GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION /

GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION / *PROVINSIALE EKSAMEN*

JUNE / *JUNIE 2016*

GRADE / *GRAAD 11*

PHYSICAL SCIENCES P1 /
FISIESE WETENSKAPPE V1

MEMORANDUM

GAUTENG DEPARTMENT OF EDUCATION /

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PHYSICAL SCIENCES P1/
FISIESE WETENSKAPPE V1

QUESTION 1 / *VRAAG 1*

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

1.7 B ✓✓ (2)

1.8 A ✓✓ (2)

1.9 C ✓✓ (2)

1.10 B ✓✓ (2)
[20]

QUESTION 2 / *VRAAG 2*

2.1
- When a body is in equilibrium it will:
  EITHER be at rest OR move with a constant linear velocity. ✓✓
- *Kragte verkeer in ewewig as dit:*
  In rus verkeer OF teen 'n konstante snelheid beweeg. ✓✓

OR: Net force is equal to zero and acceleration is equal to zero. (2)
Die netto krag is gelyk aan nul en versnelling is gelyk aan nul.

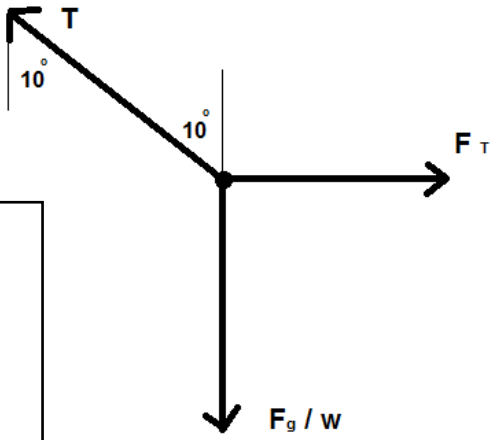
2.2 **Accepted Labels/*Aanvaarde benoemings***

W F_g/F_w/force of Earth on block/weight/6370 N/mg/gravitational force
F_g/F_w/krag van Aarde op blok/gewig/6370 N/mg/gravitasiekrag

F_{app} F_T/Force applied by Thabo
F_T/Krag aangewend deur Thabo

T T/ tension in the rope
T/ spanning in tou

ONE angle shown



Note/*Nota*
One mark for correct arrow **and** label.
If **any** other forces shown max. $^3/_4$
*Een punt vir die korrekte pyl **en** benoeming*
*Indien **enige** ander krag getoon word maks* $^3/_4$
If **force body** diagram max $^3/_4$
*Indien **kragtediagram** max* $^3/_4$

(4)

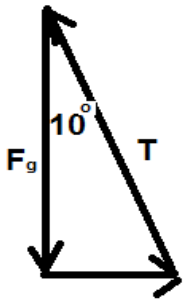
2.3

$\cos\theta = \frac{Fg}{T}$ ✓ (IF NO FORMULA CAN GIVE THE MARK TO COS 10°)

$\cos 10° = \frac{650 \times 9,8}{T}$ ✓

T = 6468,27 N ✓

Accept other trig calculations with the same answer.
Aanvaar ander trig berekeninge met dieselfde antwoord.



(3)

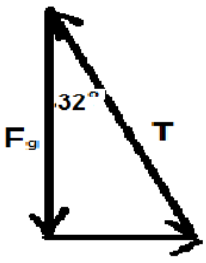
2.4

$\cos\theta = \frac{Fg}{T}$

$\cos 32°$✓ $= \frac{650 \times 9,8}{T}$ ✓

T = 7511,37 N ✓

Yes, the cable will snap. ✓ *Ja, die kabel sal breek*

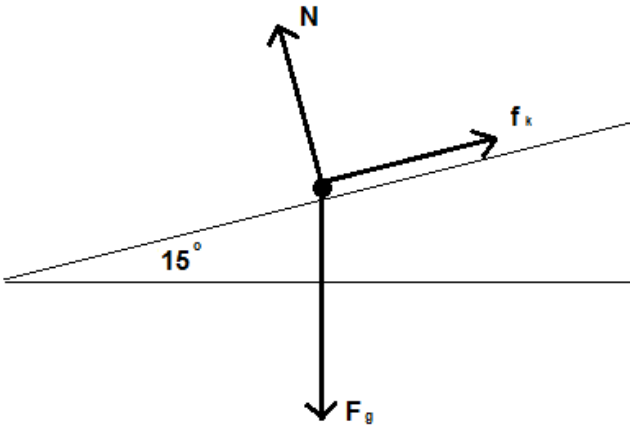


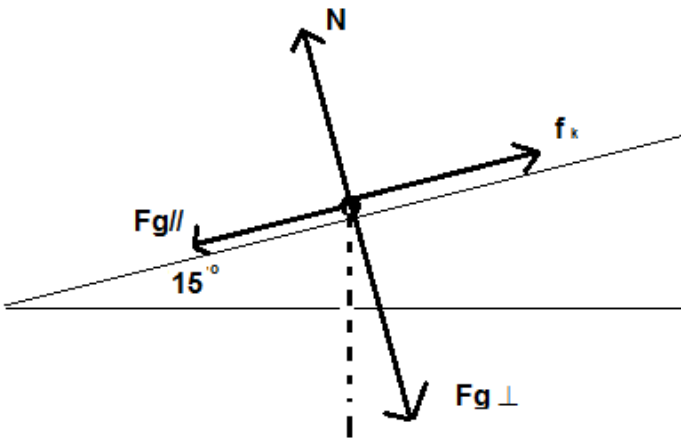
(4)

[13]

QUESTION 3/ *VRAAG 3*

3.1 Frictional force is a contact force ✓ that develops between two surfaces to oppose the motion. ✓ OR is a force that opposes the motion at an object and acts parallel to the surface at which the object is in contact with.
Wrywings krag: is 'n kontak krag✓ wat ontstaan tussen twee oppervlakte om die beweging teen te staan.✓ (2)





3.2 $f_s = F_{g//} = F_g \sin\theta$✓ OR / *OF* $f_s = F_{//} = W\sin\theta$✓

$= (320 \times 9,8) \sin 15°$✓

$= 811,66$ N ✓// up the slope ✓ (*// teen helling op)* (4)

3.3 $N = F_{g\perp} = F_g \cos\theta$ ✓ OR / OF $N = F_\perp = W\cos\theta$ ✓

$= (320 \times 9,8) \cos 15°$

$= 3029,14$ N ⊥ up slope✓ (⊥ *teen helling op)*

$\mu = \frac{f_s}{N}$ ✓ $f_s = \mu_s N$

$= \frac{811,66}{3029,14}$

$= 0,268$ / 0,27 ✓ (4)

+ marking from 3.2
+ *merk vanaf 3.2*

[10]

QUESTION 4/ *VRAAG 4*

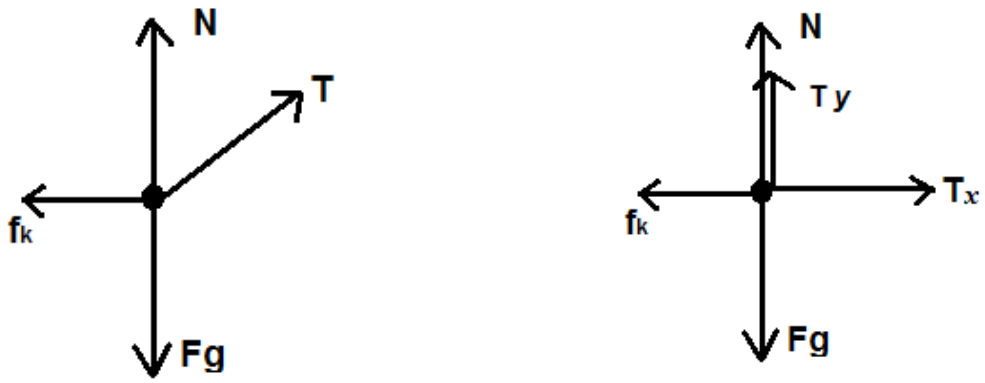
4.1 When a resultant / net force acts on a body / object, it causes the body / object to accelerate in the direction of the force. ✓ The acceleration is directly proportional to the resultant force and inversely proportional to the mass of the body / object. ✓

Indien 'n resulterende / net krag op 'n voorwerp inwerk, sal die voorwerp versnel in die 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

Accepted Labels/*Aanvaarde benoemings*	
w	F_g/F_w/force of Earth on block/weight/49 N/mg/gravitational force *F_g/F_w/krag van Aarde op blok/gewig/49 N/mg/gravitasiekrag*
N	F_N/normal *F_N/normaal*
f	Friction/Ff /f_k *Wrywing/Ff /f_k*
T	Tension *Spanning*

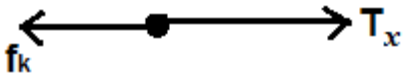
Accept/ *Aanvaar*



(4)

Note/*Nota*
One mark for correct arrow **and** label.
If **any** other forces shown max. $^3/_4$
*Een punt vir die korrekte pyl **en** benoeming*
*Indien **enige** ander krag getoon word, maks.* $^3/_4$
If force diagram max $^3/_4$
Indien kragte diagram max $^3/_4$

4.3 Horizontal forces on car / *Horisontale kragte op motor*



$F_{net\ on\ C} = ma$ ✓

$T_x - f_k = ma$

$T_x - 1\,617 = 1\,100\ a$

$T_x = 1\,100\ a + 1\,617$……(1) ✓

Horizontal forces on truck / *Horisontale kragte op trok*



$F_{net\ on\ B} = ma$

$F_{app} - T_x - f_k = ma$

$18\,000 - T_x - 5\,880 = 4\,000\ a$

$T_x = -4\,000\ a + 12\,120$ ……. (2) ✓

(1) = (2) $1\,100\ a + 1\,617 = -4\,000\ a + 12\,120$ ✓

$5\,100\ a = 10\,505$

$a = 2{,}06\ m.s^{-2}$ ✓ to the right ✓ *na regs* (6)

4.4 Into (1) / Into (2)

+ marking from 4.3
+ *merk vanaf 4.3*

$T_x = 1\,100\ a + 1\,617$ ……(1) ✓

$T\cos 30° = (1100 \times 2{,}06) + 1617$ ✓

$T = 4483{,}70$ N ✓

$T_x = -4\,000\ a + 12\,120$ ……. (2)

$T\cos 30° = (-4000 \times 2{,}06) + 12120$

$T = 4480{,}24$ N (3)

4.5 $\Delta x = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓

$= 0 + \frac{1}{2} \times 2{,}06 \times 6^2$ ✓

$= 37{,}08$ m ✓

+ marking from 4.4
+ *merk vanaf 4.4*

$v_i = 0$
$t = 6$ s
$a = 2{,}06\ m.s^{-2}$
$x = ?$

(3)

4.6 $F_{net} = 0$

$W + N + T_y = 0$ ✓

$-(1100 \times 9{,}8)$ ✓ $+ N + (1617)\tan 30°$ ✓ $= 0$

$N - 9846{,}424615 = 0$

$N = 9846{,}42$ N ✓

+ marking from 4.5
+ *merk vanaf 4.5*

Take into consideration +/- direction.
Neem +/- rigting in ag

(4)

4.7 An object will remain at rest or, in constant motion, unless acted upon by a resultant / net force. ✓✓ **(2 marks or none)**
'n *Voorwerp sal in 'n toestand van rus of konstante snelheid bly tensy 'n eksterne resultante / netto krag daarop inwerk.* ✓✓ ***(2 punte of geen)*** (2)

4.8 If the rope snaps / breaks, the car will continue forward at the same speed as before and will crash into the back of the breakdown truck. ✓✓
Indien die kabel breek sal die motor teen dieselfde snelheid aanhou voortbeweeg en teen die agterkant van die trok bots. ✓✓ (2)

4.9 1 617 N from the truck onto the car / to the left. ✓ Newton's Third law. ✓
1 617 N vanaf die trok na die motor / na links. ✓ *Newton se Derde wet.* ✓ (2)
Accept: other answers in relation to Newton's third law. Eg. Action-reaction **[28]**
***Aanvaar**: ander antwoorde met betrekking tot Newton se derde wet. Bv. Aksie reaksie.*

QUESTION 5 / *VRAAG 5*

5.1 TAKE DIRECTION OF MOTION AS POSITIVE (TO THE RIGHT)

GEBRUIK DIE RIGTING VAN BEWEGING AS POSITIEWE RIGTING.(REGS)

For 1,2 kg block/ *vir 1,2 kg blok*	For the 4 kg block/ *vir 4 kg blok*
$F_{net} = ma$	$F_{net} = ma$
$W (F_g) + T = ma$ ✓	$F_{app} + T + f_k = 4a$ ✓
$T – (1,2 \times 9,8)$ ✓ $= 1,2a$	$25 – T – 2,5 = 4a$ ✓
$T = 1,2a + 11,76$ .....(1)	$T = -4a + 22,5$ . .....(2)

(1) = (2)

$1,2a + 11,76 = -4a + 22,5$ ✓

$5,2\ a = 10,74$

$a = 2,07\ m.s^{-2}$ ✓ (6)

5.2 $f_k = \mu_k N$ ✓

$\mu_k = f_k / N$

$= \frac{2,5}{4 \times 9,8}$ ✓

$= 0,0638 / 0,064$ ✓ $(6,38 \times 10^{-2})$ (3)

5.3 If Object A exerts a force on Object B, then B will exert a force equal in magnitude, but opposite in direction on Object A. ✓✓ When Object A exerts a force an Object B, Object B simultaneously exerts an oppositely directed force at equal magnitude 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)

5.4 Block 4 kg on the table – table onto the 4 kg block
Block on the string – string on the block. } ✓✓ (any correct pair)

4 kg blok op die tafel – tafel op die 4 kg blok.
Blok op die tou – tou op die blok. } ✓✓ *(enige korrekte paar)* (2)

[13]

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 their centres. ✓

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 twee voorwerpe. ✓ (2)

6.2 OPTION 1:

$F_{AC} = \frac{Gm_Am_C}{r^2}$ ✓ $F_{BC} = \frac{Gm_Bm_C}{r^2}$

$35 = \frac{G3m_c}{r^2}$ ✓ $F_{BC} = \frac{G8m_c}{(2r)^2}$ ✓

$m_c = \frac{35\,r^2}{G3}$ $m_c = \frac{F_{BC}(2\,r)^2}{G8}$

$\frac{35\,r^2}{G3} = \frac{F_{BC}\,4\,r^2}{G8}$ ✓ ✓

$F_{BC} = \frac{(35)r^2(G)(8)}{(G)(3)(4)r^2}$

F_{BC} = 23,33 N attraction ✓ / *aantrekkingskrag*

OPTION 3:
Using ratios:
/ *gebruik verhoudings*

$F = \frac{Gmm}{r^2}$ ✓

$= \frac{(8✓/3✓)}{4}$ ✓

F = 0,667 x 35

= 23,33 N ✓✓

OPTION 2:

$F_{AC} = G\frac{m_1m_2}{r^2}$ ✓

$35 = G\frac{3m}{r^2}$ ✓

$G3m = 35r^2$

$G = \frac{35r^2}{3m}$ .....①

$F_{BC} = G\frac{m_1m_2}{r^2}$

$x = G\frac{8m}{r^2}$ ✓

$G8m = xr^2$

$G = \frac{xr^2}{8m}$ .....②

① = ②

$\frac{(35)1^2}{3m} = \frac{x(2)^2}{8m}$ ✓ ✓

$12mx = 280m$

$x = 23{,}33$

✓

F = 23,33 N attraction / *aantrekkingskrag* (6)

6.3 $F \alpha \frac{m}{r^2}$

$\therefore F = \frac{2}{\frac{1}{2}^2}$

$= 8 F$ / 186.64 N ✓✓ (2)

6.4 $F_g = w = mg$ ✓

$F = G\frac{m_1 m_2}{r^2}$

$mg = G\frac{m_1 m_2}{r^2}$ ✓

$g = G\frac{m}{r^2}$ ✓ (3)

[13]

QUESTION 7 / *VRAAG 7*

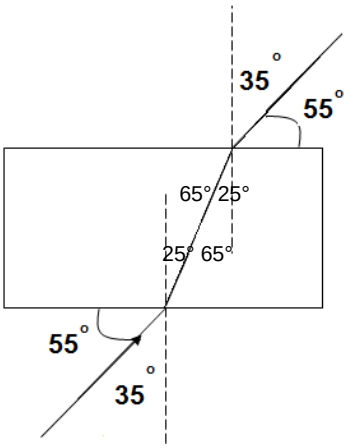
7.1 Refraction: the bending of light as it moves from one medium to another medium with a different optical density. ✓✓

Refraksie is wanneer 'n ligstraal van een optiese digte medium na 'n ander optiese digte medium beweeg, verander die straal van rigting. ✓✓ *(ligbreking vind plaas).* (2)

7.2 $\theta_i = 55°$ ✓✓ (2)

7.3 $\theta_r = 25°$ ✓ (1)

7.4



Angle of incidence on first surface = angle of r refraction at exiting surface.✓

Die invals hoek op die eerste oppervlak = die uitvalshoek ✓

Exiting ray // to incidence ray with an arrow ✓

Uittredende straal parallel aan die invalstraal met 'n pyltjie✓ (2)

7.5 Light will travel faster **in air** than in glass because the density of the glass will slow it down. ✓✓

*Lig beweeg **vinniger in lug** as in glas, aangesien die digtheid van die glas die ligstraal vertraag.* ✓✓ (2)

[9]

QUESTION 8 / *VRAAG 8*

8.1 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓✓ (2)

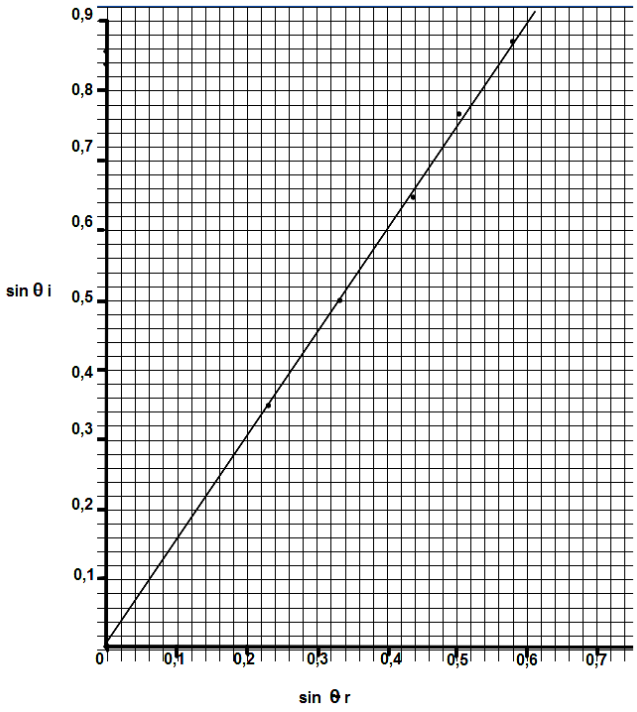
8.2

θ_i	20°	30°	40°	50°	60°	70°
Sin θ_i	0,342	0,5	0,643	0,766	0,866	0,94 ✓ (1)
θ_r	13°	19°	26°	30°	35,5°	39°
Sin θ_r	0,225	0,326	0,438	0,50	0,5	0,629 ✓ (1)

One mark for each correct completed row

Een punt vir elke korrekte voltooide ry.

Angle of incidence vs angle of refraction./ *Invalshoek teenoor brekingshoek*



✓Suitable heading
Gepaste opskrif
✓5 points plotted correctly
5 punte korrek aangedui.
✓ Best fit line drawn
Beste lyn wat pas, getrek
✓ sin θ_i on y-axis/ *op y-as*
✓ sin θ_r on y-axis/ *op x-as*
✓Calibration of axes
Indeling van asse

(6)

8.3 The refractive index of air = 1 ✓

$n_r = \frac{\sin \theta_i}{\sin \theta_r}$ ✓ = gradient of the graph = $\frac{0,94 - 0,342}{0,629 - 0,225}$ ✓ = 1,48 ✓

$m = \frac{\Delta y}{\Delta x}$

(4)

[14]

QUESTION 9 / *VRAAG 9*

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

9.2 ~~Light consisting of only one wavelength or one frequency. ✓✓~~ Not according to CAPs
~~*Ligstraal wat uit net een golflengte of een frekwensie bestaan. ✓✓*~~ ~~(2)~~

9.3.1 Wavelength ✓✓ / *Golflengte✓✓* (2)

9.3.2 Amount / angle of diffraction ✓✓ / *Mate van diffraksie of grootte van diffraksie hoek ✓✓* (2)

9.3.3 Size of the aperture ✓(size of the opening) / *Die wydte van die opening✓*
Distance from the screen ✓/ *Afstand vanaf die skerm✓* (2)

9.3.4 How will the diffraction pattern on the screen change if the wavelength of the light is decreased from 650 nm to 475 nm, keeping the width of the slit / apperture and the distance from the screen constant?
Hoe sal die diffraksie patroon verander as die golflengte van die ligstraal verminder word van 650 nm na 475 nm terwyl die wydte van die opening en die afstand vanaf die skerm konstant gehou word? (3)

- Investigative question start with HOW (not will, does etc), *Ondersoekende vraag begin met HOE, (nie sal/wil)*
- **Accept** other relevant questions where dependant, independant variables are mentioned./ ***Aanvaar*** *ander vrae waarin die afhanklike, onafhanklike veranderlikes genoem word.*

9.3.5 The longer the wavelength the bigger the diffraction it will experience ✓as the angle of diffraction is directly proportional to the wavelength ✓
Hoe langer die golflengte is hoe meer diffraksie✓sal ondervind word, omdat die mate van diffraksie direk eweredig is aan die golflengte van die lig✓ (2)

[14]

QUESTION 10 / *VRAAG 10*

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

10.2 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓
$1,46 \sin \theta_i$ ✓ $= 1,45 (\sin 90°)$ ✓
$\theta_i = 83,29°$✓ (4)

10.3 It will be reflected to the core✓✓
Dit sal terug na die kern weerkaats word. ✓✓ (2)
Accept: Total internal reflection/remains inside cable
Aanvaar: Totale interne weerkaatsing / bly binne-in kern.

10.4 Total internal reflection ✓✓
Totale interne weerkaatsing ✓✓ (2)

10.5 Light must travel from an optical more dense medium to an optical less dense medium.✓✓
Die invalstraal moet vanaf 'n opties meer digte medium na 'n opties minder digte medium beweeg. ✓✓ (2)

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. ✓✓ (2)

10.6 Endoscope ✓✓ / *Endoskoop* ✓✓ (2)
[16]

TOTAL / *TOTAAL*: 150