education

Department of Education
FREE STATE PROVINCE

JUNE EXAMINATION

GRADE 11

PHYSICAL SCIENCES

JUNE 2023

MARKS: 150

TIME: 3 HOURS

This paper consists of 15 pages and three information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 10 questions. Answer ALL questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 Two forces of 3 N and 5 N respectively, act simultaneously at the same point. The magnitude of their resultant force is 2 N. What will the angle between the two forces be?

A 0°

B 90°

C 180°

D 360° (2)

1.2 An object is moving at a CONSTANT VELOCITY, this means that …

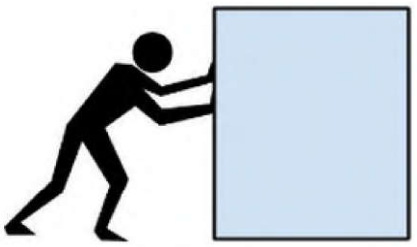
A no forces are acting on an object.

B a constant force is acting on the object.

C the only force acting on the object is gravitational force.

D all the forces acting on the object, together form a closed vector diagram. (2)

1.3 A man tries to move a block, but the block is NOT moving. Which one of the following statements best explains why the block will not move?



A The force the man exerts on the block is greater than the force the block exerts on the man.

B The force the man exerts on the block is smaller than the force the block exerts on the man.

C The force friction exerts on the block is greater than the force the man exerts on the block.

D The resultant force acting on the block is zero. (2)

1.4 Object **X** with an unknown mass is a distance **r** away from object **Y** with mass **M**. Object **X** exert a force **F** on object **Y**. What will the force **F** be if **X** is placed at a distance 2**r** from object **Y**?

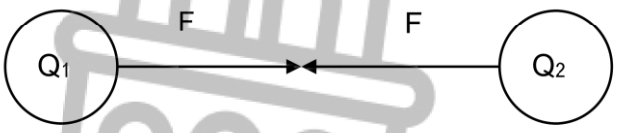
A ¼ **F**

B ½ **F**

C 2 **F**

D 4 **F** (2)

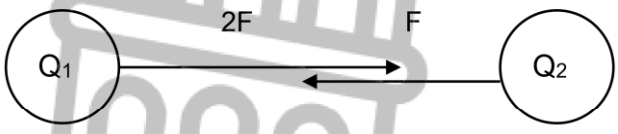
1.5 Two identical charged particles carry equal charges Q_1 and Q_2. Each charged particle experiences an electrostatic force of magnitude *F* as shown in the diagram below.



Q_1 is doubled, the distance between the particles remains the same. Which one of the following representations is CORRECT?

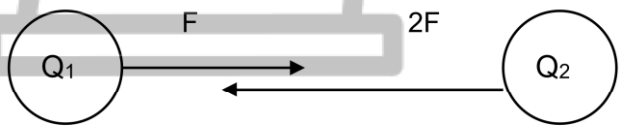
A

B



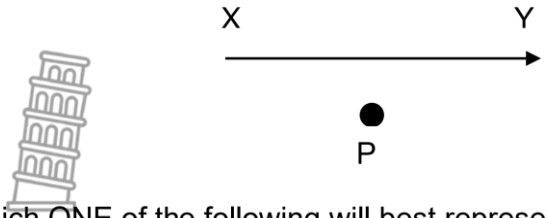
C

D



(2)

1.6 An electric current flow through a conducting wire **X** and **Y** as shown in the diagram below.



Which ONE of the following will best represent the direction of the magnetic field at point **P**?

A out of the page

B into the page

C to the right

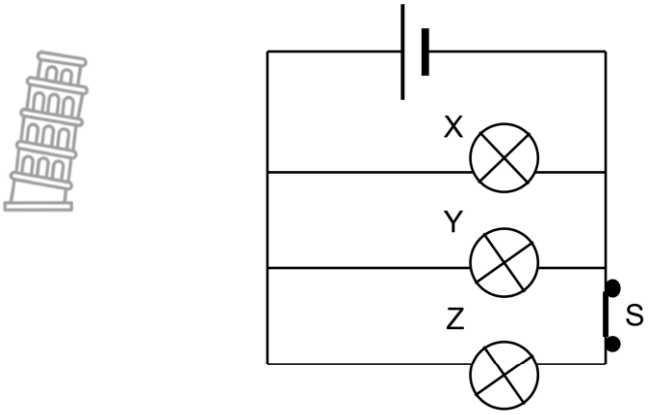
D to the left (2)

1.7 For which one of the quantities below is the CORRECT unit of measurement given?

	QUANTITY	UNIT
A	Current	$A \cdot s^{-1}$
B	Energy	kW
C	Potential difference	V
D	Resistance	V·s

(2)

1.8 Three identical bulbs **X**, **Y** and **Z** are connected in parallel in the circuit. Switch **S,** is initially closed. The internal resistance of the battery can be ignored.



Switch **S** is now open, how will this affect the brightness of the bulbs.

	Bulb **X**	Bulb **Y**	Bulb **Z**
A	increases	increases	no light
B	decreases	decreases	no light
C	no light	no light	no light
D	remain the same	remain the same	no light

1.9 Which one of the following has a dative covalent bond?

A NH_3

B N_2

C NH_4^+

D NO_2 (2)

1.10 Which one of the following substances will have the highest boiling point?

A H_2

B H_2O

C H_2S

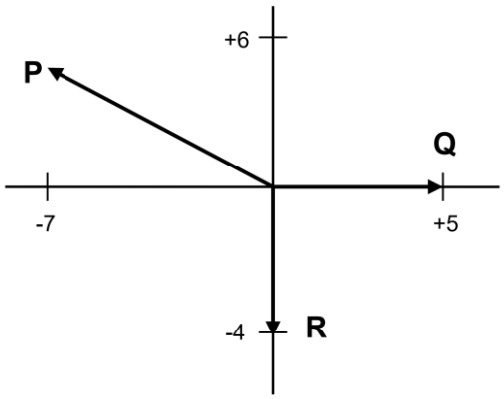
D H_2Se (2)

[20]

QUESTION 2

2.1 Fana applies a force of 20 N due North on Mpho. At the same time Thabang applies a force of 30 N on Mpho in the OPPOSITE direction to the one by Fana. Calculate the resultant force exerted by Fana and Thabang on Mpho. (3)

2.2 Three vectors **P**, **Q** and **R** on a cartesian plane (NOT DRAWN TO SCALE) are shown below.



2.2.1 Define the term *resultant vector*. (2)

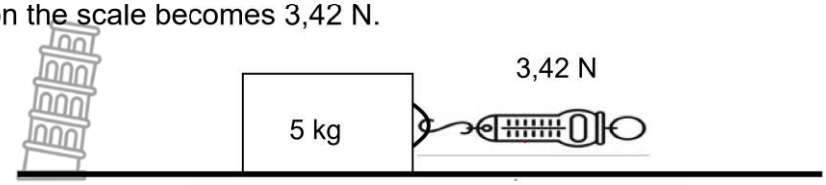
2.2.2 Determine the resultant of **Q** and **R** in Newtons by using head-to-tail method. Indicate the scale used. (6)

2.2.3 Calculate the magnitude of the resultant of all three vectors, **P**, **Q** and **R**, in Newtons. (4)

[15]

QUESTION 3

A 0,1 kg Newton scale is connected to a 5 kg wooden block as shown in the diagram below. When the block moves at a constant velocity across a horizontal surface, the reading on the scale becomes 3,42 N.



3.1 State Newton's first law of motion. (2)

3.2 Is frictional force acting on the block? Write only YES or NO. (1)

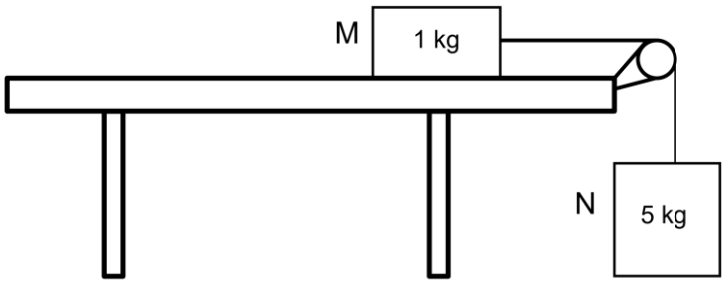
3.3 Explain your answer to 3.2 by referring to the Newton's first law of motion. (2)

3.4 Draw a free body diagram and identify ALL the forces acting on the block. (4)

3.5 Calculate the magnitude of the coefficient of the frictional force for the block. (4)
[13]

QUESTION 4

4.1 Blocks **M** and **N** of masses 1 kg and 5 kg respectively, are connected with a light inextensible string. The string runs over a frictionless pulley as shown in the diagram. The 1 kg block experiences a frictional force of 3 N.



4.1.1 Define the *frictional force* in words. (2)

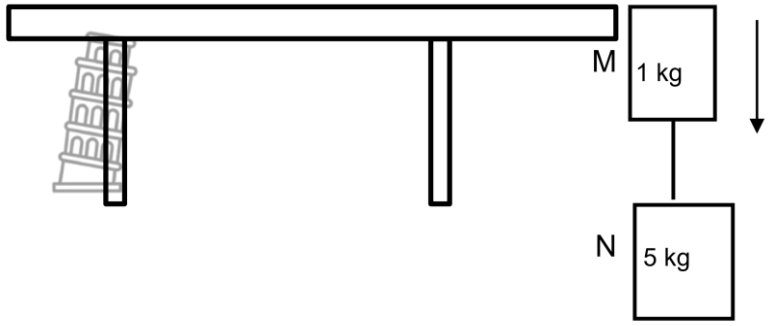
4.1.2 Calculate the magnitude of the tension on the blocks. (6)

4.1.3 A learner presents the following argument:

*The force by **M** on string is equal in magnitude but opposite in direction to the force by **N** on string. Since these two forces are equal in magnitude and opposite in direction, they will cancel each other.*

Is the learner's argument correct? Explain your answer using a relevant Physics law. (4)

4.2 The 1 kg block then sides over the pulley and both blocks fall to the ground as shown in the diagram below.



How does the acceleration of block **M** compare to that of block **N**? Write down only GREATER THAN, SMALLER THAN or EQUAL TO. Explain the answer. (2)

[14]

QUESTION 5

A 500 kg satellite is moving in an orbit of $3,6 \times 10^7$ m above the earth's surface.

5.1 State Newton's law of universal gravitation. (2)

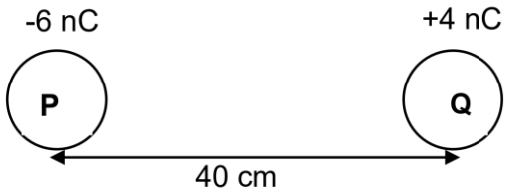
5.2 Calculate the gravitational force exerted by the earth on the satellite. (5)

5.3 Calculate the gravitational acceleration experienced by the satellite due to the force of gravity exerted by the earth on the satellite. (3)

[10]

QUESTION 6

6.1 Two metal spheres **P** and **Q,** carrying charges -6 nC and +4 nC respectively, are placed 40 cm apart along a straight line, as shown in the diagram below.



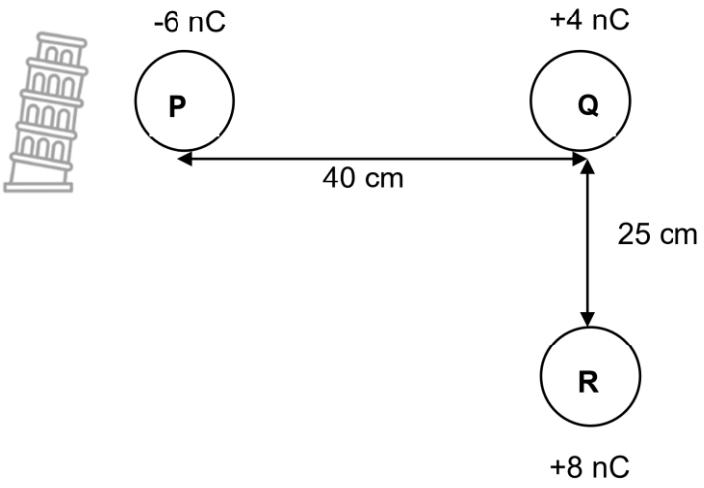
6.1.1 Sphere **Q** experiences an electrostatic force. In which direction will sphere **Q** move? Write down only TO THE LEFT or TO THE RIGHT. (1)

The spheres are now in contact with each other and then separated.

6.1.2 Were electrons REMOVED FROM or TRANSFERRED TO **P**? (1)

6.1.3 Calculate the magnitude of the net charge after the spheres are separated. (3)

6.2 A third sphere **R**, carrying a charge of +8 nC is now placed at a distance of 25 cm from sphere **Q**.



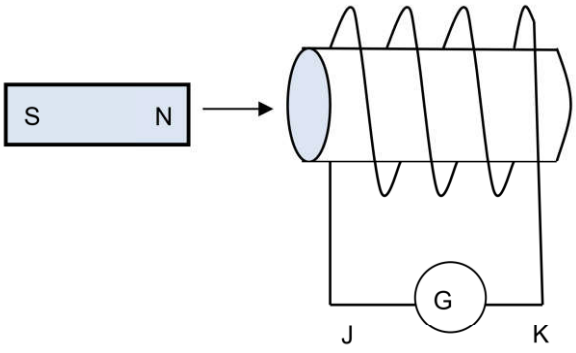
6.2.1 State Coulomb's law in words. (2)

6.2.2 Draw a vector diagram and show the electrostatic forces and the net force experienced by sphere **Q** due to **P** and **R**. (3)

6.2.3 Calculate the net electrostatic force experienced by sphere **Q** due to **P** and **R**. (7)
[17]

QUESTION 7

7.1 A conducting coil, with a diameter of 0,0015 m is connected to a galvanometer as shown in the diagram below. A bar magnet is pushed into the coil, kept stationary for a brief while and is then pulled out of the coil.

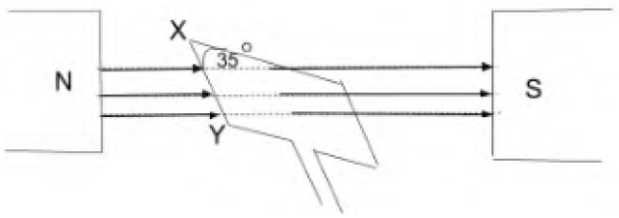


7.1.1 State Faraday's law in words. (2)

7.1.2 Explain how the reading on the galvanometer will change from the moment the magnet enters the coil to the moment it leaves the coil again. (3)

7.1.3 In which direction will the current in the conductor flow when the magnet enters the coil? Write only **J to K** or **K to J.** (1)

7.2 A coil makes an angle of 35° with the horizontal plane. The coil has an area of 0,04 m^2 and magnetic field of 0,3 T is directed which passes through the coil as shown in the diagram below.



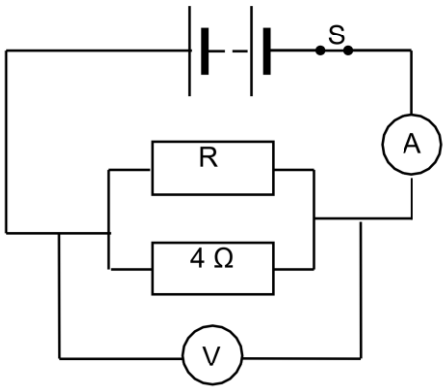
7.2.1 If the coil is rotated clockwise, in which direction does the induced current flow? Write down only X TO Y OR Y TO X. (1)

7.2.2 Which Physics law or principle is used to arrive to the answer in QUESTION 7.2.1? (1)

[8]

QUESTION 8

8.1 Two resistors, one with a resistance of 4 Ω and the other one of unknown resistance *R*, are connected in parallel. This combination is connected to a voltmeter, an ammeter, a battery and aswitch as indicated below. The current passing through the combination of parallel resistors is measured for VARIOUS potential differences across the combination.



8.1.1 Formulate an investigative question for this investigation. (2)

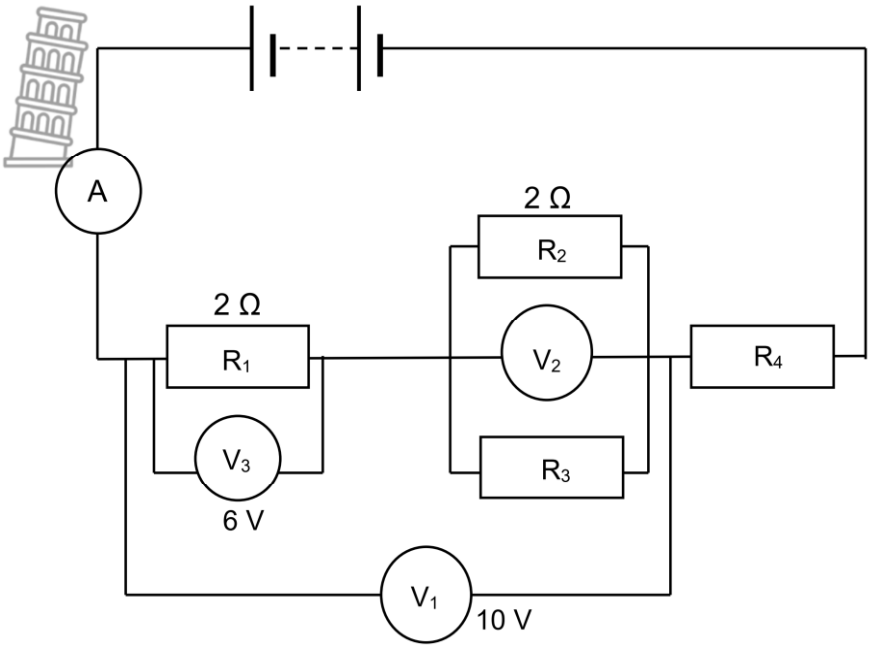
The results of the investigation are as follows:

POTENTIAL DIFFERENCE (V)	1,5	3,0	4,5	6,0	7,5
CURRENT (A)	0,75	1,50	2,25	3,00	3,75

8.1.2 Use the attached graph paper and draw a graph of potential difference versus current using the data in the table. (5)

8.1.3 Calculate the gradient by referring to the graph drawn in QUESTION 8.1.2 (4)

8.2 In the circuit represented below, the battery has negligible internal resistance. Each of resistors **R_1** and **R_2** has a resistance of 2 Ω, while the resistances of **R_3** and **R_4** are unknown. Voltmeters **V_1** and **V_3** have readings of 10 V and 6 V respectively.



8.2.1 Write down *Ohm's law* in words. (2)

Calculate:

8.2.2 The power dissipated by resistor **R_1**. (3)

8.2.3 The reading on the ammeter. (3)

8.2.4 The current in resistor **R_2**. (3)

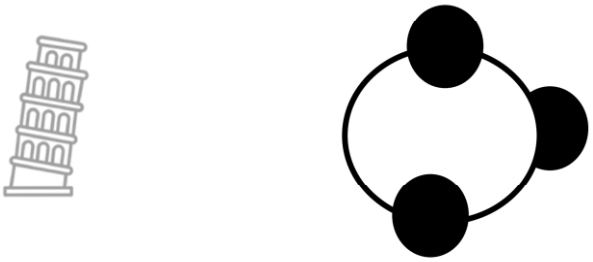
8.2.5 The resistance of resistor **R_3**. (2)

8.2.6 The potential difference across resistor **R_4** if its power is equal to 6 W. (2)

[26]

QUESTION 9

Ammonia (NH_3) is represented in the diagram below.



9.1 Write down the number of valence electrons for nitrogen. (1)

9.2 Draw the Lewis structure for ammonia. (3)

9.3 Write down the molecular shape of the ammonia molecule (1)

9.4 Explain why ammonia does not have a trigonal planar shape. (2)

9.5 Is ammonia a polar or non-polar molecule? (1)

9.6 Refer to the structure and difference in electronegativity to explain the answer to QUESTION 9.5. (2)

When a hydrogen ion reacts with an ammonia molecule, it forms the ammonium ion.

9.7 By referring to the ammonium ion, explain what is a dative covalent bond. (2)

[12]

QUESTION 10

Refer to the table below and answer questions that follow.

Substance	Melting Point (°C)	Boiling Point (°C)	Relative molecular/ atomic mass
Sodium (Na)	97,79	882,8	23
Bromine (Br_2)	-7,2	58,8	160
Hydrogen chloride (HCℓ)	-114,2	-85,1	36,5
Water (H_2O)	0	100	18

10.1 Define the term *boiling point*. (2)

10.2 By referring to the forces present in hydrogen chloride, explain the difference between intermolecular forces and interatomic forces. (2)

10.3 Which of these substances will be a liquid at +50 °C? (1)

10.4 Refer to intermolecular forces and energy and explain why the boiling point of HCℓ is lower than the boiling point of H_2O. (4)

10.5 NaCℓ is dissolved in H_2O.

10.5.1 Write down the name the intermolecular forces between NaCℓ and H_2O. (1)

10.5.2 Are the intermolecular forces stated in QUESTION 10.5.1 weaker or stronger than those of H_2O molecules. (1)

10.6 Refer to TYPE of INTERMOLECULAR FORCES, MOLECULAR MASS, STRENGTH of INTERMOLECULAR FORCES and ENERGY to explain the big difference in boiling points of Br_2 and HCℓ. (4)

[15]

GRAND TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 11
(Physics)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
(Fisika)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Mass of Earth *Massa van Aarde*	M	5,98 x 10^{24} kg
Radius of Earth *Radius van Aarde*	r_E	6,38 x 10^6 m

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/BEWEGING

$v_f = v_i + a\Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2} \right) \Delta t$

FORCE / *KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{r^2}$
$f_k = \mu_k N$	$f_s^{(max)} = \mu_s N$

WEIGHT AND MECHANICAL ENERGY / GEWIG EN MEGANIESE ENERGIE

$w = mg$ or/*of* $F_g = mg$	$U = mgh$ or/*of* $E_p = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	

ELECTROSTATICS / *ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$E = \frac{V}{d}$	$E = \frac{F}{q}$
$U = \frac{kQ_1Q_2}{r}$	$V = \frac{W}{q}$
$C = \frac{Q}{V}$	$C = \frac{\varepsilon_0 A}{d}$

ELECTROMAGNETISM / *ELEKTROMAGNETISME*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA$
$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	

ELECTRIC CIRCUITS / *ELEKTRIESE STROOMBANE*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$R_s = R_1 + R_2 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2}{R}\Delta t$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 **H** 1																	**He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

Ce 140	**Pr** 141	**Nd** 144	**Pm**	**Sm** 150	**Eu** 152	**Gd** 157	**Tb** 159	**Dy** 163	**Ho** 165	**Er** 167	**Tm** 169	**Yb** 173	**Lu** 175
Th 232	**Pa**	**U** 238	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**

KEY/*SLEUTEL*

Atomic number
Atoomgetal

29
1,9 **Cu** 63,5

Electronegativity
Elektronegatiwiteit

Symbol
Simbool

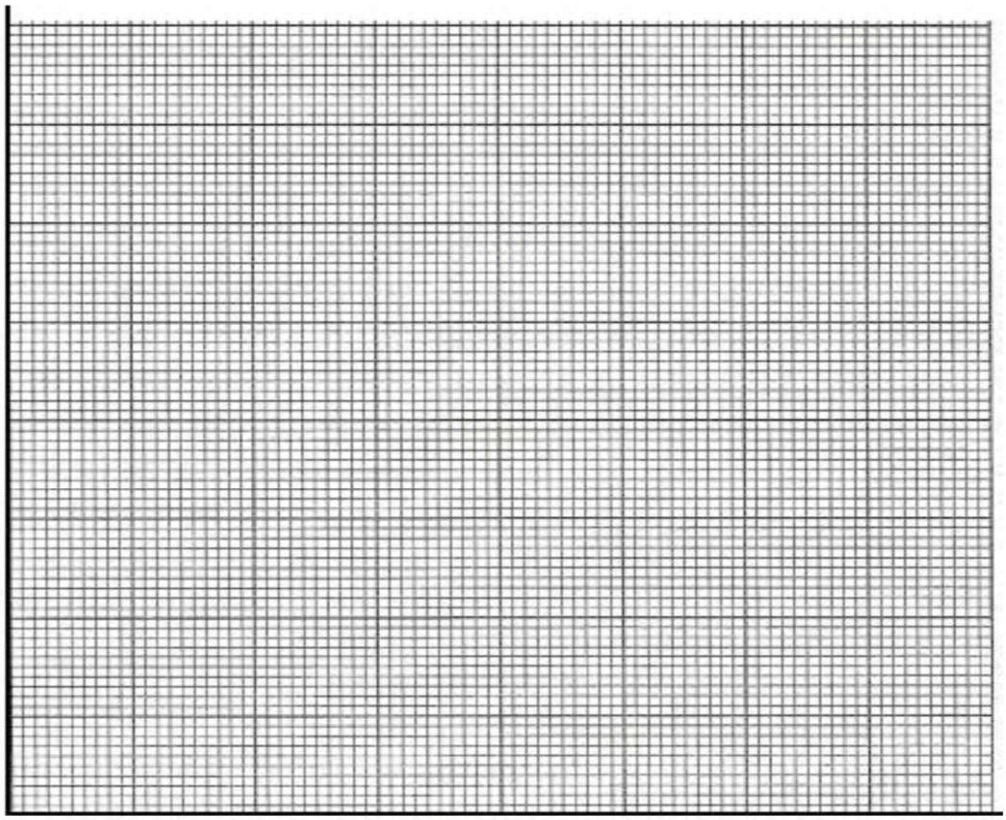
Approximate relative atomic mass
Benaderde relatiewe atoommassa

NAME: _____

CLASS: _____

8.1.2

_____



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

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*

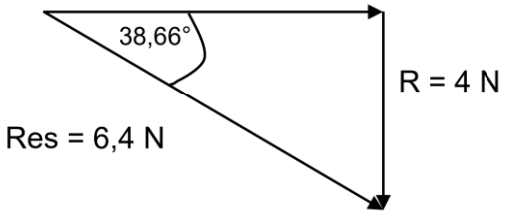
2.1

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]

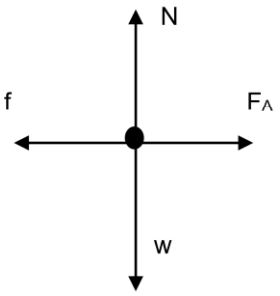
QUESTION 3 / *VRAAG 3*

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*

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

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

(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)

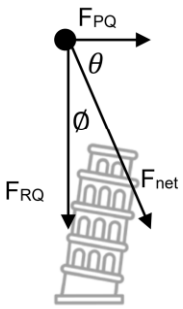
6.1.3 $Q_{net} = \frac{Q_1 + Q_2}{2}$

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

$= -1 \times 10^{-9}\ C$✓ (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 $F_{PQ} = \frac{kQ_1Q_2}{r^2}$ ✓

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

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

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

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

$\tan\theta = \frac{F_{PQ}}{F_{RQ}}$ OR/*OF* $\tan\emptyset = \frac{F_{PQ}}{F_{RQ}}$

$= \frac{1{,}152 \times 10^{-6}}{5{,}625 \times 10^{-8}}$ ✓ $= \frac{5{,}625 \times 10^{-8}}{1{,}152 \times 10^{-6}}$

$\theta = 87{,}2°\ to\ horizontal$ $\emptyset = 2{,}8°\ to\ vertical$

∴ 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]

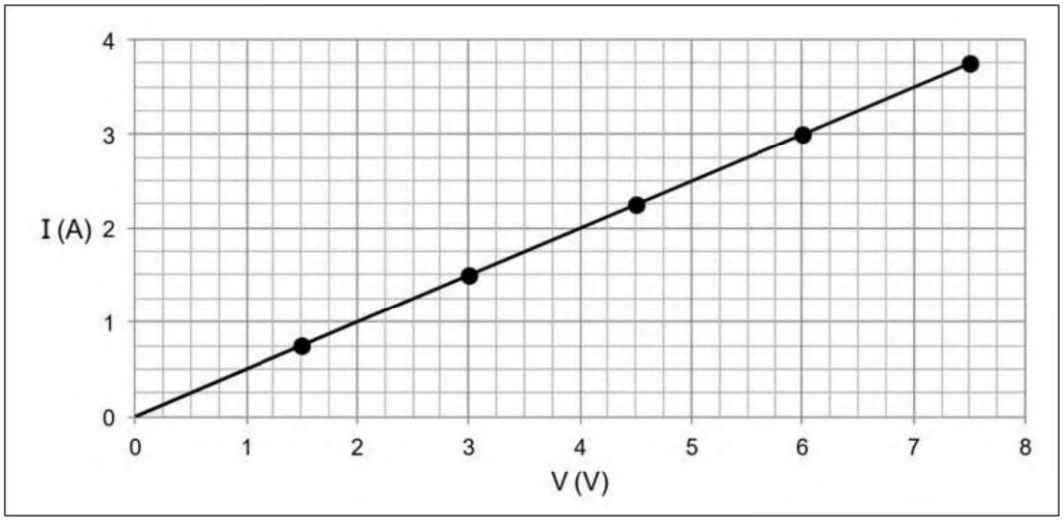
QUESTION 8 / *VRAAG 8*

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)

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

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

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

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

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

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

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***

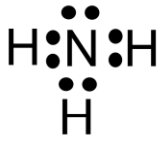
$P_4 = V_4 I_T$
$6 = V_4(3)$ ✓
$V_4 = 2\ V$ ✓

(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