



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL / NASIONALE  
SENIOR CERTIFICATE / SERTIFIKAAT**

**GRADE / GRAAD 11**

**PHYSICAL SCIENCES: PHYSICS (P1)/  
FISIESE WETENSKAPPE: FISIEKA (V1)**

**EXEMPLAR 2007  
MODEL 2007**

**MEMORANDUM**

**This memorandum consists of 14 pages.  
Hierdie memorandum bestaan uit 14 bladsye.**

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MEMORANDUM

<b>Learning Outcomes and Assessment Standards</b> <b>Leeruitkomst en Asseseringstandaarde</b>		
<b>LO 1 / LU 1</b>	<b>LO 2 / LU 2</b>	<b>LO 3 / LU 3</b>
<p><b>AS 11.1.1:</b> Plan and conduct a scientific investigation to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Beplan en voer 'n wetenskaplike ondersoek uit met betrekking tot akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p> <p><b>AS 11.1.2:</b> Seek patterns and trends, represent them in different forms to draw conclusions, and formulate simple generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor, maak gevolgtrekkings en formuleer eenvoudige veralgemenings.</i></p> <p><b>AS 11.1.3:</b> Apply known problem-solving strategies to solve multi-step problems.</p> <p><i>Pas bekende probleemoplossingsstrategieë toe om probleme met meervoudige stappe op te los.</i></p>	<p><b>AS 11.2.1:</b> Define and discuss basic prescribed scientific knowledge.</p> <p><i>Definieer en bespreek voorgeskrewe wetenskaplike kennis.</i></p> <p><b>AS 11.2.2</b> Express and explain prescribed scientific theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike teorieë, modelle en wette uit deur die verwantskap tussen verskillende konsepte in eie woorde aan te dui.</i></p> <p><b>AS 11.2.3:</b> Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p><b>AS 11.3.2:</b> Identify ethical and moral issues related to the development of science and technology and evaluate the impact (pros and cons) of the relationship from a personal viewpoint.</p> <p><i>Identifiseer etiese en morele aspekte verwant aan die ontwikkeling van wetenskap en tegnologie, en evalueer die impak (voordele en nadele) van die verwantskap uit 'n persoonlike oogpunt.</i></p> <p><b>AS 11.3.3:</b> Evaluate the impact of scientific and technological knowledge on sustainable development of resources and suggest long-term and short-term strategies to improve the management of resources in the environment.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese kennis op volhoubare ontwikkeling van bronne, en stel langtermyn en korttermyn strategieë voor om bestuur van bronne in die omgewing te verbeter.</i></p>

**SECTION A / AFDELING A**

**QUESTION 1 / VRAAG 1**

1.1	Net (resultant) force / <i>netto (resulterende) krag</i> ✓	[11.2.1]	(1)
1.2	Second class / <i>Tweede klas</i> ✓	[11.2.1]	(1)
1.3	Dielectric material / <i>Diëlektrikum</i> ✓	[11.2.1]	(1)
1.4	Fundamental / <i>Grond noot</i> ✓	[11.2.1]	(1)
1.5	Semi-conductors / <i>Halfgeleiers</i> ✓	[11.2.1]	(1)

**[5]**

**QUESTION 2 / VRAAG 2**

2.1	D ✓	[11.2.1]	(1)
2.2	A ✓	[11.2.1]	(1)
2.3	C ✓	[11.2.1]	(1)
2.4	B ✓	[11.2.3]	(1)
2.5	I ✓	[11.2.1]	(1)

**[5]**

**QUESTION 3 / VRAAG 3**

3.1	False / <i>Onwaar</i> ✓ The two <u>forces act on different bodies</u> therefore they cannot cancel each other. / <i>Die twee kragte werk in op verskillende liggame en kan mekaar nie kanselleer nie.</i>	[11.2.3]	(2)
3.2	True / <i>Waar</i> ✓✓	[11.2.1]	(2)
3.3	False / <i>Onwaar</i> ✓ <u>Pupil</u> of the eye functions like aperture OR Iris of eye functions like <u>diaphragm</u> ✓ <i>Die pupil (kyker) van die oog funksioneer soos 'n lensopening OF Die iris van die oog funksioneer soos die diafragma.</i> ✓	[11.2.1]	(2)
3.4	False / <i>Onwaar</i> ✓ Decreases with increasing distance OR increases with decreasing distance. <i>Neem af met toename in afstand OF neem toe met afname in afstand.</i>	[11.2.2]	(2)
3.5	False / <i>Onwaar</i> ✓ High voltage and <u>low current</u> ✓ / <i>Hoë potensiaalverskil en lae stroom</i> ✓	[11.2.1]	(2)

**[10]**

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**QUESTION 4 / VRAAG 4**

- 4.1 B ✓✓✓ [11.1.2] (3)
- 4.2 B ✓✓✓ [11.2.2] (3)
- 4.3 B ✓✓✓ [11.1.2] (3)
- 4.4 D ✓✓✓ [11.2.3] (3)
- 4.5 A ✓✓✓ [11.2.3] (3)
- [15]**

**TOTAL SECTION A = 35**

**SECTION B / AFDELING B**

**QUESTION 5 / VRAAG 5**

- 5.1  $\mu_s = \frac{f_{s,max}}{N}$  ✓✓ [11.2.1] (2)
- 5.2
- 5.2.1 Use the checklist to mark this question.  
*Gebruik die kontrolelys om hierdie vraag na te sien.*

<b>The investigative question refers to the: Die ondersoekende vraag verwys na die:</b>	1	0
Dependant variable / <i>Afhanklike veranderlike</i>		
Independent variable / <i>Onafhanklike veranderlike</i>		
Total out of 2 / <i>Totaal uit 2</i>		

Example of an investigative question/ *Voorbeeld van ondersoekende vraag:*

Is the coefficient of static friction for the shoe on the tile bigger than, smaller than or equal to 0,5?

*Is die koëffisiënt van statiese wrywing vir die skoën op die teël groter as, kleiner as of gelyk aan 0,5?*

What is the coefficient of static friction for the shoe on the tile?

*Wat is die koëffisiënt van statiese wrywing vir die skoën op die teël?* [11.1.1] (2)

- 5.2.2 Apparatus for method 1 / *Apparaat vir metode 2:*  
Protractor / *Gradeboog* ✓✓ OR  
Ruler / *Liniaal* ✓✓

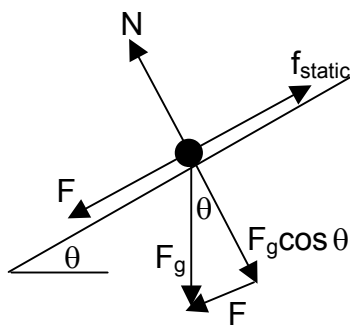
[11.1.1] (2)

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Apparatus for method 2 / *Apparaat vir metode 2:*  
 Spring balance / *Trekskaal* ✓  
 Scale / *Skaal* ✓

5.2.3 Method 1 / *Metode 1*

- Place the shoe on the tile. / *Plaas die skoën op die teël.*
- Lift the one end of the tile gradually until the shoe JUST STARTS TO SLIDE down the tile. / *Lig die een ent van die teël totdat die skoën NET BEGIN om teen die teël af te GLY.* ✓
- IF PROTRACTOR USED / AS GRADEBOOG GEBRUIK WORD:  
 Measure the angle between the tile and the horizontal surface. .  
*Meet die hoek tussen die teël en die horisontale vlak.* ✓  
 IF RULER USED / AS LINIAAL GEBRUIK WORD:  
 Measure any two of the following: perpendicular height of the tile, length of the tile or the length from the foot of the tile to the perpendicular height and then use trigonometry to determine the angle / *Meet enige twee van die volgende: loodregte hoogte van die teël, lengte van die teël of die lengte vanaf die onderste end van die teël tot die loodregte hoogte, Gebruik dan (trigonometrie) driehoeksmeting om die hoek te bepaal* ✓
- The following free body diagram illustrates the different forces acting on the shoe. / *Die volgende vryliggaamdiagram illustreer die verskillende kragte wat op die skoën inwerk.*



N: normal force or the force of surface on object / *normaalkrag of die krag van die oppervlakte op die voorwerp*  
 F: sliding force / *glykrag*  
 F<sub>g</sub>: force of gravity or force of earth on object / *gravitasiekrag of die krag van die aarde op die voorwerp*  
 f<sub>s</sub>: force of static friction / *statiese wrywingskrag*

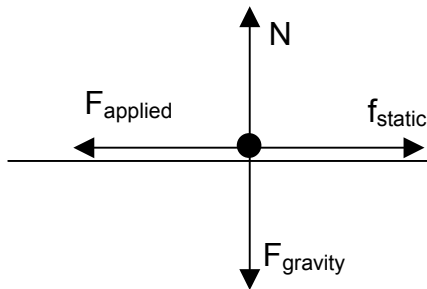
<b>The free body-diagram indicates the:</b> <b><i>Die vryliggaamdiagram dui die:</i></b>	1	0
Normal force and the force of static friction on the shoe correctly. / <i>Normaalkrag en die statiese wrywingskrag op die skoën korrek aan.</i>		
Relationship between the angle that the inclined plane forms with the horizontal and the static force of friction correctly. / <i>Verwantskap tussen die hoek wat die skuinsvlak met die horisontaal vorm en die statiese wrywingskrag korrek.</i>		
Total out of 2 / <i>Totaal uit 2</i>		

Method 2 / *Metode 2*

- Place a heavy object in the shoe and determine the mass of the shoe and the object. / *Plaas 'n swaar voorwerp in die skoën en*

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- *bepaal die massa van die skoен en die voorwerp. ✓*
- Pull the shoe with the heavy object inside with a spring balance. / *Trek die skoен met die swaar voorwerp daarin met die trekskaal. ✓*
- Take the reading on the spring balance (F) when the shoe just starts to move. / *Neem die lesing op die trekskaal (F) sodra die skoен net begin beweeg. ✓*



<b>The free body diagram:</b> <b>Die vryliggaamdiagram dui die::</b>	1	0
Normal force on the shoe correctly indicated. / <i>Normaalkrag op die skoен korrek aangetoon.</i>		
Force of friction on the shoe correctly indicated. / <i>Wrywingskrag op die skoен korrek aangetoon.</i>		
Total out of 2 / <i>Totaal uit 2</i>		

[11.1.1] (5)

5.2.4 Method 1 / *Metode 1:*

Size of the angle between tile and floor when shoe just starts to slide. / *Grootte van die hoek tussen die teël en die vloer toe die skoен net begin gly het. ✓✓*

Method 2 / *Metode 2:*

Mass of shoe and heavy object. / *Massa van skoен en swaar voorwerp. ✓*

Reading on spring balance when shoe just starts to move / *Lesing op trekskaal toe skoен net begin beweeg het. ✓*

[11.1.1] (2)

5.2.5 Method 1/ *Metode 1:*

The normal force / *normaalkrag*,  $N = F_g \cos \theta$

$$\mu_s = \frac{f_s}{N} = \frac{f_s}{F_g \cos \theta} = \tan \theta$$

If  $\mu_s$  is bigger or equal to 0,5, the grocer is not guilty.

If  $\mu_s$  is smaller than 0,5, the grocer is guilty.

*Indien  $\mu_s$  groter as of gelyk is aan 0,5, is die kruidenier nie skuldig nie.*

*Indien  $\mu_s$  kleiner as 0,5 is, is die kruidenier skuldig.*

Method 2:/ *Metode 2*

$$N = F_g = mg \quad \text{and} \quad f_{s, \max} = F \quad \therefore \mu_s = \frac{f_{s, \max}}{N} = \frac{f_{s, \max}}{mg}$$

If  $\mu_s$  is bigger or equal to 0,5, the grocer is not guilty.

If  $\mu_s$  is smaller than 0,5, the grocer is guilty.

*Indien  $\mu_s$  groter as of gelyk is aan 0,5, is die kruidenier nie skuldig nie.*

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*Indien  $\mu_s$  kleiner as 0,5 is, is die kruidenier skuldig.*

<b>The conclusion: / Die gevolgtrekking:</b>	1	0
Correct mathematical expression to determine coefficient of friction. / <i>Korrekte wiskundige verwantskap om die wrywingskoeffisiënt te bepaal.</i>		
Indicates how it will be determined whether grocer is guilty or not/ <i>Dui aan hoe dit bepaal sal word of kruidenier skuldig is of nie.</i>		
Total out of 2 / <i>Totaal uit 2</i>		

[11.1.2]

(2)  
**[15]**

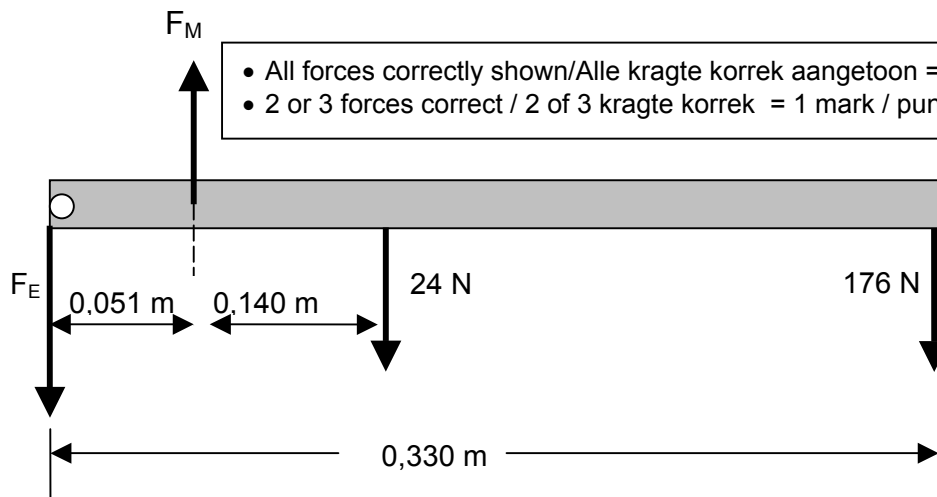
**QUESTION 6 / VRAAG 6**

6.1 The torque is a physical quantity which measures the turning ability of a force about an axis. ✓✓ /

*Die draaimoment is 'n fisiese hoeveelheid wat die draai moontlikheid van 'n krag om 'n as meet.* ✓✓

[11.2.1] (2)

6.2



[11.2.3] (2)

6.3 Since the bar is in equilibrium: / Omdat die staaf in ewewig is:

$$F_{\text{net}} = F_M - 176 - F_E - 24 = 0 \quad \checkmark$$

$$\therefore F_M - 200 - F_E = 0 \dots \dots (1)$$

$$T_{\text{net}} = 0 \text{ N} \checkmark$$

$$F_M (0,051) - 24 (0,14) - 176 (0,330) = 0 \checkmark$$

$$\therefore F_M = 1204,7 \text{ N} \checkmark$$

From / van (1)  $1204,7 - 200 - F_E = 0 \checkmark$

$$F_E = 1004,7 \text{ N} \checkmark$$

[11.1.3] (6)

6.4 Yes✓, because  $F_E$  is positive (anticlockwise) movement in relation to  $F_M$ . OR  $F_E$  moves in opposite direction to  $F_M$  ✓ /

*Ja ✓, omdat  $F_E$  positief is (antikloksgewyse) beweging in verhouding tot  $F_M$  OF  $F_E$  beweeg in die rigting teenoorgesteld aan die van  $F_M$ .* ✓

[11.2.3] (2)

6.5 Because the lever arm for the weight of the arm is longer than the lever arm for the muscle relative to the joint✓. A bigger force is therefore exerted on the muscle and elbow joint ✓ in order to lift an object and this causes much pain at the joint.

*Omdat die hefboom vir die gewig van die arm langer is as die hefboom vir die spier in vergelyking tot die elmboog. 'n Groter krag word dus op die spier en elmboog uitgeoefen om die voorwerp te lig en dit veroorsaak groter pyn in die elmboog.*

[11.3.2] (2)

[14]

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**QUESTION 7 / VRAAG 7**

- 7.1 The father suffers from short sightedness (myopia) ✓  
The child suffers from long sightedness (hyperopia) ✓ ✓  
The grandmother suffers from presbyopia (her defect is due to old age) ✓  
*Die pa ly aan bysiendheid (myopia) ✓*  
*Die kind ly aan versierendheid (hiperopia) ✓ ✓*  
*Die ouma ly aan presbiopia (haar defek is as gevolg van ouderdom) [11.1.2] (3)*

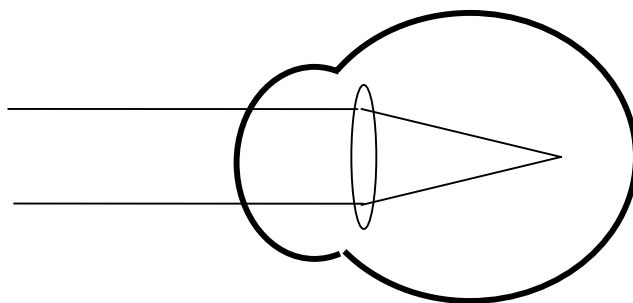
- 7.2 Myopic eye (father): Eyeball may be too long or focal length of the eye lens may be too short ✓ hence image forms in vitreous humour ✓ instead of on retina  
Child: Eyeball too short or focal length ✓ of eye lens too long hence image forms behind retina. ✓  
Grandmother: The eye has lost power of accommodation because the ciliary muscles have become tense. ✓ ✓

*Bysierende oog (pa): Die oogbal kan te lank wees of die brandpuntafstand van die ooglens is te kort. Gevolglik vorm die beeld in die glasvog in plaas van op die retina.*

*Kind: Die oogbal kan te kort wees of die ooglens kan te lank wees. Gevolglik vorm die beeld agter die retina.*

*Ouma: Die oog het die akkomodasievermoë verloor omdat die lensspier te styf geword het. [11.2.1] (6)*

7.3.1

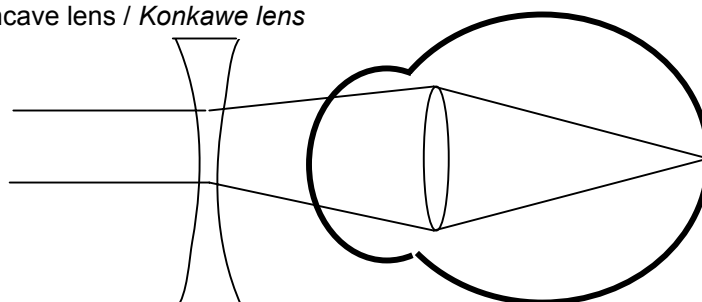


Defect / Defek

[11.2.3] (2)

7.3.2

Concave lens / Konkawe lens



Correction /  
Korreksie

[11.3.2] (3)  
**[14]**

### QUESTION 8 / VRAAG 8

8.1 dB (decibels) ✓ [11.2.1] (1)

- 8.2 Any two possible suggestions e.g.
- Put legislation in place that will regulate acceptable noise levels e.g. making double glazed windows compulsory in all homes.
  - Plant trees between houses and busy roads
  - Increase the distance between the industrial area and residential areas etc. ✓✓

*Enige twee moontlike voorstelle bv.:*

- *Stel wetgewing in stand wat aanvaarbare geraasvlakke reguleer bv. verpligtende dubbelglas in ons wonings.*
- *Plant bome tussen wonings en besige paaie.*
- *Vergroot die afstand tussen die nywerheidsgebiede en woongebiede ensovoorts* ✓✓

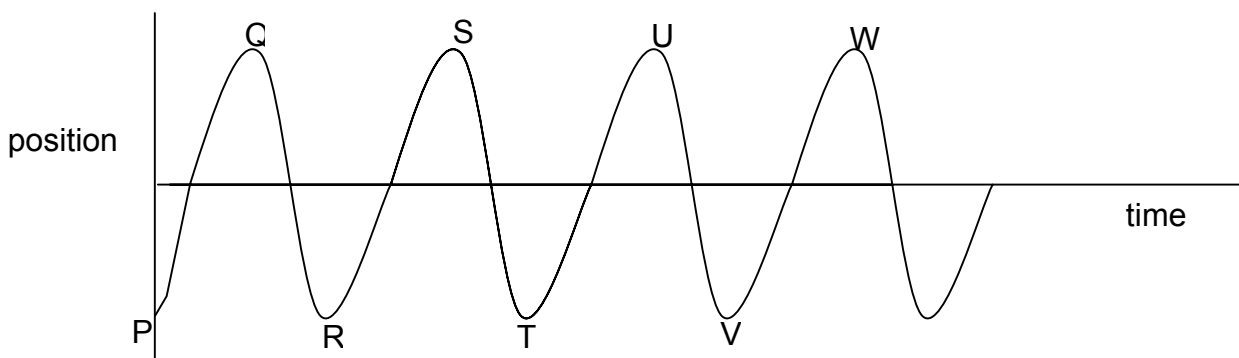
[11.3.2] (2)

- 8.3 Any two possible precautions e.g.
- using quieter engines
  - compulsory wearing of ear muffs ✓✓
  - compulsory signage of noisy areas in the factory etc.

*Enige twee moontlike voorsorgmaatreëls bv.*

- *gebruik stiller enjins* ✓✓
- *verpligte dra van oorklappe*
- *verpligte kennisgewings van raserige gebiede in fabriek ens.* [11.3.2] (2)

8.4



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<b>Criteria for the graph:</b> <b>Kriteria vir die grafiek:</b>	1	0
Positions of compressions Q, S, U, W. <i>Posisie van verdigting Q, S, U, W.</i>		
Positions of rarefactions P, R, T V. <i>Posisie van verdunning P, R, T, V.</i>		
Position (dependant variable) on the y-axis and Time (independent variable) on the x-axis <i>Posisie (afhanklike veranderlike) op die y-as en tyd (onafhanklike veranderlike) op die x-as</i>		
Shape of the graph <i>Vorm van die grafiek</i>		
Total 4 / <i>Totaal4</i>		

[11.1.2] (4)

8.5 PR ; QS ; RT ; SU ; TV ; UW ✓✓

[11.2.3] (2)

8.6  $T = \frac{1}{v}$  or  $T = \frac{1}{f}$  ✓

$T = \frac{1}{500}$  ✓

$T = 0,002 \text{ s}$  ✓

[11.2.3] (3)

8.7  $v = f \lambda$  ✓ or  $v = v \lambda$

$v = (500)(0,688)$

$v = 344 \text{ m} \cdot \text{s}^{-1}$  ✓

OR

$v = \frac{s}{t}$  ✓

$v = \frac{0,688}{0,002}$  ✓

$v = 344 \text{ m} \cdot \text{s}^{-1}$  ✓

[11.2.3] (4)

**[18]**

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**QUESTION 9 / VRAAG 9**

9.1  $v = \frac{\Delta x}{\Delta t}$  ✓

$345 = \frac{\Delta x}{0,018}$  ✓

$x = 6,21 \text{ m}$  ✓ total distance, *total afstand*,

Therefore the bat is half this distance from the wall /

*Dus is die vlermuis die helfte van hierdie afstand vanaf die muur.*

$\frac{6,21}{2} = 3,105 \text{ m.}$  ✓

[11.1.3] (5)

9.2  $\lambda = \frac{v}{\nu}$  ✓

$\lambda = \frac{345}{1,2 \times 10^5}$  ✓

$\lambda = 2,875 \times 10^{-3} \text{ m}$  ✓ i.e (3 mm)

[11.2.3] (4)  
**[9]**

**QUESTION 10 / VRAAG 10**

10.1 4 valence electrons / 4 valenselektrone ✓✓

[11.1.2] (2)

10.2 Tetrahedral / tetraëdraal ✓✓

[11.2.1] (2)

10.3 In metals the conduction and valence bands overlap ✓✓ / close together OR no energy gap between the conduction and valence bands ✓✓

*Die geleidings- en valensbande oorvleuel / na aanmekaar OF geen energiegaping tussen die geleidings- en valensbande nie.* ✓✓

[11.2.2] (2)

10.4 Germanium conducts at a lower temperature / better conductor at low temperature ✓✓ OR germanium requires a smaller amount of energy to become a conductor ✓✓

*Germanium gelei teen 'n laer temperatuur / beter geleier teen lae temperatuur ✓✓ OF germanium vereis 'n kleiner hoeveelheid energie om 'n geleier te wees.* ✓✓

[11.1.2] (2)

10.5 Silicon is a better conductor at high temperature ✓✓  
*Silikon is 'n beter geleier teen hoë temperatuur.* ✓✓

[11.1.2] (2)  
**[10]**

**QUESTION 11 / VRAAG 11**

- 11.1 Graphite will conduct electricity due to delocalised electrons, ✓  
whereas polystyrene does not have delocalised electrons and will  
therefore not conduct electricity ✓

*Grafiet sal elektrisiteit gelei weens gedelokaliseerde elektrone, terwyl  
polistireen nie gedelokaliseerde elektrone het nie en dus nie  
elektrisiteit gelei nie. ✓*

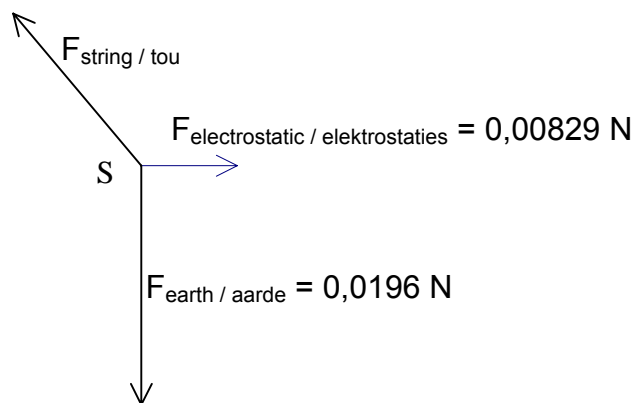
[11.2.3] (2)

11.2

$$\begin{aligned} F &= \frac{kQ_S Q_T}{r^2} \checkmark \\ &= \frac{(9 \times 10^9)(4,8 \times 10^{-8})(4,8 \times 10^{-8})}{(0,05)^2} \checkmark \\ &= 8,29 \times 10^{-3} \text{ N} \checkmark, \text{ repulsion, to the right / afstoting na regs} \checkmark \end{aligned}$$

[11.2.3] (6)

11.3



- ✓ Direction of forces / *rigting van kragte*
- ✓✓✓ Labels of forces / *benoeming van kragte*
- ✓ Magnitudes of two forces / *grootte van kragte*

[11.1.4] (5)  
**[13]**

### QUESTION 12 / VRAAG 12

12.1 The average emf induced in the circuit is equal ✓ to the rate of change of flux ✓

*Die gemiddelde emk in die stroombaan geïnduseer is gelyk ✓ aan die tempo van verandering van magnetise vloed. ✓*

[11.2.1] (2)

12.2  $\Delta\Phi = \Delta BA$  ✓

$$\Delta\Phi = (0 - 0,2)(0,1)$$
$$= -0,02 \text{ T}\cdot\text{m}^2 \text{ ✓}$$

$$\varepsilon = -N \frac{\Delta\Phi}{\Delta t} \text{ ✓}$$

$$\varepsilon = -(1) \frac{(-0,02)}{10^{-4}} \text{ ✓}$$

$$\varepsilon = 200 \text{ V } \text{ ✓}$$

[11.1.3] (8)

12.3  $R = \frac{V}{I}$  ✓

$$10 = \frac{200}{I} \text{ ✓}$$

$$I = 20 \text{ A } \text{ ✓}$$

[11.2.3] (4)  
[14]

### QUESTION 13 / VRAAG 13

13.1  $R = \frac{V}{I} \text{ ✓} = \frac{12}{1,25} \text{ ✓} = 9,6 \text{ A } \text{ ✓}$

[11.2.3] (4)

13.2  $R_{\text{tot}}$  decreases / *neem af* ✓

$I_{\text{tot}}$  increases / *neem toe* ✓

$V_{\text{lost}}$  increases / *neem toe*

$V_{\text{parallel}}$  decreases / *neem af* ✓

less work is done in moving charges through bulb ✓ bulb becomes dimmer. / *minder arbeid word verig om die ladings deur die gloeilamp te beweeg* ✓, *gloeilamp word dowwer.*

[11.1.4] (4)  
[8]

**GRAND TOTAL / GROOTTOTAAL= 150**