GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION /
GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION / *PROVINSIALE EKSAMEN*

JUNE / *JUNIE* 2018

GRADE / *GRAAD* 11

PHYSICAL SCIENCES /
FISIESE WETENSKAPPE

Physics / *Fisika*
Paper / *Vraestel* 1

MEMORANDUM

TIME / *TYD*: 3 hrs / *uur* 180 min

MARKS / *PUNTE*: 150

16 pages / *bladsye*

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PROVINCIAL EXAMINATION / ***PROVINSIALE EKSAMEN***

PHYSICAL SCIENCES: (Physics) /
***FISIESE WETENSKAPPE:* (*Fisika*)**
Paper 1 / ***Vraestel 1***

MEMORANDUM

QUESTION 1 / ***VRAAG 1:***

1.1 A (2)

1.2 C (2)

1.3 D (2)

1.4 B (2)

1.5 B (2)

1.6 D (2)

1.7 A (2)

1.8 B (2)

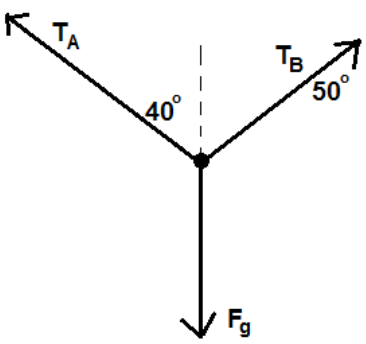
1.9 C (2)

1.10 D (2)

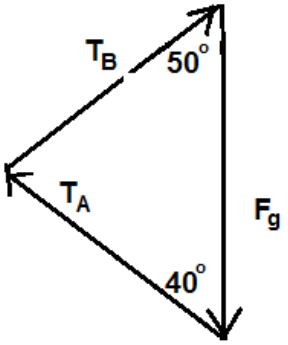
[20]

QUESTION 2 / *VRAAG 2*:

2.1



OR / *OF*



- ✓ 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*

(4)

2.2 $F_{net} = 0$ N ✓✓ (2)

2.3 Forces are in equilibrium ✓ Newton's 1st law. ✓
Kragte is in ewewig ✓Newton se Eerste wet✓ (2)

2.4

OPTION 1 / *OPSIE 1*		**OPTION 2 / *OPSIE 2***
$F_g^2 = T_A^2 + T_B^2$ ✓	**OR / *OF***	$\cos\theta = \frac{T_A}{F_g}$ ✓
$(m \times 9,8)^2$✓ $= 7,51^2 + 6^2$ ✓		$\cos 40^\circ$ ✓ = 7,51 ✓/ m x 9,8✓
$m = \frac{9,6125}{9,8}$ ✓		$m \times 9,8 = 7,51 / \cos 40^\circ$
		m = 1 kg ✓
m = 0,981 kg ✓		

(5)

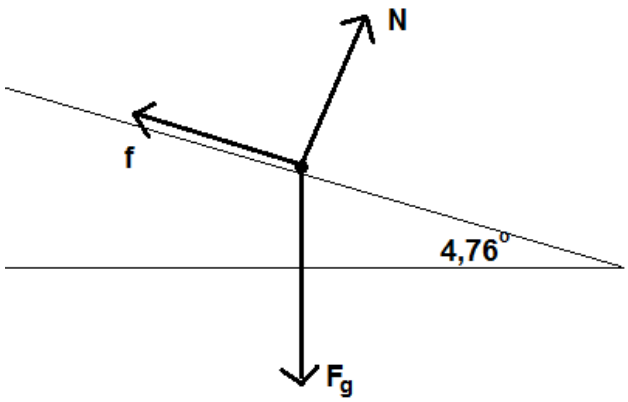
2.5 Decrease ✓✓
Verminder ✓✓ (2)

[15]

QUESTION 3 / *VRAAG 3*:

3.1 Frictional force: is a contact force ✓ that develops between two surfaces to oppose the motion. ✓
Wrywingskrag: is 'n kontakkrag✓ wat ontstaan tussen twee oppervlaktes om die beweging teen te staan. ✓ (2)

3.2



✓ F_g / w (lower case) and direction of arrow
F_g / w (klein letter), rigting en pylpunt.
✓ N and direction correct
N en rigting korrek
✓ f and direction correct
f en rigting korrek
an angle shown / *'n hoek aangetoon* (3)

3.3 3.3.1 $F_{net} \perp = 0 = +N - F_g \perp$ ✓

$\therefore$ N = (80 x 9,8) x cos 4,76° ✓

= 781,30 N $\perp$ up the slope ✓ / $\perp$ *opwaarts* ✓ (3)

3.3.2 $f_s = \mu_s \times N$ ✓

= 0,1 x 781,30

= 78,13 N // up the slope ✓ */ op met helling* ✓ (2)

3.3.3 $F_{g//} = F_g \times \sin \theta$ ✓

= (80 x 9,8) x sin 4,75° ✓

= 65,06 N // down slope. ✓ */ af teen helling* ✓

$F_{g//} < f_s$ $\therefore$ object will remain stationary ✓ $\therefore$ *voorwerp beweeg nie*✓ (4)

3.4 3.4.1 Decrease ✓

Verminder ✓ (1)

3.4.2 Remain the same ✓

Bly dieselfde ✓ (1)

3.4.3 The Normal will increase✓ as the incline decrease✓ and the mass will remain the same ∴ $f_k \alpha N$ ∴f_k increase ✓

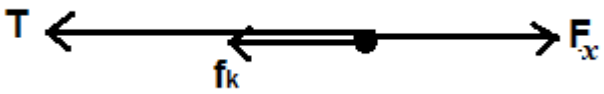
Die Normale krag sal vermeerder✓ as die helling verminder ✓en die massa van die voorwerp sal konstant bly. ∴ $f_k \alpha N$ ∴f_k word groter✓ (3)

[19]

QUESTION 4 / *VRAAG 4:*

4.1 If a resultant force acts on a body, it causes the body to accelerate in the direction of the force ✓ and **the acceleration** is directly proportional to the resultant force and indirectly proportional to the mass of the body. ✓
Indien 'n resulterende /netto krag op 'n voorwerp inwerk, sal die voorwerp versnel in the rigting van die resulterende krag. ✓ Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

4.2 4.2.1 Horizontal forces on A / *Horisontale kragte op A*



Horizontal forces on B / *Horisontale kragte op B*

$F_{net\ on\ /\ op\ A} = m \times a = T - f_k$ ✓

$15\ a = T - 11$

$T = 15\ a + 11$ ……(1) ✓

$F_{net\ on\ /\ op\ B} = m \times a = F_x - T - f_k$ ✓

$15\ a = (50 \times \cos 25^\circ) - T - 11$

$T = -15\ a + 45{,}32$……. (2) ✓

(1) + (2) $15\ a + 11 = -15\ a + 45{,}32$ ✓

$30\ a = 45.32$

$a = 1{,}15\ m{\cdot}s^{-2}$ ✓

Into (1) / In (2)

$T = 15\ a + 11$ ……(1) ✓

$T = (15 \times 1{,}15) + 11$

$T = 28{,}25\ N$ ✓

$T = -15\ a + 215{,}58$ ……. (2)

$T = (-15 \times 1{,}15) + 45{,}32$

$T = 28{,}07\ N$ (8)

4.2.2 $F_{net\,y} = 0 = N + F_y - F_g$ ✓

$N = (- 50 \times \cos 15°) + (15 \times 9,8)$

$= 101,68$ N upwards ✓ / *opwaarts*

$\mu = \frac{f_k}{N}$ ✓

$= \frac{11}{101,68}$

$= 0,10817$ / 0,108 ✓ (4)

4.3 Trolley B will experience more friction as 2 kg mass✓ was added to it, thus it will slow down. ✓

Trolley A will still experience a frictional force of 11 N and will collide into the back of trolley B. ✓

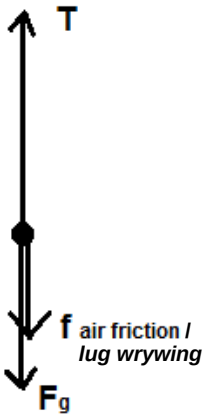
Trollie B sal 'n groter wrywingskrag ondervind as die 2 kg massa ✓ daarop geplaas word en sal dus stadiger beweeg. ✓

Trollie A sal steeds 'n wrywingskrag van 11 N ondervind en sal dus teen die agterkant van trollie B bots. ✓ (3)

[17]

QUESTION 5 / *VRAAG 5:*

5.1



Criteria for Free body diagram / *Kriteria vir vryliggaamdiagram :*	Marks/ *Punte*
T – upwards /opwaarts	✓
Fg – down towards centre of earth / - afwaarts na middel van aarde	✓
$F_{\text{air friction / lug wrywing}}$ – downwards / afwaarts	✓

- 1 for any extra forces /
- *1 vir enige ekstra kragte*. (max $^2/_3$) (3)

5.2 There is the force of gravity and air friction down to balance the tension in the rope upwards. ✓ Resultant force is zero. ✓

Die gravitasiekrag en die krag van lugweerstand afwaarts wat die spanning in die tou opwaarts balanseer. ✓Resulterende krag is nul. ✓ (2)

5.3 $F_{net} = 0 = -F_g - f_{air\ /\ lug} + T$

$0 = (-80 \times 9{,}8) - f_{air\ /\ lug} + 920$

$f_{air/\ lug} = 136$ N downwards / *afwaarts* ✓

<u>OPTION 1 / *OPSIE 1*</u> (up as +) *(op is +)*

$F_{net} = m \times a = -F_g - f_{air\ /\ lug} + T$ ✓

$-80 \times 0{,}18$ ✓ $= (-80 \times 9{,}8) - 136 + T$ ✓

$T = 905{,}60$ N upwards / *opwaarts* ✓

<u>OPTION 2 / *OPSIE 2*</u> (up as -) *(op is -)*

$F_{net} = m \times a = F_g + f_{air\ /\ lug} - T$ ✓

$80 \times 0{,}18$ ✓ $= (80 \times 9{,}8) + 136 - T$ ✓

$= -905{,}60$ N

$\therefore T = 905{,}60$ N upwards / *opwaarts* ✓ (5)

5.4 If an object A exerts a force on object B, then B will exert a force equal in magnitude, but opposite in direction on object A. ✓✓

Indien voorwerp A 'n krag op voorwerp B uitoefen, dan sal voorwerp B 'n krag, van dieselfde grootte maar in die teenoorgestelde rigting op voorwerp A uitoefen. (2)

5.5 The rope on Bale and Bale on the rope ✓✓

Rope on the helicopter and the helicopter on the rope

Earth on Bale and Bale on the earth

Earth on the helicopter and the helicopter on the earth (any one)

Die tou op Bale en Bale op die tou

Die tou op die helikopter en die helikopter op die tou

Die aarde op Bale en Bale op die aarde

Die aarde op die helikopter en die helikopter op die aarde (enige een) (2)

5.6 905,60 N downwards / *afwaarts* ✓ (1)

[15]

QUESTION 6 / *VRAAG 6:*

6.1 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. ✓ (2)

6.2 The force of the earth on Apollo 11 would be equal to the force of the moon on Apollo 11 at that point, acting in opposite directions✓✓

Die krag van die aarde op Apollo 11 sal gelyk wees aan die krag van die maan op Apollo 11 op daardie punt, maar in teenoorgestelde rigtings. ✓✓ (2)

6.3 $F_{EA} = \frac{Gm_E m_A}{r^2}$ ✓

$= \frac{6,67 \times 10^{-11} \times 6,02 \times 10^{24} \times 300}{(193620 \times 10^3 + 6,38 \times 10^6)^2}$ ✓✓✓

$= 3,012$ N ✓ (5)

6.4 The mass of the astraunaut is so small and he is so far away from any planet (earth/ moon) thus the force will be very small and he appears weightless. ✓✓

Die massa van die ruimtevaarde is so klein en hy is so vêr weg van enige planeet dat die aantrekkingskragte wat hy sal ervaar so klein is dat dit lyk of hy gewigloos is. ✓✓ (2)

6.5 $F_g = \frac{Gm_m m_c}{r^2}$ ✓

$= \frac{6,67 \times 10^{-11} \times 600 \times 10^{21} \times 899}{(1737 \times 10^3)^2}$ ✓✓

$= 11924,42$ N ✓ (4)

6.6 $F_{new} = \frac{Gm_m m_c}{r^2}$

$= \frac{1 \times ½ \times 1}{(3)^2}$

$F_n = \frac{1}{18}F$ ✓✓ or /of 0,0556 F or/of 662,47N (2)

[17]

QUESTION 7 / *VRAAG 7:*

7.1 Refraction is the change of the path of a light ray when it moves from one optical medium to another optical medium. ✓✓

Die verandering van rigting van 'n ligstraal a.g.v die verandering in spoed van een medium na die volgende. ✓✓ (2)

7.2 A = incident ray / *invallende straal* ✓

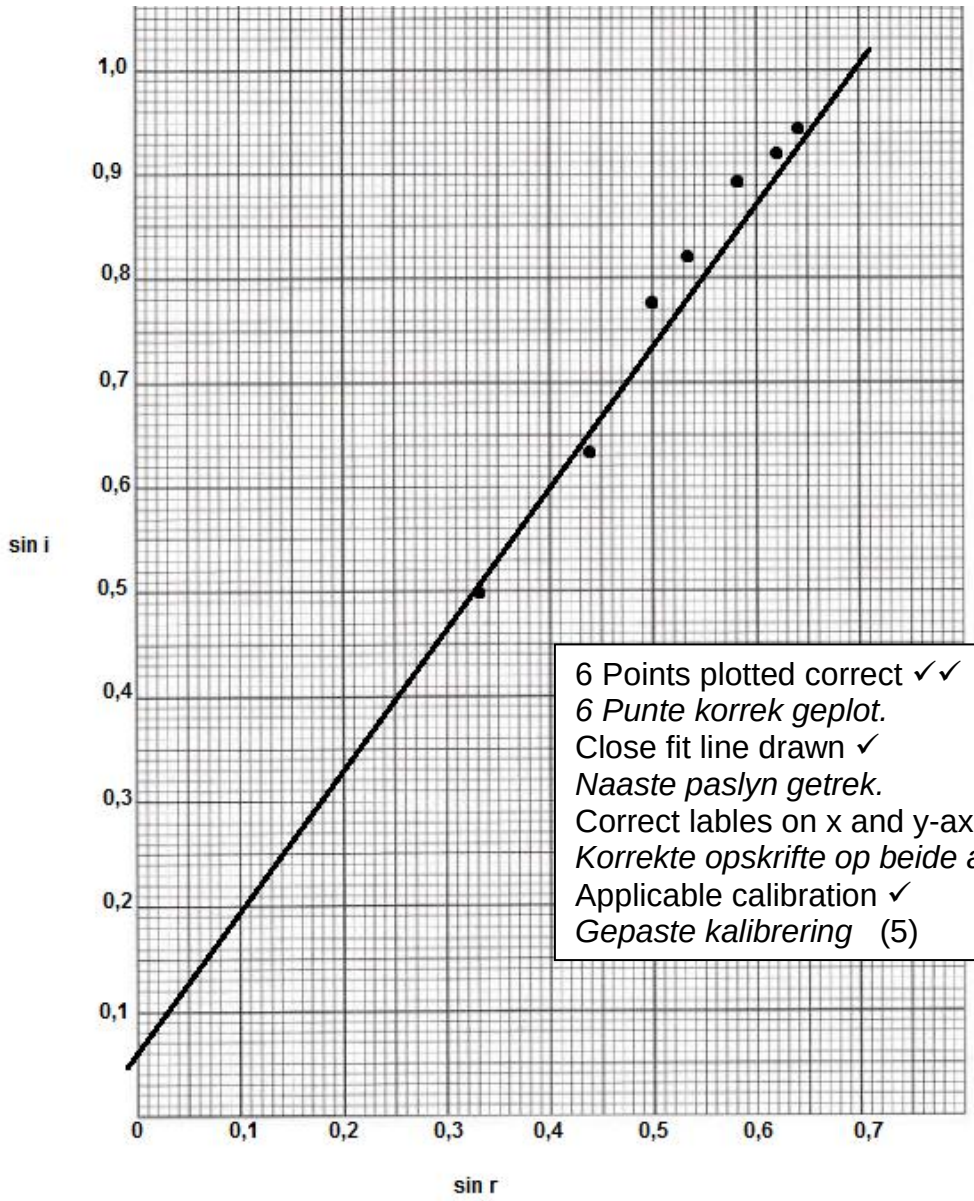
B = reflected ray / *weerkaatste straal* ✓

C = refracted ray / *gebreekte straal* ✓ (3)

7.3 To ensure a fair test ✓and obtain more accurate results / reduce the factor of human error. ✓

Om 'n meer geloofwaardige ✓en akkurate resultate te verkry / die effek van menslike foute te verminder. ✓ (2)

7.4



6 Points plotted correct ✓✓
6 Punte korrek geplot.
Close fit line drawn ✓
Naaste paslyn getrek.
Correct lables on x and y-axis✓
Korrekte opskrifte op beide asse
Applicable calibration ✓
Gepaste kalibrering (5)

(5)

7.5 According to graph is sin i α sin r ✓which is Snell's law ✓ and the gradient of graph is equal to the refractive index✓

Volgens die grafiek is sin i α sin r ✓ wat Snell se wet verteenwoordig. ✓ en *die helling van die grafiek gee die brekingsindeks*✓ (3)

7.6 $\frac{\Delta y}{\Delta x}$ ✓ = $\frac{0,94 - 0,50}{0,64 - 0,33}$ ✓ = 1,42 ✓ (4)

[19]

QUESTION 8 / *VRAAG 8:*

8.1 Towards the Normal / towards the centre of the core ✓✓

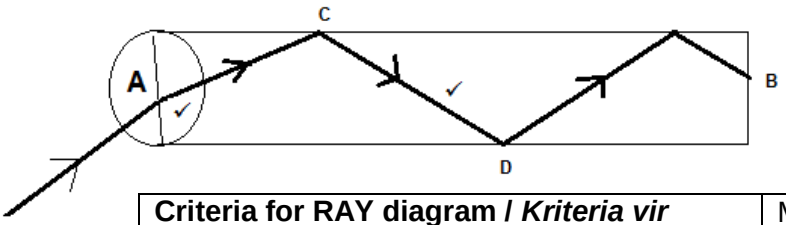
Na die normale toe/ in die rigting van die middel van die kern ✓✓ (2)

8.2 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓

1 x sin 39°✓ = 1,33 ✓sin θ_r

θ_r = 28,24 °✓ (4)

8.3



Criteria for RAY diagram / *Kriteria vir STRAALDIAGRAM*	Marks / *Punte*
At A, break towards normal *By A, breek na die normale toe*.	✓
At C: bend towards core (remains inside) *By C: buig terug na die middel van die kern*	✓
Arrows indicate direction of movement *Pyltjies dui die rigting van beweging aan*	✓

(3)

8.4 When light moves from an optical more dense to an optical less dense medium ✓ and the light ray is refracted back into the optic more dense medium✓ (angle of refraction bigger than 90˚).

Wanneer 'n ligstraal van 'n opties digter medium na 'n opties minder digte medium beweeg ✓ en die ligstraal binne in die digter en medium weerkaats word. ✓

(brekingshoek groter as 90˚) (2)

8.5 8.5.1 $n_i \sin \theta_i = n_r \sin \theta_r$

1,56 x sin θ✓ = 1 sin 90˚ ✓

= sin-1 (1 x sin 90 / 1,56)

θ_r = 39,87 °✓ (3)

8.5.2 $n_i \sin \theta_i = n_r \sin \theta_r$

$1{,}56 \times \sin \theta$✓ = 1,49 sin 90˚

= sin-1 (1,49 x sin 90 / 1,56)

θ_r = 72,77 °✓ (2)

8.6 Because the critical angle is now so much bigger, ✓ the light can travel for longer distances before undergoing TIR, thus it can travel faster. ✓

As gevolg van 'n baie groter grenshoek, ✓ kan die ligstraal baie verder in 'n reguit lyn beweeg voordat dit totale interne weerkaatsing ondergaan. ✓ (2)

[18]

QUESTION 9 / *VRAAG 9:*

9.1 Every point on a wave front is a source of a 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. ✓✓ (2)

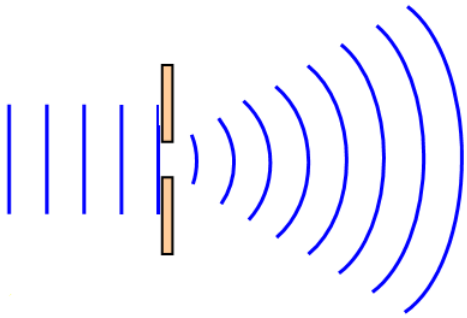
9.2 Moving a straight ✓stick or a piece of wood/object up and down in the water. ✓

Deur 'n reguit ✓*stok of stuk hout. / voorwerp op en af in die water te beweeg.* ✓ (2)

9.3 The wavelength can be shortened by moving the object up and down faster ✓✓

Die golflengte kan verkort word deur die voorwerp vinniger op en af te beweeg in die water. ✓✓ (2)

9.4



Criteria for diagram / *Kriteria vir diagram*	Marks/ *Punte*
Small slit = big diffraction (round waves) *Klein opening = groter diffraksie (ronde golwe)*	✓
Wavelength remains the same *Golflengte bly dieselfde*	✓

(2)

9.5 DECREASE ✓✓

VERMINDER ✓✓ (2)

[10]

TOTAL / *TOTAAL*: 150