education

Department of Education
FREE STATE PROVINCE

GRADE 11 / *GRAAD 11*

PROVINCIAL FORMAL ASSESSMENT TASK / *PROVINSIALE FORMELE ASSESSERINGSTAAK*

JUNE 2015/ *JUNIE 2015*

MEMORANDUM

PHYSICAL SCIENCES / *FISIESE WETENSKAPPE*
EXAMINATION / *EKSAMEN*
(PHYSICS AND CHEMISTRY) / *(FISIKA EN CHEMIE)*

TIME: 3 HOURS / *TYD: 3 UUR*

MARKS: 150 / *PUNTE: 150*

This memorandum consists of NINE pages.
***Hierdie memorandum bestaan uit NEGE bladsye*.**

QUESTION 1 / *VRAAG 1*

1.1 D ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 D ✓✓ (2)

1.6 B ✓✓ (2)

1.7 A ✓✓ (2)

1.8 B ✓✓ (2)

1.9 A ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION 2 / *VRAAG 2*

2.1

2.1.1 Length/*Lengte* = $\sqrt{3^2 + 4^2}$ ✓ = 5 m ✓ (2)

2.1.2 3 m ✓ 270° ✓ (No marks if/*Geen punte indien:* - 3 m) (2)

2.2

2.2.1 A quantity with both magnitude and direction. ✓✓
'n Hoeveelheid met beide groote en rigting. ✓✓ (2)

2.2.2. (a) 4 cos45° ✓ = 2,83 N ✓ (2)

(b) 4 sin45° ✓ = 2,83 N ✓ (2)

2.2.3 x component of/*komponent van* 5 N = 0 N
x component of/*komponent van* 3 N = 3 N ✓
x component o/*komponent van* R = 3 N ✓

y component of/*komponent van* 5 N = 5 N
y component of/*komponent van* 3 N = 0 N ✓
y component of/*komponent van* R = 5 N ✓

Magnitude of/*Grootte van* R = $\sqrt{3^2 + 5^2}$ ✓ = 5,83 N ✓ (6)

2.2.4 $\tan\theta = \frac{3}{5}$ ✓
$\therefore \theta = 30{,}96°$ ✓ (2)

[18]

QUESTION 3 / *VRAAG 3*

3.1

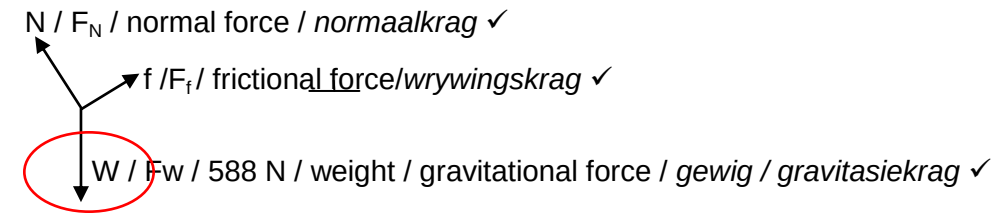
3.1.1 Newton's first law (of motion) /*Newton se eerste (bewegings) wet* ✓
A body will remain in its state of rest or motion at constant velocity ✓ unless a non-zero resultant/net force acts on it. ✓
'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard tensy 'n nie-nul resultante/netto krag daarop inwerk. (3)

3.1.2 $w = mg$ ✓
$= 60 \times 9,8$ ✓
$= 588$ N

$f_{s(max)} = \mu_s N$ ✓
$= 0,4(588)$ ✓
$= 235,2$ N ✓ (5)

3.2

3.2.1



Any other additional forces: -1
Enige addisionele kragte: -1

(3)

3.2.2 (a) $w_{//} = mg\sin\theta = (5)(9,8)\sin30°$ ✓ $= 24,5$ N ✓ (2)

(b) $F_{\perp} = mg\cos\theta = (5)(9,8)\cos30°$ ✓ $= 42,44$ N ✓ (4)

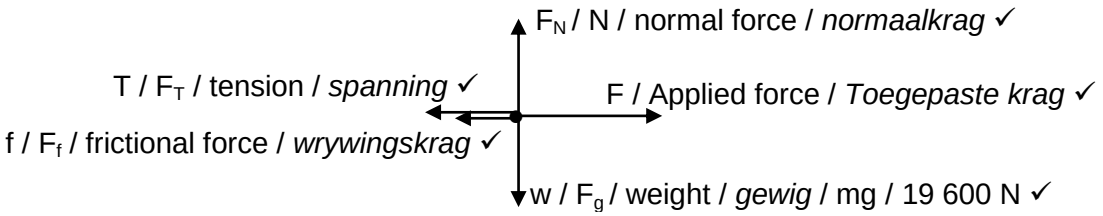
3.2.3 **POSITIVE MARKING FROM QUESTION 3.2.2.**
POSITIEWE NASIEN VAN VRAAG 3.2.2.
Upwards along incline as positive/*Opwaarts teen helling as positief:*
$F_{net} = f + w_{//}$ ✓
$F_{net} = f + mg\sin\theta$
$0 = f - 24,5$ ✓
$\therefore f = 24,5$ N
$\therefore f = 24,5$ N upwards along incline/*opwaarts teen helling* ✓ (3)

3.2.3 **POSITIVE MARKING FROM QUESTION 3.2.2.**
POSITIEWE NASIEN VAN VRAAG 3.2.2.
$f_{s(max)} = \mu_s N$ ✓
$24,5 = \mu_s(42,44)$ ✓
$\mu_s = 0,588$ ✓ (3)

[21]

QUESTION 4/*VRAAG 4*

4.1



Note/L.W.:
One mark is allocated for each force represented by an arrow pointing in the correct direction and correctly labelled.
Een punt word toegeken vir elke krag voorgestel as pyl in die regte rigting en korrek benoem.

(5)

4.2

4.2.1

OPTION 1/*OPSIE 1*
Combination of crates/*Kombinasie van kratte:*
F_{net} = ma ✓
F + f = ma
F – (150 + 100) ✓ = (2 000 + 1 000) ✓0,6 ✓
∴F = 2 050 N ✓

OPTION 2/*OPSIE 2:*
2 000 kg crate/*2 000 kg-krat:*
F_{net} = ma ✓
F + f + T = ma
F– 150 - T = (2000)(0,6) ✓……(1)

1 000 kg crate/*1 000 kg-krat*:
F_{net} = ma
f + T = ma
-100 + T = (1000)(0,6) ✓
∴ T = 700 N ……(2)

(2) in (1): ✓
F – 150 - 700 = (2000)(0,6)
∴F = 2 050 N ✓

(5)

4.2.2 **POSITIVE MARKING FROM QUESTION 4.2.1.**
POSITIEWE NASIEN VAN VRAAG 4.2.1.
Direction of motion as positive/ *Rigting van beweging as positief:*

OPTION 1/*OPSIE 1:*	**OPTION 2/*OPSIE 2:***
2 000 kg crate/*2 000 kg-krat:*	1 000 kg crate/*1 000 kg-krat*:
F_{net} = ma ✓	F_{net} = ma ✓
F + f + T = ma	f + T = ma
2 050 ✓– 150 ✓+ T = (2000)(0,6) ✓	-100 ✓ + T ✓ = (1000)(0,6) ✓
T = - 700	T = 700
T = 700 N ✓	T = 700 N ✓

(5)
[15]

QUESTION 5/ VRAAG 5

5.1 Each body in the universe attracts every other body ✓
with a force that is directly proportional to the product of their masses ✓
and inversely proportional to the square of the distance between their centres. ✓
Elke liggaam in die heelal trek elke ander liggaam aan
met 'n krag direk eweredig aan die produk van hul massas
en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte. (3)

5.2 ⟶ ✓ (1)

5.3 $F = \frac{Gm_1m_2}{r^2}$ ✓

$= \frac{6{,}67 \times 10^{-11}(5{,}98 \times 10^{24})(60)}{(6\,371\,000 + 3\,630)^2}$ ✓ ✓

= 588,94 N ✓

(**Accept answers from/*Aanvaar antwoorde van**:* 588,94 to/*tot* 589,79 N) (4)

5.4

5.4.1 Equal to / *Gelyk aan* ✓ (1)

5.4.2 A / The suit with the lower friction. / *Die pak met die laer wrywing.* ✓ (1)

5.4.3 No/*Nee* ✓
Gravitational acceleration is independent of the mass of objects. ✓
Gravitasieversnelling onafhanklik van massa van voorwerpe.
$g = \frac{GM}{r^2}$ ✓
(3)

5.4.4 Smaller than / *Kleiner as* ✓
According to $g = \frac{GM}{r^2}$, ✓ if r (radius) increases, g will decrease. ✓
Volgens $g = \frac{GM}{r^2}$, ✓ *indien r (radius) verhoog, sal g verlaag.* (3)

[16]

QUESTION 6/*VRAAG 6*

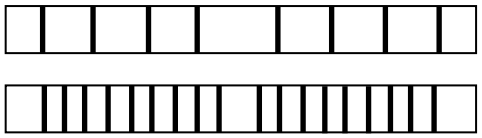
6.1 Diffraction / *Diffraksie* ✓ (1)

6.2 **X** ✓ (1)

6.3 Light/*Ligte* areas - constructive interference/*konstruktiewe interferensie* ✓
Dark/*Donker* areas - destructive interference/*destruktiewe interferensie* (2)

6.4

6.4.1



✓✓

Marking criteria:/*Nasienriglyne:*
- Central light line narrower than with red light. ✓
  Sentrale helder lyn smaller as met rooi lig.
- *Light lines to sides also narrower than with red light.* ✓
  Helder lyne na die kante ook smaller as vir rooi lig.

(2)

6.4.2 Blue light has a smaller wavelength ✓ and thus will experience less diffraction. ✓
Blou lig het 'n kleiner golflengte en ondergaan dus minder diffraksie. (2)
[8]

QUESTION 7 / VRAAG 7

7.1 $n = \frac{c}{v}$ ✓

$\therefore n = \frac{3 \times 10^8}{2{,}1 \times 10^8}$ ✓

$= 1{,}43$ ✓ (3)

7.2 $n = \frac{c}{v}$

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

$\therefore v =$ ~~1,19 x 10^8~~ $m \cdot s^{-1}$ ✓ 9,38 x 10^7 $m.s^{-1}$ ($9{,}375 \times 10^7$ $m.s^{-1}$) (2)

7.3 (Medium) 1 ✓
Light moves at higher speed. */Lig beweeg teen 'n groter spoed.* ✓

OR/*OF*
Medium 1 has smaller refraction index/*Medium 1 het 'n kleiner brekingsindeks* (2)

7.4 $n_1 \sin\theta_1 = n_2 \sin\theta_2$ ✓
$(3{,}2) \sin\theta_1$ ✓ $= (1) \sin 90°$ ✓
$\theta_1 = 18{,}2°$ ✓ (4)
[11]

QUESTION 8/*VRAAG 8*

8.1

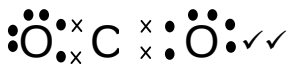
8.1.1 1 ✓ (1)

8.1.2 6 ✓ 4 (1)

8.2 A covalent bond is the sharing of electrons ✓ between atoms. ✓
'n Kovalente binding is die deling van elektrone tussen atome. (2)

8.3

8.3.1 H×○H ✓✓ (2)

8.3.2  ✓✓ (2)

8.4

8.4.1 Hydrogen bonds / *Waterstofbinding* ✓ (1)

8.4.2 Induced dipole-dipole forces/ / London forces ✓
Geïnduseerde dipool-dipoolkragte / Londonkragte (1)

8.4.3 Induced dipole-dipole forces/ / London forces ✓
Geïnduseerde dipool-dipoolkragte / Londonkragte (1)

8.5

8.5.1 Angular / *Hoekig* ✓ (1)

8.5.2 Linear / *Lineêr* ✓ (1)

8.6

8.6.1 The distance ✓ between the nuclei of atoms. ✓
Die afstand tussen die kerne van atome. (2)

8.6.2 Bond energy increases/decreases as the bond length decreases/increases. ✓✓
Bindingsenergie verhoog/verminder soos die bindingslengte verminder/verhoog.

OR/*OF*
Shorter/higher bond length, higher/shorter bond energy.
Korter/langer bindinglengte, hoër/laer bindingsenergie. (2)

8.6.3 Due to the <u>double bond</u>, atoms in <u>bond</u> 4 are closer together. ✓
D*ie atome in binding 4 is nader aan mekaar as gevolg van die dubbelbinding tussen die atome.* (1)

8.7

8.7.1 Between <u>water molecules are strong hydrogen bonds</u>. ✓
Between molecules of compounds 2<u>, 3 and 4 are weak induced dipole forces</u> / London forces. ✓
Tussen <u>watermolekule kom sterk waterstofbindings voor</u>. Tussen die molekule van verbindings <u>2, 3 en 4 is swak geïnduseerde dipool-dipool (London) kragte.</u> (2)

8.7.2 Boiling point increases from compound 2 to compound 4 / top to bottom. ✓
Kookpunt neem toe van verbinding 2 tot 4/ van bo na onder.

OR/*OF*
Boiling point decreases from compound 4 to 2/bottom to top*.*
Kookpunt verminder van verbinding 4 na 2/ van onder na bo. ✓ (1)

8.7.3

- Smallest molecular size / molecular mass. ✓
  Kleinste molekuulgrootte/ molekulêre massa.
- Weakest intermolecular forces / Van der Waals forces. ✓
- *Swakste intermolekulêre kragte/Van der Waalskragte.*
- Least energy needed to overcome intermolecular forces / Van der Waals forces. ✓
- *Minste energie benodig om die intermolekulêre / Van der Waalskragte te oorkom.* (3)

[24]

VRAAG 9/*VRAAG 9*

9.1 $pV = k$ ✓✓ OR $p_1V_1 = p_2V_2$ (2)

9.2 $p_1V_1 = p_2V_2$ ✓

180 x 300 ✓ = 120 x V_2 ✓

$V_2 = 450\ cm^3$ ✓ (4)

9.3 $pV = nRT$ ✓

$\therefore$ (149,58 x 10^3) ✓ (200 x 10^{-6}) ✓ = n(8,31)300 ✓

$\therefore n = 0,012$ mol

$n = \frac{m}{M}$

$0,12 = \frac{0,384}{M}$ ✓

$\therefore M = 32\ g \cdot mol^{-1}$ ✓

Note:/*Let Wel*:
Pressure must be in Pa and volume in m^3 when using this formula./ *Druk moet in Pa en volume in m^3 wees wanneer hierdie formule gebruik word.*

$n(O) = \frac{32}{16} = 2$ mol ✓ $M(O_2) = 2(16) = 32\ g \cdot mol^{-1}$ (7)

IF ERROR IN PAPER WAS NOT CORRECTED:
INDIEN FOUT OP VRAESTEL NIE REGGEMAAK IS NIE:

149,58 Pa instead of 149,58 x 10^3 Pa/*149,58 Pa in plaas van 149,58 x 10^3 Pa*

$pV = nRT$ ✓

(149,58) ✓ (200 x 10^{-6}) ✓ = n(8,31)300 ✓

$\therefore n = 0,000012$ mol (1,2 x 10^{-5} mol)

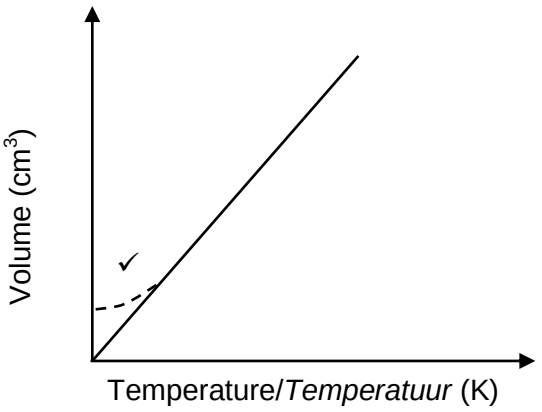
$n = \frac{m}{M}$

$1,2 \times 10^{-5} = \frac{0,384}{M}$ ✓

$\therefore M = 32\ 000\ g \cdot mol^{-1}$ ✓

$n(O) = \frac{32000}{16} = 2000$ mol ✓

9.4
9.4.1



(1)

9.4.2

- At low temperatures, molecules move slower / with less kinetic energy. ✓
  By lae temperature beweeg die molekule stadiger/ met minder kinetiese energie.
- Intermolecular forces become more effective. ✓
  Die intermolekulêre kragte raak meer effektief (beduidend).
- The gas liquifies and the volume is larger than predicted for ideal gases. ✓
  Die gas vervloei en die volume is groter as voorspel deur ideale gas teorie. (3)

[17]

GRAND TOTAL / *GROOTTOTAAL*: 150