
</tr>
<tr>
<td>L75</td>
<td></td>
<td>but..bear # in the back of your minds</td>
</tr>
<tr>
<td>L76</td>
<td></td>
<td>that it # ’s GRAVITATIONAL potential energy..&lt;ENERGY due to HEIGHT&gt;..</td>
</tr>
<tr>
<td>L77</td>
<td></td>
<td>SO IT# ’s GOT the POTENTIAL to do WHAT?</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

- **MODULATION**
  - ‘okay you can just call it potential energy but bear in the back of your minds that it’s gravitational potential energy energy due to height’ [L74-L76] (finite: modulated) [3] (degree of modulation: low) [4]
  - **CONCESSION [6]**
  - **CONTINUATIVES [6]**
    - ‘okay you can just call it potential energy’ [L74]

**EXPERIENTIAL**

- **PROCESSES**
  - ‘you can just call it’ [L74] (Pr: behavioural)
  - ‘but bear in the back of your minds that it’s GRAVITATIONAL potential energy..<ENERGY due to HEIGHT>..’ [L75]

**INTERPERSONAL**

- **SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative)**
  - ‘so it’s got the potential to do what?’ [L77] (‘whole class response unprompted’) [7]
minds that it's [know] gravitational potential energy’ (Pr: cognition) [L75; L76]

<p>| L78 | Ls | to fall down |
| L79 | T  | “to fall down”.. |</p>
<table>
<thead>
<tr>
<th>L80</th>
<th>alright WATER # at the TOP of a WATERFALL…HAS?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEMANDING INFORMATION [4] - ‘water at the top of a waterfall has’ [L80] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]</td>
</tr>
<tr>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td>KEY LEXICAL ITEMS ‘water’ [L80]; ‘waterfall’ [L80]</td>
</tr>
<tr>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td>CONJUNCTION 1) internal conjunction: - ‘alright’ [L80] (conjunction type: addition; staging; framing) [6]</td>
</tr>
<tr>
<td>L81</td>
<td>Ls (gravitational).potential.energy</td>
</tr>
<tr>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>L82</td>
<td>T potential.energy..gravitational potential energy</td>
</tr>
<tr>
<td></td>
<td>SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - ‘kinetic energy is what sort of energy?’ [L87] (‘whole class response unprompted’) [7]</td>
</tr>
<tr>
<td></td>
<td>MONOGLOSSIA - ‘kinetic energy is energy due to</td>
</tr>
<tr>
<td>L83</td>
<td>alright..ANYTHING that is at a HEIGHT..compared to something else # ..</td>
</tr>
<tr>
<td>L84</td>
<td>alright?</td>
</tr>
<tr>
<td>L85</td>
<td>has got potential energy</td>
</tr>
<tr>
<td>L86</td>
<td>okay..NOW what about the second one</td>
</tr>
</tbody>
</table>
we’re going to [unclear] which is <KINETIC energy>…

kinetic energy # is what sort of energy?

---

<table>
<thead>
<tr>
<th>L87</th>
<th>TEXTUAL</th>
<th>EXPERIENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONJUNCTION 1) internal conjunction: ‘okay’ [L86]; ‘now’ [L86]; ‘alright’ [L83] (conjunction type: addition; staging; framing) [6]</td>
<td>KEY LEXICAL ITEMS - ‘kinetic energy’ [L86]</td>
</tr>
<tr>
<td></td>
<td>REFERENCE 1) comparative: - ‘okay now what about the second one we’re going to [unclear] which is kinetic energy’ [L86]</td>
<td>movement’ [L87-L89]</td>
</tr>
</tbody>
</table>

| L88 | Ls | [unclear] |

<p>| L89 | T | &lt;ENERGY due to MOVEMENT&gt; |
| L90 |  | right as soon as there # ’s MOVEMENT |
| L91 |  | there # is KINETIC energy… |
| L92 |  | AND then TOGETHER # what are gravitational potential energy and kinetic |</p>
<table>
<thead>
<tr>
<th>L93</th>
<th>Ls</th>
<th>energy called?</th>
<th>gravitational potential kinetic energy</th>
<th>a number of the learners attempt to come up with names</th>
</tr>
</thead>
<tbody>
<tr>
<td>L94</td>
<td>T</td>
<td>some strange names coming out of here today…</td>
<td>INTERPERSONAL SPEECH FUNCTION COMMAND (expressed by the teacher)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L95</td>
<td>&lt;KINETIC energy..and POTENTIAL</td>
<td>INTERPERSONAL DEMANDING INFORMATION [4] - ‘and it’s going to’ [L97]</td>
<td></td>
</tr>
</tbody>
</table>
energy # together...make MECHANICAL energy>...
[chalkboard (4)]

RIGHT let’s # think AGAIN..about the WATER at the top of a WATERFALL...

and it # ’s going to?..FALL down...

you # can’t LOSE

or # gain energy

it # gets?

- ‘you can’t lose or gain energy it gets’ [L98-L100] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

- typical clause Mood imperative) ‘right let’s think again about the water at the top of a waterfall’ [L96] (‘an imperative consisting of a MOOD element of subject only’) [3]

APPRAISAL
1.1) attitude (appreciation):
- ‘some strange names coming out of here today’ [L94]

1.2) graduation (quantity):
- ‘some strange names coming out of here today’ [L94]

EXPERIENTIAL

PROCESSES
- ‘let’s think again’ [L96] (Pr: cognition)

LOGICAL

CONJUNCTION
1) external conjunction:
- ‘and’ [L95]; ‘and’ [L97] (conjunction type: ‘addition’; ‘addition’) [6]
<table>
<thead>
<tr>
<th>L101</th>
<th>Ls</th>
<th>Transferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>L102</td>
<td>T</td>
<td>TRANSFERRED,</td>
</tr>
<tr>
<td>L103</td>
<td></td>
<td><em>some books # say</em> TRANSFORMED,</td>
</tr>
<tr>
<td>L104</td>
<td></td>
<td><em>some books # say</em> CHANGED</td>
</tr>
<tr>
<td>L105</td>
<td></td>
<td><em>I don’t mind which WORD you use</em>&lt;…</td>
</tr>
<tr>
<td>L106</td>
<td></td>
<td><em>it # can get CHANGED from ONE form...to ANOTHER...</em></td>
</tr>
</tbody>
</table>

**CONJUNCTION**
1) circumstances:
   - *today* [L94]
2) internal conjunction:
   - *right* [L96] (conjunction type: addition; staging; framing) [6]

**REFERENCE**
1) anaphoric:
   - *right let’s think again about the water at the top of a waterfall* [L96]

**METADISCOURSE**
- *some strange names coming out of here today* [L94]

**INTERPERSONAL**
- *I don’t mind which word you use* [L105]

**INTERPERSONAL**
- ‘what in the end changed into’ [L109] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

**EXPERIENTIAL**
| L107 | SO, for the WATER for the WATERFALL or her ERASER... it # STARTED with?.. potential energy what in the end changed into? |
| L108 | |
| L109 | |
| L110 | Ls kinetic energy |

**TEXTUAL**

**REFERENCE**
1) first person sg.
- ‘I don’t mind which word you use’ [L105]
2) reference:
- ‘some books say transformed’ [L103]
- ‘some books say changed’ [L104]

**METADISCOURSE**
- ‘I don’t mind which word you use’ [L105]

**PROCESSES**
- ‘transferred’ [L102]; ‘transformed’ [L103]; ‘changed’ [L104] (Pr: intensive)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘or’ [L107] (conjunction type: ‘addition’; ‘alternation’) [6]

**TEXTUAL**

**REFERENCE**
1) comparative:
- ‘it can get changed from one form to another’ [L106]
<table>
<thead>
<tr>
<th>L111</th>
<th>T</th>
<th>KINETIC energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>L112</td>
<td>it # GOT..FASTER</td>
<td></td>
</tr>
<tr>
<td>L113</td>
<td>and # FASTER</td>
<td></td>
</tr>
<tr>
<td>L114</td>
<td>as it # went..down..</td>
<td></td>
</tr>
<tr>
<td>L115</td>
<td>**okay..**there # was MOVEMENT</td>
<td></td>
</tr>
<tr>
<td>L116</td>
<td>and there # was more</td>
<td></td>
</tr>
<tr>
<td>L117</td>
<td>and # MORE..movement..</td>
<td></td>
</tr>
<tr>
<td>L118</td>
<td>**alright..**MECHANICAL energy..at the TOP..</td>
<td></td>
</tr>
<tr>
<td>L119</td>
<td>“<strong>let’s # think about</strong> the mechanical energy at the TOP”..</td>
<td></td>
</tr>
<tr>
<td>L120</td>
<td>was it # [unclear]</td>
<td></td>
</tr>
<tr>
<td>L121</td>
<td>KINETIC</td>
<td></td>
</tr>
<tr>
<td>L122</td>
<td>or # POTENTIAL?</td>
<td></td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**SPEECH FUNCTION COMMAND** (expressed by the typical clause Mood imperative)
- ‘**let’s think about** the mechanical energy at the top’ [L119] (‘an imperative consisting of a MOOD element of subject only’) [3]

**EXPERIENTIAL**

**PROCESSES**
- ‘**let’s think about**’ [L119] (Pr: cognition)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘or’ [L122] (conjunction type: ‘addition’; ‘alternation’) [6]
<p>| L123 | Ls | potential | 1) internal conjunction: - ‘okay’ [L115]; ‘alright’ [L118] (conjunction type: addition; staging; framing) [6] | 1) comparative: - ‘and there was more and more movement’ [L116; L117] |
| L124 | T | the TOP |  |
| L125 |  | ‘don’t put’ your eraser away | INTERPERSONAL |
| L126 |  | we ‘re using this eraser’ | SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative) - ‘alright at the top here is it moving?’ [L127; L128] (‘whole class chorus ‘yes’/ ‘no’’) [7] |
| L127 |  | ALRIGHT at the TOP HERE |  |
| L128 |  | is it # MOVING? | TEXTUAL CONJUNCTION 1) internal conjunction: - ‘alright’ [L127] (conjunction type: addition; staging; framing) [6] |
| L129 | Ls | no | REFERENCE 1) exophoric reference: - ‘don’t put your eraser away we’re using this eraser’ [L125; L126] |</p>
<table>
<thead>
<tr>
<th>L130</th>
<th>T</th>
<th>so the mechanical energy # is ALL potential..</th>
</tr>
</thead>
<tbody>
<tr>
<td>L131</td>
<td></td>
<td>HALFWAY DOWN..</td>
</tr>
<tr>
<td>L132</td>
<td>so it #’s going from THERE to the DESK..</td>
<td></td>
</tr>
<tr>
<td>L133</td>
<td></td>
<td>HALFWAY DOWN #..HALF will be kinetic..</td>
</tr>
<tr>
<td>L134</td>
<td>and # HALF will be?..</td>
<td></td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**DEMANDING INFORMATION** [4]
- ‘and half will be’ [L134] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

**MODALIZATION**
- ‘halfway down half will be kinetic’ [L133] (finite: modal) [3] (degree of modalization: median) [4]
- ‘and half will be potential’ [L134; L135] (finite: modal) [3] (degree of modalization: median) [4]

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘so’ [L130]; ‘so’ [L132] (conjunction type: ‘consequence’; ‘cause’) [6]

**TEXTUAL**

**REFERENCE**
1) exophoric reference:
- ‘so it’s going from there to the..."
2) comparative:
- ‘so the mechanical energy is all potential’ [L130]
- ‘halfway down half will be kinetic’ [L133]
- ‘and half will be’ [L134]
3) location in space:
- ‘so it’s going from there to the desk’ [L132]

L135 Ls potential

L136 T POTENTIAL
and at the BOTTOM # ..now it’s got NO potential

L138 it # ’s not going to fall any further

L139 all the mechanical energy # is?

INTERPERSONAL

DEMANDING INFORMATION [4]
- ‘all the mechanical energy is’ [L139] (‘whole class prompted cloze chorus – teacher pauses and waits for class to complete sentence’) [7]

NEGATION [6]
- ‘it’s not going to fall any further’ [L138]

LOGICAL

CONJUNCTION
1) external conjunction:
<table>
<thead>
<tr>
<th>Line</th>
<th>Role</th>
<th>Text</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>L140</td>
<td>Ls</td>
<td>kinetic energy</td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[a couple of learners call out ‘kinetic energy’]</td>
<td></td>
</tr>
<tr>
<td>L141</td>
<td>T</td>
<td>KINETIC energy.</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>L142</td>
<td></td>
<td>the table # is going to stop it...</td>
<td></td>
</tr>
<tr>
<td>L143</td>
<td></td>
<td>[the bell rings]</td>
<td></td>
</tr>
<tr>
<td>L144</td>
<td></td>
<td>THINK # of EXAMPLES TONIGHT PLEASE,</td>
<td></td>
</tr>
<tr>
<td>L145</td>
<td></td>
<td>I # ‘m going to ASK you for EXAMPLES TOMORROW,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF you GO LADIES</td>
<td></td>
</tr>
</tbody>
</table>

**TEXTUAL**

**CONJUNCTION**
1) circumstances:
- ‘now’ [L137]

**REFERENCE**
1) comparative:
- ‘all the mechanical energy is’ [L139]

**INTERPERSONAL**

SPEECH FUNCTION
COMMAND (expressed by the typical clause Mood imperative)
- ‘think of examples tonight please’ [L143] (‘an imperative consisting of only a RESIDUE’) [3]

**EXPERIENTIAL**

PROCESSES
- ‘think of examples’ [L143] (Pr: cognition)
<table>
<thead>
<tr>
<th>TEXTUAL</th>
<th>TEXTUAL</th>
<th>TEXTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONJUNCTION</strong>&lt;br&gt;1) circumstances:&lt;br&gt;- ‘tonight’ [L143]; ‘tomorrow’ [L144]&lt;br&gt;&lt;br&gt;<strong>REFERENCE</strong>&lt;br&gt;1) second person pl.&lt;br&gt;- ‘I’m going to ask you for examples tomorrow’ [L144]</td>
<td></td>
<td><strong>REFERENCE</strong>&lt;br&gt;1) exophoric:&lt;br&gt;- ‘the table is going to stop it’ [L142]</td>
</tr>
</tbody>
</table>
TEXTS USED IN THIS ANALYSIS:

- TEXT 1: Bloor and Bloor, 2004
- TEXT 2: Christie, 2002
- TEXT 3: Eggins, 1994
- TEXT 4: Halliday, 1994
- TEXT 5: Lemke, 1993
- TEXT 6: Martin and Rose, 2003
- TEXT 7: Probyn, 2004
- The teacher’s notes; handouts; the learners’ notebooks and the textbook(s) used by the teacher and learners

HETEROGLOSSIA (INTERPERSONAL)

Projection; Modality; Concession

TAXANOMIC RELATIONS (EXPERIENTIAL)

Class to member; Wholes to parts; Equivalence and Contrast

THEME (TEXTUAL)

The Theme-Rheme boundary is shown by #. [4]

PERIODICITY AND SERIAL EXPANSION (TEXTUAL)

macro-/ hyperTheme; macro-/ hyperNew; Metadiscourse; Headings
<table>
<thead>
<tr>
<th></th>
<th>PEDAGOGIC DISCOURSE</th>
<th>REGULATIVE REGISTER</th>
<th>INSTRUCTIONAL REGISTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>T</td>
<td>alright..NOW..what we then did here.. # was to find the RESULTANT</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td>NOW..now..°we # then..drew something like that...</td>
<td>POSITIVE POLARITY</td>
</tr>
<tr>
<td>M3</td>
<td></td>
<td>we # had something like this°</td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td>M4</td>
<td></td>
<td>[code-switches]</td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td></td>
<td>in our experiment</td>
<td>KEY LEXICAL ITEMS - ‘experiment’ [M5]</td>
</tr>
<tr>
<td>M6</td>
<td></td>
<td>[code-switches]</td>
<td>PROCESSES - ‘alright now what we then did here was to find the resultant’ [M1] (Pr: intensive)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘now now we then drew something like that’ [M2] (Pr: behavioural)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘we had something like this in our experiment’ [M3; M5] (Pr: possession)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EQUIVALENCE AND CONTRAST - ‘we then drew something like that’ [M2]; ‘we had something like this’ [M3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LOGICAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EXPERIENTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KEY LEXICAL ITEMS - ‘resultant’ [M1]</td>
</tr>
<tr>
<td>M7</td>
<td>Ls</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td></td>
</tr>
</tbody>
</table>

**CONJUNCTION**
1) external conjunction:
- *then* [M1]; *then* [M2]
(conjunction type: ‘time’; ‘successive’) [6]

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:
- *alright* [M1]; *now* [M1]; *now* [M2]; *now* [M2]
(conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

**REFERENCE**
1) first person pl.
- *alright now what we then did here was to find* the resultant’ [M1]
- *now now we then drew something like that* [M2]
2) possessive:
- *we had something like this in our experiment*’ [M3; M5]
3) location in space:
- *alright now what we then did here was to find* the resultant’ [M1]
<table>
<thead>
<tr>
<th>M8</th>
<th>T</th>
<th>right in our experiment # [unclear] we had something like that repetition1 …</th>
</tr>
</thead>
<tbody>
<tr>
<td>M9</td>
<td>o we # had something like that repetition1 …</td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>we # had something like that repetition1 ..</td>
<td></td>
</tr>
<tr>
<td>M11</td>
<td>then..you # made your experiment..</td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>and then you… # you said..</td>
<td></td>
</tr>
<tr>
<td>M13</td>
<td>there # ’s a FORCE, this side</td>
<td></td>
</tr>
<tr>
<td>M14</td>
<td>[there # is] a FORCE, this side</td>
<td></td>
</tr>
<tr>
<td>M15</td>
<td>and [there # is] a force here</td>
<td></td>
</tr>
<tr>
<td>M16</td>
<td>I # ’ve got one NEWTON,</td>
<td></td>
</tr>
<tr>
<td>M17</td>
<td>zero point eight NEWTONS,</td>
<td></td>
</tr>
<tr>
<td>M18</td>
<td>zero point seven</td>
<td></td>
</tr>
<tr>
<td>M19</td>
<td>the POINT # is acting here</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td>and we # then wanted to find WHAT? the RESULTANT of these two forces</td>
<td></td>
</tr>
<tr>
<td>M21</td>
<td>and of course it # was quite EASY</td>
<td></td>
</tr>
<tr>
<td>M22</td>
<td>because you # used WHAT’…you used</td>
<td></td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

**DEMANDING INFORMATION**

[4]

- ‘and we then wanted to find what’ [M20]
- ‘because you used what you used your pair of what of your your your pair of what of’ [M22] (‘whole class prompted cloze chorus’) [7]

**APPRAISAL**

1.1) attitude (appreciation)

- ‘and of course it [the problem] was quite easy’

1.2) graduation (force; intensifiers)

- ‘and of course it [the problem] was quite easy’

**EXPERIENTIAL**

**PROCESSES**

- ‘right in our experiment [unclear] we had something like that’ [M8] (Pr: possession)
- ‘then you made your experiment’ [M11] (Pr: material)
- ‘and then you said’ [M12] (Pr: verbal)
- ‘and then we wanted to find what the resultant of these two
**your PAIR of WHAT? of your your your PAIR of WHAT? of?**

- ‘and of course it was quite easy’ [M21] (Pr: intensive)
- ‘because you used what you used your pair of what of your your your pair of what of compasses’ [M22; M23] (Pr: material)

**LOGICAL**

**CONJUNCTION**

1) external conjunction:
- ‘then’ [M11]; ‘then’ [M12]; ‘then’ [M20] (conjunction type: ‘time’; ‘successive’) [6]

**TEXTUAL**

**CONJUNCTION**

1) internal conjunction:

**REFERENCE**

1) reference:
- ‘and then you said’ there’s a force

**REFERENCE**

1) exophoric:
- ‘right in our experiment [unclear] we had something like that’ [M8]; ‘we had something like that’ [M9]; ‘we had something like that’ [M10]; ‘there’s a force this side’ [M13]; ‘a force this side’
| M23 | Ls | compasses |
| M24 | T  | COMPASSES (sic) .. to get THAT there, |
|     |    | and of course again HERE, to get it THERE, |
| M25 |    | > I # hope |
| M26 |    | I # ’ll be RIGHT here<, |
| M27 |    | then we # joined the TWO repetition2 .. |
| M28 |    | then we # JOINED the two repetition2 .. |
| M29 |    | > I # ’m lucky.. |
| M30 |    | not very<.. |
| M31 |    | we # JOINED the two repetition2, |

- “we had something like that” [repetition1]

- “and then we wanted to find what” the resultant of these two forces’ [M20]

- ‘and a force here’ [M15]; ‘the point is acting here’ [M19]

- “I’m lucky..” [M30; M31]

- “I’m lucky not very” [M30; M31]

- “I hope I’ll be RIGHT here” [M30; M31]

- “I’m lucky not very” [M30; M31]

- “not very<..” [M32]
| M33 | and we # found out | NEGATION [6] |
| M34 | that...the resultant # is like that | - ‘I’m lucky not very’ [M30; M31] |
| M35 | and then I # asked you a few questions | CONTINUATIVES [6] |
| M36 | so THIS # is the resultant of this force | - ‘and of course again here to get it there’ [M25] |
| M37 | and # this force.. | EXPERIENTIAL |
| M38 | mm?. | KEY LEXICAL ITEMS |
| M39 | this # is the resultant | - ‘questions’ [M35] |
| M40 | this line # is the resultant of these forces° | PROCESSES |
| M41 | now..IF THIS..sorry.. | - ‘to get that there’ [M24]; ‘and of course again here to get it there’ [M25] (Pr: material) |
| M42 | if this.. # is the result- | - ‘I hope I’ll be right here’ [M26; M27] (Pr: affection) |
| M43 | if this line..the DIAGONAL of this..RECTANGLE.. # is the RESULTANT of these two forces | - ‘I hope I’ll be right here’ [M26; M27] (Pr: intensive) |
| M44 | what # do you find? | - ‘then we joined the two’ [M28] (Pr: material) |
| M45 | you # actually found | - ‘and then I asked you a few questions’ [M35] (Pr: verbal) |
| M46 | that? | LOGICAL |
| M47 | its magnitude # is equal to what? | CONJUNCTION |

**M48**

| repetition3 | ...
| "its magnitude is equal to what?" |

[chalkboard (4)]

**M49**

| yes boy? |

| ‘addition’) [6] |
| - ‘then’ [M28]; ‘then’ [M29]; ‘then’ [M35] (conjunction type: ‘time’; ‘successive’) [6] |

**TEXTUAL**

**CONJUNCTION**

1) internal conjunction:

**REFERENCE**

1) first person sing.
   - ‘I hope I’ll be right here’ [M26; M27]
   - ‘I’m lucky not very’ [M30; M31]
   - ‘and then I asked you a few questions’ [M35]

2) reference:
   - ‘yes boy’ [M49]

3) location in space:
   - ‘to get that there’ [M24]
   - ‘and of course again here to get it there’ [M25]
   - ‘I hope I’ll be right here’ [M26; M27]

**REPETITION**

- ‘then we joined the two’

**M49**

| yes boy? |

| ‘and’ [M37] (conjunction type: ‘addition’; ‘addition’) [6] |
| - ‘if’ [M41]; ‘if’ [M42]; ‘if’ [M43] (conjunction type: ‘consequence’; ‘condition’) [6] |

**TEXTUAL**

**REFERENCE**

1) exophoric:
   - ‘to get that there’ [M24]; ‘that the resultant is like that’ [M34]; ‘so this is the resultant of this force and this force’ [M36; M37]; ‘this is the resultant’ [M39]; ‘this line is the resultant of these forces’ [M40]; ‘if this line the diagonal of this rectangle is the resultant of these two forces’ [M43]

**REPETITION**

- ‘its magnitude is equal to what’

repetition3
**METADISCUSSION**
- ‘and then I asked you a few questions’ [M35]

<table>
<thead>
<tr>
<th>M50</th>
<th>L</th>
<th>to the one newton force acting downwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>M51</td>
<td>T</td>
<td>to the one newton force acting DOWNWARDS</td>
</tr>
<tr>
<td>M52</td>
<td></td>
<td>we # found</td>
</tr>
<tr>
<td>M53</td>
<td></td>
<td>that it # is almost EQUAL here</td>
</tr>
<tr>
<td>M54</td>
<td></td>
<td>&gt;we # found out</td>
</tr>
<tr>
<td>M55</td>
<td></td>
<td>that this force here # is also that force there&lt;</td>
</tr>
<tr>
<td>M56</td>
<td></td>
<td>so the RESULTANT of these two forces..&lt; # is one newton&gt;</td>
</tr>
<tr>
<td>M57</td>
<td></td>
<td>Ơbut..these two forces..these two forces..of EIGHT and seven.. # were balanced by this forceơ…</td>
</tr>
<tr>
<td>M58</td>
<td></td>
<td>remember #</td>
</tr>
<tr>
<td>M59</td>
<td></td>
<td>these two forces..</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**
**CONTINUATIVES [6]**
- ‘that this force here is also that force there’ [M55]

**SPEECH FUNCTION**
**QUESTION (expressed by typical clause Mood interrogative)**
- ‘which force balanced them?’ (passive construction) [M63] (‘individual response’) [7]

**NEGATION [6]**
- ‘they accelerated and needed a a force to balance those forces not to accelerate’ [M60-M62]

**CONCESSION [6]**
- ‘but’ [M57]

**EXPERIENTIAL**
**PROCESSES**
- ‘remember these two forces’ [M58; M59] (Pr: cognition)

**KEY LEXICAL ITEMS**
- ‘to balance’ [M61]; ‘to accelerate’ [M62]
they # accelerated.

and # needed a force to BALANCE those forces

not to ACCELERATE...

°which # force balanced them?°

yes?

EQUIVALENCE AND CONTRAST
- ‘that this force here is also that force there’ [M55]

LOGICAL

CONJUNCTION
1) external conjunction:
- ‘so’ [M56] (conjunction type: ‘consequence’; ‘cause’) [6]

TEXTUAL

REFERENCE
1) exophoric:
- ‘we found out that this force here is also that force there’ [M54; M55]; ‘so the resultant of these two forces is one newton’ [M56]; ‘but these two forces these two forces of eight and seven were balanced by this force’ [M57]; ‘these two forces they accelerated and needed a force to balance those forces’ [M59-M61]

2) location in space:
- ‘we found that it is almost equal here’ [M52; M53]
- ‘we found out that this force here
| L | M65 | the one newton force | EXPERIENTIAL |
| L | M66 | the?..ONE newton force # **was used** to balance what?..the resul- sorry these two forces | INTERPERSONAL |
|   | M67 | **but** these two forces # had a resultant..this way.. | DEMANDING INFORMATION [6] |
|   | M68 | so THIS force is a force that does what?..that balances what? | CONCESSION [6] |

**EXPERIENTIAL**

**KEY LEXICAL ITEMS**
- ‘the one newton force’ [M65]

**INTERPERSONAL**

**DEMANDING INFORMATION [6]**
- ‘so this force is a force that does what that balances what’ [M68] (active construction)

**CONCESSION [6]**
- ‘but’ [M67]

**EXPERIENTIAL**

**PROCESSES**
- ‘the one newton force **was used** to balance what the resul- sorry these two forces’ [M66] (Pr: material)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
<table>
<thead>
<tr>
<th>M69</th>
<th>L</th>
<th>[unclear]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M70</td>
<td>T</td>
<td>no</td>
</tr>
<tr>
<td>M71</td>
<td></td>
<td>zero point eight and zero point seven # have a resultant of one newton..</td>
</tr>
<tr>
<td>M72</td>
<td></td>
<td>[code-switches]</td>
</tr>
<tr>
<td>M73</td>
<td></td>
<td>right now..these two forces</td>
</tr>
<tr>
<td>M74</td>
<td></td>
<td>when we # did not have this force downwards here</td>
</tr>
<tr>
<td>M75</td>
<td></td>
<td>this # ACCELERATED this way</td>
</tr>
<tr>
<td>M76</td>
<td></td>
<td>we # then put in another force here to do what?</td>
</tr>
</tbody>
</table>

**INTERPERSONAL**

NEGATION [6]
- ‘when we did not have this force downwards here this accelerated this way’ [M74; M75]

**EXPERIENTIAL**

- ‘we then put in another force here to do what?’ [M76] (Pr: material)

**LOGICAL**

- ‘the one newton force was used to balance what the result- sorry these two forces’ [M66]; ‘but these two forces had a resultant this way’ [M67]; ‘so this force is a force that does what that balances what?’ [M68]

**TEXTUAL**

**REFERENCE**
1) exophoric:
- ‘the one newton force was used to balance what the result- sorry these two forces’ [M66]; ‘but these two forces had a resultant this way’ [M67]; ‘so this force is a force that does what that balances what?’ [M68]
CONJUNCTION
1) external conjunction:
- ‘when’ [M74] (conjunction type: ‘time’; ‘simultaneous’) [6]
- ‘then’ [M76] (conjunction type: ‘time’; ‘successive’) [6]

TEXTUAL
CONJUNCTION
1) internal conjunction:
- ‘right’ [M73]; ‘now’ [M73]
(conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

REFERENCE
1) exophoric:
- ‘right now these two forces’ [M73]; ‘when we did not have this force downwards here’ [M74]; ‘this accelerated this way’ [M75]
2) location in space:
- ‘when we did not have this force downwards here’ [M74]; ‘we then put in another force here to do what?’ [M76]
3) comparative:
- ‘we then put in another force here to do what?’ [M76]

M77  L  to balance the two forces

M78  T  to BALANCE the two forces...

M79  T  so this # is a force that does what?...that?

INTERPERSONAL

DEMANDING INFORMATION [4]
- ‘so this is a force that does what
balances

that BALANCES these two forces..

it # is a FORCE that BALANCES

we # actually put a force here of what? of, of a hundred..grams equal..one newton

and it # became
| M85 | it | EXPERIENTIAL |
| M86 | the whole thing # shifted | PROCESSES |
| M87 | and # became like this.. | - ‘we actually put a force here of what of of a hundred grams equal one newton’ [M83] (Pr: material) |
| M88 | it it # made this thing to come...to rest.. | EXPERIENTIAL |
| [chalkboard (3)] | | KEY LEXICAL ITEMS |
| M89 | it # actually made..the resultant..to do what? repetition4 ... | - ‘to come to rest’ [M88] |
| M90 | it # made the resultant do what? repetition4 | LOGICAL |
| M91 | yes? | CONJUNCTION |
| | | 1) external conjunction: |
| | | - ‘and’ [M84]; ‘and’ [M87] (conjunction type: ‘addition’; ‘addition’) [6] |
| M92 | L | TEXTUAL |
| | it # made it zero | REFERENCE |
| | 1) location in space: | 1) exophoric: |
| | - ‘we actually put a force here of what of of a hundred grams equal one newton’ [M83] | - ‘that balances these two forces’ [M81]; ‘the whole thing shifted and became like this’ [M86; M87] |
| | | REPETITION |
| | | - ‘it [actually] made the resultant to do what?’ repetition4 |
| | | EXPERIENTIAL |
| M93 | T | I # agree                         |  | KEY LEXICAL ITEMS - ‘zero’ [M92] |
|-----|----|----------------------------------|  |                               |
| M94 |    | you # are actually quite correct |  |                               |
| M95 |    | once something # is at rest      |  |                               |
| M96 |    | the resultant # is               |  | INTERPERSONAL
|     |    |                                  |  | DEMANDING INFORMATION [4]     |
|     |    |                                  |  | ‘once something is at rest the |
|     |    |                                  |  | resultant is’ [M95; M96]      |
|     |    |                                  |  | (‘whole class prompted cloze |
|     |    |                                  |  | chorus’) [7]                  |
|     |    |                                  |  | EXPERIENTIAL
|     |    |                                  |  | PROCESSES
|     |    |                                  |  | - ‘I agree you are actually quite |
|     |    |                                  |  | correct’ [M93; M94]            |
|     |    |                                  |  | - ‘I agree you are actually quite |
|     |    |                                  |  | correct’ [M93; M94] (Pr: intense) |
|     |    |                                  |  | TEXTUAL
|     |    |                                  |  | REFERENCE
|     |    |                                  |  | 1) first person sing.
|     |    |                                  |  | - ‘I agree’ [M93]
| M97 | Ls | zero                             |  |                               |
| M98 | T  | zero                             |  | INTERPERSONAL
|     |    |                                  |  | SPEECH FUNCTION
|     |    |                                  |  | COMMAND (expressed by non- |
|     |    |                                  |  | INTERPERSONAL
<p>|     |    |                                  |  | DEMANDING INFORMATION [4]     |
|     |    | the resultant force acting on    |  |                               |
|     |    | that THING # is zero             |  |                               |</p>
<table>
<thead>
<tr>
<th>M100</th>
<th><strong>NOW, NOW ..?can you # give...</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>M101</td>
<td><strong>can you # define..this force?..</strong></td>
</tr>
<tr>
<td>[apparatus (1)]</td>
<td></td>
</tr>
<tr>
<td>M102</td>
<td>the force acting downward.. # is a force that does what?°</td>
</tr>
<tr>
<td>M103</td>
<td>[name]</td>
</tr>
</tbody>
</table>

**typical clause Mood modulated interrogative)**
- ‘**now now can you give’** [M100]
- ‘**can you define this force?’** [M101]

**MODULATION**
- ‘**now now can you give’** [M100];
  ‘**can you define this force?’** [M101]
  (finite: modulated) [3] (degree of modulation: low) [4]

**TEXTUAL**

**CONJUNCTION**
1) internal conjunction:
- ‘**now’** [M100]; ‘**now’** [M100]
  (conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

**REFERENCE**
1) second person sing.
- ‘**now now can you give’** [M100]
- ‘**can you define this force?’** [M101]

**METADISCUSSION**
- ‘**can you define this force?’** [M101]

**TEXTUAL**

**REFERENCE**
1) exophoric:
- ‘the resultant force acting on that thing is zero’ [M99]
- ‘**can you define this force?’** [M101]
<table>
<thead>
<tr>
<th>M104</th>
<th>L</th>
<th>that balances</th>
<th>INTERPERSONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>M105</td>
<td>T</td>
<td>that BALANCES?</td>
<td>DEMANDING INFORMATION [4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘that balances’ [M105] (‘individual response’) [7]</td>
</tr>
<tr>
<td>M106</td>
<td>L</td>
<td>all forces</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td>M107</td>
<td>T</td>
<td>ALL forces acting at this point..</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SPEECH FUNCTION QUESTION (expressed by typical clause Mood interrogative)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘if this force was not there what would be <strong>what do you think would actually happen?</strong>’ [M121-M125] (‘individual response’) [7]</td>
</tr>
<tr>
<td>M108</td>
<td>N</td>
<td><strong>NOW we # THINK</strong></td>
<td>MODALIZATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘if this force was not here…what do you think would actually happen?’ [M121-M125]</td>
</tr>
<tr>
<td>M109</td>
<td>N</td>
<td>there # is a point here<strong>repetition5</strong></td>
<td>NEGATION [6]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ‘if this force was not here…what do you think would actually happen?’ [M121-M125]</td>
</tr>
<tr>
<td>M110</td>
<td>N</td>
<td><strong>ne?..</strong></td>
<td></td>
</tr>
<tr>
<td>M111</td>
<td>N</td>
<td><strong>now we # think</strong></td>
<td></td>
</tr>
<tr>
<td>M112</td>
<td>N</td>
<td>you know there # is a point here<strong>repetition5</strong></td>
<td></td>
</tr>
<tr>
<td>M113</td>
<td>N</td>
<td>[code-switches]</td>
<td></td>
</tr>
<tr>
<td>M114</td>
<td>N</td>
<td>there # is a point here<strong>repetition5</strong></td>
<td></td>
</tr>
<tr>
<td>M115</td>
<td>N</td>
<td><strong>and I # ‘ve got</strong> two forces acting on this point</td>
<td></td>
</tr>
</tbody>
</table>
| M116 | **but now suddenly I # have now** | modalization: median)  
- ‘if this force was not there what would be **what do you think would actually happen?’** [M125] (finite: modal) [3] (degree of modalization: median) [4] | **LOGICAL**  
**CONCESSION**  
- ‘**but**’ [M116]  
- ‘**suddenly**’ [M116] |
| M117 | [code-switches] |  | **LOGICAL**  
**CONJUNCTION**  
1) external conjunction:  
- ‘**and**’ [M115] (conjunction type: ‘addition’; ‘addition’) [6]  
- ‘**if**’ [M121]; ‘if’ [M123] (conjunction type: ‘consequence’; ‘condition’) [6] |
| M118 | THIS force # balances the forces acting on that point  
[chalkboard (5)] | **TEXTUAL**  
**CONJUNCTION**  
1) circumstances:  
- ‘**but now suddenly I have now**’ [M116]  
1) internal conjunction:  
- ‘**now**’ [M108]; ‘**now**’ [M111] |
| M119 | WHY? because this force # ACTS in this direction  
[chalkboard(4)] | **TEXTUAL**  
**REFERENCE**  
1) exophoric:  
- ‘all forces acting at this point’ [M107]; ‘**and I’ve got**’ two forces acting on this point’ [M115]; ‘this force balances the forces acting on |
<table>
<thead>
<tr>
<th>M127</th>
<th>L</th>
<th>the whole system # would collapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>M128</td>
<td>T</td>
<td>&gt;the WHOLE SYSTEM # would COLLAPSE&lt;</td>
</tr>
<tr>
<td>M129</td>
<td></td>
<td>[code-switches]</td>
</tr>
</tbody>
</table>

(conjunction type: ‘addition’; ‘staging’; ‘framing’) [6]

REPETITION - ‘[now we think] [you know] there is a point here’ repetition5

that point’ [M118]; ‘why because this force acts in this direction’ [M119]; ‘and this one acts in that direction’ [M120]; ‘if this force was not here’ [M121]; ‘if this force was not here’ [M123]

2) location in space:
- ‘there is a point here?’ [M109; M110]; ‘you know there is a point here’ [M112]; ‘there is a point here’ [M114]; ‘if this force was not here’ [M121]; ‘if this force was not there’ [M123]

INTERPERSONAL

MODALIZATION

EXPERIENTIAL

KEY LEXICAL ITEMS
- ‘whole system’ [M127]; ‘collapse’ [M127]

INTERPERSONAL

DEMANDING INFORMATION - ‘so this force we found out it is
right.. SO, SO, this force # is a force... that BALANCES... that balances the two forces...

so..this force we found out it is equal to what?

equal to what’ [M131] (‘individual response’) [7]

MODALIZATION

LOGICAL
CONJUNCTION
1) external conjunction:
- ‘so’ [M130]; ‘so’ [M130]; ‘so’ [M131] (conjunction type: ‘consequence’; ‘cause’) [6]

REFERENCES:
1) exophoric:
- ‘right so so this force is a force that balances the two forces’ [M130]; ‘so this force we found out it is equal to what?’ [M131]

<table>
<thead>
<tr>
<th>M132</th>
<th>L</th>
<th>to the resultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>M133</td>
<td>T</td>
<td>to the resultant force</td>
</tr>
<tr>
<td>M134</td>
<td>so</td>
<td>this force</td>
</tr>
<tr>
<td>M135</td>
<td>so a force..that BALANCES..OTHER FORCES</td>
<td>- ‘a force that balances other forces must be equal to what’ [M137] (‘whole class prompted cloze chorus’) [7]</td>
</tr>
<tr>
<td>M136</td>
<td>[code-switches]</td>
<td>MODALIZATION</td>
</tr>
<tr>
<td>M137</td>
<td>a force..that BALANCES..OTHER FORCES.. # MUST be equal to what?</td>
<td>- ‘a force that balances other forces must be equal to what to the resultant force’ [M137; M138] (finite: modal) [3] (degree of modalization: high) [4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LOGICAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONJUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) external conjunction:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘so’ [M134]; ‘so’ [M135] (conjunction type: ‘consequence’; ‘cause’) [6]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEXTUAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) exophoric:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ‘so this force’ [M134]</td>
</tr>
<tr>
<td>M138</td>
<td>Ls</td>
<td>to the resultant force</td>
</tr>
<tr>
<td>M139</td>
<td>T</td>
<td>&gt;TO THE RESULTANT FORCE&lt;..</td>
</tr>
<tr>
<td>M140</td>
<td>so here THIS FORCE.. # BALANCES</td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INTERPERSONAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPEECH FUNCTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEMANDING INFORMATION</td>
</tr>
<tr>
<td>M141</td>
<td>the..the other..forces..</td>
<td></td>
</tr>
<tr>
<td>M142</td>
<td>it # balances them # repetition6 ..</td>
<td></td>
</tr>
<tr>
<td>M143</td>
<td>°it # balances them° repetition6 ..</td>
<td></td>
</tr>
<tr>
<td>M144</td>
<td>but this force.. # is the resultant..</td>
<td></td>
</tr>
<tr>
<td>M145</td>
<td>now..these two forces # ARE? EQUAL</td>
<td></td>
</tr>
<tr>
<td>M146</td>
<td>now we # want to use a SPECIAL name here to to to give you know this force that balances you know other forces</td>
<td></td>
</tr>
<tr>
<td>M147</td>
<td>&gt;who knows&lt;…</td>
<td></td>
</tr>
<tr>
<td>M148</td>
<td>am I # teaching three people here? repetition? …</td>
<td></td>
</tr>
<tr>
<td>M149</td>
<td>am I # teaching three people here? repetition?</td>
<td></td>
</tr>
<tr>
<td>M150</td>
<td>it # ’s very easy for me to say you know</td>
<td></td>
</tr>
<tr>
<td>M151</td>
<td>get out #</td>
<td></td>
</tr>
<tr>
<td>M152</td>
<td>and # run back (sic)</td>
<td></td>
</tr>
</tbody>
</table>

**QUESTION (expressed by typical clause Mood interrogative)**
- ‘now we want to use a special name here to to to give you know this force that balances you know other forces who knows?’ [M146; M147]

**SPEECH FUNCTION COMMAND (expressed by non-typical clause Mood declarative)**
- ‘let’s now form a new word you know for this force yes’ [M157; M158] (=form a new word for this force) (‘individual response’) [7]

**APPRAISAL**
1) attitude (appreciation):
- ‘now we want to use a special name here to to to give you know this force that balances you know other forces’ [M146]

**EXPERIENTIAL**

**PROCESSES**
- ‘now we want to use a special name here to to to give you know this force that balances you know other forces’ [M146] (Pr: affection)
- ‘who knows’ [M147] (Pr:
<table>
<thead>
<tr>
<th>M153</th>
<th>[code-switches]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M154</td>
<td>yes?</td>
</tr>
<tr>
<td>M155</td>
<td>[code-switches]</td>
</tr>
<tr>
<td>M156</td>
<td>yes?..yes?..eh he..THIS FORCE # is EQUAL to THIS FORCE</td>
</tr>
<tr>
<td>M157</td>
<td>let’s # now form a NEW word..you know for this force…</td>
</tr>
<tr>
<td>M158</td>
<td>yes?</td>
</tr>
</tbody>
</table>

**cognition)**
- ‘am I teaching three people here?’ [M148]; ‘am I teaching three people here?’ [M149] (Pr: behavioural)
- ‘it’s very easy for me to say you know get out and run back’ (sic) [M150-M152] (Pr: verbal)
- ‘it’s very easy for me to say you know get out and run back’ (sic) [M150-M152] (Pr: material)
- ‘let’s now form a new word you know for this force’ [M157] (Pr: material)

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘and’ [M152] (conjunction type: ‘addition’; ‘addition’) [6]

**TEXTUAL**

**CONJUNCTION**
1) ‘let’s now form a new word you know for this force’ [M157]
1) internal conjunction:

**LOGICAL**

**CONJUNCTION**
1) external conjunction:
- ‘so’ [M140] (conjunction type: ‘consequence’; ‘cause’) [6]

**TEXTUAL**

**REFERENCE**
1) exophoric:
- ‘so here this force balances the the other forces’ [M140]; ‘but this force is the resultant’ [M144]; ‘now we want to use a special name here to to give you know this force that’
REFERENCE
1) first person pl.
- ‘now we want to use a special name here to give you know this force that balances you know other forces’ [M146]
2) first person sing.
- ‘am I teaching three people here?’ [M148]
- ‘am I teaching three people here?’ [M149]
- ‘it’s very easy for me to say you know get out and run back’ (sic) [M150-M152]
3) location in space:
- ‘now we want to use a special name here to give you know this force that balances you know other forces’ [M146]
- ‘am I teaching three people here?’ [M148]
- ‘am I teaching three people here?’ [M149]
REPETITION
- ‘am I teaching three people here?’ repetition7

METADISCOURSE
- ‘now we want to use a special name here to give you know this force that balances you know other forces’ [M146]; ‘yes yes eh he this force is equal to this force’ [M156]; ‘let’s now form a new word you know for this force’ [M157]
2) location in space:
- ‘so here this force balances the the other forces’ [M140]
3) comparative:
- ‘now we want to use a special name here to give you know this force that balances you know other forces’ [M146]

REPETITION
- ‘it balances them’, repetition6
name here to to to give you know this force that balances you know other forces’ [M146]  
- ‘let’s now form a new word you know for this force’ [M157]  

| M159 | L | equilibrant | EXPERIENTIAL  
| KEY LEXICAL ITEMS  
- ‘equilibrant’ [M159]  

| M160 | T | it # ’s the? | INTERPERSONAL  
| DEMANDING INFORMATION  
[4]  
- ‘it’s the’ [M160] (‘individual response’) [7]  

| M161 | L | equilibrant |  

| M162 | T | the equilibrant | INTERPERSONAL  

| M163 | yes |  

| M164 | so..this # is called…the equilibrant ..  
[chalkboard (4)] |  

| M165 | it # is a force that BALANCES..other forces.. | LOGICAL  

- ‘what do (sic) we know about a force that balances other forces is that [it] is equal to what’ [M166-M168] (‘whole class prompted cloze chorus’) [7]
| M166 | what do (sic) we know about a force that balances other forces # is that |
| M167 | [code-switches] |
| M168 | [it] # is equal to what? |

**CONJUNCTION**
1) external conjunction:

**TEXTUAL**

**REFERENCE**
1) exophoric:
- ‘so this is called the equilibrant’ [M164]
2) comparative:
- ‘it is a force that balances other forces’ [M165]; ‘what do (sic) we know about a force that balances other forces is that [it] is equal to what’ [M166-M168]

| M169 | Ls to the resultant |

| M170 | T to the RESULTANT of those two forces |
| M171 | what # is the SECOND..condition..of the equilibrant? |
| M172 | what # is the SECOND thing about you know about the equilibrant?… |
| M173 | eh? |

**INTERPERSONAL**

**SPEECH FUNCTION**
QUESTION (expressed by typical clause Mood interrogative)
- ‘what is the second condition of the equilibrant?’ [M171]
- ‘what is the second thing about you know about the equilibrant?’ [M172]
one condition is that the equilibrant is always equal to the resultant force.

number two?

[name]?

SPEECH FUNCTION QUESTION
- ‘number two’ (=what is number two?)
- (‘individual extended response unassisted’) [7]

EXPERIENTIAL

KEY LEXICAL ITEMS
- ‘second condition’; ‘equal’

TEXTUAL

REFERENCE
1) exophoric:
- ‘to the resultant of those two forces’ [M170]
2) comparative:
- ‘what is the second condition of the equilibrant?’ [M171]; ‘what is the second thing about you know about the equilibrant?’ [M172]

TEXTUAL

REFERENCE
1) comparative:
- ‘it acts in the same straight line as the resultant’
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M179</td>
<td>T</td>
<td>it # ACTS in the SAME STRAIGHT LINE as the RESULTANT, very good, yes?</td>
<td>INTERPERSONAL APPRAISAL 1.1) attitude (appreciation – positive) - ‘very good’ [answer]’ [M180] 1.2) graduation (force; intensifiers) - ‘very good’ [answer]’ [M180]</td>
</tr>
<tr>
<td>M180</td>
<td></td>
<td></td>
<td>INTERPERSONAL DEMANDING INFORMATION [4] - ‘it acts in the same straight line as the resultant…yes’ [M179-M181]</td>
</tr>
<tr>
<td>M181</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M182</td>
<td>L</td>
<td>but [it # acts] in the opposite direction</td>
<td>INTERPERSONAL CONCESSION - ‘but’ [M182]</td>
</tr>
<tr>
<td>M183</td>
<td>T</td>
<td>BUT [it # acts] in the opposite direction very good boy, very good..</td>
<td>INTERPERSONAL SPEECH FUNCTION</td>
</tr>
<tr>
<td>M184</td>
<td></td>
<td></td>
<td>CONCESSION [6]</td>
</tr>
</tbody>
</table>
in the opposite direction
that # ’s what the equilibrant is...

**NOW, now, now** [unclear]...
clean # the board for me please you know this side [unclear]
|   |   | 1) first person sing.  
- ‘**clean the board for me please you know this side** [unclear]’ [M188]  
2) exophoric:  
- ‘**clean the board for me please you know this side** [unclear]’ [M188]  
3) reference:  
- ‘**very good boy very good**’ [M184] |