



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

**GAUTENG DEPARTMENT OF EDUCATION /
GAUTENGSE DEPARTEMENT VAN ONDERWYS
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**PHYSICAL SCIENCES /
FISIESE WETENSKAPPE
Physics / Fisika
Paper 1 / Vraestel 1**

MEMORANDUM

14 pages / bladsye

GAUTENG DEPARTMENT OF EDUCATION /
GAUTENGSE DEPARTEMENT VAN ONDERWYSPREPARATORY EXAMINATION /
VOORBEREIDENDE EKSAMENPHYSICAL SCIENCES /
FISIESE WETENSKAPPE
(Paper / Vraestel 1)

QUESTION 1 / VRAAG 1:

- | | | | |
|------|---|----|-----|
| 1.1 | D | ✓✓ | (2) |
| 1.2 | B | ✓✓ | (2) |
| 1.3 | C | ✓✓ | (2) |
| 1.4 | B | ✓✓ | (2) |
| 1.5 | D | ✓✓ | (2) |
| 1.6 | B | ✓✓ | (2) |
| 1.7 | C | ✓✓ | (2) |
| 1.8 | A | ✓✓ | (2) |
| 1.9 | A | ✓✓ | (2) |
| 1.10 | C | ✓✓ | (2) |

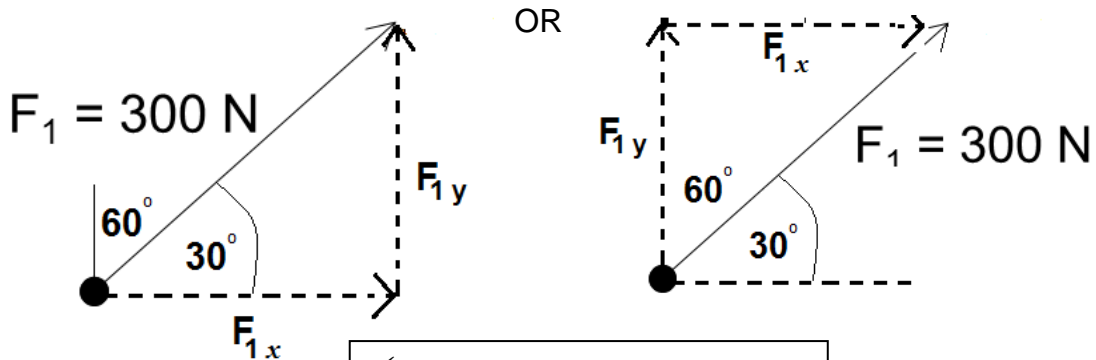
[20]

QUESTION 2 / VRAAG 2:

- 2.1 The vector sum of all the vectors/forces acting on an object ✓✓ **OR**
The single vector that will have the same effect as the original vectors/forces taken together.

*Die vektorsom van al die vektore/kragte wat op 'n voorwerp inwerk ✓✓ **OF**
Die enkele vektor wat dieselfde effek het as al die ander vektore/kragte saam.* (2)

2.2



- ✓ F_{1y} , and direction of arrow
 F_{1y} , en rigting van pylvunt.
- ✓ F_{1x} and direction correct
 F_{1x} , en rigting korrek
- ✓ an angle shown 30° or 60° /
'n hoek 30° of 60° aangetoon

(3)

2.3.1 $F_{1y} = F \times \sin 30^\circ$ ✓
 $= 300 \times \sin 30^\circ$
 $= 150 \text{ N at } 0^\circ / \text{North/ upwards}$
Noord / opwaarts

$F_{1x} = F \times \cos 30^\circ$ ✓
 $= 300 \times \cos 30^\circ$
 $= 259,80... \text{ N at } 90^\circ / \text{East/ right}$
Oos/ regs

$F_{2y} = F \times \sin 20^\circ$ ✓
 $= 450 \times \sin 20^\circ$
 $= 153,90... \text{ N at } 180^\circ / \text{South/ down}$
Suid / afwaarts

$F_{1x} = F \times \cos 20^\circ$ ✓
 $= 450 \times \cos 20^\circ$
 $= 422,86... \text{ N at } 90^\circ / \text{East/ right}$
Oos/ regs

$F_{1y} = F \times \cos 60^\circ$ ✓
 $= 300 \times \cos 60^\circ$
 $= 150 \text{ N at } 0^\circ / \text{North/ upwards}$
Noord / opwaarts

$F_{1x} = F \times \sin 60^\circ$ ✓
 $= 300 \times \sin 60^\circ$
 $= 259,81 \text{ N at } 90^\circ / \text{East/ right}$
Oos/ regs

$F_{2y} = F \times \cos 70^\circ$
 $= 450 \times \cos 70^\circ$
 $= 153,91 \text{ N at } 180^\circ / \text{South/ down}$
Suid / afwaarts

$F_{1x} = F \times \sin 70^\circ$
 $= 450 \times \sin 70^\circ$
 $= 422,86 \text{ N at } 90^\circ / \text{East/ right}$
Oos/ regs

$$\begin{aligned}
 F_{\text{net } y} &= F_{1y} + F_{2y} \checkmark \\
 &= +150 - 153,91 \\
 &= -3,91 \text{ N} \\
 &= 3,91 \text{ N at } 180^\circ \text{ south/ downwards } \textit{Suid / afwaarts} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_{\text{net } x} &= F_{1x} + F_{2x} \\
 &= +259,81 + 422,86 \\
 &= 682,67 \text{ N at } 90^\circ \text{ / East/ right } \textit{Oos/ regs} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_{\text{net}}^2 &= F_{\text{net } y}^2 + F_{\text{net } x}^2 \checkmark \\
 &= 3,91^2 + 682,67^2
 \end{aligned}$$

$$F_{\text{net}} = 682,68 \text{ N} \checkmark$$

(9)

2.3.2 OPTION 1: $\tan \theta = \frac{o}{a} \checkmark$

$$\begin{aligned}
 \theta &= \tan^{-1} (T_B / F_g) \\
 &= \tan^{-1} x (3,91 / 682,67) \checkmark \\
 &= 0,328^\circ \checkmark
 \end{aligned}$$

OPTION 2: $\sin \theta = \frac{o}{h}$

$$\begin{aligned}
 \sin \theta &= F_x / F_{\text{net}} \checkmark \\
 &= (3,91 / 682,68) \checkmark \\
 &= 0,328^\circ \checkmark
 \end{aligned}$$

OPTION 3:

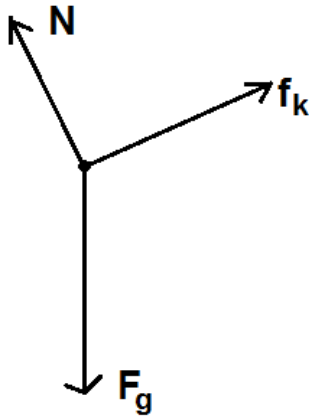
$$\begin{aligned}
 \cos \theta &= \frac{a}{h} \\
 \cos \theta &= F_y / F_{\text{net}} \checkmark \\
 &= (682,67 \div 682,68) \checkmark \\
 &= 0,31^\circ \checkmark
 \end{aligned}$$

(3)

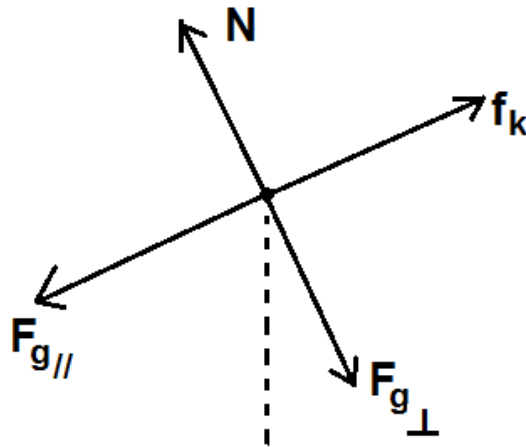
[17]

QUESTION 3 / VRAAG 3:

3.1



ACCEPT:



OR

Criteria for Free body diagram / <i>Kriteria vir vryliggaam</i> :	Marks/ Punte
F_k – upwards / opwaarts	✓
F_g / W // $F_{g\perp}$ & $F_{g\parallel}$ – down towards centre of earth – afwaarts na middel van aarde	✓
F_N - upwards \perp to F_k / opwaarts \perp met F_k	✓

(3)

3.2 The force that opposes the motion of an object and which acts parallel to the surface. ✓✓

Is die krag wat die beweging van 'n voorwerp teëstaan en wat parallel met die oppervlak werk ✓✓

(2)

3.3 **OPTION 1:**

$$f_k = \mu_k \times N \quad \checkmark$$

$$= 0,112 \checkmark \times (70 \times 9,8 \checkmark \times \cos 20^\circ) \checkmark$$

$$= 72,20 \text{ N} \checkmark // \text{ up the slope} \checkmark \quad // \text{ op met helling}$$

OPTION 2:

$$N = F_g \times \cos 20^\circ \checkmark$$

$$= (70 \times 9,8) \times \cos 20^\circ \checkmark$$

$$= 644,63 \text{ N} \checkmark$$

$$f_k = \mu_k \times N \checkmark$$

$$= 0,112 \times 644,63 \checkmark$$

$$= 72,20 \text{ N} // \text{ up the slope} \checkmark \quad // \text{ op met helling}$$

(6)

3.4.1 DECREASE ✓✓ VERMINDER (2)

3.4.2 $F_g \perp$ will decrease \therefore Normal F will decrease ✓

⊖ $F_g \perp$ sal verminder as die helling steiler word \therefore die Normale krag sal verminder. ✓

Since $f_k \propto N$, then f_k will also decrease. ✓

Aangesien $f_k \propto N$, sal die f_k ook verminder. ✓ (2)

3.5.1 REMAIN THE SAME ✓✓

⊖ BLY DIESELFDE ✓✓ (2)

3.5.2 As the mass increase, the normal will increase ✓ \therefore f_k will increase proportionally
 $f_k \propto N$ and μ remains the same for the surface. ✓

As die massa verhoog, sal die Normaalkrag verhoog ✓ \therefore f_k sal proporsioneel verhoog $f_k \propto N$ en μ bly dieselfde vir die spesifieke oppervlak. ✓ (2)

OR / OF

$a \propto 1/m$ \therefore as m increase, a will decrease, but $F_{g\parallel}$ and f_k will proportionally increase as well

$a \propto 1/m$ \therefore as m vermeerder sal a verminder, maar $F_{g\parallel}$ en f_k sal proporsioneel verhoog

[19]

QUESTION 4 / VRAAG 4:

- 4.1 An object will remain at rest or, if it is moving, will carry on moving in a straight line unless acted upon by a resultant/ net force. ✓✓
’n Voorwerp sal in ’n toestand van rus of konstante snelheid bly voortbeweeg tensy ’n eksterne resultante/netto krag daarop inwerk. ✓✓ (2)
- 4.2 The box will continue to move forward at $30 \text{ m}\cdot\text{s}^{-1}$ ✓✓
Die boks sal aanhou vorentoe beweeg teen $30 \text{ m}\cdot\text{s}^{-1}$ ✓✓ (2)
- 4.3
 $F_{\text{net}} = m \times a$ ✓
 $= 20 \times -30$ ✓
 $= -600 \text{ N}$
 $= 600 \text{ N}$ ✓ against the motion ✓ / *teen rigting van beweging* ✓ (4)
- 4.4
 The back of the car seat has a much bigger area than the straps ✓ ∴ as pressure $\propto 1/\text{area}$ ✓ it will mean that the baby/toddler has a much bigger chance to survive as the pressure will decrease significantly. ✓
Die agterkant van die karstoeltjie het ’n baie groter oppervlak as die veiligheids-gordels ✓ ∴ as die druk $\propto 1/\text{area}$ ✓ dit sal dus beteken dat die baba/kleuter ’n baie groter kans het op oorlewing. ✓ (3)

[11]

QUESTION 5: VRAAG 5

5.1



- ✓ F_g / w (lower case) and direction of arrow
 F_g / w (klein letter), rigting van pylpunt.
- ✓ T and direction correct
T en rigting korrek

(2)

5.2 If a resultant force act 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 /net 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)

$$\begin{aligned}
 5.3 \quad F_{\text{net on A}} &= m \times a = -T + F_g \checkmark & F_{\text{net on B}} &= m \times a = -F_g + T \checkmark \\
 0,375a &= -T + (0,375 \times 9,8) & 0,225a &= -(0,225 \times 9,8) + T \\
 T &= -0,375a + 3,675 \dots (1) \checkmark & T &= 0,225a + 2,205 \dots (2) \checkmark \\
 (1) = (2): & -0,375a + 3,675 = 0,225a + 2,205 \checkmark \\
 & 0,6a = 1,47 \\
 & a = 2,45 \text{ m}\cdot\text{s}^{-2} \checkmark
 \end{aligned}$$

(5)

5.4 Into (1)

$$\begin{aligned}
 T &= -0,375a + 3,675 \dots (1) \checkmark \\
 T &= (-0,375 \times 2,45) + 3,675 \checkmark \\
 T &= 2,76 \text{ N} \checkmark
 \end{aligned}$$

/ Into (2)

$$\begin{aligned}
 T &= 0,225a + 2,205 \dots (2) \\
 T &= (0,225 \times 2,45) + 2,205 \\
 T &= 2,76 \text{ N}
 \end{aligned}$$

(3)

[12]

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 $F = \frac{Gm_1m_2}{r^2}$ ✓

$$3,64 \times 10^6 \text{ ✓} = \frac{6,67 \times 10^{-11} \times 5,98 \times 10^{24} \times 419725}{r^2} \text{ ✓}$$

$$r = 6781804,029 \text{ m} \quad \text{accept / aanvaar } 6781804,03 \text{ m}$$

∴ distance above the earth

$$= r - \text{radius of the earth}$$

$$= 6781804,029 - 6,38 \times 10^6 \text{ ✓}$$

$$= 401804,029 \text{ m}$$

$$= 401,80 \text{ km} \text{ ✓ above the surface of the earth/}$$

(5)

bokant die oppervlak van die aarde

6.3 $F_g / w = m \times g$ ✓

$$650 = m \times 9,8$$

$$m = 66,33 \text{ kg} \text{ ✓ } (= 66,3265 \text{ kg})$$

Mass remains constant / *Massa is 'n konstante* ✓

(3)

6.4 $F = m \times a$
 $= 419\,725 \times 0,6 \checkmark$
 $= 251835 \text{ N}$
 $\therefore F_{\text{net}} = F_{\text{app}} - F_{\text{earth}} \checkmark$
 $251835 = F_{\text{app}} - 3,64 \times 10^6 \checkmark$
 $= 3891835 \text{ N} \checkmark$ away from the earth. / Weg van die aarde af \checkmark (5)

6.5.1 DECREASE / VERMINDER $\checkmark\checkmark$ (2)

6.5.2 The gravitational force decreases as the satellite moves away from the earth. \checkmark

$g \propto 1/r^2 \checkmark$ (2)

Die gravitasiekrag verminder hoe verder die sateliet van die aarde af beweeg. \checkmark

$g \propto 1/r^2 \checkmark$

[19]

QUESTION 7 / VRAAG 7:

7.1 The refractive index (n) is the ratio of the speed of light in air to the speed of light through another medium. $\checkmark\checkmark$ (2)

Die brekingsindeks (n) is die verhouding van die spoed van lig in 'n vakuum tot die spoed van lig in die medium $\checkmark\checkmark$

7.2 When light is moving from a less dense medium (air) to a more dense medium (water) it will be refracted towards the normal. $\checkmark\checkmark$ (2)

Wanneer lig van 'n minder digte medium (lug) na 'n meer digte medium (water) beweeg word dit na die normaal toe gebreek. $\checkmark\checkmark$

7.3 $n = \frac{c}{v} \checkmark$

$1,33 = \frac{3 \times 10^8}{v} \checkmark$

$v = 2,26 \times 10^8 \text{ m}\cdot\text{s}^{-1} \checkmark$ (3)

7.4 $n_i \sin \theta_i = n_r \sin \theta_r \checkmark$

$1 \times \sin 42^\circ \checkmark = 1,33 \checkmark \sin \theta_r$

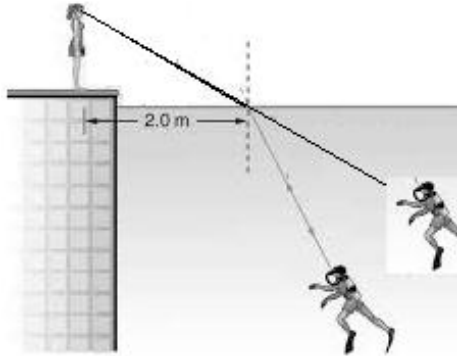
$\theta_r = 30,21^\circ \checkmark$ (4)

7.5.1 Snell's law ✓✓ / Snell se wet ✓✓ (2)

7.5.2 The ratio of the sine of the angle of incidence in one medium to the sine of the angle of refraction in the other medium is constant. ✓✓

Die verhouding van sin van die invalshoek in een medium tot sin van die brekingshoek in die ander medium is konstant. ✓✓ (2)

7.6



Marking Grid: Merk gids

✓ The line is extrapolated straight into the water. *Die lyn word reguit verleng in die water in.*

✓ The diver is seen higher up in the water. *Die duiker word hoër op in die water gesien.*

✓ the diver is a bit further away from the normal. *Die duiker word 'n bietjie verder van die normaal af waargeneem.*

(3)

7.7 If the light from the fish hits the surface at 90° ✓ there will be no refraction of the light, ✓ making it much easier for the bird to determine the exact position of the fish. ✓

(3)

As die lig wat van die vis af weerkants die oppervlak teen 90° ✓ bereik, sal daar geen breking/ buiging van die lig plaasvind nie. ✓ wat dit dus makliker maak vir die voël om die presiese posisie van die vis vas te stel. ✓

[21]

QUESTION 8 / VRAAG 8

8.1 45° ✓✓ (2)

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

(2)

8.3.1 Total internal reflection. ✓✓
Totale interne weerkaatsing. ✓✓

(2)

8.3.2 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 minderdigte 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)

8.4 $n = \frac{c}{v}$ ✓

$$= \frac{3 \times 10^8}{2,21 \times 10^8}$$
 ✓

$$= 1,36$$
 ✓ (3)

8.5 Telescope ✓✓ / Microscope/ binoculars (Any One)
Teleskoop/ mikroskoop/ verkyker (Enige een) ✓✓ (2)

8.6 Signal move much faster
 Less interference / more data can be transferred
 Very difficult to tap/ safer transfer of data
Sein beweeg baie vinniger
Minder steurings / meer data kan versend word
Dit is baie moeilik om inligting te steel.

} Any 2 ✓✓
 } (2)
 } Enige 2 ✓✓

[17]

QUESTION 9 / VRAAG 9:

9.1 All points on a wave front act like a point source. Each one of these point sources (secondary sources) produces small circular waves moving forwards with the same speed as the wave. The new wave front is obtained by drawing a tangent to all the new little wave fronts. ✓✓ (2)

Elke punt van 'n golffront dien as 'n puntbron van klein sferiese sekondêre golwe. Die golffront is dan 'n raaklyn loodreg op die kleiner sekondêre golwe. ✓✓

9.2.1 Diffraction ✓✓ *Diffraksie* ✓✓ (2)

9.2.2 The ability of a wave to spread out in wave fronts as they pass through a small opening or around a sharp edge. ✓✓ (2)

Die vermoë van 'n golf om uit te spreid in golffronte soos die golf deur 'n klein opening of om 'n skerp hoek voortplant. ✓✓

9.3.1 Constructive interference ✓✓

Konstruktiewe interferensie ✓✓

(2)

9.3.2 The angle of interference is directly proportional to the wavelength. ✓✓

∴ if the wavelength is longer (red light) the observed diffraction pattern is bigger
✓✓

Die diffraksiehoek is direk eweredig aan die golflengte. ✓✓

(4)

∴ hoe langer die golflengte(rooi lig) hoe groter die diffraksiepatroon wat
waargeneem word. ✓✓

9.3.3 Decrease the opening of the slit. ✓✓

(2)

Maak die opening van die spleet kleiner ✓✓

[14]

TOTAL / TOTAAL: 150

