Education and Sport Development
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NORTH WEST PROVINCE

PROVINCIAL MID YEAR EXAMINATIONS

GRADE 11

PHYSICAL SCIENCE

MAY/JUNE 2018

MEMORANDUM

MARKS: 150

TIME: 3 hours

MEMORANDUM
QUESTION 1 / VRAAG 1

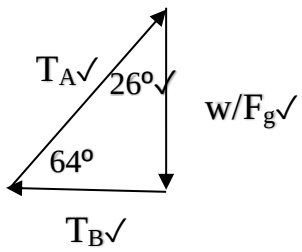
1.1 B✓✓
1.2 A✓✓
1.3 B✓✓
1.4 B✓✓
1.5 B✓✓
1.6 A✓✓
1.7 D✓✓
1.8 D✓✓
1.9 D✓✓
1.10 A✓✓ **[20]**

QUESTION 2 / VRAAG 2

2.1 An object is in **equilibrium** if it remains in a state of rest or motion at constant velocity with a zero resultant / net force acting on it.✓ ✓

'n Voorwerp is in ewewig as dit in rus is of met 'n konstante snelheid beweeg met geen resulterende / netto krag wat daarop inwerk nie.✓✓ (2)

2.2



✓ Fg / w (lower case) and direction of arrow
Fg / w (klein letter), rigting en pylpunt
✓ T_A and direction correct
T_A en rigting korrek
✓ T_B and direction correct
T_B en rigting korrek
✓ an angle shown / 'n hoek aangetoon
ANY CORRECT TRIANGLE
ENIGE KORREKTE DRIEHOEK

(4)

2.3
2.3.1 **OPTION 1 /OPSIE 1**

$\cos 26^\circ = \frac{w}{T_A}$ ✓ [F = mg
$T_A = \frac{1620(9.8)}{\cos 26^\circ}$ ✓ = 1620 x 9,8
= 17 663.67N ✓ = 15876 N]

OPTION 2/ OPSIE 2

$\sin 64° = \frac{Fg}{T_A}$ ✓
$T_A = \frac{(1620 \times 9,8)}{\sin 64° \checkmark}$
= 17663,67 N✓ (3)

2.3.2 Positiewe nasien vanaf 2.3.1./ Positive marking from 2.3.1

OPTION 1 /OPSIE 1

[F = mg
= 1620 x 9,8
= 15876 N]

$$\text{Tan } 64^\circ = \frac{F_g}{T_B} \quad \surd$$

$$= \frac{15876}{T_B} \quad \surd$$

$$= \mathbf{7743.24N} \quad \surd$$

OPSTION 2 / OPSIE 2

$$\text{Sin } \Theta = \frac{T_B}{T_A} \quad \surd$$

$\mathbf{T_B}$ **=** sin 26˚ x 17663,67 √

= 7743,24 N √

OPTION 3 / OPSIE 2

$$\text{Cos } \Theta = \frac{T_B}{T_A} \quad \surd$$

T_B = cos 64˚ x 17663.67√

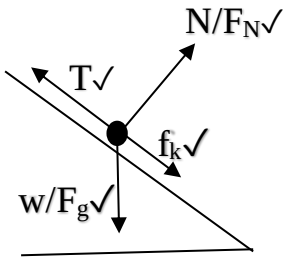
= 7743,24 N√ **(3)**

[12]

QUESTION 3 / VRAAG 3

3.1 **Normal force:** The force exerted by a surface on an object✓ in contact with it and it always acts perpendicular to the surface. ✓
Normaalkrag: Die krag wat deur die oppervlak waarop die voorwerp rus ✓ uitgeoefen word loodreg vanaf die oppervlak.✓ (2)

3.2



(Components of weight can also be given
Komponente van gewig kan ook aangedui word.)
- 1 for any extra forces /
-1 vir enige ekstra kragte. (max ¾) (4)

3.3 **Static friction** is the frictional force when an object is standing still on a surface✓✓,OR Static friction is the frictional force of one contact surface on another when there is no relative motion between the objects.√√

while **kinetic friction** is the frictional force when an object moves / slides over a surface✓✓ OR is the force that opposes the motion of a moving object relative to a surface OR Kinetic friction is the frictional force of one contact surface on another when one or both objects are moving.√√

Statiese wrywing is die wrywingskrag van 'n voorwerp wat op 'n oppervlak stilstaan✓✓ OF Statiese wrywing is die wrywingskrag van een kontakoppervlakte op

'n ander wanneer daar geen relatiewe beweging tussen die voorwerpe is nie ✓✓

terwyl **kinetiese wrywing** 'n wrywingskrag is wanneer 'n voorwerp oor 'n oppervlak beweeg / gly ✓✓ OF Kinetiese wrywing is die wrywingskrag wat 'n oppervlakte op 'n voorwerp uitoefen wanneer die voorwerp beweeg.√√ (4)

3.4.1 **OPTION 1 / OPSIE 1**

$N = F_{g\perp} = F_g \times \underline{\cos 30°}$✓

$= (5 \times 9,8) \times \cos 30°$

$= 42,44$ N ⊥ up slope / ⊥ opwaarts ✓

$\mu_k = \frac{f_k}{N}$✓

$0,18 = \frac{fk}{42,44}$

$= 7,64$ N // down plane / // afwaarts ✓

OPTION 2 / OPSIE 2

$\mu x = \frac{f_k}{N}$✓

$0,18 = \frac{fk}{(5 \times 9,8)✓ \times \cos 30°✓}$

$= 7,64$ N // down plane / // afwaarts ✓ (4)

3.4.2 **POSITIEWE NASIEN VAN 3.4.1 AF/ POSITIVE MARKING FROM 3.4.1**

$\mathbf{F_{g\perp}} = F \cos \Theta$ = 68 cos 12˚ **= 66,15 N** en / and $F_{g//} = F_g \sin \Theta$ = (5 x 9,8 sin 30˚) **= 24,5 N**

$F_{net} = ma$

F_{net} on 7kg: $F_x - T - f_k = m \times a$ ✓ *Any formula / enige formule*

$(68 \times \cos 12°) - T - 6 = 7a$

$T = - 7a + 60,51$..(1) ✓

$F_{net} = ma$

F_{net} on 5kg: $- Fg// + Tx - fk = m \times a$ ✓

$(- 5 \times 9,8 \times \sin 30°) + T - 7,64 = 5a$

$T = 5a + 32,14$ ……. (2) ✓

(1) + (2): $- 7a + 60,51 = 5a + 32,14$ ✓

$12a = 28,37$

$a = 2,36$ m.s-2 ✓ to the left ✓ / na links (7)

3.4.3 **POSITIEWE NASIEN VAN 3.4.2. AF / POSITIVE MARKING FROM 3.4.2.**

OPTION 1 / OPSIE 1

T = - 7a + 60,51……(1) ✓
= - 7 (2,36) ✓+ 60,51
= - 16,52 + 60,51
= 43,99 N ✓

OPTION 2 / OPSIE 2

T = 5a + 32,14 ……. (2) ✓
= 5 (2,36)✓ + 32,14
= 43,94 N ✓ (3)

[24]

QUESTION 4 / VRAAG 4

4.1 **Newton's Law of Universal Gravitation**
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. ✓

Newton se Universele Gravitasie Wet
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 omqekeerd ewerediq is aan die kwadraat van die afstand tussen die massa-middelpunte van die twee voorwerpe.✓ (2)

4.2 $F = \frac{Gm_s m_A}{r^2}$ ✓

5000✓ = $\frac{6,67 \times 10^{-11}(615)}{r^2}$ ✓$\frac{5,98 \times 10^{24}}{}$ ✓

r = 7 004 321,38 m
= 7 004,32 km✓ (5)

[7]

QUESTION 5 / VRAAG 5

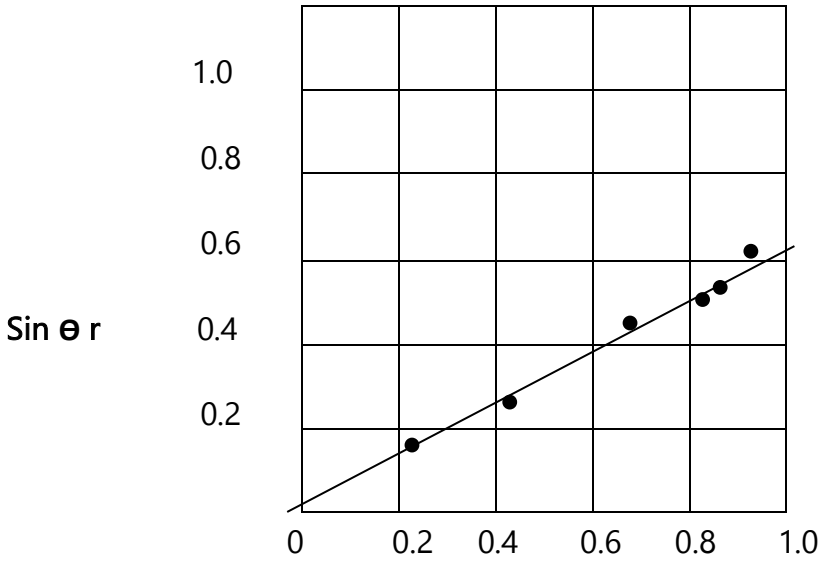
5.1.1 r/ sin Ɵ r✓ (1)

5.1.2 i/sin Ɵ i ✓ (1)

5.1.3 The type of block used/temperature of the surroundings/source of light/surface on which block is placed

Die tipe blok gebruik/temperatuur van die omgewing/bron van die lig/ oppervlak waarop blok geplaas word. (1)

5.2 **Graph of sin ϴi versus sin ϴr / Grafiek van sin ϴi teenoor sin ϴ r**



Slope of graph/Helling van grafiek = n = $\frac{\Delta y}{\Delta x} = \frac{\Delta \sin r}{\Delta \sin i}$ ✓

$= \frac{(0,6 - 0)}{(0,9 - 0)}$ ✓

= 0.67 ✓

OR $n = \frac{\Delta \sin r}{\Delta \sin i}$ √

OR $\frac{(0.629-0.174)}{(0.940-0.259)}$ √

= 0.668 √

RUBRIC FOR MARKING GRAPH / RUBRIEK VIR NASIEN VAN GRAFIEK

Axes correctly chosen and labelled/ Asse korrek gekies en benoem	***√***
Graph has a descriptive title/ grafiek het 'n beskrywende titel	***√***
Correctly plotted points(minimum of 4 points)/ punte korrek geteken (minimum van 4 punte)	***√√***
Best line of fit / Beste lyn van plasing	***√***
Deduct a maximum of 1 mark if more than 3 points are incorrectly plotted Trek 'n maksimum van 1 punt af indien meer as 3 punte verkeerd getrek is.	

(8)

POSITIVE MARKING FROM 5.2 / POSITIEWE MERK VAN 5.2 AF

5.3 $n = \frac{c}{v}$ ✓

$v = \frac{3 \times 10^8}{0.67}$ ✓

$= 4.48 \times 10^8 \text{ m·s}^{-1}$ ✓ (3)

[14]

QUESTION 6 / VRAAG 6

6.1 The refractive index is the ratio between the speed of light in a vacuum ✓and the speed of light in a medium. ✓

Die brekingsindeks is die verhouding tussen die spoed van lig in 'n vakuum ✓ en die spoed van lig in 'n medium. ✓ (2)

6.2 $n_i \sin\theta_i = n_r \sin\theta_r$ ✓
$1.33 \sin 37^o$ ✓ $= 1.47 \sin \theta_r$ ✓
$\Theta_r = 32.99^o$ ✓ (4)

6.3 Olive oil has a higher optical density than water. ✓✓
Olyfolie het 'n groter optiese digtheid as water.

OR/OF
Water has a lower optical density than water. ✓✓
Water het 'n laer optiese digtheid as olyfolie. (2)

6.4 AWAY from the normal✓
WEG van die normal

The *speed of light in air* is faster than the *speed of light in oil* because the refractive index of oil is higher than of air. ✓
Die spoed van lig in lug is vinniger as die spoed van lig in olie omdat die brekingsindeks van olie groter is as die van lug.
OR/OF
Light is moving from an optical more dense to a less dense medium. ✓
Lig beweeg van 'n optiese digter na 'n optiese minder digte medium. (2)

6.5 Oil to air ✓ (1)
Olie na lug

[11]

QUESTION 7 / VRAAG 7

7.1 Light consisting of only one wavelength.
Lig wat uit net een golflengte bestaan. (1)

7.2.1 INCREASE / TOENEEM (1)
7.2.2 INCREASE / TOENEEM (1)

7.3 A central bright band of coloured light with alternating dark and light bands✓ to the sides getting dimmer.✓
'n Helder breë sentrale kleurband afgewissel deur swart bande ✓en helder bande, wat dowwer word na die kante. ✓ (2)
[5]

QUESTION 8 / VRAAG 8

8.1 Boiling point is the temperature when a liquid's vapour pressure is equal to its atmospheric pressure.✓✓

Kookpunt is die temperatuur wanneer die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk.✓✓ (2)

8.2 8.2.1 He ✓ (1)
8.2.2 NH_3 ✓ (1)
8.2.3 NaCℓ ✓ (1)
8.2.4 $CCℓ_4$ ✓ (1)

8.3 8.3.1 London / dispersion forces✓
London / dispersiekragte.✓ (1)

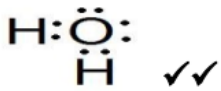
8.4 Dative covalent bond✓
Datief kovalente binding. ✓ (1)

8.5 CCl_4 ✓ & CH_4 ✓ (2)
[10]

QUESTION 9 / VRAAG 9

9.1 Hydrogen bonds ✓
Waterstofbinding ✓ (1)

9.2 Specific heat is the amount of heat needed to raise the temperature of one kilogram of mass by 1ºC. ✓
Spesifieke warmte kapasiteit is die hoeveelheid hitte wat nodig is om die temperatuur van 'n massa van 1kg met 1ºC te laat styg. ✓ (1)

9.3  ✓✓ (2)

9.4 Angular/bent √
Hoekig √ (1)

9.5 Polar. ✓
The O atom is more electronegative than the H atom. ✓
Both dipole moments work in the same direction to give a net dipole moment in the direction of the O atom. ✓
The oxygen side of the molecule becomes slightly more negative than the hydrogen side and a polar molecule forms. ✓

Die O atoom is meer elektronegatief as die H atoom. ✓
Beide dipoolmomente werk in dieselfde rigting en gee 'n netto dipoolmoment in die rigting van die O atoom. ✓
Die suurstofkant van die molekuul word gedeeltlike negatief en die waterstofkant positief sodat 'n polêre molekuul vorm. ✓ (4)

9.6 KCℓ ✓
The KCℓ is an ionic substance with Coulomb forces which are comparable in size with the hydrogen bonding found in water. ✓

Die KCℓ is 'n ioniese stof met Coloumbkragte wat van dieselfde grootte/sterkte as die waterstofbinding in die water is. ✓ (2)

9.7 Capillarity ✓
Adhesion forces between the water molecules and the glass causes water to rise up the edges of the glass. ✓

Kapillariteit ✓
Adhesie kragte tussen die watermolekules en die glas veroorsaak dat die water opstoot in die glasbuis. ✓ (2)

9.8 9.8.1 Higher heat capacity✓✓
Hoër warmte kapasiteit✓✓ (2)

9.8.2 Water has strong hydrogen bonding between its particles✓. This means, it takes more heat to raise the temperature of water✓ one degree than any other liquid (except ammonia).
Water het sterk waterstofbindings tussen die molekules. ✓ Dit beteken dat meer hitte nodig is om water met een graad te laat styg as enige ander vloeistof. .(behalwe ammoniak) ✓ (2)

9.8.3 There would be large changes in temperature✓and life would not exist✓.

Daar sal groot verandering in die temperatuur wees✓ wat lewe op aarde onmoontlik sal maak. ✓ (2)

[19]

QUESTION 10 / VRAAG 10

10.1 10.1.1 $p \alpha \frac{1}{V}$ ✓ **OR/OF** $V \alpha \frac{1}{p}$ ✓ (1)

10.1.2 Boyle's law/Boyle se wet ✓ (1)

10.1.3 As the volume of the container decreases, the number of collisions per unit area ✓ on the walls of the container increases. ✓

Soos die volume van die houer afneem, neem die aantal botsings per eenheidsoppervlakte ✓ teen die wande van die houer toe. ✓ (2)

10.2 Mass ✓ & temperature ✓
Massa ✓ & temperatuur ✓

ANY TWO/ENIGE TWEE: ✓✓

- Wait a while after increasing the pressure before taking a volume reading.
  Wag 'n rukkie voordat die volumelesing geneem word nadat die druk verhoog is.

- Increase the pressure in small amounts to limit the temperature change.
  Verhoog die druk in klein hoeveelhede om die temperatuurstyging te beperk.

- Same mass of gas is trapped (in tube), ensure that there is no leakage of gas
  Dieselfde massa gas is vasgevang (in buis), maak seker dat daar geen lekkasie van die gas is nie (4)

10.3 $30cm^3$ ✓ (1)

Notes/*Aantekeninge*
May use any set of values from the graph that gives the correct answer.
Mag enige stel waardes op die grafiek wat die korrekte antwoord gee gebruik.

10.4 $p_1V_1 = p_2V_2$ ✓
$(120)(30)$ ✓ $= p2(5)$ ✓
$\therefore p2 = 720$ kPa ✓ (4)

10.5 High pressures / Hoë drukke✓
Low temperatures / Lae temperature ✓ (2)

[15]

QUESTION 11 / VRAAG 11

11.1 $A\ell_2(SO_4)_3$ ✓ (1)

11.2 M $[A\ell_2(SO_4)_3]$ = (27 x 2) + (32 x 3) + (16 x 12)
= 54 + 96 + 192
= 342 $g \cdot mol^{-1}$ ✓

$n = \frac{m}{M}$ ✓ $= \frac{40}{342}$ ✓ = 0.12 mol ✓ (4)

11.3 $\%A\ell = \frac{54}{342} \times 100 = 15{,}79\%$ ✓

$\%\ S = \frac{96}{342} \times 100 = 28{,}07\%$ ✓

$\%\ O = \frac{192}{342} \times 100 = 56{,}14\%$ ✓ (3)

11.4

$n(A\ell) = \frac{15{,}79}{27} = 0{,}585$ ✓ $\therefore \frac{0{,}585}{0{,}585} = 1$

$n(S) = \frac{28{,}07}{32} = 0{,}877$ ✓ $\therefore \frac{0{,}877}{0{,}585} = 1{,}5$

$n(O) = \frac{56{,}14}{16} = 3{,}509$ ✓ $\therefore \frac{3{,}509}{0{,}585} = 6$

mole ratio = 1 : 1,5 : 6 (x2)
= 2 : 3 : 12 ✓ (5)

∴ Empirical formula: $A\ell_2S_3O_{12}$ ✓ [13]

GRAND TOTAL / GROOT TOTAAL [150]