education

Department of Education
FREE STATE PROVINCE

EXAMINATION / *EKSAMEN*

GRADE 11 / *GRAAD 11*

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

JUNE 2019 / *JUNIE 2019*

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 C ✓✓ (2)
1.2 A ✓✓ (2)
1.3 A ✓✓ (2)
1.4 D ✓✓ (2)
1.5 C ✓✓ (2)
1.6 D ✓✓ (2)
1.7 B ✓✓ (2)
1.8 B ✓✓ (2)
1.9 D ✓✓ (2)
1.10 C ✓✓ (2)
[20]

QUESTION 2 / *VRAAG 2*

2.1 A physical quantity that can be expressed in both magnitude and direction. ✓✓ */'n Fisiese hoeveelheid wat beskryf kan word met beide grootte en rigting.* (2)

2.2.1 **OPTION 1 / *OPSIE 1***

$\cos\theta = \frac{F_x}{F_1}$

$F_{1} = \frac{4}{\cos 60°}$ ✓

$F_1 = 8\ N$ ✓

OPTION 2 / *OPSIE 2*

$sin\ \theta = \frac{F_Y}{F_1}$

$F_1 = \frac{7}{sin\ 60°}$ ✓

$F_1 = 8{,}08\ N$ ✓

sin 30° and cos 30° can also be used to calculate F_1.
sin 30° en cos 30° kan ook gebruik word om F_1 te bereken.

OPTION 3 / *OPSIE 3*

$F_1^2 = y^2 + x^2$
$= 7^2 + 4^2$ ✓
$F_1 = 8{,}06$ N ✓ (2)

2.2.2 $F_y = F_3 \sin\theta$
$= 10 \sin 30°$ ✓
$= 5$ N ✓ (2)

2.2.3 **POSITIVE MARKING FROM 2.2.2 / *POSITIEWE NASIEN VANAF 2.2.2***

$R_x = F_2 + F_{1x} + F_{3x}$
$= \underline{20 + 4}$ ✓ $+ (-10 \cos 30°)$ ✓
$= 15{,}34$ N

$R_y = F_{1y} + F_{3y}$
$= 7 + (-5)$ ✓
$= 2$ N

$R^2 = R_x^2 + R_y^2$
$= (15{,}34)^2 + (2)^2$ ✓
$R = 15{,}47$ N ✓ (5)

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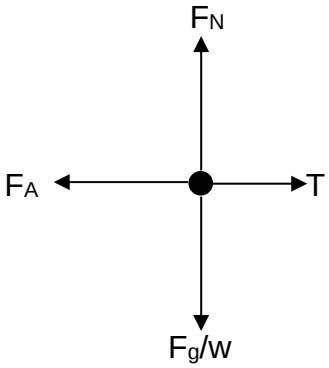
QUESTION 3 / *VRAAG 3*

3.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force ✓ at an acceleration directly proportional to the force and ✓ inversely proportional to the mass of the object. ✓/ *Wanneer 'n netto krag op 'n voorwerp inwerk, sal die voorwerp versnel die rigting van die krag met 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.* (3)

3.2



Accepted labels/ *Aanvaar benoeming*		
Fg	Weight/*Gewig*/29,4 N	✓
T	Tension/*Spanning*	✓
F_A	$F_{applied/toegepas}$/ 20 N	✓
F_N	N/Normal force/*Normaalkrag*	✓
NB Do not penalise for the length of arrows/*Geen penalisering vir die lengte van pyle nie*		

(4)

3.3.1

3 kg	**1,5 kg**
$F_{net} = ma$ ✓	$F_{net} = ma$
$F_A - T = ma$	$T - w = ma$
$20 - T$ ✓$= 3a$ .....(1)	$T - (1,5)(9,8)$ ✓$= 1,5a$ .....(2)

✓

(1) + (2): $a = 1,18\ m{\cdot}s^{-2}$ ✓ (5)

3.3.2 **POSITIVE MARKING FROM 3.3.1 / *POSITIEWE NASIEN VANAF 3.3.1***
$a = 1,18\ m{\cdot}s^{-2}$ in (1) or/of (2)

$20 - T$ ✓$= 3(1,18)$ ✓	OR/*OF*	$T - (1,5)(9,8)$ ✓$= 1,5(1,18)$ ✓
$T = 16,46$ N ✓		$T = 16,47$ N ✓ (3)

[15]

QUESTION 4 / *VRAAG 4*

4.1.1 $F_N + F_g + F_v = 0$ ✓
$F_N - (10)(9,8)$✓$- 50 \sin 30°$ ✓$= 0$
$F_N = 123$ N ✓ (4)

4.1.2 $F_{net} = ma$ ✓
$F_H + f_k = ma$
$50 \cos 30° + f_k$ ✓$= (10)(1,5)$ ✓
$f_k = -28,30$ N
$f_k = 28,30$ N ✓ (4)

4.2 Decreases / *Afneem* ✓ (1)

4.3 When θ decreases; F_y decreases ✓ As θ afneem; F_y neem af ✓
N decreases ✓ N neem af ✓
and $f_k = \mu_k N$ / f_k α N ✓ en $f_k = \mu_k N$ / f_k α N ✓ (3)

[12]

QUESTION 5 / *VRAAG 5*

5.1 Kinetic (frictional force) ✓ Kinetiese (wrywingskrag) ✓ (1)

5.2.1 $F_{g\perp} = mg\cos\theta$
$= 20 \times 9,8 \cos 12°$ ✓
$= 191,72$ N ✓ (2)

5.2.2 **POSITIVE MARKING FROM 5.2.1 / *POSITIEWE NASIEN VANAF 5.2.1***
$F_{net} = ma$
$F_A + F_f + w_{//} = ma$ ✓
$F_A + \mu_k N + mg\sin\theta = ma$
$99 + (-0,3 \times 191,72)$ ✓$+ (-20 \times 9,8 \sin 12°)$ ✓$= 20a$ ✓
$a = 0,04\ m{\cdot}s^{-2}$ ✓ (5)

5.3.1 Each 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/liggaam in die heelal trek elke ander deeltjie/liggaam aan met 'n gravitasiekrag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig aan die vierkant van die afstand tussen hul middelpunte.* (3)

5.3.2 $F = \frac{GM_1M_2}{r^2}$ ✓

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

$\therefore r = 6{,}45 \times 10^6\ m\ or/of\ 6{,}45 \times 10^3\ km$

Distance above surface/Afstand bo oppervlak $= 6{,}45 \times 10^6$ ✓$- 6{,}4 \times 10^6$

$= 50\,000\ m$ ✓

Accept answer in km / *Aanvaar antwoord in km* (5)

[16]

QUESTION 6 / *VRAAG 6*

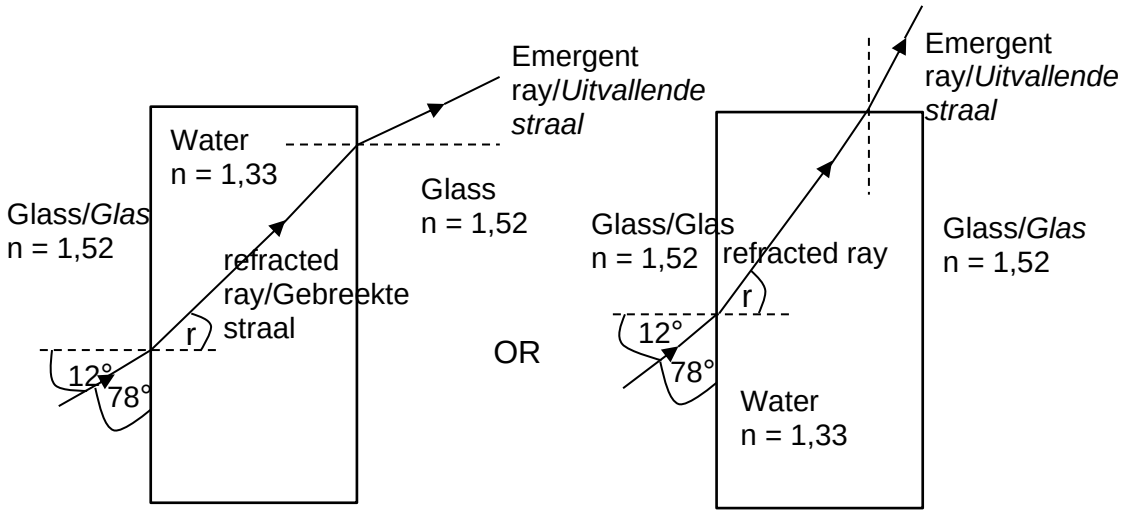
6.1.1 The ratio of the speed of light in vacuum to the speed of light in a material. ✓✓ / *Die verhouding van die spoed van lig in 'n vakuum tot die spoed van lig in die medium/stof/material.* (2)

6.1.2 The change in direction of a light ray due to a change in speed ✓ when light travels from one medium into the another of different optical density.✓/ *Die verandering in rigting van 'n ligstraal as gevolg van 'n verandering in spoed wanneer lig van een medium na 'n ander met verskillende optiese digtheid beweeg.* (2)

6.2.1 Normal/*Normaal* ✓ (1)

6.2.2 12° ✓ (1)

6.2.3



Emergent ray correctly labelled. *Uittreestraal korrek benoem.*	✓
Angle of refraction correctly labelled. *Brekingshoek korrek benoem.*	✓
Emergent ray bend towards the normal. *Uittreestraal breek na die normaal toe.*	✓
Refracted ray bend away from the normal. Gebreekte straal breek weg vanaf die normaal.	✓

(4)

6.2.4 $n_i \sin\theta_i = n_r \sin\theta_r$ ✓
1,52 sin 12° ✓= 1,33 sin θ_r ✓
θ_r = 13,75° ✓ (4)
[14]

QUESTION 7 / *VRAAG 7*

7.1.1 Total internal reflection / *Totale interne weerkaatsing* ✓✓ (2)

7.1.2 Air to Perspex: Light travels from an optically less dense medium to an optically denser medium. ✓/ *Lug na perpex: Lig beweeg vanaf optiese minder digte medium na 'n optiese meer digte medium.*
Diamond to air: Light travels from an optically denser medium to an optically less dense medium. ✓/ Diamant na lug: *Lig beweeg vanaf optiese meer digte medium na 'n optiese minder digte medium.* (2)

7.2.1 $n = \frac{c}{v}$ ✓
$2{,}42 = \frac{3 \times 10^8}{v}$ ✓
$v = 1{,}24 \times 10^8 \text{ m} \cdot s^{-1}$ ✓ (3)

7.2.2 $n_i \sin\theta_i = n_r \sin\theta_r$ ✓
$\sin\theta_c = \frac{1}{2{,}42} sin90^0$ ✓
$\theta = 24{,}41°$ ✓ (3)
[10]

QUESTION 8 / *VRAAG 8*

8.1 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 bron van sirkelvormige sekondêre golwe wat vorentoe beweeg met dieselfde spoed as die golf.* (2)

8.2 Ability of a wave to spread out in wave fronts ✓as the wave passes through a small aperture or around a sharp edge. ✓ / *Die vermoë van 'n golf om uit te sprei as 'n golffront wanneer dit deur 'n nou opening of om 'n skerp rand beweeg.* (2)

8.3

Central bright band indicated *Sentrale helder band aangedui*	✓
Alternate bands of dark and bright band indicated. *Alternatiewe donker en helder bande aangedui*	✓

(2)

8.4.1 Less / *Minder* ✓✓ (2)

8.4.2 Less / *Minder* ✓✓ (2)

[10]

QUESTION 9 / *VRAAG 9*

9.1.1 F_2 ✓& $C\ell_2$ ✓ (2)

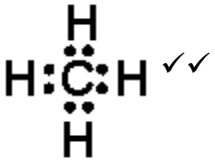
9.1.2 CH_4 ✓& CO_2 ✓ (2)

9.2.1 Trigonal bipyramidal / *Trigonaal-bipiramidaal* ✓✓ (2)

9.2.2 Linear / *Lineêr* ✓✓ (2)

9.3.1  ✓✓ (2)

Or correct alternatives.
Of korrekte alternatiewe

9.3.2  ✓✓ (2)

9.4.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓/ *Die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk.* (2)

9.4.2 CH_4 → London forces or mutually induced dipole forces ✓/*Londonkragte of geïnduseerde dipoolkragte*
HCℓ → Dipole-dipole forces ✓ / *Dipool-dipoolkragte* (2)

9.4.3 Between the molecules of H_2O are hydrogen bonds. ✓
Between the ions of NaCℓ and water molecules are ion-dipole forces.✓
Ion-dipole forces are stronger than hydrogen bonds. ✓
More energy is needed to break the stronger ion-dipole forces. ✓ /
Tussen die molekules van H2O is waterstofbindings.
Tussen die NaCℓ ione en watermolekules is ioon-dipool kragte.
Ioon-dipoolkragte is sterker as waterstofbindings.
Meer energie is nodig om die sterker ioon-dipool kragte te verbreek. (4)

9.4.4 CH_4 ✓ (1)

9.4.5 Between the molecules of CH_4 are London (mutually induced dipole) forces. ✓
London (mutually induced dipole) forces are the weakest forces. ✓ / *Tussen die molekules van CH_4 is Londen (geïnduseerde dipool) kragte. Londen (geïnduseerde dipool) kragte is die swakste kragte.* (2)

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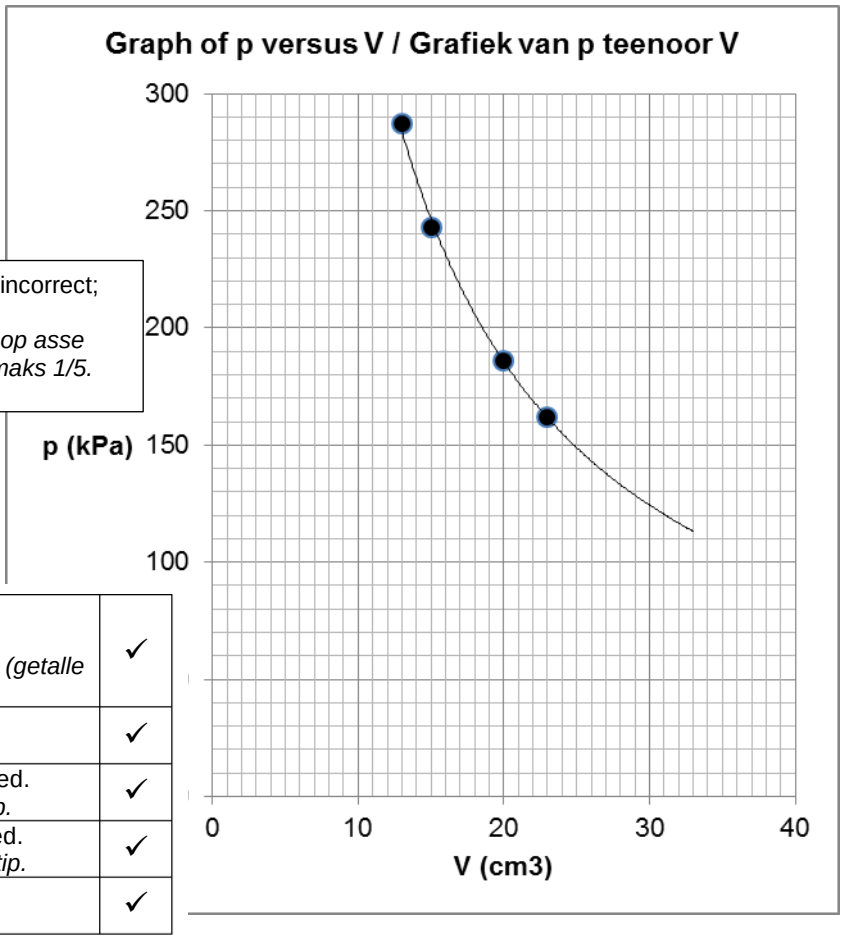
QUESTION 10 / *VRAAG 10*

10.1.1



If either x- or y-divisions on axes incorrect; no marks for plotting: max 1/5.
Indien óf die x- óf die y-indelings op asse verkeerd is; geen punte vir stip: maks 1/5.

Correct scaling on both axis (numbers evenly spaced). *Korrekte indeling op beide asse (getalle eweredig versprei).*	✓
Any one point correctly plotted. *Enige een punt korrek gestip.*	✓
Any second point correctly plotted. *Enige tweede punt korrek gestip.*	✓
Two more points correctly plotted. *Twee verdere punte korrek gestip.*	✓
Best-fit curve drawn. *Bes-passende kurwe geteken.*	✓

(5)

10.1.2 p α 1/V ✓ **Negative marking/*Negatiewe nasien***

Decrease in the volume increases the number of collisions per unit area ✓ on the walls of the container ✓

Afname in volume vermeerder die aantal botsing per eenheidsarea ✓ op die kante van die houer. ✓ (3)

10.1.3 Mass/moles (of gas)/*Massa/mol (gas)* ✓
Temperature/*Temperatuur* ✓ (2)

10.1.4 No leakages / *Geen lekplekke* ✓

Increase the pressure in small amounts to limit the temperature change. ✓
Verhoog die druk in klein hoeveelhede om die toename in temperatuur te beperk

OR/*OF*

Wait a while after increasing the pressure before taking a volume reading.
Wag 'n rukkie na die toename in druk voor 'n volumelesing geneem word. (2)

10.1.5 20 cm^3 - 21 cm^3 ✓ (1)

10.2 $pV = nRT$ ✓
$p \times 0,02 \times 10^{-6}$ ✓ $= 2 \times 8,31 \times 303$ ✓
$p = 2,52 \times 10^{11}$ Pa ✓ (4)

10.3 High pressure/*Hoë druk* ✓
Low temperature/*Lae temperatuur* ✓ (2)
[19]

GRAND TOTAL: 150 / *GROOTTOTAAL: 150*