The education

Department of Education
FREE STATE PROVINCE

JUNE EXAMINATION
JUNIE EKSAMEN

GRADE/GRAAD 11

PHYSICAL SCIENCES
FISIESE WETENSKAPPE
MEMORANDUM

JUNE/JUNIE 2023

MARKS/PUNTE: 150

TIME/TYD: 3 HOURS/URE

This memorandum consists of 11 pages.
Die memorandum beslaan 11 bladsye

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Please turn over/*Blaai asseblief om*

QUESTION 1 / *VRAAG 1*

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

QUESTION 2 / *VRAAG 2*

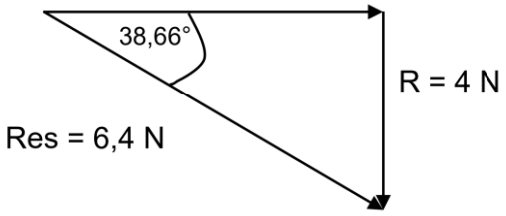
2.1

OPTION 1/*OPSIE 1*	**OPTION 2/OPSIE 2**
POSITIVE TO THE NORTH / *NOORD POSITIEF*	**POSITIVE TO THE SOUTH / *SUID POSITIEF***
F_{res} = 20 ✓+ (-30) ✓ = -10 N = 10 N South/*Suid* ✓	F_{res} = (-20) ✓ + 30 ✓ = 10 N = 10 N South/*Suid* ✓

(3)

2.2.1 The vector sum of two or more vectors, i.e. a single vector having the same effect as two or more vectors together. ✓✓/ *Die vektorsom van twee of meer vektore, dit wil sê 'n enkele vektor met die dieselfde effek as twee of meer vektore saam*. (2)

2.2.2 Scale/*Skaal*: 1 cm = 1 N



Criteria for marking: / *Nasienkriteria*	
• Scale indicated/*Skaal aangedui*	✓
• Right angled triangle correctly drawn./*Reghoekige driehoek korrek geteken*	✓
• Vector **Q** (both magnitude and arrow headed line)/ *Vektor **Q** (beide grootte en pylpunt)*	✓
• Vector **R** (both magnitude and arrow headed line)/ *Vektor **R** (beide grootte en pylpunt)*	✓
• Resultant (both magnitude and arrow headed line)/ Resultant *(beide grootte en pylpunt)*	✓
• The direction for the resultant (38,66°)/ *Die rigting van die resultant (38,66°)*	✓

(6)

2.2.3 For horizontal vectors/*Vir horisontale vektore* = +5 – 7 = –2 N ✓
For vertical vectors/*Vir vertikale vektore* = +6 – 4 = 2 N ✓

$Res^2 = x^2 + y^2$
$= (–2)^2 + (2)^2$ ✓
Res = 2,83 N ✓ (4)
[13]

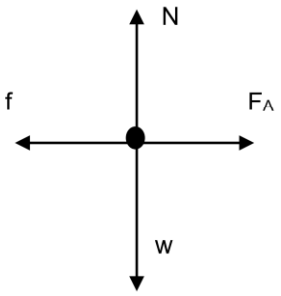
QUESTION 3 / *VRAAG 3*

3.1 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 resulterende/netto krag daarop inwerk. (2)

3.2 Yes/*Ja* ✓ (1)

3.3 The block is moving at constant velocity, thus the acceleration is zero.
The resultant force acting on the system is zero. ✓
Which leads to friction NOT being equal to zero/ friction being 3,42N ✓ /
Die blok beweeg teen 'n konstante snelheid, dus is die versnelling nul.
Die resulterende krag wat op die stelsel inwerk is nul.
Wrywing is NIE gelyk is aan nul nie/ wrywing is 3,42N (2)

3.4



ACCEPTABLE LABELS/ *AANVAARDE BYSKRIFTE*		
F_A	$F_{applied}$ / Applied Force / 3,42 N / *$F_{toegepas}$ / Toegepaste krag*	✓
f	Friction / F_f / Frictional force /3,42 N / *Wrywing / Wrywingskrag*	✓
N	Normal Force / F_N / Normal / *Normaalkrag / Normaal*	✓
w	F_g / weight / gravitational force / *gewig / gravitasiekrag*	✓

NOTES: / NOTAS:
- One mark for each arrow and correct label./*Een punt vir elke korrekte pyl en byskrif*
- Penalise ONCE for each of the following:/ *Penaliseer eenmalig vir:*
  - No arrows/*Geen pyle*
  - No dot/*Geen kol*
  - Space between the dot and line./ *Spasie tussen kol en lyn*
  - Dotted lines drawn./ *Stippellyn geteken*

(4)

3.5 $f_k = \mu_k N$ ✓
$3,42$ ✓ $= \mu_k (5 \times 9,8)$ ✓
$\mu_k = 0,07$ ✓ (4)
[13]

QUESTION 4 / *VRAAG 4*

4.1.1 The force that opposes the motion of an object and which acts parallel to the surface. ✓✓ / *Die krag wat teen die bewegingsrigting van 'n voorwerp inwerk en wat parallel aan die oppervlak is.* (2)

4.1.2

OPTION 1/*OPSIE 1*

POSITIVE TO THE RIGHT/*POSITIEF NA REGS*

For block M: / *Vir blok M:*

$F_{net} = ma$
$(-f) + T = ma$ ✓ anyone/*enige een*
$-3 + T$ ✓ $= 1a$ ..... **(1)**

For block N/ *Vir blok N* ✓ for both/ *vir beide*

$F_{net} = ma$
$(-T) + F_g = ma$
$-T + (5 \times 9{,}8)$ ✓ $= 5a$.....**(2)**

(1) + (2):

$-3 + 49 = 6a$
$a = 7{,}67\ m{\cdot}s^{-2}$

From / *Vanaf* (1):

$-3 + T = 1(7{,}67)$ ✓
$T = 10{,}67\ N$ ✓

OR/*OF*

From/*Vanaf* (2):

$-T + (5 \times 9{,}8) = 5a$
$-T + (5 \times 9{,}8) = 5(7{,}67)$
$= 10{,}67\ N$

OPTION 2 / *OPSIE 2*

POSITIVE TO THE LEFT/*POSITIEF NA LINKS*

For block M: / *Vir blok M :*

F_{net} = ma
f + (-T) = ma
3 -T ✓ = 1a …… **(1)**

✓ anyone/*enigeen*

For block N / *Vir blok N*

✓ for both/*vir beide*

F_{net} = ma
T + (-F_g)= ma
T - (5 x9,8) ✓ = 5a…… **(2)**

(1) + (2):

3 - 49 = 6a
a = 7,67 m·s^{-2}

From/*Vanaf* (1):

3 - T = 1(7,67) ✓
T = 10,67 N ✓

OR/*OF*

From/*Vanaf* (2):

T - (5 x9,8) = 5a
-T + (5 x9,8) = 5(7,67)
= 10,67 N

(6)

4.1.3 No ✓ / *Nee*

- According to Newton's third law ✓, the force that M (or N) exerts on the string must be equal to the force the string exerts on M (or N) / involves 2 objects. ✓
- The force that N exerts on the string and the force that M exerts on the string are not on the same plane so cannot cancel each other. ✓ /
- Volgens Newton se derde wet is die krag wat M (of N) op die tou uitoefen gelyk wees aan die krag wat die tou op M (of N) uitoefen / behels 2 voorwerpe.
- Die krag wat N op die tou uitoefen en die krag wat M op die tou uitoefen is nie op dieselfde vlak nie, en kan dus nie mekaar uitkanselleer nie. (4)

4.2 Equal to ✓/*Gelyk aan*
Both experience gravitational acceleration. ✓ / *Beide vernel as gevolg van gravitasie.* (2)

[14]

QUESTION 5 / VRAAG 5

5.1 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 in die heelal trek elke ander deeltjie aan met 'n gravitasiekrag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte.* (2)

5.2 $F = \frac{G m_1 m_2}{r^2}$ ✓

$= \frac{(6{,}67 \times 10^{-11})(500)(5{,}98 \times 10^{24})}{(3{,}6 \times 10^{7} + 6{,}38 \times 10^{6})^2}$ ✓✓

$= 111{,}04\ N$ ✓ (5)

5.3 **POSITIVE MARKING FROM QUESTION 5.2/**
MERK POSITIEF VAN VRAAG 5.2

w = mg ✓

111,04 = 500 g ✓

g = 0,22 m·s^{-2} ✓ (3)

[10]

QUESTION 6 / *VRAAG 6*

6.1.1 To the left ✓ / *Na links* (1)

6.1.2 Removed from ✓ / *Verwyder van* (1)

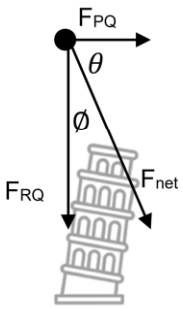
6.1.3 $Q_{net} = \frac{Q_1 + Q_2}{2}$

$= \frac{(-6 \times 10^{-9})✓ + (+4 \times 10^{-9})✓}{2}$

$= -1 \times 10^{-9}\ C$✓ (3)

6.2.1 The magnitude of the electrostatic force exerted by two point charges on each other is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓ / *Die grootte van die elektrostatiese krag wat uitgeoefen word deur twee puntladings op mekaar is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.* (2)

6.2.2



MARKING CRITERIA:	
$F_{P\ on\ Q}$ if correct direction	✓
$F_{R\ on\ Q}$ if correct direction	✓
Resultant vector	✓
NASIENKRITERIA:	
$F_{P\ op\ Q}$ as rigting korrek	✓
$F_{R\ op\ Q}$ as rigting korek	✓
Resultante vektor	✓

(3)

6.2.3 $F_{PQ} = \frac{kQ_1Q_2}{r^2}$ ✓

$$= \frac{(9 \times 10^9)(1 \times 10^{-9})(1 \times 10^{-9})}{(0{,}4)^2} \checkmark$$
$$= 5{,}625 \times 10^{-8}\ N$$

$$F_{RQ} = \frac{kQ_1Q_2}{r^2}$$

$$= \frac{(9 \times 10^9)(1 \times 10^{-9})(8 \times 10^{-9})}{(0{,}25)^2} \checkmark$$
$$= 1{,}152 \times 10^{-6}\ N$$

$$F_{net}^2 = F_{PQ}^2 + F_{RQ}^2$$
$$= (5{,}625 \times 10^{-8})^2 + (1{,}152 \times 10^{-6})^2 \checkmark$$
$$Fnet = 1{,}15 \times 10^{-6}\ N$$

$$\tan\theta = \frac{F_{PQ}}{F_{RQ}}$$
$$= \frac{1{,}152 \times 10^{-6}}{5{,}625 \times 10^{-8}} \checkmark$$
$$\theta = 87{,}2°\ to\ horizontal$$

OR/*OF*

$$\tan\emptyset = \frac{F_{PQ}}{F_{RQ}}$$
$$= \frac{5{,}625 \times 10^{-8}}{1{,}152 \times 10^{-6}}$$
$$\emptyset = 2{,}8°\ to\ vertical$$

∴ F_{net} = 1,15 x 10^{-6} N ✓, in the direction of 87,2° to horizontal ✓ / *87,2° met die horisontaal*

OR/*OF*

F_{net} = 1,15 x 10^{-6} N, in the direction of 2,8° to vertical / *2,8° met die vertikaal*

OR/*OF*

F_{net} = 1,15 x 10^{-6} N, on a bearing of 177,2°/ *rigting 177,2°*



(7)
[17]

QUESTION 7 / *VRAAG 7*

7.1.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓/ *Die grootte van die geïnduseerde emk oor die punte van 'n geleier is direk eweredig aan die tempo van verandering in die magnetiese vloedkoppeling met die geleier.* (2)

7.1.2 When the magnet enters the coil, the galvanometer will reach its maximum. ✓
When the magnet is inside the coil, the galvanometer will have no reading. ✓
When the magnet leaves the coil, the galvanometer shows a reading in opposite direction. ✓ /
Wanneer die magneet die spoel binnegaan, sal die galvanometer sy maksimum lesing wys. □
Wanneer die magneet binne die spoel is, sal die galvanometer geen lesing hê nie.
Wanneer die magneet die spoel verlaat, wys die galvanometer 'n lesing in teenoorgestelde rigting (3)

7.1.3 J to/*na* K✓ (1)

7.2.1 X to/*na* Y✓ (1)

7.2.2 Faraday's Law OR Electromagnetic induction ✓
Faraday's se wet OF Electrogmanetiese induksie (1)
[8]

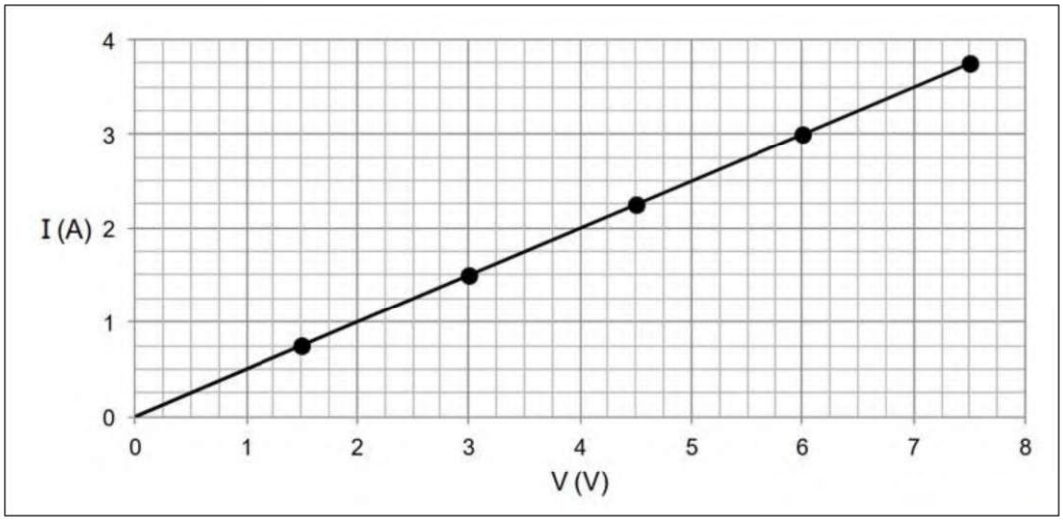
QUESTION 8 / *VRAAG 8*

8.1.1 What is the relationship between the current in a conductor and the potential difference across the conductor? / *Wat is die verband tussen die stroom in 'n geleier en die potensiaalverskil oor die geleier?*

Criteria for marking / *Nasienkriteria*	
Dependent and independent variables are stated./*Afhanklike en onafhanklike veranderlikes word genoem*	✓
Ask a question about the relationship between the dependent and independent variables./ *'n Vraag oor die verband tussen die afhanlike en onafhanklike veranderlikes word gestel.*	✓

(2)

8.1.2 **Graph of current vs potential difference**
Grafiek van stroom teenoor potensiaalverskil



Criteria for marking / N*asienkriteria*	
Appropriate heading for the graph/*Gepaste opskrif vir die grafiek*	✓
Both axis with labelled with units (even if they are swopped)/ *Beide asse benoem met eenhede (selfs indien omgedraai)*	✓
Two coordinates plotted correctly/ *Twee koordinate korrek geplot*	✓
Three coordinates plotted correctly/ *Drie koordinate korrek geplot*	✓
Best fit straight line starting at 0/ Passende r*eguitlyn vanaf 0*	✓

(5)

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8.1.3 **ACCEPT ANY VALUES USED FROM THE GRAPH / *AANVAAR ENIGE WAARDES VANAF DIE GRAFIEK***

$$\text{Gradient} = \frac{\Delta I}{\Delta V} \checkmark$$
$$= \frac{7{,}5 - 6 \checkmark}{3{,}75 - 3 \checkmark}$$
$$= 2\,\Omega^{-1} \checkmark$$ (4)

8.2.1 The potential difference across the conductor is directly proportional to the current in the conductor at constant temperature. ✓✓ / *Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in 'n geleier by 'n konstante temperatuur.* (2)

8.2.2 $$P = \frac{V^2}{R} \checkmark$$
$$= \frac{6^2}{2} \checkmark$$
$$= 18\ \text{W} \checkmark$$ (3)

8.2.3 $$R_1 = \frac{V}{I_T} \checkmark$$
$$2 = \frac{6}{I_T} \checkmark$$
$$I_T = 3\text{A} \checkmark$$ (3)

8.2.4 $$V_2 = V_1 - V_3$$
$$= 10 - 6 \checkmark$$
$$= 4\text{V}$$

$$R_2 = \frac{V}{I_2}$$
$$2 = \frac{4}{I_2} \checkmark$$
$$I_2 = 2\text{A} \checkmark$$ (3)

8.2.5 **POSITIVE MARKING FROM QUESTION 8.2.3 / *POSITIEF MERK VAN VRAAG 8.2.3***

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$R_3 = \frac{V_2}{I_3}$ $= \frac{4}{1}$ ✓ $= 4\Omega$ ✓	$R_{T\ for\ 1,2,3} = \frac{V_1}{I_T}$ $= \frac{10}{3}$ ✓ $= 3{,}333\Omega$ $R_p = R_T - R_1$ $= 3{,}333 - 2$ $= 1{,}333\Omega$ $\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{1{,}333} = \frac{1}{2} + \frac{1}{R_3}$ $R_3 = 4\ \Omega$ ✓

(2)

8.2.6 **POSITIVE MARKING FROM 8.2.3/ *POSITIEF MERK VAN VRAAG 8.2.3***

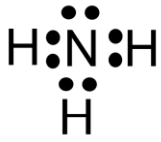
$P_4 = V_4 I_T$
$6 = V_4(3)$ ✓
$V_4 = 2\ V$ ✓ (2)

[26]

QUESTION 9/*VRAAG 9*

9.1 5 ✓ (1)

9.2



Criteria for marking/*Nasienkriteria*	
lone pair of N/*Alleenpaar van N*	✓
Any shared electron pair between N and H /*Enige gedeelde elektronpaar tussen N en H*	✓✓

(3)

9.3 (Trigonal) pyramidal ✓/ *(Trigonaal) piramidaal* (1)

9.4 Molecules with lone pairs on the central atom ✓ do not have one of the ideal shapes. ✓ / *Molekules met alleenpare op die sentrale atom het nie ideale vorms nie.*

OR/*OF*

The attraction that lone e-pair has on the shared electron pair differs from the attraction that two shared pairs have on each other. / *Die aantrekking*

wat alleen elektronpare het op die gedeelde elektronpare verskil van die aantrekking wat twee gedeelde pare op mekaar het. (2)

9.5 Polar (molecule). ✓ / *Polêr (molekule)* (1)

9.6 The difference in electronegativity between N and H causes the H-atom to be slightly positive and N-atom to be slightly negative. ✓
Since all the H-atoms are connected to one side of the molecule, the molecule will have a slightly more positive side and slightly more negative side. ✓ / *Die verskil in elektronegatiwiteit tussen N en H veroorsaak dat die H-atoom effens positief en die N-atoom om effens negatief sal wees. Aangesien al die H-atome aan die een kant van die molekule voorkom, het die molekule 'n effens meer positiewe en negatiewe kant.* *(2)*

9.7 A dative covalent bond forms when one atom shares a lone pair of electrons with an ion. ✓
In the case of NH_4^+ the lone pair from Nitrogen bonds with the H^+- ion ✓, which has no electrons to contribute./ *'n Datief kovalente binding vorm wanneer een atoom 'n aleenpaar elektrone deel met 'n ioon.*
In die geval van NH_4^+ bind die alleenpaar van stikstof met die H^+- ioon, wat geen elektrone het om by te dra nie. (2)
[12]

QUESTION 10 / *VRAAG 10*

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

10.2 Intermolecular forces are forces between two/different HCℓ molecules. ✓
Interatomic forces are forces between H and Cℓ atoms within one HCℓ molecule. ✓ *Intermolekulêre kragte is kragte tussen twee/verskillende HCℓ-molekules. Interatomiese kragte is kragte tussen H- en Cℓ-atome binne een HCℓ molekule.* (2)

10.3 Bromine ✓ / *Broom* (1)

10.4

	HCℓ	**H_2O**
Intermolecular forces / *Intermolekulêre kragte*	Dipole- dipole forces ✓ *Dipool-dipoolkragte*	hydrogen bonds ✓ *waterstofbinding*
Strength of the Intermolecular force / *Sterkte van intermolekuêre kragte*	Weaker intermolecular force ✓ / *Swakker intermolekulêre kragte*	Stronger intermolecular force / *Sterker intermolekulêre kragte*
Energy needed / *Energie benodig*	Less energy needed to overcome the	More energy needed to overcome the

	intermolecular forces between HCℓ ✓/ *Minder energie benodig om die intermolekulêre kragte te oorkom tussen HCℓ molekules*	intermolecular forces H_2O molecules. / *Meer energie benodig om die intermolekulêre kragte te oorkom tussen H_2O molekules*

(4)

10.5.1 Ion-dipole. ✓ / *Ioon-dipool* (1)

10.5.2 Weaker ✓ / *Swakker* (1)

10.6

	Br_2	**HCℓ**
Intermolecular forces / *Intermolekulêre kragte*	Induced dipole forces✓/ *Geïnduseerde dipool-dipoolkragte*	Dipole- dipole forces *Dipool-dipoolkragte*
Strength of the Intermolecular force / *Sterkte van intermolekuêre kragte*	Stronger intermolecular force ✓/ *Sterker intermolekulêre kragte*	Weaker intermolecular force / *Swakker intermolekulêre kragte*
	Higher molecular mass✓ / *Hoër molekulêre massa*	Lower molecular mass / *Kleiner molekulêre massa*
Energy needed / *Energie benodig*	More energy needed to overcome the intermolecular forces✓ / *Meer energie benodig om die intermolekulêre kragte te oorkom.*	Less energy needed to overcome the intermolecular forces / *Minder energie benodig om die intermolekulêre kragte te oorkom.*

(4)
[15]

GRAND TOTAL: 150
GROOTTOTAAL: 150