education

Department of Education
FREE STATE PROVINCE

EXAMINATION / *EKSAMEN*

GRADE 11 / *GRAAD 11*

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

JUNE 2018 / *JUNIE 2018*

MARKS: 150 / *PUNTE*: 150

TIME: 3 HOURS / *TYD*: 3 *UUR*

This memorandum consists of 10 pages.
Hierdie memorandum bestaan uit 10 bladsye.

QUESTION 1 / *VRAAG 1*

1.1	A✓✓	1.6	C✓✓
1.2	C✓✓	1.7	C✓✓
1.3	B✓✓	1.8	D✓✓
1.4	A✓✓	1.9	D✓✓
1.5	B✓✓	1.10	C✓✓

[20]

QUESTION 2 / *VRAAG 2*

2.1.1 They have both magnitude✓ and direction. ✓
Beide het grootte en rigting. (2)

2.1.2

F_x = 3 + 4 cos 35° OR/*OF* 3 + 4 sin 55° ✓
= 6,277 N

F_y = 5 – 4 sin 35° OR/*OF* 5 – 4 cos 55° ✓
= 2,706 N

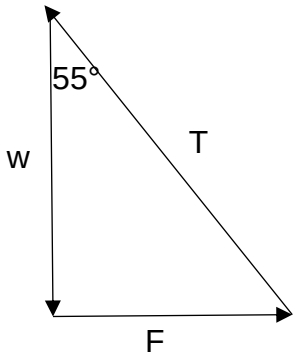
$F_{net} = \sqrt{F_x^2 + F_y^2}$ ✓
$= \sqrt{6{,}28^2 + 2{,}71^2}$ ✓
= 6,83 N ✓
(6,83 N – 6,84 N)

$tan\theta = \frac{2{,}71}{6{,}28}$ ✓ θ is the angle with postive x-axis.
$\theta = 23{,}32°$ ✓ *θ is die hoek moet positiewe x-as.*
(23,32° – 23,34°)

(7)

2.2.1 The resultant of all forces (acting on the box) is zero. (✓✓)
Die resultant van al die kragte (wat inwerk op die boks) is nul. (2)

2.2.2



- Correct shape of a triangle; tail-to-head correct./*Korrekte vorm van driehoek;stert-by-kop korrek*. ✓
- 55° angle correctly indicated./ 55°-h*oek korrek aangedui* ✓
- Correct labels (accept correct alternatives)/*Korrekte byskrifte (aanvaar korrekte alternatiewe)*✓

Numbers for labels not accetable.
Getalle as byskrifte is nie aanvaarbaar nie.

(3)

2.2.3 **OPTION 1/*OPSIE 1***

$$\cos 55° = \frac{w}{T}$$
$$\cos 55° = \frac{60}{T} \checkmark$$
$$T = 104{,}61N \checkmark$$

$$\tan 55° = \frac{F}{w}$$
$$\tan 55° = \frac{F}{60} \checkmark$$
$$F = 85{,}69N \checkmark$$

Any second trigonometric solution can be replaced with Pythagoras, e.g:
Enige tweede trigonometriese oplossing kan met Pythagoras vervang word, bv.

$T^2 = F^2 + w^2$
$104{,}61^2 = F^2 + 60^2$ ✓
$F = 85{,}69$ N ✓

OPTION 2/*OPSIE 2*

$$\sin 35° = \frac{w}{T}$$
$$\sin 35° = \frac{60}{T} \checkmark$$
$$T = 104{,}61N \checkmark$$

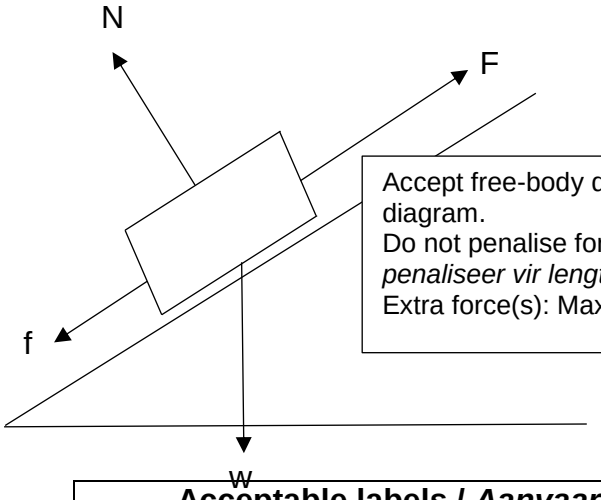
$$\tan 35° = \frac{w}{F}$$
$$\tan 35° = \frac{60}{F} \checkmark$$
$$F = 85{,}69N \checkmark$$

Also here
Ook hier

(4)
[18]

QUESTION 3 / *VRAAG 3*

3.1



Accept free-body diagram./Aanvaar vryekragte-diagram.
Do not penalise for length of arrows./*Moenie penaliseer vir lengte van pyle nie*.
Extra force(s): Max -1/ *Ekstra kragte: Maks -1*

Acceptable labels / *Aanvaarbare byskrifte*		
w	F_g/F_w/weight/*gewig*/mg	✓
f	F_f /$F_{friction/wrywin}$/f_k/friction/*wrywing*	✓
N	F_N /$F_{normal/normaal}$/Normal force/*Normaalkrag* Normal/*Normaal*	✓
F	$F_{applied/Toegepas}$	✓

(4)

3.2.1

$F_{net} = ma$ ✓
$370 = 350 \times a$ ✓
$a = 1{,}06\ m.s^{-2}$ ✓

(3)

3.2.2

$F_f = \mu_k F_N$ ✓
$= \mu_k mg \cos \theta$
$= 0{,}23$ ✓ x $\underline{350 \times 9{,}8 \cos 25°}$ ✓
$= 714{,}99$ N ✓

(4)

3.2.3 **POSITIVE MARKING FROM 3.2.2/*POSITIEWE NASIEN VANAF 3.2.2***

Up + / *Op +*
$F_{net} = F_{app/toegepas} + f + w_{//}$
$= F_{app/toegepas} + f + mg \sin 25°$ } ✓ either one/*enige een*
$\underline{370 = F_{app/toegepas} + (-714{,}99)}$ ✓ $- (350 \times 9{,}8 \sin 25°)$ ✓
$F_{app/toegepas} = 2\,534{,}57$ N ✓

(4)
[15]

QUESTION 4 / *VRAAG 4*

4.1 When a resultant (net) force acts on an object, the object will accelerate in the direction of the force ✓ with an acceleration directly proportional to the force✓ and inversely proportional to the mass of the object. ✓ (3)

Wanneer 'n resultante (netto) krag op voorwerp inwerk, versnel die voorwerp in die rigting van die krag ✓teen 'n versnelling direk eweredig aan die krag ✓ en omgekeerd eweredig aan die massa van die voorwerp is. ✓

4.2.1

For 6 kg block:/*Vir die 6 kg blok:*

$F_{net} = ma$ ✓
$T + f = ma$
$T - 11,76$✓ $= 6a$ … (1)

For 2 kg block

$F_{net} = ma$ ✓ Both 2a & 6a/*Beide 2a & 6a*
$w + F + T = ma$
$(2 \times 9,8) + 2 - T$✓ $= 2a$ …(2)

(1) + (2): $9,84 = 8a$
$a = 1,23\ m.s^{-2}$ ✓

System method: Max 2/5
Sisteemmetode: Maks 2/5

$F_{net} = ma$ ✓
$F + w + f = ma$
$2 + (2)(9,8) + (-11,76) = 8a$ ✓
$a = 1,23\ m \cdot s^{-2}$

(5)

4.2.2 **POSITIVE MARKING FROM 4.2.1/*POSITIEWE NASIEN VANAF 4.2.1***

OPTION 1/*OPSIE 1*

$T - 11,76 = 6(1,23)$ ✓ ⟹ $T = 19,14$ N✓

OPTION 2/*OPSIE 2*

$21,6 - T = 2(1,23)$ ✓ ⟹ $T = 19,14$ N✓

(2)

4.3 Increase/*Toeneem* ✓ (1)
[11]

QUESTION 5 / *VRAAG 5*

5.1 **OPTION 1/*OPSIE 1***

$$F = \frac{Gm_1m_2}{r^2} \checkmark$$
$$= \frac{6,67\times10^{-11}(90)(6,5\times10^{20})}{(5,5\times10^{5})^2} \checkmark \checkmark$$
$$= 12,90N \checkmark$$

OPTION 2/*OPSIE 2*

$$g = \frac{Gm}{r^2}$$
$$= \frac{(6,67\times10^{-11})(6,5\times10^{20})}{(5,5\times10^{5})^2} \checkmark$$
$$= 0,143 m.s^{-2}$$
$$F = mg$$
$$= 90\times0,143 \checkmark$$
$$= 12,90N \checkmark$$

✓

(4)

5.2.1 Every particle in the universe attracts every other particle with a gravitational force ✓ that is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres. ✓

Elke deeltjie in die heelal trek elke ander deeltjie aan met 'n gravitasiekrag ✓wat direk eweredig aan die produk van hul massas ✓en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte is. ✓ (3)

5.2.2

$$F = \frac{Gm_1m_2}{r^2}$$

$2,4 \times 10^3$ ✓ $= \frac{(6,67\times10^{-11})(5,98\times10^{24})(250)}{r^2}$ ✓

$r = 6,446 \times 10^6$ m

$h = 6,446 \times 10^6 - 6,38 \times 10^6$ ✓ **OR/OF** $h = 6,446 \times 10^3 - 6,38 \times 10^3$
$= 65,82 \times 10^3$ m ✓ $h = 65,82$ km
$= 65,82$ km ✓ (65,82 km – 70 km)

Mark allocation for h
Puntetoekenning vir h
Conversion/*Omskakeling* ✓
Subtraction/*Aftrek* ✓
Answer/*Antwoord* ✓

(5)
[12]

QUESTION 6 / *VRAAG 6*

6.1.1 $n_1\sin\theta_1=n_2\sin\theta_2$ ✓
1 sin 47°✓ = 1,33 $\sin\theta_2$ ✓
$\sin\theta_2$ = 0,55
θ_2 = 33,36 ✓ (4)

6.1.2 $n_1\sin\theta_1=n_2\sin\theta_2$
1,33 sin47°✓=1 $\sin\theta_2$✓
θ_2 = 76,58✓ (3)

6.1.3

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

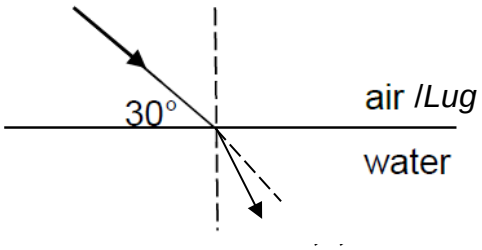
$$1{,}33 = \frac{3\times10^8}{v} \checkmark$$

$$v = 2{,}26\times10^8\ m.s^{-1} \checkmark$$

(3)

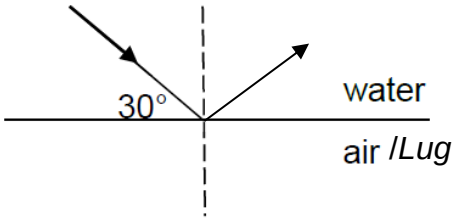
6.2 $n_1\sin\theta_1=n_2\sin\theta_2$
1,33 $\sin\theta_1$ = 1 sin 90°✓ θ_1= 48,75° ✓ (2)

6.3.1



(✓✓) (2)

6.3.2



(✓✓) (2)

6.4 Any TWO of the following or correct alternatives:
Enige TWEE van die volgende of korrekte alternatiewe: ✓✓

Telecommunications / *Telekommunikasie*
Video communications / *Videokommunikasie*
Data communications/ *Datakommunikasie*
Medies - endoscope/ *Medies – endoskoop* (2)
[18]

QUESTION 7 / *VRAAG 7*

7.1 Every point of a wave front serves as a point source ✓ of spherical, secondary waves that move forward with the same speed as the wave. ✓
Elke punt van 'n golffront dien as 'n puntbron ✓ van sferiese, sekondêre golwe wat voorwaarts beweeg teen dieselfde spoed as die golf. ✓ (2)

7.2 **A** – Central bright broad band/ *Sentrale breë ligband* ✓

B – Dark band/*Donker band* ✓ (2)

7.3 A ✓ (1)

7.4.1 Broader/*Breër* (✓✓) (2)

7.4.2 Broader/*Breër* (✓✓) (2)

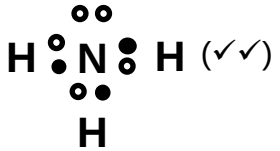
7.5 diffraction α wavelength/*diffraction α golflengte* (✓✓) (2)
[11]

QUESTION 8 / *VRAAG 8*

8.1.1 The energy needed to break one mole of a compound's molecules ✓ into separate atoms. ✓
Die energie benodig om een mol van 'n verbinding se molekule ✓ in aparte atome op te breek. ✓ (2)

8.1.2 H-F ✓
- Largest amount of bond energy
Grootste hoeveelheid bindingsenergie✓ (2)

8.2.1 Covalent/*Kovalent* ✓ (1)

8.2.2  (✓✓) (2)

8.2.3 A measure of the tendency of an atom in a molecule to attract bonding electrons. (✓✓)
'n Maatstaf van die neiging van 'n atoom in 'n molekuul om bindingselektrone aan te trek. (✓✓) (2)

8.2.4 Polar/*Polêr* ✓
- Nitrogen is more electronegative than hydrogen. ✓
Stikstof is meer elektronegatief as waterstof. (2)

8.2.5 1 ✓ (1)

8.2.6 Trigonal pyramidal/*Trigonaal-piramidaal* (✓✓) (2)
[14]

QUESTION 9 / *VRAAG 9*

9.1.1 In addition to London forces/dispersion forces/induced dipole forces HBr has dipole-dipole forces between the molecules. ✓
In addition to London forces/dispersion forces/induced dipole forces H_2O has hydrogen bonds between the molecules. ✓
The intermolecular forces of H_2O are stronger than those of HBr. ✓
More energy is needed to overcome/break the intermolecular forces of H_2O than those of HBr. ✓

Bykomend to Londonkragte/dispersiekragte/geïnduseerde dipoolkragte is daar dipool-dipoolkragte tussen die molekule van HBr. ✓
Bykomend to Londonkragte/dispersiekragte/geïnduseerde dipoolkragte is daar waterstofbindings tussen die molekule van H_2O.
Die intermolekulêre kragte van H_2O is sterker as dié van HBr. ✓
Meer energie is nodig om die intermolekulêre kragte van H_2O te oorkom/te breek as die van HBr. ✓ (4)

9.1.2 Between the molecules of both I_2 and Br_2 are London forces/dispersion forces/induced dipole forces. ✓
The molecular mass of I_2 is more than the molecular mass of Br_2. ✓
The intermolecular forces of I_2 are stronger than those of Br_2. ✓
More energy is needed to overcome/break the intermolecular forces of I_2 than those of Br_2. ✓

Tussen die molekule van beide I_2 en Br_2 word Londonkragte/dispersiekragte/geïnduseerde dipoolkragte aangetref. ✓
Die molekulêre massa van I_2 is groter as dié van Br_2. ✓
Die intermolekulêre kragte van I_2 is sterker as dié van Br_2. ✓
Meer energie is nodig om die intermolekulêre kragte van I_2 te oorkom/te breek as die van Br_2. ✓ (4)

9.2 Yes / *Ja* ✓ (1)

9.3 - In addition to London forces/dispersion forces/induced dipole forces H_2O has hydrogen bonds between the molecules. ✓
In addition to London forces/dispersion forces/induced dipole forces ethanol has hydrogen bonds between the molecules. ✓
The intermolecular forces are therefore of comparable strength. ✓ (3)

9.4.1 The pressure exerted by a vapour at equilibrium with its liquid ✓ in a closed system.✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof ✓ *in 'n geslote sisteem.* ✓ (2)

9.4.2 The lower the boiling point the higher the vapour pressure. (✓✓)
Hoe laer die kookpunt, hoe hoër is die dampdruk. (2)
[16]

QUESTION 10 / *VRAAG 10*

10.1.1

pV = nRT ✓

101,3 x 10^3 ✓ x (100 x 10^{-6})✓ = n x 8,31 x 308✓

n = 3,96 x 10^{-3} mol✓

(5)

10.1.2

$\frac{p_1v_1}{T_1} = \frac{p_2v_2}{T_2}$ ✓

$\frac{101,3 \times 100✓}{308✓} = \frac{p_2 \times 200✓}{584}$

$p_2 = 96,04kPa$ ✓

pV = nRT with positive marking for n from 10.1.1 is also acceptable.

pV = nRt met positiewe nasien vir n vanaf 10.1.1 is ook aanvaarbaar.

(5)

10.2 The gas particles are in a constant state of motion ✓ and collides with the inside walls of the container ✓ to exert a force ✓ on the insides walls of the container.

Die gasdeeltjies is 'n konstante staat van beweging ✓ en bots teen die binnekant van die houer ✓ waar dit dan 'n krag (op die binnekant van die houer) uitoefen. ✓ (3)

10.3 High pressure / *Hoë druk* ✓
Low temperature / *Lae temperatuur* ✓ (2)

[15]

GRAND TOTAL/*GROOTTOTAAL*: 150