GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION

PROVINSIALE EKSAMEN

JUNE/*JUNIE* 2017

GRADE 11

PHYSICAL SCIENCES /
FISIESE WETENSKAPPE
Paper / *Vraestel* 1

Physics / *Fisika*

MEMORANDUM

14 pages / *bladsye*

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

PHYSICAL SCIENCES:Physics /
FISIESE WETENSKAPPE: Fisika

MEMORANDUM

QUESTION 1 / ***VRAAG 1***

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 A ✓✓ (2)

1.10 C ✓✓ (2)

[20]

QUESTION 2 / *VRAAG 2*

2.1 The resultant or net force is the vector sum of all the forces acting on that object. ✓✓

Die resulterende of netto krag is die vektor som van al die kragte wat op daardie voorwerp inwerk. ✓✓ (2)

2.2.1 Y – direction: = 9 - Fy ✓

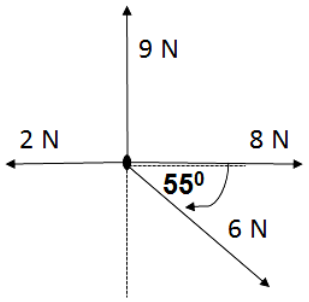
Y – rigting: = 9 – (6 x sin 55°)✓

= 9 - 4,91

= 4,085... N upwards / *opwaarts* / 0 °✓

X – direction: = -2 + 8 + (6 x cos 55°) ✓

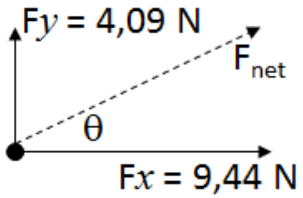
X – rigting: = 9,4416... N to the right / *regs* / 90° ✓



$F_{net}^2 = F_y^2 + F_x^2$ ✓

$= (4,085)...^2 + (9,4416)...^2$

F_{net} = 10,29 N ✓



(7)

2.2.2

OPTION 1/ OPSIE 1		**OPTION 2/ OPSIE 2**		**OPTION 3/ OPSIE 3**
$\sin\theta = \frac{o}{h}$ ✓	**OR / *OF***	$\tan\theta = \frac{o}{a}$	**OR / *OF***	$\cos\theta = \frac{a}{h}$
$= \frac{4,09}{10,29}$ ✓		$= \frac{4,09}{9,44}$		$= \frac{9,44}{10,29}$
θ = 23,42° ✓		= 23,43°		= 23,45°

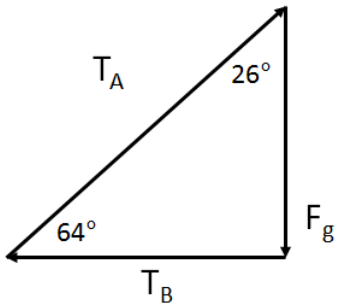
(3)

[12]

QUESTION 3 / *VRAAG 3*

3.1 An object is in equilibruim if it remains in a state of rest or motion at constant velocity with a zero resultant / net force acting on it.✓ ✓
'n Voorwerp is in ewewig as dit in rus is of met 'n konstante snelheid beweeg met geen resulterende / netto krag wat daarop inwerk nie.✓✓ (2)

3.2



- ✓ F_g / w (lower case) and direction of arrow
  F_g / w (klein letter), rigting en pylpunt
- ✓ T_A and direction correct
  T_A en rigting korrek
- ✓ T_B and direction correct
  T_B en rigting korrek
- ✓ an angle shown / 'n *hoek aangetoon*

ANY CORRECT TRIANGLE

ENIGE KORREKTE DRIEHOEK

(4)

3.3 3.3.1 **OPTION 1/ *OPSIE 1***

$\cos \theta = \frac{a}{h}$

$\cos 26° = F_g / T_A$ ✓

$T_A = (1620 \times 9,8) / \cos 26°$ ✓

$= 17663,67$ N✓

OPTION 2/ *OPSIE 2*

$\sin \theta = \frac{o}{h}$

$\sin 64° = F_g / T_A$ ✓

$T_A = (1620 \times 9,8) \div \sin 64°$ ✓

$= 17663,67$ N✓ (3)

3.3.2 **OPTION 1/ *OPSIE 1***

$\tan \theta = \frac{o}{a}$

$\tan 26° = T_B / F_g$ ✓

$T_B = \tan 26° \times (1620 \times 9,8)$ ✓

$= 7743,24$ N✓

OPTION 2/ *OPSIE 2*

$\sin \theta = \frac{o}{h}$

$\sin 26° = T_B / T_A$ ✓

$T_B = (17663,67) \sin 26°$ ✓

$= 7743,24$ N✓

OPTION 3 / *OPSIE 3*

$\cos \Theta = \frac{a}{h}$

$\cos 64° = T_B / T_A$ ✓

$T_B = (17663.67) \times \cos 64°$ ✓

$= 7743,24$ N✓

OPTION 4 / OPSIE 4

$\tan \Theta = \frac{o}{a}$

$\tan 64° = F_g / T_B$ ✓

$T_B = (1620 \times 9,8) / \tan 64°$ ✓ (3)

$= 7743,24$ N✓

[12]

QUESTION 4 / *VRAAG 4*

4.1 4.1.1 Acceleration / *Versnelling*✓

4.1.2 Mass of trolley / *massa van trollie* ✓

4.1.3 Force applied / *toegepaste krag*✓ (3)

4.2

Criteria for investigative question /*Kriteria vir ondersoekende vraag:*	**Mark / *Punt***
The dependent and independent variables are stated.	✓
Die afhanklike en onafhanklike veranderlikes is genoem.	
Ask a question about the relationship between dependent and independent variables.	✓
Vraag moet gestel word oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.	

OR / *OF*

What effect does a change in mass have on the acceleration of the trolley? / *Watter effek het 'n verandering in massa op die versnelling van die trollie?*

Independent variable / *Onafhanklike veranderlike*:

Mass of trolley / *Massa van trollie*

Dependent variable / *Afhanklike veranderlike:*

Acceleration of trolley / *Versnelling van trollie.*

Example / *Voorbeeld:*

What is the relationship between the acceleration of the trolley and the mass of the trolley while the applied force is kept the same?/ *Wat is die verwantskap tussen die versnelling van die trollie en die massa van die trollie terwyl die toegepaste krag konstant gehou word?*

Notes/*Aantekeninge:*
A question that does not contain a relationship: Max $^1/_2$
'n Stelling wat geen verwantskap bevat nie: Maks. $^1/_2$
A question that starts with WILL, DO, DOES, SHALL. No MARKS
'n Vraag wat begin met SAL/ WIL. Geen PUNTE

(2)

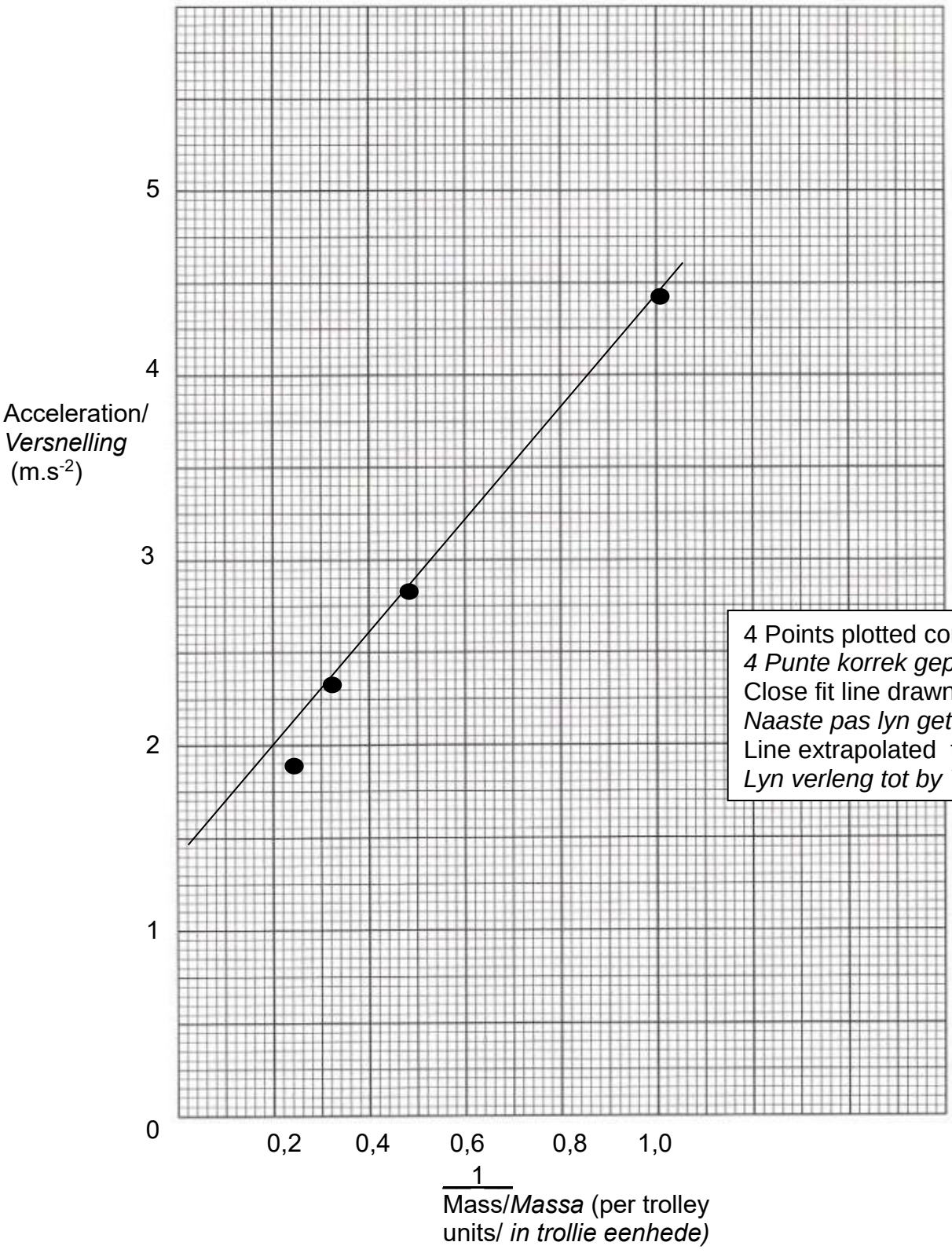
4.3 **See next page/ *Sien volgende bladsy***

4.4 Acceleration is inversely proportional to mass✓ if force is kept constant.✓
Refers to the dependent, independent and controlled variables.
Die versnelling is omgekeerd eweredig aan die massa ✓van die voorwerp as die krag konstant gehou word. ✓ Moet na die afhanklike, onafhanklike en kontrole verwys word (2)

4.5 Friction increases with an increase in mass as $f_k = \mu kN$. ✓ The incline was kept constant, ∴ Ff ↑ as mass ↑ , ∴ a ↓ ✓
Wrywing verhoog met 'n toename in massa omdat $f_k = \mu kN$. ✓ Die helling is konstant gehou, ∴ Ff ↑ soos massa ↑, ∴ a ↓✓ (2)

4.6 For a constant applied force, an increase in mass decreases the negative acceleration. (a α 1/m)✓/ Vehicle is slow to respond / Causes the stopping time to increase ✓ and therefore the vehicle has a greater stopping distance.
As die toegepaste krag konstant gehou word is versnelling omgekeerd eweredig aan die massa (a α 1/m)✓/ Voertuig is stadig om te reageer/ veroorsaak verhoogde stoptyd en die voertuig benodig dus 'n groter afstand om te stop.✓ (2)

QUESTION 4.3/ *VRAAG 4.3*



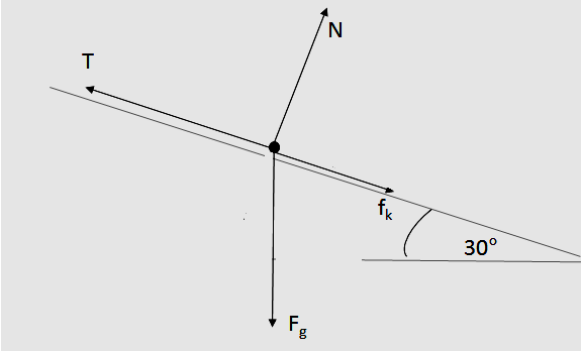
4 Points plotted correct ✓✓
4 Punte korrek geplot.
Close fit line drawn ✓
Naaste pas lyn getrek.
Line extrapolated to Y-axis✓
Lyn verleng tot by Y -as (4)

[15]

QUESTION 5 / *VRAAG 5*

5.1 The force exerted by a surface on an object✓ in contact with it and it always acts perpendicular to the surface. ✓
Die krag wat deur die oppervlak waarop die voorwerp rus ✓uitgeoefen word loodreg vanaf die oppervlak.✓ (2)

5.2



Criteria for Free body diagram / *Kriteria vir vryliggaam :*	Marks/ *Punte*
T – upwards /*opwaarts*	✓
N - ⊥ up from plane / ⊥ *opwaarts*	✓
Fg – down towards centre of earth/ *afwaarts na middel van aarde*	✓
f_k - // downwards / *//afwaarts*	✓

- 1 for any extra forces /
-1 vir enige ekstra kragte. (max ¾)

(4)

OR is the force that opposes the tendency of motion of a stationary object relative to a surface /
***OF** is die krag wat die geneigdheid tot beweging van 'n statiese objek opponeer relatief tot 'n oppervlak*

5.3 Static friction is the frictional force when an object is standing still on a surface✓✓, while kinetic friction is the frictional force when an object moves / slides over a surface✓✓ OR is the force that opposes the motion of a moving object relative to a surface
Statiese wrywing is die wrywingskrag van 'n voorwerp wat op 'n oppervlak stilstaan✓✓ terwyl kinetiewe wrywing 'n wrywingskrag is wanneer 'n voorwerp oor 'n oppervlak beweeg / gly ✓✓ (4)

5.4

5.4.1 **OPTION 1 / *OPSIE 1***

$N = F_{g\perp} = F_g \times \underline{\cos 30°}$ ✓

$= (5 \times 9{,}8) \times \cos 30°$

$= \underline{42{,}44}$ N ⊥ up slope / ⊥ *opwaarts* ✓

$\mu_x = \frac{f_k}{N}$ ✓

$0{,}18 = \frac{f_k}{42{,}44}$

$f_k = \mu_x N$

$f_k = 0{,}18.42{,}44$ ✓✓

$f_k = 7{,}64 N$

= 7,64 N // down plane / // *afwaarts* ✓

OPTION 2 / *OPSIE 2*

$\mu_x = \frac{f_k}{N}$ ✓

$0{,}18 = \frac{f_k}{(5 \times 9{,}8)✓ \times \cos 30°✓}$

= 7,64 N // down plane / // *afwaarts* ✓ (4)

5.4.2 $F_{net\ on\ 7kg} = m \times a = F_x - T - f_k$ ✓ $F_{net\ on\ 5kg} = m \times a = -F_{g//} + T_x - f_k$ ✓

$7a = (68 \times \cos 12°) - T - 6$ $5a = (-5 \times 9{,}8 \times \sin 30°) + T - 7{,}64$

$T = -7a + 60{,}51$……(1) ✓ $T = 5a + 32{,}14$ ……. (2) ✓

(1) + (2) $-7a + 60{,}51 = 5a + 32{,}14$ ✓

$12a = 28{,}37$

$a = 2{,}36\ m{\cdot}s^{-2}$ ✓ to the left ✓ / *na links* (7)

5.4.3 **OPTION 1 / OPSIE 1**

$T = -7a + 60{,}51$……(1) ✓

$= -7\ (2{,}36)$ ✓ $+ 60{,}51$

$= 43{,}99$ N ✓

OPTION 2 / OPSIE 2

$T = 5a + 32{,}14$ ……. (2) ✓

$= 5\ (2{,}36)$ ✓ $+ 32{,}14$

$= 43{,}94$ N ✓

(3)

[24]

QUESTION 6 / *VRAAG 6*

6.1 Newton's Law of Universal Gravitation / *Newton se Universele Gravitasie Wet*✓

Every particle in the universe exerts a force of gravitational attraction on every other particle. The force between the two particles is directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between them. ✓

Elke voorwerp in die heelal trek elke ander voorwerp aan met 'n krag wat direk eweredig is aan die produk van die massas van die voorwerpe ✓*en omgekeerd eweredig is aan die kwadraat van die afstand tussen die massa-middelpunte van die twee voorwerpe.* ✓ (3)

6.2 EQUAL TO / *GELYK AAN*✓✓ (2)

6.3 The mass of the Earth is so much greater than the mass of the plane.✓✓
Aangesien die massa van die aarde soveel groter is as die massa van die vliegtuig.✓✓

(2)

6.4 $F_{EP} = \frac{Gm_Em_P}{r^2}$ ✓

$= \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24}\ ✓)(3 \times 10^4)✓}{(3,5 \times 10^3 + 6,38 \times 10^6)^2 ✓}$

$= 293\ 650,37$ N ⊥ downwards / ⊥*afwaarts* ✓

$= \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24}\ ✓)(30000)✓}{(3500 + 6,38 \times 10^6)^2 ✓}$

OR / *OF*

$2,94 \times 10^{75}$ N ⊥ downwards / ⊥*afwaarts*

$2,94 \times 10^5$ N

$29,37 \times 10^6$ N
$2,94 \times 10^7$ N ✓

(5)

6.5 $F_n = \frac{Gm_Bm_C}{r^2}$

$= \frac{1 \times 2 \times 1}{(\frac{1}{3})^2}$ ✓ ✓

$F_n = 18F$ ✓

(3)
[15]

QUESTION 7 / *VRAAG 7*

7.1 Diffraction / *Diffraksie* ✓✓ (2)

7.2 Huygen's principle / *Huygen se beginsel* ✓✓
Every point on a wavefront is a source of secondary wavelets. These wavelets spread out in the forward direction, at the same speed as the source wave.✓✓
Elke punt op 'n golffront reageer as die bron van sekondêre golfies wat in alle rigtings met dieselfde spoed as die golf uitsprei. ✓✓ (4)

7.3 A central bright band of coloured light ✓with alternating dark and light bands✓ to the sides getting dimmer.✓
'n Helder breë sentrale kleurband ✓afgewissel deur swart bande ✓en helder bande, wat dowwer word na die kante. ✓ (3)

7.4 Destructive interference / *Destruktiewe interferensie*✓✓ (2)

7.5 7.5.1 INCREASE / *VERMEERDER* ✓
The angle of interference is inversely proportional to the width of the slit. ✓✓
Die diffraksiehoek is omgekeerd eweredig aan die wydte van die spleet.✓✓ (3)

7.5.2 DECREASE / *VERMINDER* ✓
The angle of interference is directly proportional to the wavelength. ✓✓
Die diffraksiehoek is direk eweredig aan die golflengte.✓✓ (3)
[17]

QUESTION 8 / *VRAAG 8*

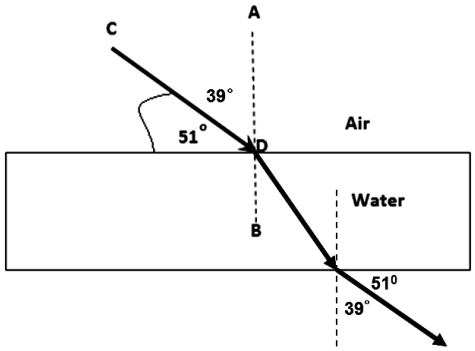
8.1 8.1.1 Refraction / *Refraksie* ✓✓ (2)

8.1.2 When light moves from a more dense to a less dense✓ substance, it will break (bend) away ✓ from the normal and because light travels in a straight line it appears as if the pencil is broken.✓
Lig wat van 'n opties meer digte medium na opties minder digte medium beweeg breek weg ✓van die normale en aangesien lig in 'n reguit lyn beweeg lyk dit asof die potlood gebuig is.✓ (3)

8.2.1 Normal line / *Normaal* lyn✓✓ (2)

8.2.2 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓
$1 \times \sin \underline{39°✓} = 1{,}33 ✓ \sin \theta_r$
$\theta_r = 28{,}24 °✓$ (4)

8.2.3



Criteria for RAY diagram / *Kriteria vir :*	Marks/ *Punte*
At D, break towards normal/ *By D, breek na die normaal toe*	✓
Exiting the water: bend away from the normal / *Wanneer uit water beweeg, breek weg van die normaal*	✓
CD and exiting ray are parallel to each other./ *CD en uitgaande straal is parallel aan mekaar.*	✓
Angles shown/ *Hoeke aangetoon*	✓

- 1 for any extra forces /
- 1 vir enige ekstra kragte (max / *maks ¾*)

(4)

8.3 DECREASES / *VERLAAG*. ✓✓ (2)

8.4 The patricles of the water✓ are much closer together and thus it will slow down the light ray✓/ *die deeltjies van die water is baie meer kompak✓en sal dus die ligstraal se spoed verlaag.* ✓ (2)
[19]

QUESTION 9 / *VRAAG 9*

9.1 Light must travel from an optically more dense medium to an optically less dense medium.✓✓
Die invalstraal moet vanaf 'n opties meer digte medium na 'n opties minder digte medium beweeg.

The angle of incidence must be bigger than the critical angle of that medium.✓✓
Die invalshoek moet groter as die grenshoek van die betrokke medium wees. (4)

9.2 Is that angle of incidence that provides an angle of refraction of 90°.✓✓
Die invalshoek wat 'n brekingshoek van 90° tot gevolg het. (2)

9.3 9.3.1 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓

$1,45 \times \sin \theta_i$ ✓ = 1,40 ✓$\sin 90°$

θ_i = 74,91 °✓ (4)

9.3.2 $n = \frac{c}{V}$ ✓

$1,45$ ✓ $= \frac{3 \times 10^8 \checkmark}{V}$

$V = 2,07 \times 10^8$ m·s^{-1} ✓ (206 896 551,70 // $206,9 \times 10^6$) (4)

9.4 High speed data transfer / *hoë oordragspoed van data*✓
No resale value ∴ doesn't get stolen / *lae herverkoop waarde, geen diefstal* ✓
Not as easy to tap / bigger confidentiality / *Moeliker om data te steel*
(Any two applicable reasons / *Enige twee gepaste redes*) (2)

[16]

TOTAL/ *TOTAAL*: 150

Taxonomy Grid

	Recall		Comprehension		Analysis		Evaluation	
	Q no:	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**
	1.1	2	1.5	2	1.7	2	1.10	2
	1.2	2	1.6	2	1.8	2	4.5	2
	1.3	2	2.2	9	1.9	2	4.6	2
	1.4	2	3.2	4	4.1	3	5.4.2	8
	2.1	2	3.3	3	4.4	2		
	3.1	2	3.4	3	5.4.3	3		
	5.1	2	4.2	2	6.3	2		
	6.1	2	4.3	4	6.4	5		
	7.1	2	5.2	4	6.5	3		
	8.1	2	5.3	2	7.4	3		
	8.2	2	5.4.1	4	7.5	8		
			6.2	2	8.5	3		
			7.2	2				
			7.3	2				
			8.2	3				
			8.3	4				
			8.4	4				
		22		56		38		14
Total mark	**15%**	**22.5**	**35%**	**52,5**	**40%**	**60**	**10%**	**15**
Total %/**100%**	**P1&2: 15%**		**P1:35%/P2:40%**		**P1:40%/P2:35%**		**P1&2: 10%**	