LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2025

MARKS: 100

TIME : 2 HOURS

This question paper consists of 14 pages including 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 11A) in the appropriate spaces on the ANSWER SHEET.
2. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER SHEETS.
3. Start EACH question on a NEW page in the ANSWER SHEET.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, etc. where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1 (MULTIPLE CHOICE QUESTIONS)

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question numbers (1.1 to 1.5) in the ANSWER BOOK, e.g. 1.11 E.

1.1. A bird-catcher observes a bird flying from A to B; B to C; and then from C to B. Which one of the following correctly describes the displacement of the bird?

A. A to B

B. B to A

C. C to A

D. A to C (2)

1.2. A roller coaster moves from rest at the bottom of a rail; and accelerates at a constant rate upwards. By the time it reaches the highest point of the rail, which one of the following will be correct?

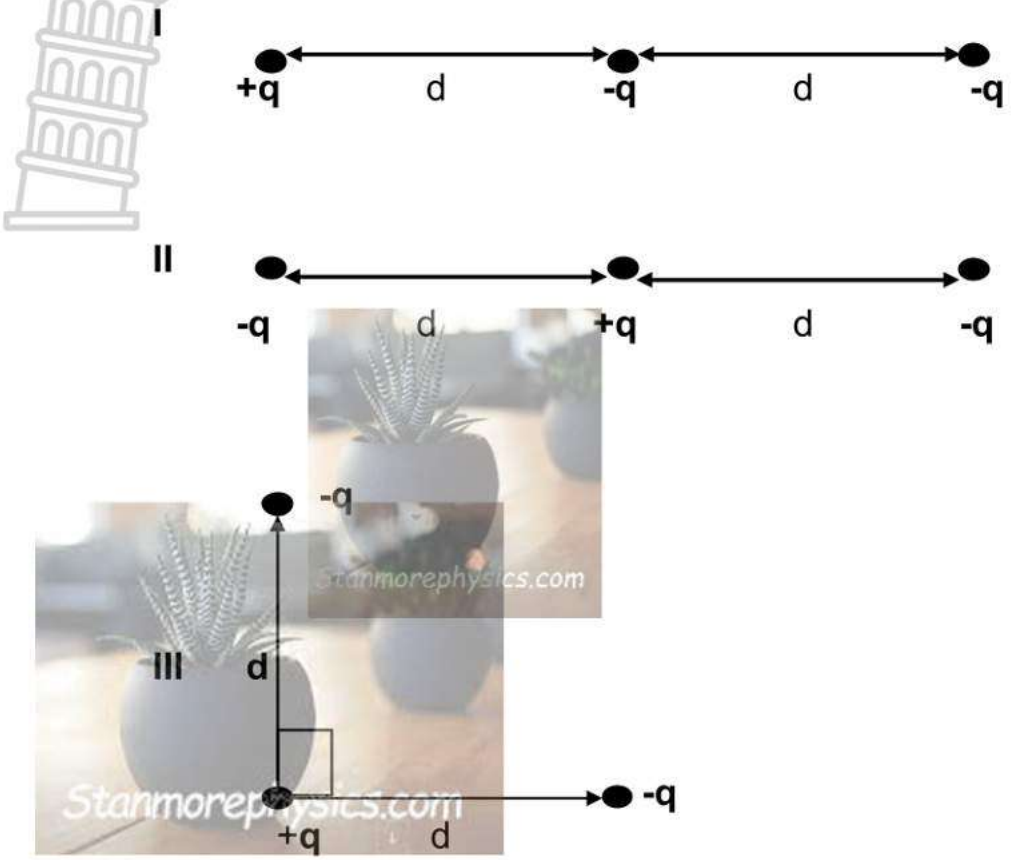
A. Both the mass and the net force shall have increased.

B. Both the velocity and the net force shall have increased.

C. The velocity and the net force shall have remained constant.

D. The velocity shall have increased while the net force shall have remained constant. (2)

1.3 Sketches **I, II** and **III**, not drawn to scale, are different ways in which these point charges are arranged. The charges are identical in MAGNITUDE and the distance d between the charges is the same.



In which of these arrangements will the magnitude of the NET electrostatic force experienced by the **+q** charge be the LARGEST and SMALLEST respectively?

	GREATEST NET FORCE on +q	**SMALLEST NET FORCE on +q**
A	**I**	**II**
B	**II**	**III**
C	**III**	**I**
D	**III**	**II**

(2)

1.4 The magnetic flux linkage through a coil depends on …

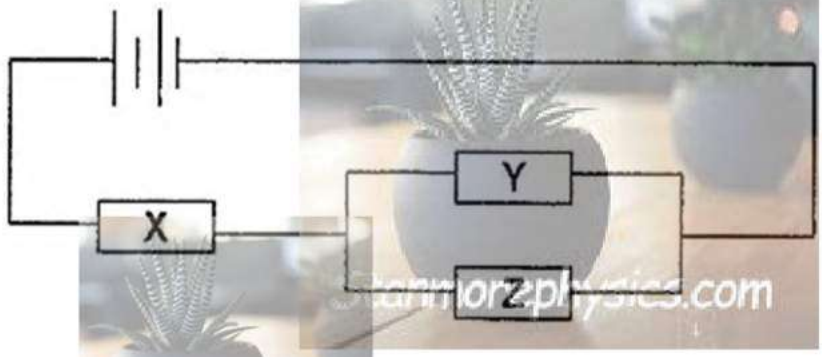
A. the thickness of the wire in the coil.

B. the angle between the coil and the magnetic field.

C. the direction of the magnetic field.

D. the material the coil is made of. (2)

1.5 Three identical resistors **X**, **Y** and **Z** are connected as shown in the circuit below.



If the power in **X** is **P**, then the power in **Y** is…

A. 2P

B. P

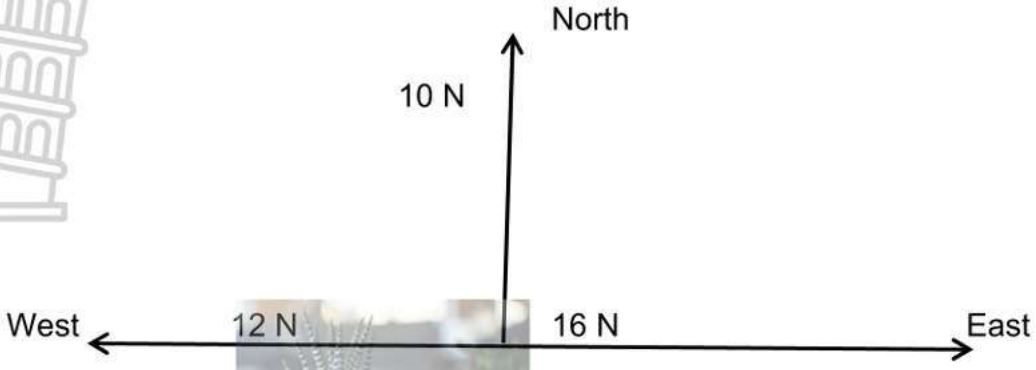
C. P/4

D. P/2 (2)

[10]

QUESTION 2 (Start on a new page)

The diagram below shows three forces of **10 N** north, **12 N** west and **16 N** east acting on an object on the same plane. The diagram is not drawn to scale.



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

2.2. Calculate:

2.2.1 The magnitude of the resultant force acting on the object. (4)

2.2.2 The direction of the resultant force. (2)

2.3. A fourth force is added in the system, such that the resultant force is zero.

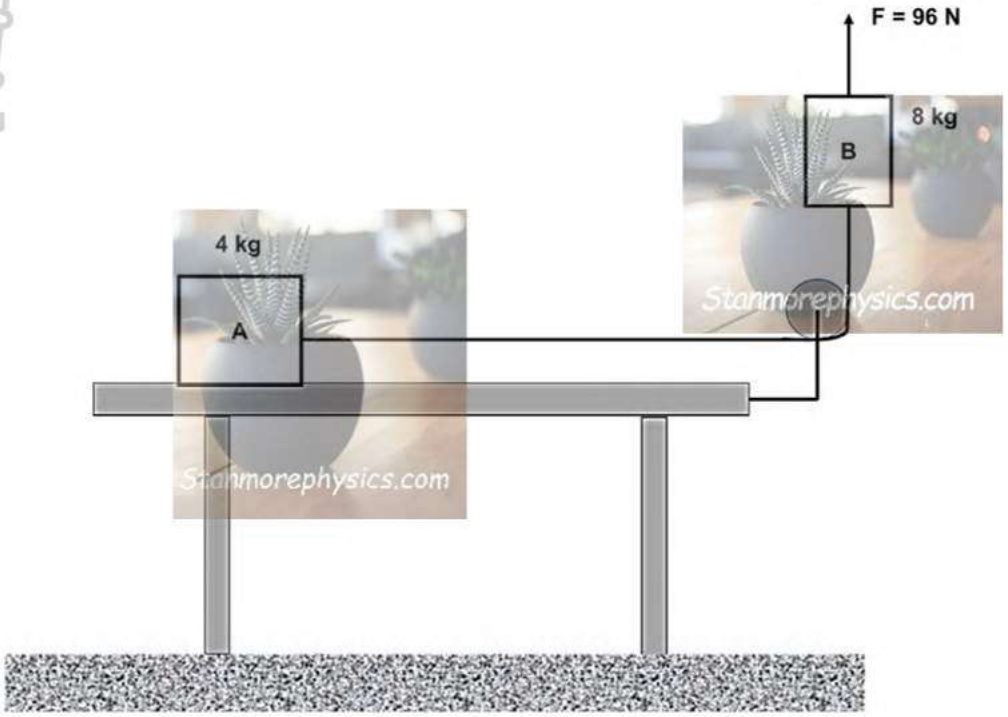
2.3.1. What is this fourth force called? (1)

2.3.2 Determine the magnitude and direction of the force. (2)

[11]

QUESTION 3 (Start on a new page)

Block **A** of mass 4 kg is moving with a constant velocity on a rough horizontal table and is connected to another block **B** of mass 8 kg by a light inextensible string which passes through a light frictionless pulley. A force of magnitude 96 N is applied vertically upwards on block **B**, as shown in the diagram below.



3.1. State *Newton's First Law of Motion* in words. (2)

3.2. Draw a free-body diagram for block **B**. (3)

3.3. Calculate the magnitude of the tension force acting on block **B**. (3)

The string connecting **A**, and **B** suddenly breaks while force **F** is still being applied.

3.4. Is the direction of the acceleration of block **A**, now towards the LEFT or the RIGHT? Explain your answer. (2)

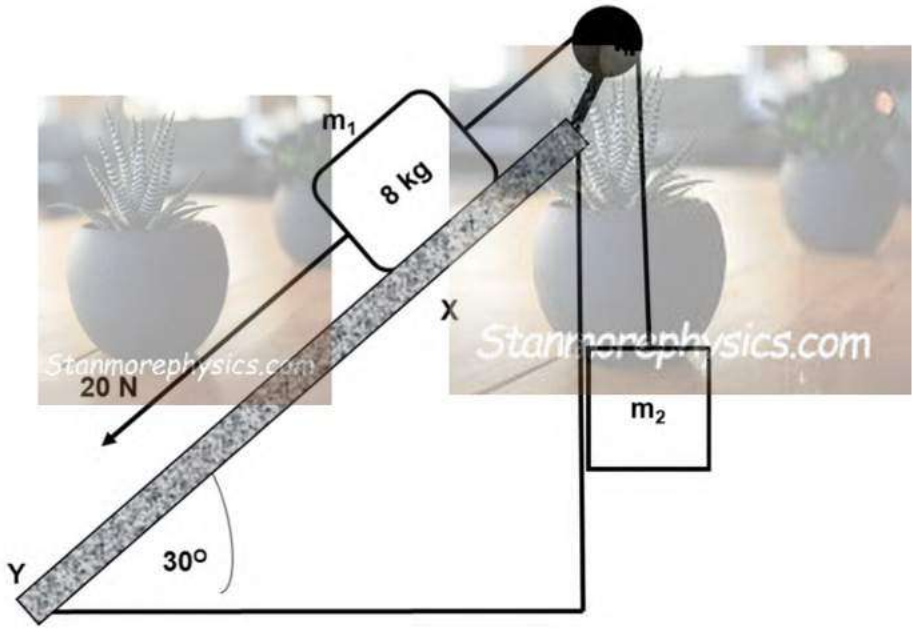
3.5. How will the net force acting on block **B** be affected.

Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

[11]

QUESTION 4 (Start on a new page)

A block m_1, with mass 8 kg, on an inclined plane with a rough surface, is attached by an inextensible string to an unknown hanging mass, m_2. A force of 20 N is applied to the m_1 down the plane from **X** to **Y** as shown in the figure below. Block m_1 is moving down the plane at a constant velocity. The coefficient of kinetic friction acting on the block between points **X** and **Y** is 0,2.



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

Consider the motion of block m_1 between **X** and **Y**.

4.1.2. Draw a free-body diagram for block m_1. (5)

4.1.3. Calculate the magnitude of the frictional force acting on m_1. (3)

4.1.4. Calculate the tension in the string. (3)

4.2 A man has a weight of 809,48 N on earth. He then travels to planet **X** whose diameter is 1,914 x10^7 m and the mass of 1,794 x10^{25} kg.

4.2.1. State *Newton's Law of Universal Gravitation* in words. (2)

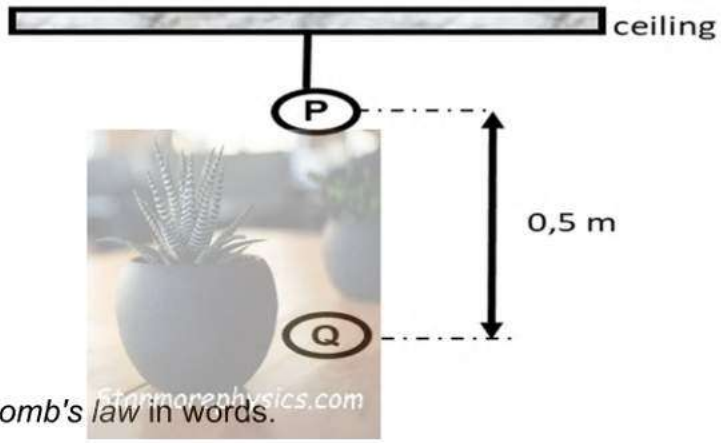
4.2.2. Calculate the man's weight on planet **X**. (4)

[19]

QUESTION 5 (Start on a new page)

A charged sphere **P** is suspended from a horizontal bar in a laboratory by a light inextensible, insulated string.

Another charged sphere **Q**, of mass 4,08 x 10^{-4} kg and carrying a charge of + 4,08 x 10^{-8} C, remains STATIONARY vertically below sphere **P**. The centres of the spheres are 0,5 m apart, as shown in the diagram below.



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

5.2. State whether the charge on sphere **P** is POSITIVE or NEGATIVE. (1)

5.3. Draw a labelled free-body diagram for sphere **Q**. (2)

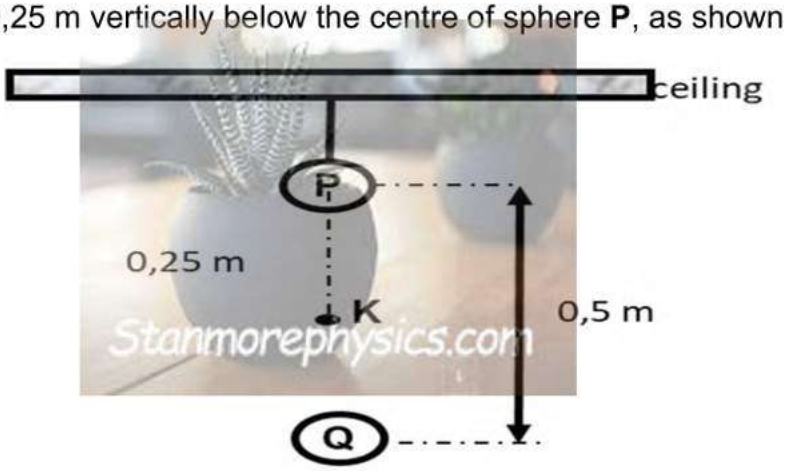
5.4. Calculate the magnitude of the charge on sphere **P**. (5).

5.5. How does the electrostatic force that sphere **P** exerts on sphere **Q** compare to that exerted by sphere **Q** on sphere **P** with respect to:

5.5.1. magnitude (1)

5.5.2. direction (1)

Point **K** lies 0,25 m vertically below the centre of sphere **P**, as shown below.

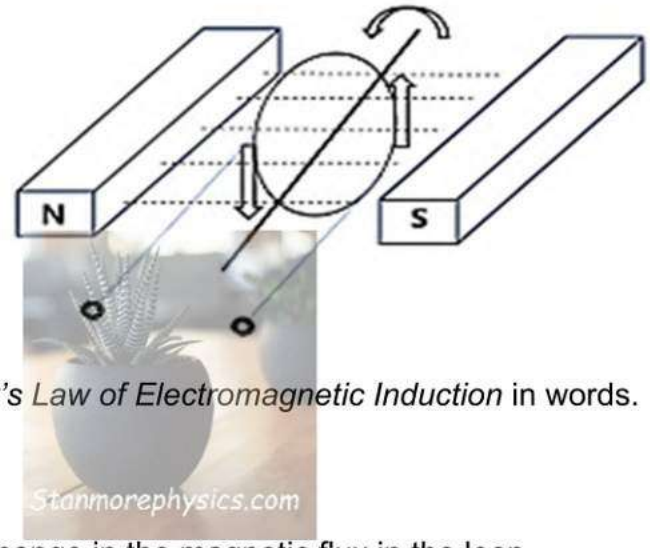


5.6. Calculate the net electric field at point **K**. (5)

[17]

QUESTION 6 (Start on a new page)

A coil with a diameter of 0,6 m contains 60 turns and lies so that the magnetic field strength is at its maximum of +0,15 T. The field then changes to its minimum in 1,6 s. ($A = \pi r^2$)



6.1 State *Faraday's Law of Electromagnetic Induction* in words. (2)

6.2 Calculate:

6.2.1 The change in the magnetic flux in the loop. (4)

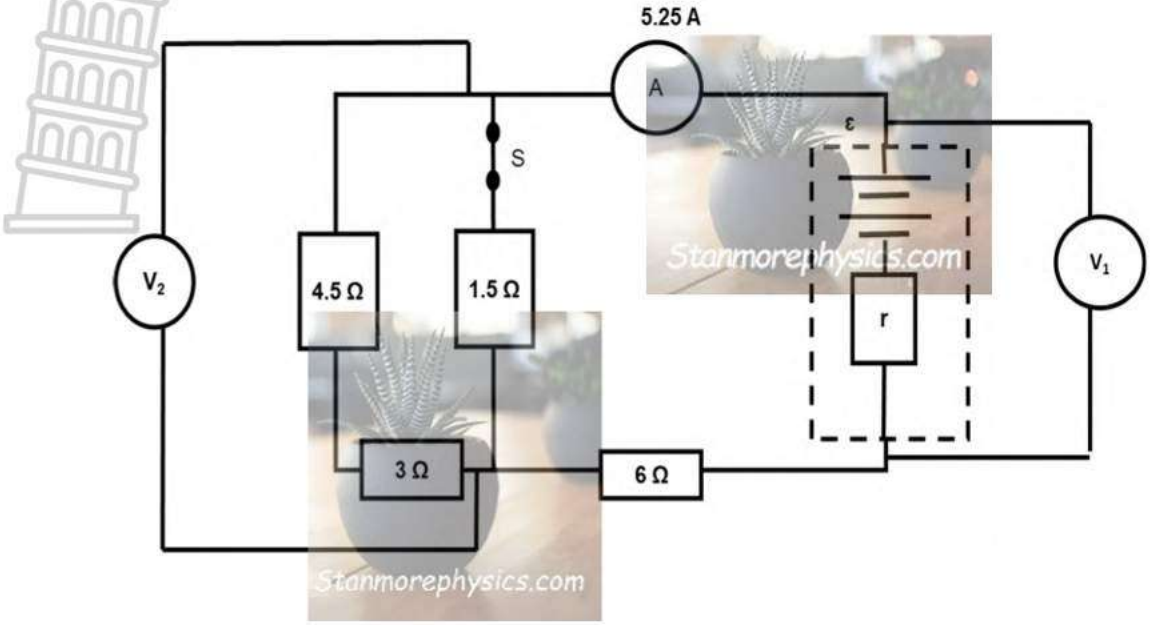
6.2.2 The average induced emf in the loop in 1,6 s. (3)

6.3 If the coil is now rotated in 1,8 s, how would it change the induced emf?
Write only INCREASE, DECREASE or REMAIN THE SAME.
Explain the answer. (3)

[12]

QUESTION 7 (Start on a new page)

The circuit diagram below shows four resistors connected to a battery of emf **ε** and internal resistance **r**. The resistances of the ammeter and the connecting wires are negligible, while the voltmeters have very high resistances.



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

Switch **S** is CLOSED.

7.2 The reading on the ammeter is 5,25 A.

7.2.1 Calculate the total external resistance of the circuit. (4)

7.2.2 Calculate the reading on voltmeter $\mathbf{V_1}$. (3)

7.2.3 How does the reading on voltmeter $\mathbf{V_2}$ compare to the reading on voltmeter $\mathbf{V_1}$? Choose from SMALLER THAN, EQUAL TO or GREATER THAN. (1)

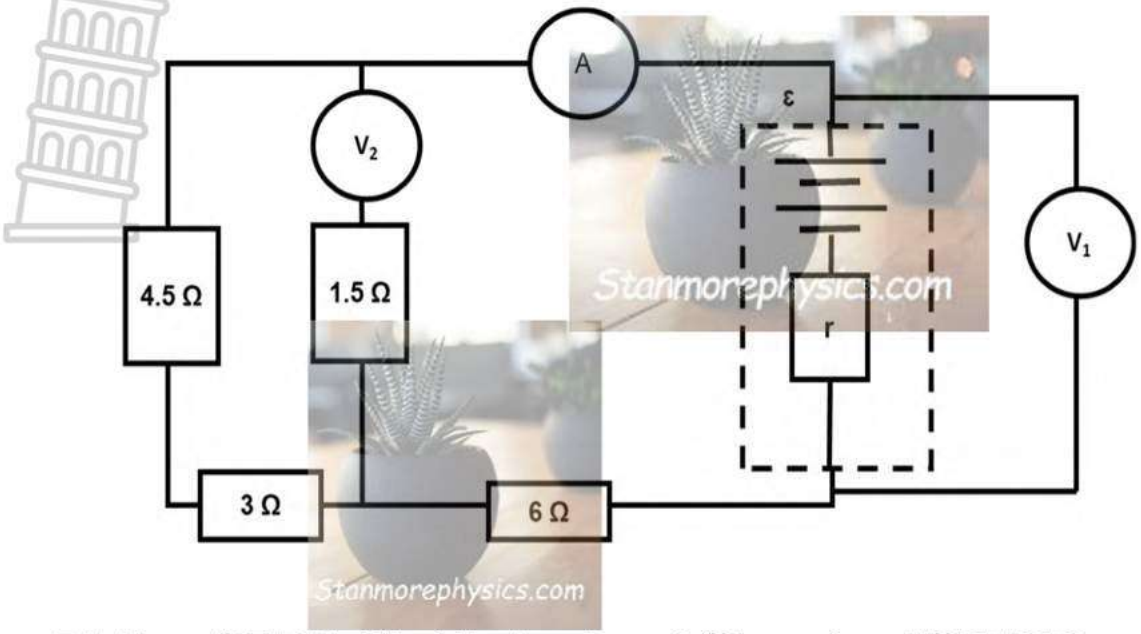
7.3 A learner concludes that the emf of the battery is equal to the reading on voltmeter $\mathbf{V_1}$.

7.3.1 Define the term *emf.* (2)

7.3.2 Is the learner's conclusion CORRECT? Choose from YES or NO .(1)

7.3.3 Give a reason for the answer to QUESTION 7.3.2. (1)

Switch **S** is now removed and replaced by voltmeter V_2, as shown in the circuit diagram below.



7.4. How will EACH of the following change? (Choose from INCREASES, DECREASES or REMAINS THE SAME.)

7.4.1 The power dissipated by the 6 Ω resistor. (1)

7.4.2 The reading on voltmeter V_1. (1)

7.4.3 Explain the answer to QUESTION 7.4.2. (4)

[20]

TOTAL: 100

Information sheets – Paper 1 (Physics)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth	R_E	6,38 x 10^6 m
Mass of Earth	M_E	5,98 x 10^{24} kg
Speed of light in a vacuum	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant	h	6,63 x 10^{-34} J·s
Coulomb's constant	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$w = mg$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F = G\frac{m_1 m_2}{d^2}$ or $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or $g = G\frac{M}{r^2}$

ELECTROMAGNETIC INDUCTION

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

WAVES, SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS

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

ELECTRIC CIRCUITS

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

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GRADE/*GRAAD* 11

PHYSICAL SCIENCES: PHYSICS (P1)/*FISIESE WETENSKAPPE: FISIKA (V1)*

MARKING GUIDELINES/*NASIENRIGLYNE*

JUNE 2025/*JUNIE 2025*

MARKS/*PUNTE*: 100

These marking guidelines consist of 11 pages/*Hierdie nasienriglyne bestaan uit 11 bladsye.*

QUESTION 1/*VRAAG* 1

1.1. A✓✓ (2)

1.2. D✓✓ (2)

1.3. D✓✓ (2)

1.4. B✓✓ (2)

1.5. C✓✓ (2)

[10]

QUESTION 2/*VRAAG* 2

2.1. The resultant force is a single force having the same effect as two or more forces together. ✓✓/ *Die resulterende krag is 'n enkele krag wat dieselfde effek het as twee of meer kragte saam.* (2)

2.2.1 $R_y = 10\ N$ ✓

$R_x = -12 + 16 = 4\ N$ ✓

$F_{net}^2 = R_x^2 + R_y^2$

$F_{net}^2 = (4)^2 + (10)^2$ ✓

$F_{net} = 10.77\ N$ ✓ (4)

2.2.2

OPTION/*OPSIE* 1	OPTION/*OPSIE* 2	OPTION/*OPSIE* 3
$\tan\theta = \frac{R_y}{R_x}$ $= \frac{10}{(4)}$ ✓ $\theta = 68{,}20°$ ✓	$\sin\theta = \frac{R_y}{F_{net}}$ $\sin\theta = \frac{10}{10{,}77}$ ✓ $\theta = 68{,}20°$ ✓	$\cos\theta = \frac{R_x}{F_{net}}$ $\cos\theta = \frac{4}{10{,}77}$ ✓ $= 68{,}20°$ ✓

(2)

2.3.1 Equilibrant✓/*Ekwilibrant* (1)

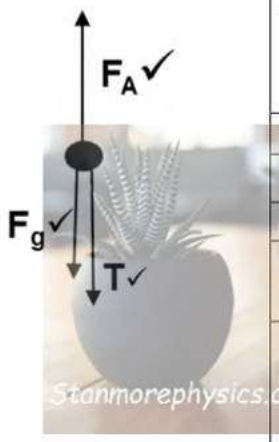
2.3.2 $R_x = 10{,}77\ N$, ✓ in the opposite direction✓ or 68,20° from negative *x* –axis/*in die teenoorgestelde rigting of 68,20° vanaf die negatiewe x-as.* (2)

[11]

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 bly tensy 'n nie-nul resulterende/netto krag daarop inwerk.* (2)

3.2.



Accepted labels/*aanvaarde byskrifte*	
w	F_g/F_w/weight/mg gravitational force/force of gravity/*gewig/mg gravitasie krag/krag van gravitasie*
T	F_T/Tension/F_{string}/*spanning/*F_{tou}
F_A	$F_{applied}$/$F_{toegepas}$
Notes/*notas*:	
Mark awarded for label and arrow/ *Punte toegeken vir byskrif en pyl*	
Do not penalise for length of arrows since drawing is not to scale./ *Moenie penaliseer vir die lengte van pyle nie, aangesien die tekening nie volgens skaal is nie*	
Any other additional force(s) - Max 2/3 / *Enige ander bykomende krag(te) - Maks 2/3*	
If force(s) do not make contact with body - Max 2/3. / *Indien krag(te) nie kontak met die liggaam maak nie - Maks 2/3.*	

(3)

3.3

$$\left.\begin{aligned} F_{net} &= ma \\ T + F_g + F_A &= ma \end{aligned}\right\}\checkmark$$

$$T + (8 \times (-9.8)) + 96 = 0 \checkmark$$

$$T = 17{,}6\ N \checkmark$$

(3)

3.4 Left✓ The block is slowing down✓/negative acceleration due to friction / *Links. Die blok beweeg stadiger/negatiewe versnelling as gevolg van wrywing* (2)

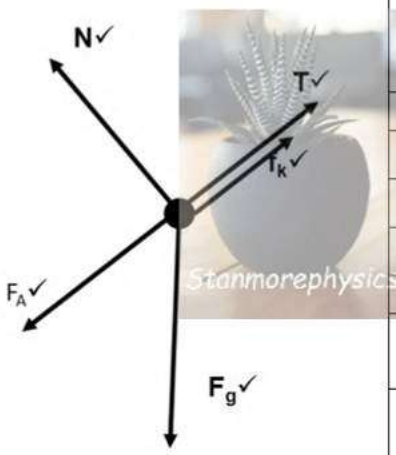
3.5 Increases✓/*neem toe* (1)

[11]

QUESTION 4/*VRAAG 4*

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

4.1.2.



Accepted labels/*aanvaarde byskrifte*	
w	F_g/F_w/weight/mg gravitational force/force of gravity/ *gewig/mg gravitasie krag/krag van gravitasie*
T	F_T/Tension/F_{string}/ *spanning*/F_{tou}
f_k	$F_{friction}$/F_f/Friction/$F_{wrywing}$/*Wrywing*
N	$F_{friction}$/Normal/F_N/*Normaal*
F_A	Force applied/*krag toegepas*
Notes/*notas*:	
Mark awarded for label and arrow / *Punte toegeken vir byskrif en pyl*	
Do not penalise for length of arrows since drawing is not to scale./ *Moenie penaliseer vir die lengte van pyle nie, aangesien die tekening nie volgens skaal is nie*	
Any other additional force(s) - Max 3/4 / *Enige ander bykomende krag(te) - Maks 2/3*	
If force(s) do not make contact with body – Max 3/4. /*Indien krag(te) nie kontak met liggaam maak nie - Maks 3/4.*	
NO MARK awarded for drawing Fg components./ *GEEN PUNTE toegeken vir die teken van Fg-komponente nie*	

(5)

4.1.3 $f_k = \mu N$ ✓
$f_k = (0{,}2)(9{,}8 \times 8)\cos 30°$ ✓
$f_k = 13{,}58\ N$ ✓ (3)

4.1.4 **POSITIVE MARKING FROM 4.1.3/ *POSITIEWE NASIEN VANAF 4.1.3***

8 kg Block/*8 kg blok*

$$\left.\begin{aligned} F_{net} &= ma \\ T + f_k + F_{g//} &= ma \end{aligned}\right\} \checkmark$$

$$F_A + F_{g//} - T - f_k = 0$$

$$20 + (9{,}8 \times 8)\sin 30° - T - 13{,}58 \checkmark = 0$$

$$59{,}2 - T - 13{,}58 = 0$$

$$T = 45{,}62 \text{ N } \checkmark$$

Note: Accept using energy principles for full marks. Note: if using the systems approach, max. 2 marks.
[1 mark for formula and 1 mark for final answer only]/
***Let wel**: Aanvaar die gebruik van energiebeginsels vir volpunte. Let wel: indien die sisteembenadering gebruik word, maksimum 2 punte.*
[1 punt vir formule en 1 punt vir finale antwoord alleenlik] (3)

4.2.1 Every body in the universe attracts every other body with a force which is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres ✓/ *Elke liggaam in die heelal trek elke ander liggaam aan met 'n krag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte.* (2)

4.2.2 $$m = \frac{F_g}{g} = \frac{809{,}48}{9{,}8} = 82{,}6 \text{ kg} \checkmark$$

$$F = \frac{Gm_1m_2}{r^2} \checkmark$$

$$F = \frac{(6{,}67\times10^{-11})(82{,}6)(1{,}794\times10^{25})\checkmark}{(\frac{1{,}914\times10^{7}}{2})^2\checkmark}$$

$F_g = 1079{,}21$ N /1,08 x 10^3 N✓ (4)

[19]

QUESTION 5/*VRAAG 5*

5.1 The magnitude of the electrostatic force exerted by one point charge on another 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 deur een puntlading op 'n ander uitgeoefen word, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle*. (2)

5.2 Negative ✓/*Negatief* (1)

5.3

F_E	$F_{electrostatic}$/ F/ FM ON N/ electrostatic force/ FM/ *FM op N/elektrostatiese krag*
W	Fg / w/ mg/ gravitational force / Fw/ weight/ gravity/*gravitasie krag/gewig*
	Notes/*notas* • Do not penalise for length of arrows./ *Moenie penaliseer vir die lengte van pyle nie* • Any other additional force(s)/ *Enige ander bykomende krag(te)* – Max/*maks 1/2* • If arrows are omitted but correctly labelled: Max 1/2 / *Indien pyle weggelaat maar korrek benoem is: Maks 1/2* • If force(s) do not make contact with the dot: Max ½ / *Indien krag(te) nie kontak met die punt maak nie: Maks. 1/2*

(2)

5.4

Marking criteria/*nasien kriteria*

- Correct substitution to calculate weight of M/ *Korrekte vervanging om gewig van M te bereken*
- Coulomb's formula/ *Coulomb se formule*
- Substitute Fnet = 0/ mg = r^2 (equating forces)/ 0,02 = r^2 (equating forces) / *Vervang Fnet = 0/ mg = r^2 (stel kragte gelyk)/ 0,02 = r^2 (stel kragte gelyk)*
- Correct substitution into r^2 / *Korrekte vervanging in r^2*
- Correct final answer (accept negative value: 2,33 x 10^{-6} C to 2,32 x 10^{-6} C/ *Korrekte finale antwoord (aanvaar negatiewe waarde*: 2,33 x 10^{-6} C tot 2,32 x 10^{-6} C)

$F_g = mg$
$= (4,08 \times 10^{-4})(9,8)$ ✓
$= 3,998 \times 10^{-3} N$ or $4,0 \times 10^{-3} N$

$F = \frac{kQ_PQ_Q}{r^2}$ ✓

$F_{net} = mg - \frac{kQ_PQ_Q}{r^2}$
$0 = 3,998\ x\ 10^{-3}$✓ $- \frac{(9\times10^9)(Q_P)(4,08\times10^{-8})}{(0,5)^2}$✓

$Q_P = 2,72 \times 10^{-6}$ C✓

OR/*OF*

$F = \frac{kQ_PQ_Q}{r^2}$ ✓

$3,998 \times 10^{-3}$✓ $= \frac{(9\times10^9)(Q_P)(4,08\times10^{-8})}{(0,5)^2}$✓

$Q_P = 2,72 \times 10^{-6}$ C✓

(5)

5.5.1 Equal✓/*gelyk* (1)

5.5.2 Opposite✓/upwards/*teenoorgesteld/opwaarts* (1)

5.6 **POSITIVE MARKING FROM QUESTION 5.4/ POSITIEWE NASIEN VANAF VRAAG 5.4**

$E_{net} = E_1 + E_2$ ✓
$= \frac{kQ_Q}{r^2} + \frac{kQ_P}{r^2}$
$= \frac{(9\times10^9)(4,08\times10^{-8})}{(0,25)^2}$ ✓ $+ \frac{(9\times10^9)(2,72\times10^{-8})}{(0,25)^2}$ ✓

$= 5,88 \times 10^3 + 3,92 \times 10^3$ ✓
$= 9,79 \times 10^3$ N.C^{-1} upwards/towards P/*in the direction of P*✓/*Opwaarts/na P/In die rigting van P* (5)

[17]

QUESTION 6/*VRAAG 6*

6.1 Faraday's law of electromagnetic induction: 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✓/*Faraday se wet van elektromagnetiese induksie: Die grootte van die geïnduseerde emk oor die punte van 'n geleier is direk eweredig aan die tempo van verandering in die magnetiese vloedverbinding met die geleier.* (2)

6.2.1 $\Phi i = \beta A cos\,\theta$✓

$= (0{,}15)\pi r^2 cos\,\theta$

$= (0{,}15)(\pi \times 0{,}3^2) cos\,0^\circ$ ✓

$= 4{,}24 \times 10^{-2}$ Wb

$\Delta\Phi = \Phi_f - \Phi_{ii}$ ✓

$= 0 - 4{,}24 \times 10^{-2}$

$= 4{,}24 \times 10^{-2} Weber/Wb$ ✓ (4)

6.2.2 **POSITIVE MARKING FROM QUESTION 6.2.1/*POSITIEWE NASIEN VANAF VRAAG 6.2.1***

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

$\varepsilon = \frac{(-60)(-4{,}24\times10^{-2})}{1{,}6}$ ✓

$= 1{,}59\,V$ ✓ (3)

6.3 Decrease ✓/*afneem*

The emf is inversely proportional to the time of rotation, ✓ thus if the time increases the emf will decrease. ✓ / *Die emk is omgekeerd eweredig aan die rotasietyd, dus as die tyd toeneem, sal die emk afneem* (3)

[12]

QUESTION 7/*VRAAG 7*

7.1 The potential difference across a conductor is directly proportional to the current✓ in the conductor at constant temperature (provided temperature and all other physical conditions are constant. ✓ / *Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier teen konstante temperatuur (mits die temperatuur en alle ander fisiese toestande konstant is).*

(2)

7.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**

$\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$✓
$\frac{1}{R_{//}} = \frac{1}{1,5} + \frac{1}{7,5}$ ✓
$R_{//} = 1,25\Omega$
$R_{tot\ ext} = 1,25 + 6$ ✓
$R_{tot\ ext} = 7,25\ \Omega$✓
	$R_P = \frac{R_1 R_2}{R_1 + R_2}$ ✓
	$= \frac{1,5 \times 7,5}{1,5+7,5}$ ✓
	$R_{//} = 1,25\Omega$
	$R_{tot\ ext} = 1,25 + 6$ ✓
	$R_{tot\ ext} = 7,25\ \Omega$✓

(4)

7.2.2 **POSITIVE MARKING FROM QUESTION 7.2.1/*POSITIEWE NASIEN VANAF VRAAG 7.2.1***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$R = \frac{V}{I}$ ✓ $7,25 = \frac{V}{5,25}$ ✓ $V = 38,06\ V$ ✓	$R_{//} = \frac{V_2}{I}$ ✓ $1,25 = \frac{V_2}{5,25}$ ✓ $V_2 = 6,56V$ $R_{6\Omega} = \frac{V_{6\Omega}}{I}$ $6 = \frac{V_{6\Omega}}{5,25}$ $V_{6\Omega} = 31,5\ V$ $V_1 = V_2 + V_6$ $= 6,56 + 31,5$ $= 38,06\ V$ ✓

(3)

7.2.3 Smaller than ✓/*Kleiner as* (1)

7.3.1

Marking criteria/*nasien kriteria*:
If any of the underlined key words/phrases in the correct context is omitted deduct 1 mark/ *Indien enige van die onderstreepte sleutelwoorde/frases in die korrekte konteks weggelaat word, trek 1 punt af.*

Maximum work done by the battery per unit charge. ✓✓/ *Maksimum werk verrig deur die battery per eenheidslading.*
OR/*OF*
Maximum energy supplied by the battery per unit charge. ✓✓/ *Maksimum energie wat deur die battery per eenheidslading gelewer word*
OR/*OF*
The total amount of electric energy supplied by the battery per coulomb/per charge. ✓✓/ *Die totale hoeveelheid elektriese energie wat deur die battery per coulomb/per lading verskaf word.* (2)

7.3.2 No ✓/*Nee* (1)

7.3.3 The battery has internal resistance. ✓/ *Die battery het interne weerstand*
OR/*OF*
Some energy per coulomb of charge/volts is used to overcome internal resistance. ✓/ *'n Sekere hoeveelheid energie per coulomb lading/volt word gebruik om interne weerstand te oorkom.*
OR/*OF*
There is a potential drop/lost volts inside the battery. ✓/ *Daar is 'n potensiële verlies (daling/afname) van volts binne die battery.*
OR
$\varepsilon = V_{ext} + V_{int}$
OR/*OF*
$\varepsilon > V_{ext}$ ✓ (1)

7.4.1 Decreases ✓ /*neem af* (1)

7.4.2 Increases ✓/neem toe (1)

7.4.3 When the voltmeter is connected/ *Wanneer die voltmeter gekoppel is*:

- No/very little current through the 1,5 Ω branch ✓/ *Geen/baie min stroom deur die 1,5 Ω-tak*

  OR/*OF*

  Branch with 1,5 Ω resistor is disabled/bypassed/ *Tak met 1,5 Ω weerstand is gedeaktiveer/omseil*

  OR/*OF*

  A voltmeter has a very high resistance/ *'n Voltmeter het 'n baie hoë weerstand*

  OR/*OF*

  The resistance of the parallel branch increases. /*Die weerstand van die parallelle tak neem toe*

- (Total) resistance of the circuit increases. ✓/*(Totale) weerstand van die stroombaan neem toe*

- Current in circuit decreases. ✓/ *Stroom in stroombaan neem af*

- $V_{internal}$/ Internal volts/ V_{lost} decreases. Therefore, external volts increase for a constant emf.✓/ *Vintern/ Interne spanning/ $V_{verlore}$ neem af. Daarom neem eksterne spanning toe vir 'n konstante emk.* (4)

[20]

TOTAL/*TOTAAL*: 100