education

Department of Education
FREE STATE PROVINCE

JUNE EXAMINATION

GRADE 11

PHYSICAL SCIENCES

JUNE 2025

MARKS: 150

TIME: 3 HOURS

This paper consists of 16 pages and 3 information sheets.

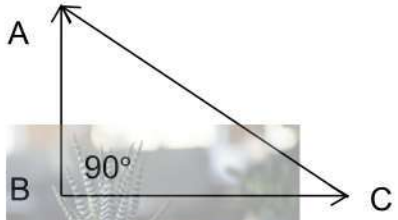
INSTRUCTIONS AND INFORMATION

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 Consider the following vector diagram:



The vector which represents the resultant of the other two, is …

A AB

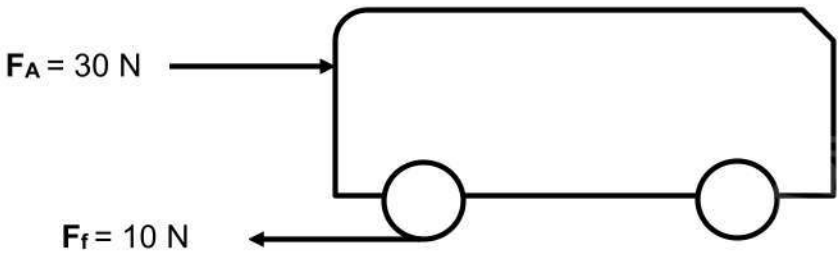
B AC

C CB

D BA

(2)

1.2 A boy is pushing a toy car towards the right with a force, F_A with a magnitude of 30 N. A frictional force, F_f of 10 N acts between the rough surface and the toy as indicated below.

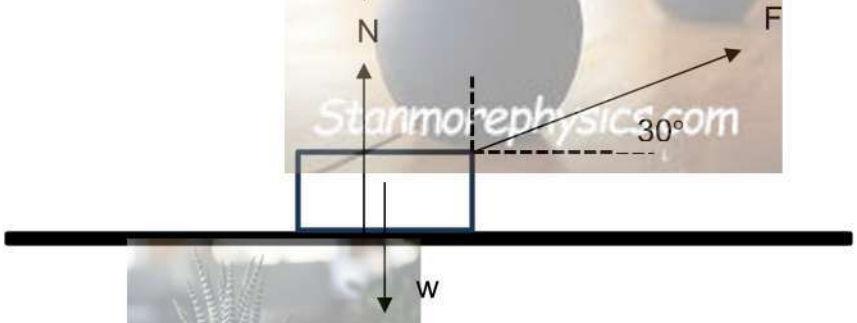


The Newton 3rd Law force acting on the boy by the toy is:

	FORCE	DIRECTION
A	0 N	No direction
B	10 N	To the right
C	20 N	To the right
D	30 N	To the left

(2)

1.3 An object is being pulled towards the right at a CONSTANT VELOCITY by a force **F** acting at an angle of 30° with the horizontal surface. The coefficient of kinetic friction is 0,1.



The magnitude of the frictional force(f_k) is …

A $f_k = 0,1(w - F)$

B $f_k = F\cos 30°$

C $f_k = 0,1(N - F\sin 30°)$

D $f_k = 0,1(F\cos 30°)$ (2)

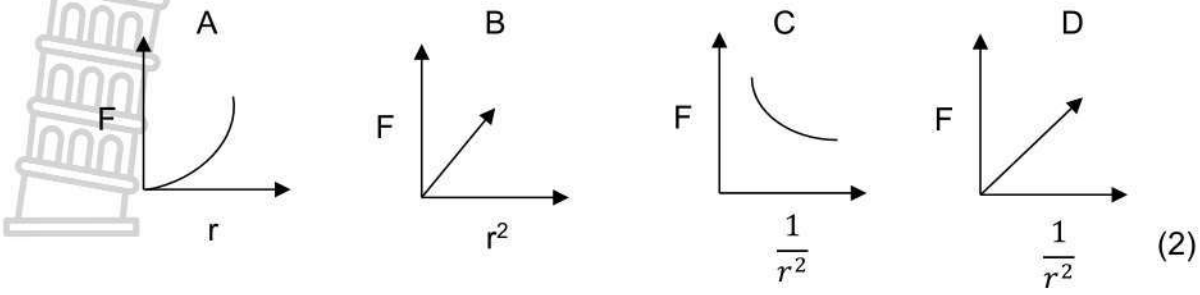
1.4 Two identical stationary charged particles, Q_1 with a charge of +4 nC and Q_2 with a charge of -6 nC, exert a force *F* on each other. The two particles are now allowed to make contact. Afterwards they are taken back to their original positions.

Which combination correctly describes the magnitude and direction of the new force the particles exert on each other compared to the original force?

	MAGNITUDE OF FORCE	DIRECTION OF FORCE
A	Smaller than *F*	Towards each other
B	Smaller than *F*	Away from each other
C	Greater than *F*	Towards each other
D	Greater than *F*	Away from each other

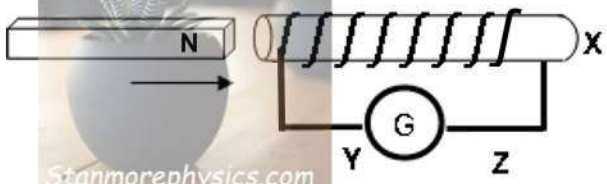
(2)

1.5 Which one of the following graphs correctly shows the relationship between the electrostatic force and distance between two charges in Coulomb's law?



(2)

1.6 In the following sketch the N-pole of a magnet is inserted into a coil.



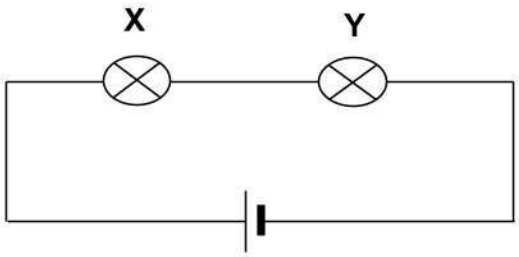
Which combination below is correct for the magnetic pole induced at point **X** and the direction of the induced current through the galvanometer between points **Y** and **Z**?

.

	Magnetic pole at X	**Direction of current through galvanometer**
A	N	Z to Y
B	N	Y to Z
C	S	Z to Y
D	S	Y to Z

(2)

1.7 The diagram below shows two light bulbs, **X** and **Y**, connected in series to a battery with negligible internal resistance.



If bulb **X** glows brighter than bulb **Y**, then the …

A current through bulb **X** is smaller than that through bulb **Y**.

B current through bulb **X** is greater than that through bulb **Y**.

C resistance of bulb **X** is smaller than that of bulb **Y**.

D resistance of bulb **X** is greater than that of bulb **Y**. (2)

1.8 Electric lamps **A** and **B** are marked: **A**: 100 W; 200 V and **B**: 100 W; 100 V

Which statement is correct regarding the power dissipated by **A** and **B**?

A $P_A = \frac{1}{4} P_B$

B $P_A = P_B$

C $P_A > P_B$

D $P_A = 2P_B$ (2)

1.9 The shape of a CH_4 molecule is:

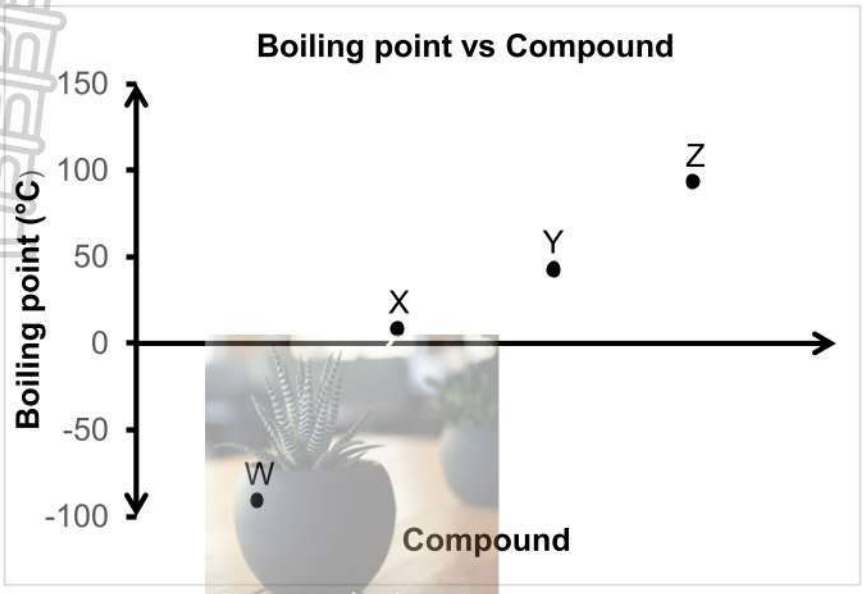
A Linear

B Tetrahedral

C Planar triangular

D Trigonal bipyramidal (2)

1.10 The graph below shows the boiling points of four different compounds. Which compound will have the HIGHEST vapour pressure?



A Z

B Y

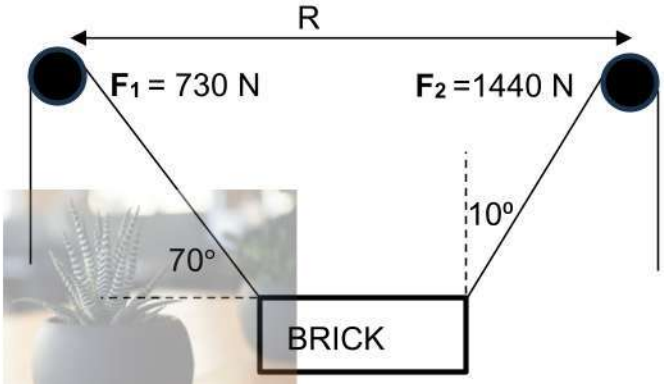
C X

D W

(2)
[20]

QUESTION 2

A brick is lifted by two ropes and two pulleys, as shown in the diagram below. The two pulleys are distance **R** apart. The force, F_1 is 730 N and the force F_2 is 1440 N. F_1 forms an angle of 70º with the horizontal and F_2 10º with the vertical. The brick is moving with a CONSTANT VELOCITY.



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

2.2 The net force acting on the brick is 0 N. Explain why this statement is true. (2)

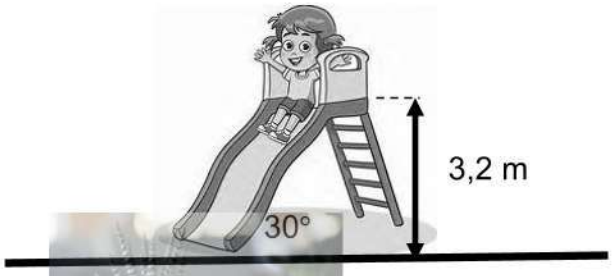
2.3. Calculate the magnitude of the vertical component of F_1. (2)

2.4 Calculate the magnitude of the weight of the brick. (4)

2.5 Explain why the ropes and the pullies will be less effective if the distance **R** between the pulleys is increased while the applied forces remain the same. (2)
[12]

QUESTION 3

A child with a mass of 30 kg slides at the park.The slide has a constant slope and a kinetic frictional coefficient of 0,15. The slide is 3,2 m high which makes an angle of 30° with the ground.



3.1 Draw a labelled free body diagram of the forces acting on the child while sliding down the slope. (3)

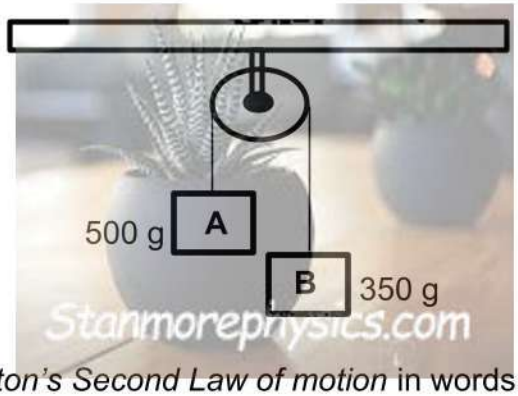
3.2 Calculate the magnitude of the frictional force experienced by the child. (4)

3.3 How will the net force acting on the child change if the child rubs oil on her legs thus lowering her friction. Choose from INCREASE, REMAIN THE SAME and DECREASE. (1)

3.4 The slope of the slide is decreased to 20°. How will this change affect the kinetic coefficient of friction.
Choose from INCREASE, REMAIN THE SAME and DECREASE.
Explain the answer. (2)
[10]

QUESTION 4

4.1 Two blocks, **A** mass 500 g, **B** mass of 350 g, hang on a thin string over a frictionless pulley as shown. Ignore the mass of the pulley and string.

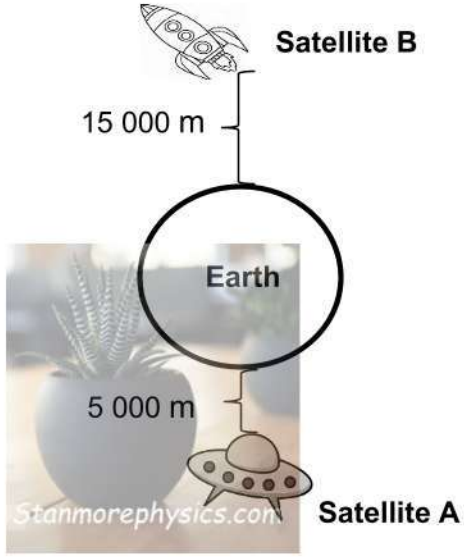


4.1.1 State *Newton's Second Law of motion* in words. (2)

4.1.2 Draw a force diagram showing all the forces acting on block **A**. (2)

4.1.3 Calculate the magnitude of the acceleration of the blocks. (6)

4.2 Two satellites orbiting the Earth are situated on opposite sides of the Earth as shown in the diagram. The distance between satellite **A**, with mass 2 800 kg and **B**, with mass 3 500 kg and the surface of the earth is 5 000 m and 15 000 m respectively.



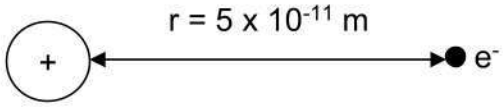
4.2.1 State *Newton's law of Universal gravitation*. (2)

4.2.2 Calculate the magnitude of the force between the Earth and Satellite **B**. (4)

4.2.3 Satellite **A** exert a force 2,74 x 10^3 N on the Earth. Calculate the magnitude of the *net force* experienced by the Earth due to Satellite **A** and **B**. (3)
[19]

QUESTION 5

5.1 A proton and an electron in a hydrogen atom are 5 x 10^{-11} m apart.

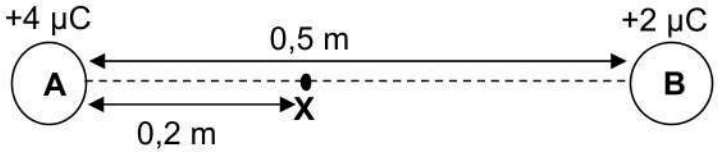


5.1.1 Draw the electric field pattern between the proton and the electron. (3)

5.1.2 State *Coulomb's law* in words. (2)

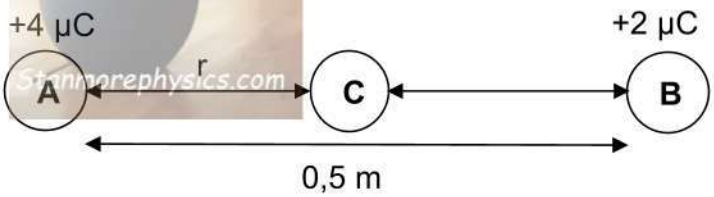
5.1.3 Calculate the magnitude of the electrostatic force that the proton and electron exert on each other. (4)

5.2 In the given diagram identical spheres **A** and **B** are placed 0,5 m apart. Sphere **A** has a charge of +4 μC and sphere **B** has a charge of +2 μC. Spheres **A** and **B** are in FIXED positions. Point **X** is 0,2 m from sphere **A**.



5.2.1 Calculate the magnitude of the electric field at point **X** due to sphere **A** only. (3)

Sphere **C**, with an unknown charge is now placed between sphere **A** and **B** a certain distance *r* from sphere **A.** Sphere **C** which is free to move, remains stationary.



5.2.2 Calculate the distance *r* that sphere **C** is from sphere **A**. (6)
[18]

QUESTION 6

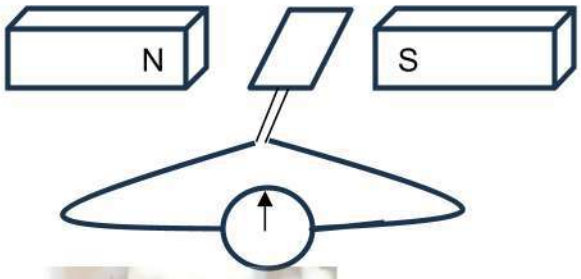
6.1 The following formula applies to Faraday's law of electromagnetic induction:

$$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$$

6.1.1 State *Faraday's law of electromagnetic induction* in words. (2)

6.1.2 By what factor will the *emf* change if only the number of turns is doubled? (2)

6.2 A single rectangular coil is connected to a galvanometer and then placed in a magnetic field to investigate Faraday's law as shown in the simplified diagram below.



When the coil is rotated clockwise, the needle of the galvanometer deflects.

6.2.1 Name TWO ways to change the direction of deflection of the galvanometer's needle. (2)

The rectangular coil has dimensions of 0,04 m x 0,06 m. The magnetic field has a strength of 0,5 T.

6.2.2 Show by means of a calculation that the magnetic flux, Φ, is zero when the coil is in the position as shown in the sketch above. (3)

The coil is now rotated clockwise through an angle of 30° with respect to the horizontal in 2 x 10^{-3} s.

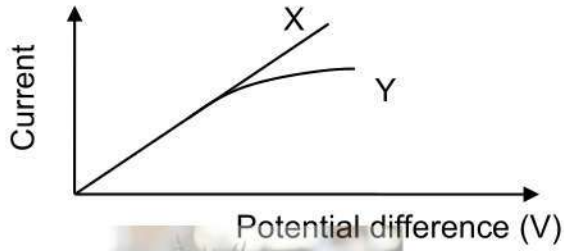
6.2.3 Calculate the:

6.2.3(a) change in the magnetic flux linkage (4)

6.2.3(b) induced emf. (3)
[16]

QUESTION 7

7.1 The two graphs below show the relationship between current and potential difference for two different conductors, **X** and **Y**.

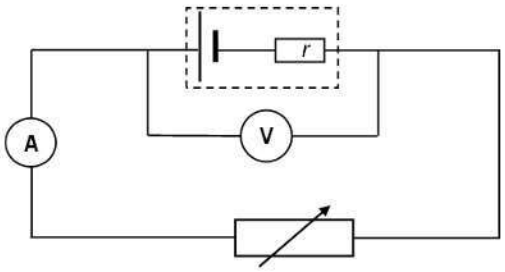


7.1.1 State *Ohm's law* in words. (2)

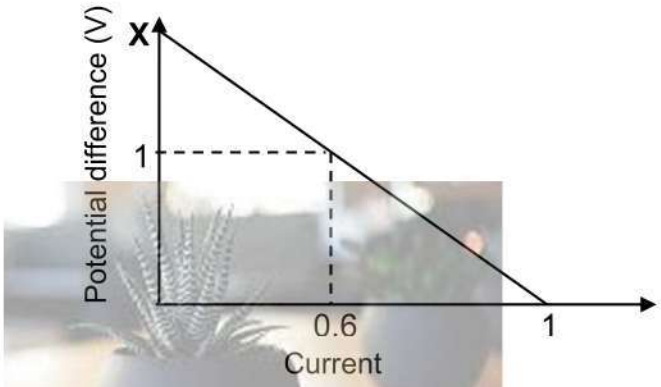
7.1.2 Which ONE of the two conductors, **X** or **Y**, is ohmic?
Refer to the graph and give a reason for your answer. (2)

7.1.3 State ONE condition where non-ohmic and ohmic conductors behave the same. (1)

7.2 Learners want to determine the *emf* and internal resistance (r) of a cell. They set up a circuit as shown in the diagram below and measure the potential difference using the voltmeter for different currents in the circuit.



The results obtained are shown in the graph below. The graph is NOT drawn to scale



7.2.1 Calculate the gradient of the graph. (3)

7.2.2 What physical quantity does the gradient of the graph represent? (1)

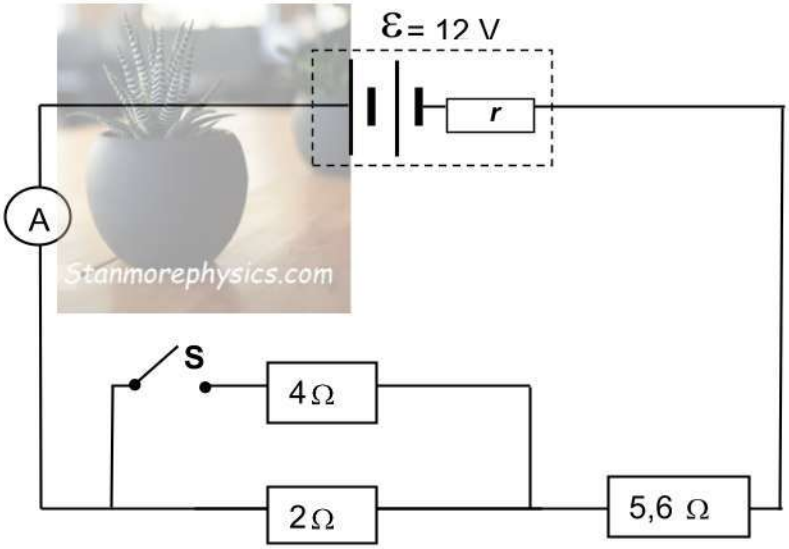
7.2.3 Calculate the value of **X**. (3)

7.2.4 Determine the external resistance of the circuit when the current was 0,6 A. (3)

[15]

QUESTION 8

The circuit diagram below represents a combination of resistors in series and parallel. The battery has an *emf* of 12 V and an unknown internal resistance r.



With switch **S** OPEN, ammeter **A** gives a reading of 1,2 A.

Calculate the:

8.1 total resistance of the circuit. (3)

8.2 internal resistance of the battery (3)

8.3 energy dissipated in the 2Ω resistor in 180 seconds. (3)

Switch **S** is now CLOSED.

8.4 Explain how the power dissipated by the 5,6 Ω resistor will change after the switch S is closed. (4)

[13]

QUESTION 9

The following compounds are given: NH_3, H_2O and HF.

9.1 Define the term *covalent bond*. (2)

9.2 For the H_2O molecule:

9.2.1 Draw the Lewis structure. (2)

9.2.2 Explain why it is a polar molecule. (2)

9.3 How many lone pair(s) does the HF molecule have? (2)

9.4 The ammonium ion (NH_4^+) can be formed by the reaction between one of the above compounds and a hydrogen ion (H^+):

9.4.1 Name the type of bond formed in this reaction. (2)

9.4.2 Draw a Lewis diagram of the ammonium ion (NH_4^+). (3)
[13]

QUESTION 10

Consider the list of five substances with their formulae and boiling points in the table.

NAME	FORMULA	BOILING POINT (°C)
Carbon dioxide	CO_2	-78
Hydrogen Fluoride	HF	20
Bromine	Br_2	60
Iodine	I_2	145
Water	H_2O	100

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

10.2 Explain the difference in boiling points between the two halogens (Br_2 and I_2) in the table by referring to the intermolecular forces between the compounds and energy. (4)

10.3 Give the name of the type of intermolecular force that exist between water molecules. (1)

10.4 Write down the NAME of one more compound from the list given with the same intermolecular force as water. (1)

Soda water is made when CO_2 is mixed with water at high pressure.

10.5.1 Identify the intermolecular force between CO_2 and H_2O molecules (2)

10.5.2 Explain why carbon dioxide is not soluble in water at atmospheric pressure by referring to the polarity, type of intermolecular forces and strength of intermolecular forces in each substance. (4)

[14]

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	$9{,}8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6{,}63 \times 10^{-34}\ J{\cdot}s$
Coulomb's constant *Coulomb se konstante*	k	$9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Charge on electron *Lading op elektron*	e	$1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Mass of the Earth *Massa van die Aarde*	M	$5{,}98 \times 10^{24}\ kg$
Radius of the Earth *Radius van die Aarde*	R_E	$6{,}38 \times 10^{6}\ m$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

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

ELECTROSTATIC/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{F}{Q}$
$V = \frac{W}{Q}$	$E = \frac{kQ}{r^2}$
$n = \frac{Q}{q_e}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	emf (ε) = I(R + r) emk (ε) = I(R + r)
$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

ELECTROMAGNETISM / *ELEKTROMAGNETISME*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA\cos\theta$

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 **1** H 1																	**2** He 4
1,0 **3** Li 7	1,5 **4** Be 9											2.0 **5** B 11	2.5 **6** C 12	3.0 **7** N 14	3.5 **8** O 16	4,0 **9** F 19	**10** Ne 20
0,9 **11** Na 23	1,2 **12** Mg 24											1.5 **13** Aℓ 27	1.8 **14** Si 28	2.1 **15** P 31	2.5 **16** S 32	3.0 **17** Cℓ 35,5	**18** Ar 40
0,8 **19** K 39	1,0 **20** Ca 40	1,3 **21** Sc 45	1.5 **22** Ti 48	1,6 **23** V 51	1,6 **24** Cr 52	1.5 **25** Mn 55	1.8 **26** Fe 56	1.8 **27** Co 59	1.8 **28** Ni 59	1.9 **29** Cu 63,5	1.6 **30** Zn 65	1.6 **31** Ga 70	1.8 **32** Ge 73	2.0 **33** As 75	2.4 **34** Se 79	2,8 **35** Br 80	**36** Kr 84
0,8 **37** Rb 86	1,0 **38** Sr 88	1,2 **39** Y 89	1.4 **40** Zr 91	**41** Nb 92	1,8 **42** Mo 96	1.9 **43** Tc	2.2 **44** Ru 101	2.2 **45** Rh 103	2.2 **46** Pd 106	1.9 **47** Ag 108	1.7 **48** Cd 112	1.7 **49** In 115	1.8 **50** Sn 119	1.9 **51** Sb 122	2.1 **52** Te 128	2.5 **53** I 127	**54** Xe 131
0,7 **55** Cs 133	0,9 **56** Ba 137	**57** La 139	1.6 **72** Hf 179	**73** Ta 181	**74** W 184	**75** Re 186	**76** Os 190	**77** Ir 192	**78** Pt 195	**79** Au 197	**80** Hg 201	1.8 **81** Tℓ 204	1.8 **82** Pb 207	1.9 **83** Bi 209	2.0 **84** Po	2,5 **85** At	**86** Rn
0,7 **87** Fr	0,9 **88** Ra 226	**89** Ac															

58 Ce 140	**59** Pr 141	**60** Nd 144	**61** Pm	**62** Sm 150	**63** Eu 152	**64** Gd 157	**65** Tb 159	**66** Dy 163	**67** Ho 165	**68** Er 167	**69** Tm 169	**70** Yb 173	**71** Lu 175
90 Th 232	**91** Pa	**92** U 238	**93** Np	**94** Pu	**95** Am	**96** Cm	**97** Bk	**98** Cf	**99** Es	**100** Fm	**101** Md	**102** No	**103** Lr

KEY/*SLEUTEL*

Atomic number *Atoomgetal*

Electronegativity *Elektronegatiwiteit*

29
1,9 Cu
63,5

Symbol *Simbool*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

education

Department of Education
FREE STATE PROVINCE

JUNE EXAMINATION/*JUNIE EKSAMEN*

GRADE/*GRAAD* 11

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

JUNE/*JUNIE* 2025

MARKS/*PUNTE*: 150

TIME: 3 HOURS
TYD: 3 URE

This marking guideline consists of 13 pages.

Hierdie nasienriglyn bestaan uit 13 bladsye.

QUESTION 1/*VRAAG 1*

1.1 D ✓✓

1.2 D ✓✓

1.3 B ✓✓

1.4 B ✓✓

1.5 D ✓✓

1.6 C ✓✓

1.7 D ✓✓

1.8 B ✓✓

1.9 B ✓✓

1.10 D ✓✓

[10 × 2] = 20

QUESTION 2/*VRAAG 2*

2.1 The vector sum of two or more vectors✓✓ OR The single vector having the same effect as two or more vectors / *Die vektorsom van twee of meer vektore OF Die enkele vektor wat dieselfde effek het as twee of meer vektore.* (2)

2.2 The brick is moving at constant velocity/ acceleration of zero / $F_{net} = 0$✓✓ / *Die baksteen beweeg teen konstante snelheid/versnelling van nul/* $F_{net} = 0$ (2)

2.3

Option/*Opsie* 1	**Option/*Opsie* 2**
$F_{Y1} = F_1 \sin 70°$ $= 730 \sin 70°$✓ $= 685.98$N✓	$F_{Y1} = F_1 \sin 20°$ $= 730 \cos 20°$✓ $= 685.98$N✓

(2)

2.4 **Positive marking from question 2.3 (underlined) and option 1 or 2/**
Positief nasien vanaf vraag 2.3 (onderstreep) en opsie 1 of 2

Option/*Opsie* 1	**Option/*Opsie* 2**
$F_{y2} = F_2 \cos 10°$ $= 1440 \cos 10°$ ✓ $= 1418{,}12$ N	$F_{y2} = F_2 \sin 80°$ $= 1440 \sin 80°$ ✓ $= 1418{,}12$ N

$w = F_{Y1} + F_{y2}$

$= \underline{685.98 \text{ N}} + 1418{,}12 \text{ N}$ ✓ adding/ *bymekaartel* ✓

$= 2104$ N ✓

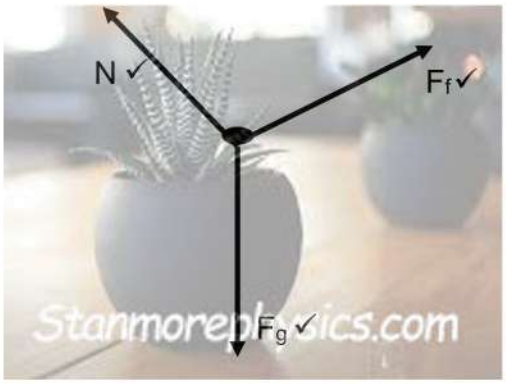
(4)

2.5 If the distance R between the two pulleys increase the vertical components of the applied force will decrease✓, and the system will not be able to pick up the brick as the weight will be more than the upwards vertical components of the forces✓OR there will be a net force downwards./ *As die afstand R tussen die twee katrolle toeneem, sal die vertikale komponente van die toegepaste kragte afneem en die stelsel sal nie die baksteen kan optel nie, aangesien die gewig meer as die opwaartse vertikale komponente van die kragte sal wees OF daar sal 'n netto krag afwaarts wees.*

(2)
[12]

QUESTION 3 / *VRAAG 3*

3.1



Force/*Krag*	Accepted labels/*Aanvaarde byskrifte*
F_f	$F_{friction}$/ f/ kinetic friction/ $F_{wrywing}$/*kinetiese wrywing*
F_g	F_w/ w/ weight/ mg/ gravitational force/*gewig/ gravitasiekrag*
N	F_N/ F_{normal}/ Normal force/ $F_{normaal}$/ *Normaalkrag*

NOTES:/*NOTAS*
• One mark for each arrow and correct label. / *Een punt vir elke pyl en korrekte byskrif.* • Penalise ONCE for each of the following:/ *Penaliseer EENMALIG vir elk van die volgende:* No arrows/ *Geen pyle* No dot / *Geen kol* Space between dot and arrow/ *Spasie tussen kol en pyl* Dotted lines drawn / *Stippelyne geteken* Force diagram is drawn / *Kragtediagram geteken.*

(3)

3.2

MARKING CRITERIA / *NASIENRIGLYN*
Any one of the two formulas ✓/ *Enige een van die twee formules* Co-efficient substitution ✓ / *Koëffisiëntvervanging* Component of weight ✓ / *Gewigskomponent* Answer with unit and direction ✓/ *Antwoord met eenheid en rigting*

Option/*Opsie* 1	**Option/*Opsie* 2**
$f_k = \mu_k N$ ✓ $= \mu_k mg\cos\theta$ $= (0,15)$✓$(30)(9,8\cos 30°)$✓ $= 38,19$ N ✓	$f_k = \mu_k N$ ✓ $= \mu_k mg\sin\theta$ $= (0,15)$✓$(30)(9,8\sin 60°)$✓ $= 38,19$ N ✓
Option 3/*Opsie 3*	**Option 4/*Opsie 4***
$w = mg\cos\theta$ $= (30)(9,8\cos 30°$✓$)$ ✓ $= 254,61$ N $f_k = \mu_k N$ $= 0,15(254,61)$ $= 38,19$ N ✓	$w = mg\sin\theta$ $= (30)(9,8\sin 60°$✓$)$ ✓ $= 254,61$ N $f_k = \mu_k N$ $= 0,15$✓ $(254,61)$ $= 38,19$ N ✓

(4)

3.3 INCREASE/*VERHOOG*✓ (1)

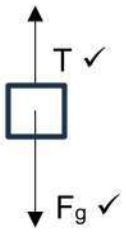
3.4 Remain the same. ✓ The coefficient is only affected by the type of surfaces moving with respect to each other. ✓/ *Bly dieselfde. Die koëffisiënt word slegs beïnvloed deur die tipe oppervlaktes wat ten opsigte van mekaar beweeg.* (2)

[10]

QUESTION 4 / *VRAAG 4*

4.1.1 When a resultant/ net force acts on the 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 resulterende/netto krag op die voorwerp inwerk, sal die voorwerp versnel in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.* (2)

4.1.2



Acceptable lables/*Aanvaarde benoemings*	
F_g	F_w/ w/ weight/ mg/ gravitational force/ *gewig/gravitasiekrag*
T	FT/Tension/*Spanning*

Marking criteria:/*Nasienriglyn*
-1 Mark/*Punt* if a free body diagram was drawn/*indien 'n vrye ligaamdiagram geteken was*

-1 Mark/*Punt* if F_g not drawn from centre/ *as F_g nie van die middel geteken was nie*

(2)

4.1.3

Marking criteria:/*Nasienriglyn*
Formula ✓/*Formule*
Substitution of both masses ✓/ *Substitusie van beide massas*
Substitution of F_g and T : 1 mark for each block ✓✓ / *Substitusie van F_g en T : 1 punt vir elke blok*
Two equations equal to each other✓/ *Twee vergelykings gelyk aanmekaar stel*
Answer for acceleration with correct SI unit.✓/ *Antwoord vir versnelling met korrekte SI eenheid*

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
For 500 g block/*Vir 500 g blok*	*For 500 g block Vir 500 g blok*
$F_{net} = ma$ $F_g + (-T) = ma$ } Any one✓ *Enigeen*	$F_{net} = ma$ $F_g + (-T) = ma$ } Any one✓ *Enigeen*
$(0,5 \times 9,8) + (-T)$ ✓$= 0,5a$ $T = -0,5a + 4,9$…..(1)	$(0,5 \times 9,8) + (-T)$ ✓$= 0,5a$ $T = -0,5a + 4,9$…..(1)
For 350 g block/ Vir 350 g blok ✓	*For 350 g block/ Vir 350 g blok* ✓
$F_{net} = ma$ $T + (-F_g) = ma$ $T + (-0,35 \times 9,8)$ ✓$= 0,35a$ $T = 0,35a + 3,43$ …..(2)	$F_{net} = ma$ $T + (-F_g) = ma$ $T + (-0,35 \times 9,8)$ ✓$= 0,35a$ $T = 0,35a + 3,43$ …..(2)
(1) = (2) $-0,5a + 4,9 = 0,35a + 3,43$✓ $a = 1,73\ m{\cdot}s^{-2}$ ✓	(1) = (2) $9,8 - 2T = \frac{T}{0,35} - 9,8$✓ $T = 4,035\ N$ $a = 1,73\ m{\cdot}s^{-2}$ ✓

(6)

4.2.1 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 is aan die kwadraat van die afstand tussen hul middelpunte.* (2)

4.2.2

Marking criteria:/*Nasieriglyn*
Formula ✓ / *Formule* Substitution of numerator ✓ / *Substitusie van noemer* Substitution of distance ✓ / *Substitusie van afstand* Final answer with SI unit ✓ / *Finale antwoord met SI eenheid*
$F = \frac{Gm_1m_2}{r^2}$ ✓ $F = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(3500)}{(15\,000+6,38 \times 10^{6})^2}$ ✓✓ $F = 34136,1$ N ✓

(4)

4.2.3 Positive marking from 4.2.2/ *Positief nasien vanaf 4.2.2*

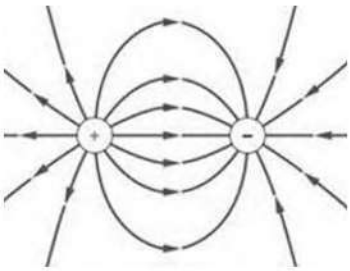
Marking criteria:/*Nasienriglyn*
Substitution of $F_{earth\ \&\ sat\ A}$ ✓/ *Sustitusie van* $F_{aarde\ en\ sateliet\ A}$ Adding forces ✓ / *Tel kragte bymekaar* Final answer with SI unit ✓ / *Finale antwoord met SI eenheid*
$F_{net} = F_{earth\ on\ B} + F_{earth\ on\ A}$ ✓ $F_{net} = 2{,}74 \times 10^3$ N - 34136,1 N ✓ $F_{net} =$ 31396,1 N ✓

(3)
[19]

QUESTION 5 / *VRAAG 5*

5.1.1

Marking criteria/ Nasienriglyn	
Charges indicated correctly / *Ladings korrek aangedui*	✓
Correct shape / *Korrekte vorm*	✓
Correct direction of arrows / *Korrekte rigting van pyle*	✓



(3)

5.1.2 The magnitude the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. ✓✓ / *Die grootte van die elektrostatiese krag wat een puntlading op 'n ander puntlading uitoefen, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle* ✓✓ (2)

5.1.3 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$$= \frac{(9 \times 10^9)(1{,}6 \times 10^{-19})(1{,}6 \times 10^{-19})}{(5 \times 10^{-11})^2} \checkmark$$

$$= 9{,}22 \times 10^{-8}\ N \checkmark$$

(4)

5.2.1

$$E = \frac{kQ_A}{r^2} \checkmark$$
$$= \frac{(9\times10^9)(4\times10^{-6})}{(0,2)^2} \checkmark$$
$$= 9 \times 10^5\ N \cdot C^{-1} \checkmark$$

(3)

5.2.2

OPTION 1/*OPSIE 1*

$$E_{net} = E_A + E_B$$
$$E_{net} = \frac{kQ_A}{r_A^2} + \frac{kQ_B}{r_B^2}$$

Anyone✓/*Enigeen*

$$0\checkmark = \frac{(9\times10^9)(4\times10^{-6})}{(r)^2} \checkmark \quad -\checkmark \quad \frac{(9\times10^9)(2\times10^{-6})}{(0,5-r)^2} \checkmark$$

$$\therefore \frac{(9\times10^9)(2\times10^{-6})}{(0,5-r)^2} = \frac{(9\times10^9)(4\times10^{-6})}{(r)^2}$$
$$\therefore 18000r^2 = 36000(0,5-r)^2$$
$$\therefore 18r^2 = 36(0,25 - r + r^2)$$
$$0 = 2r^2 - 4r + 1$$

r = 0,29 m or/*of* r = 1,71 m
∴ r = 0,29 m ✓

OPTION 2/*OPSIE 2*

$$F_{net} = F_A + F_B$$
$$F_{net} = \frac{kQ_AQ_C}{r_A^2} + \frac{kQ_BQ_C}{r_B^2}$$

Anyone✓/*Enigeen*

$$0\checkmark = \frac{(9\times10^9)(4\times10^{-6})Q}{(r)^2} \checkmark \quad -\checkmark \quad \frac{(9\times10^9)(2\times10^{-6})Q}{(0,5-r)^2} \checkmark$$

$$\therefore \frac{(9\times10^9)(2\times10^{-6})Q}{(0,5-r)^2} = \frac{(9\times10^9)(4\times10^{-6})Q}{(r)^2}$$

$$\therefore 18000r^2 = 36000(0,5-r)^2$$
$$\therefore 18r^2 = 36(0,25 - r + r^2)$$
$$0 = 2r^2 - 4r + 1$$

r = 0,29 m or/*of* r = 1,71 m
∴ r = 0,29 m ✓

Marking criteria / *Nasienriglyn*	
Correct formula / *korrekte formule*	✓
$E_{net} = 0$	✓
Substitution of values in E-formulas / *Substitusie van waardes in E-formules*	✓✓
Opposite directions /- sign / *Teenoorgestelde rigtings / - teken*	✓
Final answer / *Finale antwoord*	✓

(6)
[18]

QUESTION 6 / *VRAAG 6*

6.1.1 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 geinduseerde emk oor die ente van 'n geleier, is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier.* (2)

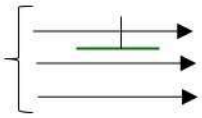
6.1.2 2 / doubled ✓✓/ *Verdubbel* (2)

6.2.1 Rotate the plate in the opposite/anticlockwise direction✓ Change around the poles of the magnet / the direction of magnetic field✓/ *Roteer die plaat in die teenoorgestelde / antikloksgewyse rigting. Ruil die pole van die magneet om / verander die rigting van die magneetveld* (2)

6.2.2 $\Phi = BA\cos\theta$ ✓

$= (0,5)(0,04 \times 0,06)$✓ $\cos 90°$ ✓

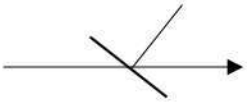
$= 0$ Wb (3)



6.2.3(a) $\Delta\Phi = \Phi_f - \Phi_i$ ✓

$= (0,5)(0,04 \times 0,06) \cos 60°$✓ $- 0$✓

$= 6 \times 10^{-4}$ Wb ✓ (4)



6.2.3(b) **POSITIVE MARKING FROM QUESTION 6.2.3(a) / *MERK POSITIEF VANAF VRAAG 6.2.3(a)***

$$\varepsilon = -\frac{N\Delta\emptyset}{\Delta t} \quad \checkmark$$

$$= -\frac{(1)(6 \times 10^{-4})}{2 \times 10^{-3}} \checkmark$$

$$= 0,3\,V \quad \checkmark$$

(3)
[16]

QUESTION 7 / *VRAAG 7*

7.1.1 The potential difference across a 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 die geleier by konstante temperatuur.* (2)

7.1.2 X✓ The potential difference is directly proportional to the current/The graph is a straight line.✓/ *Die potensiaalverskil is direk eweredig aan die stroom / Die grafiek is 'n reguitlyn.* (2)

7.1.3 Low current OR Low temperature✓/ *Lae stroom OF Lae temperatuur* (1)

7.2.1 $\text{Gradient} = \frac{\Delta V}{\Delta I}$ ✓
$= \frac{1-0}{0,6-1}$ ✓
$= -2,5$ ✓ $r_i = 2,5\ \Omega$ (4)

7.2.2 Internal resistance / r_i / *Interne weerstand* ✓ (1)

7.2.3 **POSITIVE MARKING FROM QUESTION 7.2.1 / *POSITIEF NASIEN VANAF VRAAG 7.2.1***

$\text{Gradient} = \frac{\Delta V}{\Delta I}$
-2,5✓ $= \frac{1-X}{0,6-0}$ ✓
$X = 2,5\ V$✓ (3)

7.2.3 **POSITIVE MARKING FROM QUESTION 7.2.1 and 7.2.3 / *POSITIEF NASIEN VANAF VRAAG 7.2.1 en 7.2.3***

$\varepsilon = I(R + r)$✓
$2,5 = 0,6(R + 2,5)$ ✓
$R = 1,67\ \Omega$✓ (3)
[15]

QUESTION 8 / *VRAAG 8*

8.1 $R_t = \frac{\varepsilon}{I_t}$ ✓ $= \frac{12}{1,2}$ ✓ $= 10\ \Omega$✓ (3)

8.2 **POSITIVE MARKING FROM QUESTION 8.1 / *POSITIEF NASIEN VANAF VRAAG 8.1***

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
$r_i = R_t - R_{external/ekstern}$ ✓ $= 10 - (2+5,6)$ ✓ $= 2,4\ \Omega$✓	$\varepsilon = I(R + r)$✓ $12 = 1,2(7,6$✓$ + r)$ $r_i = 2,4\ \Omega$✓

(3)

8.3 $W = I^2Rt$✓
$= 1,2^2x2x180$✓
$= 518,4J$✓ (3)

8.4 R_t smaller✓, I_t increases✓ thus from $P = I^2R$✓ the power will be more✓. (4)
[13]

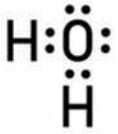
QUESTION 9 / *VRAAG 9*

9.1 The sharing of electrons between two atoms to form a molecule ✓✓/
Die deel van elektrone tussen twee atome om 'n molekule te vorm. (2)

9.2.1 **Marking Criteria/ *Nasienkriteria***

- Angular structure OR 8 valence electrons in total✓ */Hoekige struktuur OF 8 valenselektrone in totaal*

- 2 lone pairs around oxygen✓ / *2 alleenpare rondom suurstof*



(2)

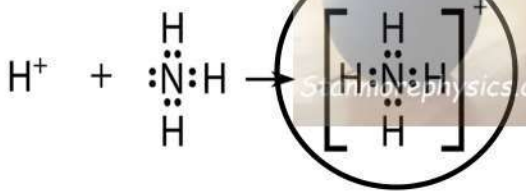
9.2.2 The bonds have an electronegativity difference OR the covalent bonds are polar ✓ Molecular geometry is asymmetrical/bent/ angular OR the central atom has a lone pair valence electrons ✓ / *Die bindings het 'n elektronegatiwiteitsverskil OF die kovalente bindings is polêr. Molekulêre vorm is asimmetries/gebuig/hoekig OF die sentrale atoom het 'n alleenpaar valenselektrone.* (2)

9.3 3 ✓✓ (2)

9.4.1 Dative covalent bond✓✓ / *Datief kovalente binding* (2)

9.4.2 Marking criteria / *Nasienkriteria*

- Indicating the ionic charge. ✓ /*Dui die ioniese lading aan*
- The H- ion bonding to lone pair.✓/ *Die H -ioon op alleenpaar*
- 8 electrons around the N atom.✓ / *8 elektrone om N atoom*



(3)
[13]

QUESTION 10 / *VRAAG 10*

10.1 Temperature at which the vapour pressure of a liquid equals atmospheric pressure.✓✓ / *Die temperaruur waar die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk.* (2)

10.2 Both the iodine and bromine have only London forces between their respective molecules.✓
Iodine is a larger molecule compared to bromine/Molecular mass of Iodine is greater than the molecular mass of bromine.✓
As a result, Iodine will have stronger London forces between the molecules.✓
Thus, more energy will be required to overcome the intermolecular forces between the Iodine molecules.✓
OR
Both the iodine and bromine have only London forces between their respective molecules.✓
Bromine is a smaller molecule compared to Iodine /Molecular mass of bromine is less than the molecular mass of iodine.✓
As a result, bromine will have weaker London forces between the molecules.✓
Thus, less energy will be required to overcome the intermolecular forces between the bromine molecules.✓ /

Beide die jodium en broom het slegs Londenkragte tussen hul onderskeie molekules.
Jodium is 'n groter molekule in vergelyking met broom / Molekulêre massa van jodium is groter as die molekulêre massa van broom.
Gevolglik sal jodium sterker Londenkragte tussen die molekules hê.
Dus sal meer energie benodig word om die intermolekulêre kragte tussen die jodiummolekules te oorkom.
OF
Beide die jodium en broom het slegs Londenkragte tussen hul onderskeie molekules.
Broom is 'n kleiner molekule in vergelyking met jodium / Molekulêre massa van broom is minder as die molekulêre massa van jodium.
Gevolglik sal broom swakker Londenkragte tussen die molekules hê.
Dus sal minder energie benodig word om die intermolekulêre kragte tussen die broommolekules te oorkom. (4)

10.3 Hydrogen bond ✓ / *Waterstogbinding* (1)

10.4 Hydrogen Fluoride ✓ / *Waterstoffluoried* (1)

10.5.1 Induced/Temporary dipole✓- dipole forces✓ /
Tydelike/Geïnduseerde dipool-dipool kragte (2)

10.5.2 Carbon dioxide molecules are <u>non-polar</u>✓ and have <u>London forces</u>✓ between the molecules.
Water molecules are <u>polar</u> ✓ and have hydrogen bonds between them.
The intermolecular forces are of <u>incomparable strength/polar and non-polar substances do not mix.</u> ✓ /
Koolstofdioksiedmolekules is <u>nie-polêr</u> en het <u>Londenkragte</u> tussen die molekules. Watermolekules is <u>polêr</u> en het waterstofbindings tussen hulle. Die intermolekulêre kragte is van <u>onvergelykbare sterkte/polêr en nie-polêre stowwe meng nie</u>. (4)
[14]

<u>GRAND TOTAL/*GROOTTOTAAL*: 150</u>