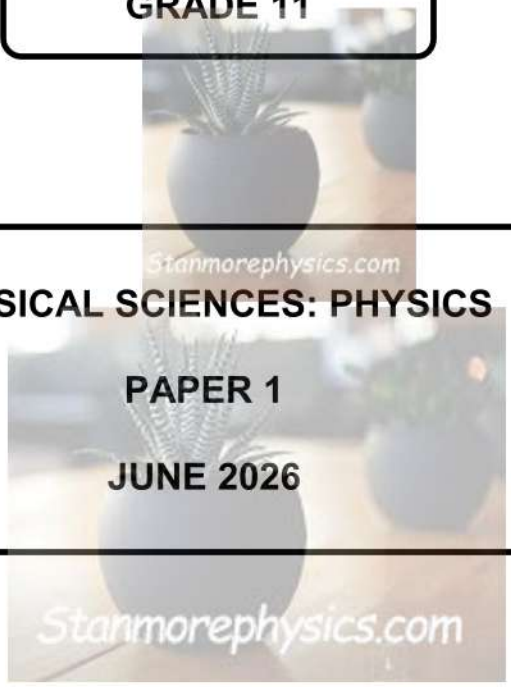
Northern Cape Department of Education

CURRICULUM PROVINCIAL QUESTION PAPER

GRADE 11



PHYSICAL SCIENCES: PHYSICS

PAPER 1

JUNE 2026

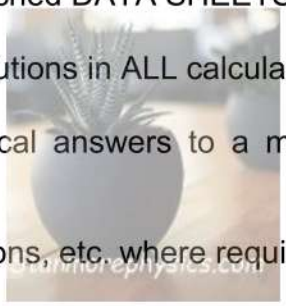
MARKS: 100

TIME: 2 hours

This question paper consists of 11 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and surname in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of SEVEN questions. Answer ALL the 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 subquestions, 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. 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.
11. Give brief motivations, discussions, etc. where required.
12. Write neatly and legibly.



QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various possible options are provided as 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 1.7) on the answer sheet, e.g. 1.8 D.

1.1 Consider the statement below:

The force that opposes the tendency of motion of a stationary object relative to a surface.

Which ONE of the following forces is defined by the statement above?

A Normal force

B Gravitational force

C Static frictional force

D Kinetic frictional force (2)

1.2 A learner sits at rest on a chair in a classroom.

Which ONE of the following forces is the reaction force to the weight of the learner, as described by Newton's Third Law?

The force exerted by the:

A Chair on learner

B Learner on Earth

C Learner on chair

D Earth on chair (2)

1.3 Two hypothetical planets, X and Y, have the SAME mass. The diameter of planet Y is TWICE that of planet X.

If the acceleration due to gravity on the surface of planet X is g, then the acceleration due to gravity on the surface of planet Y will be ...

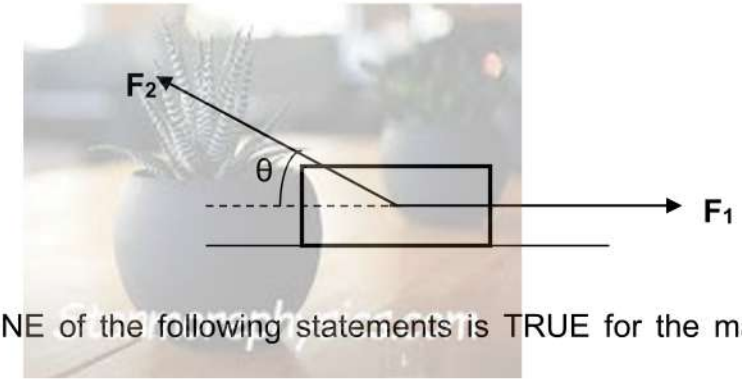
A $\frac{g}{2}$.

B $\frac{g}{16}$.

C $\frac{g}{4}$.

D 2g. (2)

1.4 Two forces, F_1 and F_2, are acting on a body that is placed on a frictionless surface as shown below. The body moves with a CONSTANT SPEED towards the right.



Which ONE of the following statements is TRUE for the magnitudes of the forces?

A $F_1 = F_2 \cos\theta$

B $F_1 = F_2 \sin\theta$

C $F_1 > F_2 \cos\theta$

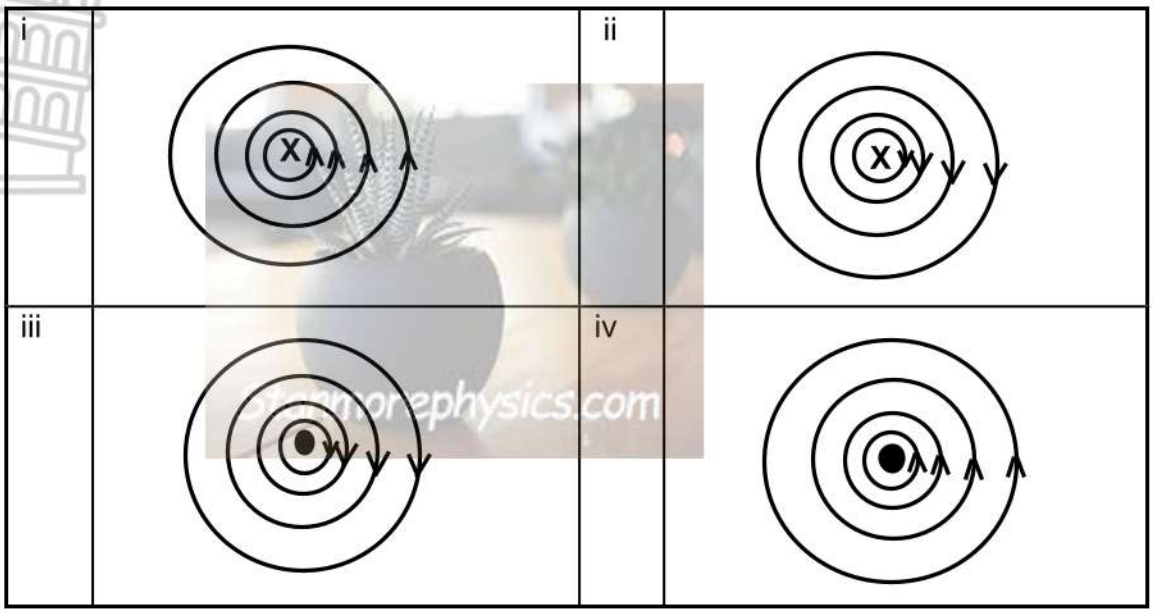
D $F_1 = F_2$ (2)

1.5 Which ONE of the following combinations is CORRECT regarding the properties of electric field lines?

	DIRECTION	STRENGTH OF THE FIELD
A	Positive to negative	Strongest where the lines are densest
B	Negative to positive	Weakest where the lines are least dense
C	North to south	Strongest where the lines are densest
D	North to south	Weakest where the lines are least dense

(2)

1.6 The diagrams below illustrate the shape and direction of the magnetic field around a straight conductor carrying current. Which diagram(s) given below represent(s) the CORRECT magnetic field around the conductor?



A i only

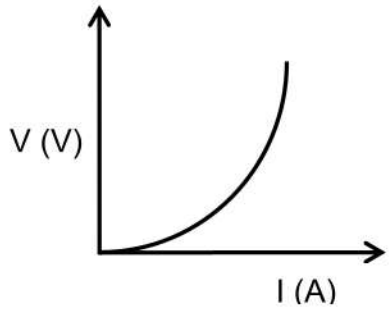
B i and iii only

C iv only

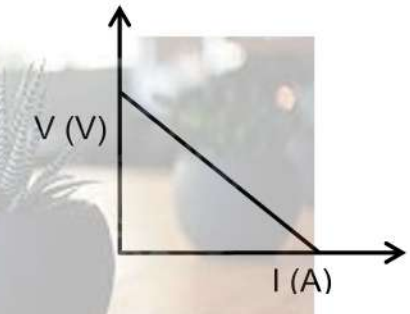
D ii and iv only (2)

1.7 Which ONE of the graphs below CORRECTLY represents the relationship between potential difference and current in a non-ohmic resistor?

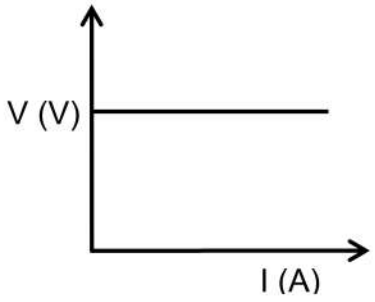
A



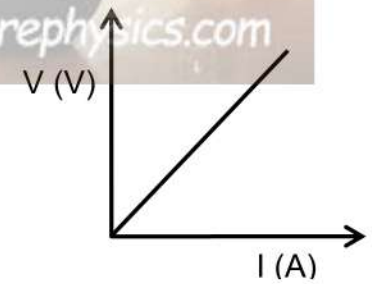
B



C



D



(2)
[14]

QUESTION 2

The picture below shows a man pushing a lawn mower, of mass 25 kg, across a lawn at CONSTANT SPEED, applying a constant force at 30°.

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

2.2 Draw a labelled free-body diagram of the lawn mower to show all the forces acting on it. (4)

While the lawn mower is moving at constant speed, the man applies a force of 180 N at an angle of 30° to the horizontal.

2.3 Calculate the:

2.3.1 Normal force acting on the lawn mower (3)

2.3.2 Coefficient of kinetic friction between the lawn mower and the lawn (3)

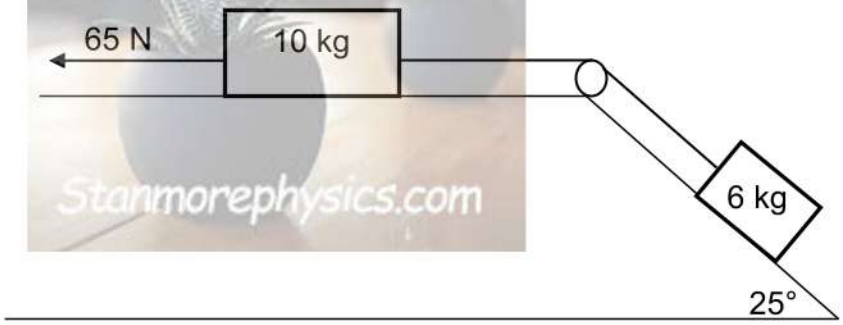
2.4 The man applies a force greater than 180 N, at the same angle as before. How will this change affect your answer to QUESTION 2.3.1?

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

[13]

QUESTION 3

In the diagram below, a 10 kg block is connected to a 6 kg block by means of a light, inextensible string over a light pulley. A constant force of 65 N is applied to the 10 kg block so that it accelerates to the LEFT.



The kinetic frictional force between the 10 kg block and the horizontal plane is 8 N, whereas the coefficient of kinetic friction for the 6 kg block and the inclined plane is 0,30.

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

3.2 Draw a free body diagram of all forces acting on the 6 kg block. (4)

3.3 Calculate the magnitude of the acceleration of the 6 kg block. (6)

3.4 The angle between the inclined plane and the horizontal surface is decreased to 15°. How will this change affect the coefficient of kinetic friction between the 6 kg block and the inclined plane?

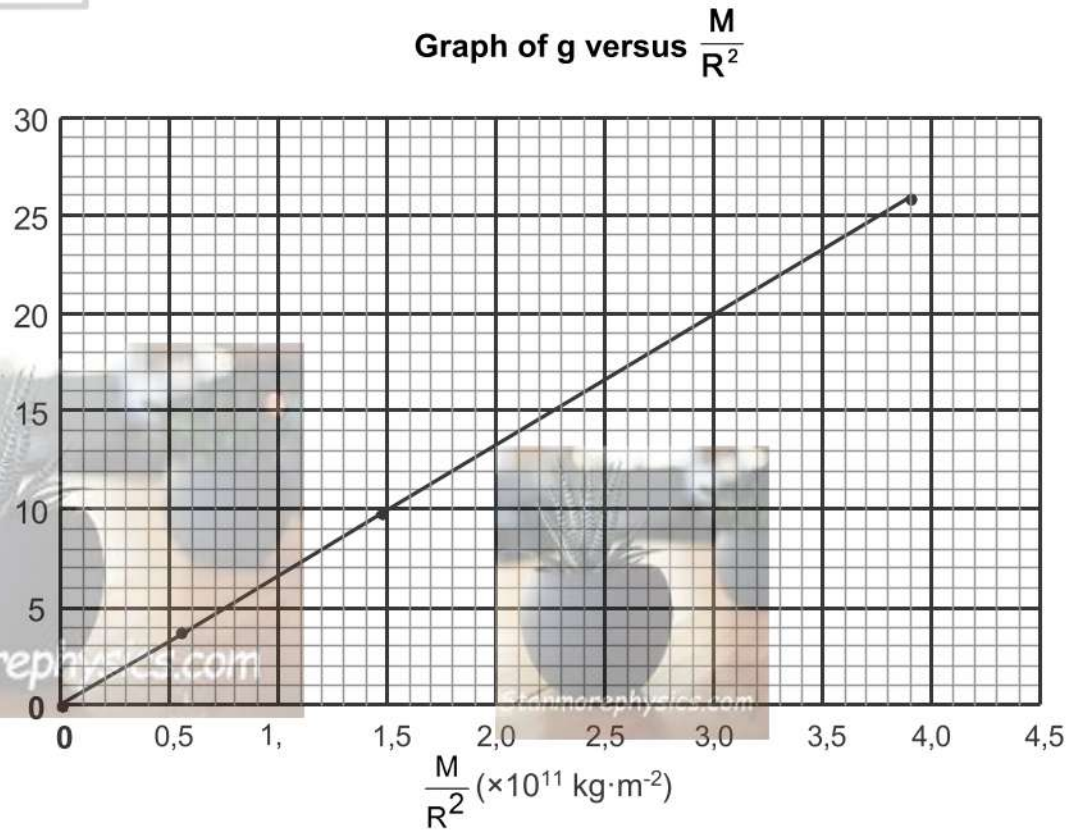
Choose from INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (2)

[14]

QUESTION 4

The relationship between gravitational acceleration and the ratio of the mass to the square of the radius $(\frac{M}{R^2})$ of different planets are investigated.

The graph below was obtained from the collected data.



4.1 What relationship between g and $\frac{M}{R^2}$ can be deduced from the graph? (1)

4.2 Calculate the gradient of the graph. (3)

4.3 Which physical constant is represented by the gradient of the graph? (1)

4.4 The gravitational acceleration on Jupiter is 25 $m \cdot s^{-2}$. Use the graph to determine the $\frac{M}{R^2}$ value for Jupiter. (2)

4.5 Calculate the:

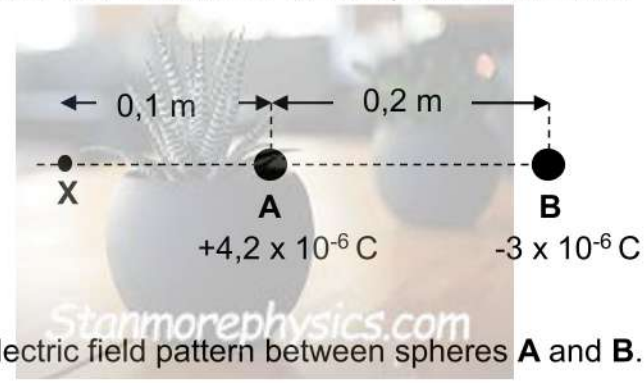
4.5.1 Mass of Jupiter if its radius is $6,99 \times 10^7$ m (2)

4.5.2 Magnitude of the gravitational force that Jupiter exerts on the Earth, if the distance between the centres of these planets is $5,88 \times 10^{11}$ m (3)

[12]

QUESTION 5

Two small, identical spheres, **A** and **B**, carrying charges +4,2 x 10^{-6} C and -3 x 10^{-6} C respectively, are placed at a distance of 0,2 m apart, as shown in the diagram below.



5.1 Draw the electric field pattern between spheres **A** and **B**. (2)

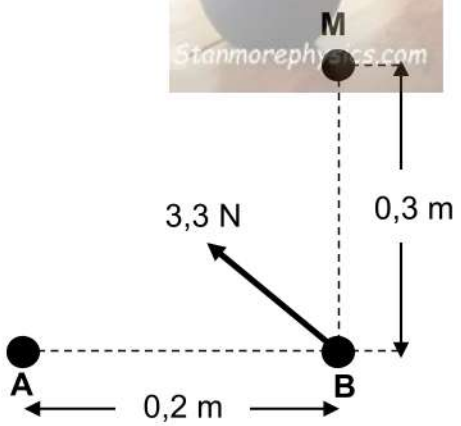
5.2 Calculate the magnitude of the electrostatic force exerted on sphere **A**. (3)

Point **X** is 0,1 m to the left of sphere **A**.

5.3 Define the term *electric field at a point.* (2)

5.4 Calculate the magnitude of the net electric field at point **X**. (5)

A third charged sphere, **M**, with an unknown charge, is placed a distance of 0,3 m from sphere **B** such that the three charged spheres are at the vertices of a right angle, as shown in the diagram below.



The net electrostatic force experienced by sphere **B** is 3,3 N, in the direction as shown above.

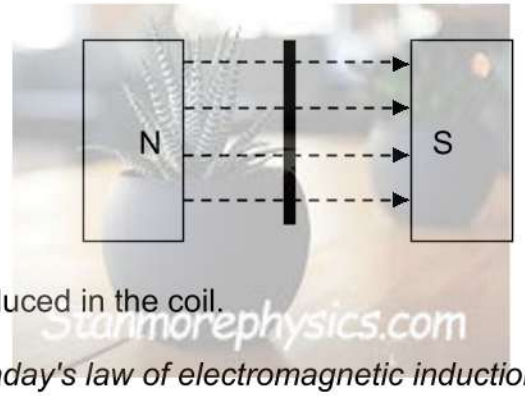
5.5 Is the charge on sphere **M** POSITIVE or NEGATIVE? (1)

5.6 Calculate the magnitude of the unknown charge of sphere **M**. (3)

[16]

QUESTION 6

A SQAURE induction coil with a side length 4 cm and 250 windings, is placed perpendicularly in a uniform magnetic field and then rotated through an angle of 60° in 0,12 s.



An emf of 9 V is induced in the coil.

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

6.2 Calculate the:

6.2.1 Change in the magnetic flux (3)

6.2.2 Magnitude of the magnetic field (4)

6.3 If the square coil is replaced with a CIRCULAR coil with a radius of 4 cm and the same movement is made in the same amount of time, how will the induced emf be affected?

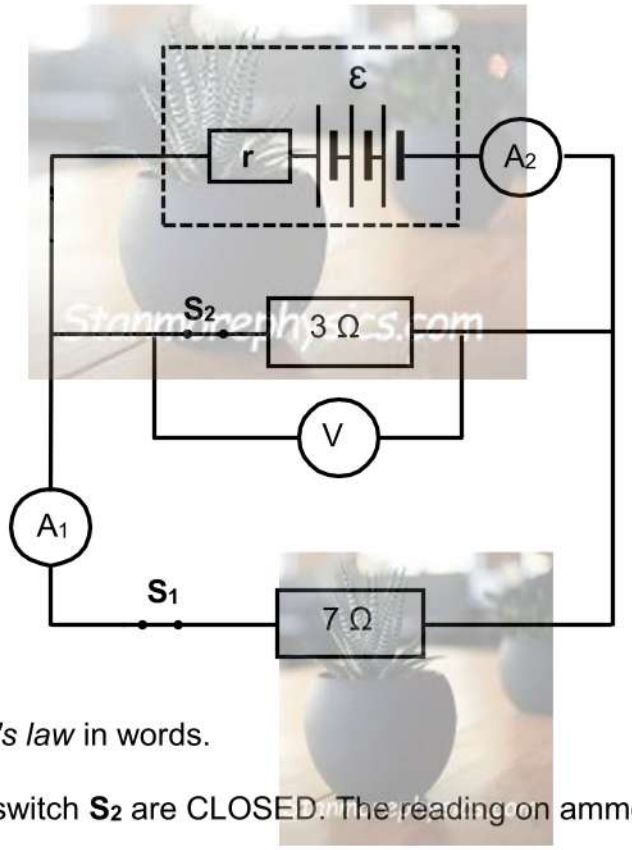
Choose from LESS THAN, GREATER THAN or EQUAL TO. (1)

6.4 Explain the answer to QUESTION 6.3. (2)

[12]

QUESTION 7

A battery with unknown emf (**ε**) and unknown internal resistance (**r**) is connected to two resistors, a high-resistance voltmeter, two switches and two ammeters of negligible resistance, as shown below.



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

Both switch **S1** and switch **S2** are CLOSED. The reading on ammeter A_1 is 1,5 A.

7.2 Calculate the reading on the:

7.2.1 Voltmeter (3)

7.2.2 Ammeter A_2 (4)

Switch **S1** is now OPENED, while switch **S2** remains CLOSED. The reading on ammeter A_2 is now 3,64 A.

7.3 How does the reading of the voltmeter change? Choose from INCREASES, DECREASES or REMAINS THE SAME. (2)

7.4 Calculate the emf of the battery. (5)

7.5 An electric kettle is rated at 2 200 W. The cost of electricity is R2,75 per unit (kWh).

Calculate the cost of using the kettle for 4 hours each day for 7 days. (3)

[19]

TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 1 (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 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J·s
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
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

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

ELECTROSTATICS/ELEKTROSTATIKA

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

ELECTROMAGNETISM/ELEKTROMAGNETISME

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

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

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

Northern Cape Department of Education

CURRICULUM PROVINCIAL QUESTION PAPER/
KURRIKULUM PROVINSIALE VRAESTEL

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: PHYSICS/
FISIESE WETENSKAPPE: FISIKA

PAPER/*VRAESTEL* 1

JUNE/*JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

These marking guidelines consist of 14 pages./
Hierdie nasienriglyne bestaan uit 14 bladsye.

QUESTION 1/*VRAAG 1*

1.1 C✓✓ (2)

1.2 B✓✓ (2)

1.3 C✓✓ (2)

1.4 A✓✓ (2)

1.5 A✓✓ (2)

1.6 D✓✓ (2)

1.7 A✓✓ (2)
[14]

QUESTION 2/VRAAG 2

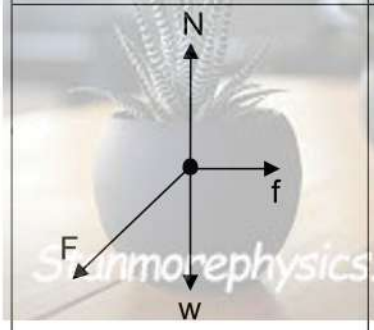
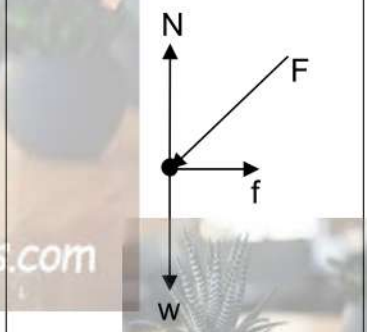
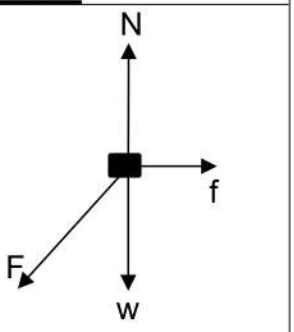
2.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase.
Indien enige onderstreepte sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase.

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)

2.2

	ACCEPT/*AANVAAR*	
		

Accepted Labels/*Aanvaarde benoemings*	
w	F_g/F_w/force of Earth on lawn mower/weight/245N/mg/gravitational force *F_g/F_w/krag van Aarde op grassnyer/gewig/245N /mg/gravitasiekrag*
N	F_N/F_{normal}/normal (force)/335N F_N/$F_{normaal}$/*normaal(krag)/335N*
f	F_f/f_k/(kinetic) friction/(*kinetiese*) *wrywing*/
F	$F_{applied}$/F_A/F/Applied force $F_{toegepas}$/F_A/F/Toegepaste krag

Notes/*Aantekeninge:*
- Mark awarded for label and arrow/*Punt toegeken vir benoeming en pyltjie*
- Do not penalise for length of arrows since drawing is not to scale/*Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie*
- Any other additional force(s)/*Enige ander addisionele krag(te):* Max/*Maks* $^3/_4$
- If everything is correct, but no arrows/*Indien alles korrek is, maar geen pyltjies:* Max/*Maks* $^3/_4$
- If force(s) do not make contact with the dot/*As krag(te) nie met die kolletjie kontak maak nie:* Max/*Maks* $^3/_4$
- If components are drawn/*Indien komponente geteken:* Max/*Maks* $^3/_4$

(4)

2.3.1

$\sum F_Y = 0$ OR/*OF* $F_{net} = 0$
$N + (-mg - F\sin 30°) = 0$
$N = mg + F\sin 30°$
✓ Any one/*Enige een*

$N = \underline{(25)(9,8)+(180)\sin 30°}$ ✓
$= \underline{335 \text{ N upwards}}$ ✓/*opwaarts* (3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1/ *POSITIEWE NASIEN VANAF VRAAG 2.3.1***

$f_k = \mu_k N$
$F_{A_x} = \mu_k N$
$F\cos\theta = \mu_k N$
✓ Any one/*Enige een*

$\underline{180 \cos 30° = \mu_k(335)}$ ✓
$\mu_k = 0,47$ ✓ (3)

2.4 Increases✓/*Toeneem* (1)
[13]

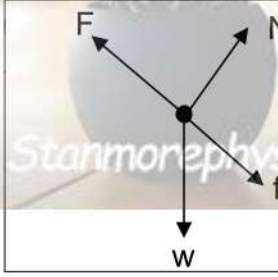
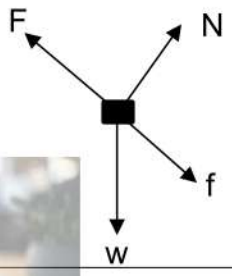
QUESTION 3/*VRAAG 3*

3.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase.
Indien enige onderstreepte sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase.

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, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp (2)

3.2

	ACCEPT/*AANVAAR*
	

Accepted Labels/*Aanvaarde benoemings*	
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N	F_N/F_{normal}/normal force/ $F_N/F_{normaal}$/*normaalkrag*
f	F_f/f_k/(kinetic) friction/(*kinetiese*) *wrywing*/
F	$F_{applied}/F_A/F/F_T/F_{Tension}$ $F_{toegepas}/F_A/F/F_T/F_{Spanning/Tou}$

Notes/*Aantekeninge:*
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- If components are drawn/*Indien komponente geteken:* Max/*Maks* $^3/_4$

(4)

3.3

LEFT AS POSITIVE/
LINKS AS POSITIEF

10-kg mass/*massa*

$F_{net} = ma$
$F - T - f = ma$ ✓ Any one/*Enige een*

$\underline{65 - T - 8}$ ✓ $= 10a$
$57 - T = 10a$ … (1)

✓ Any one/*Enige een*

6-kg mass/*massa*

$F_{net} = ma$
$T - f - Fg_{//} = ma$
$T - \underline{(0,3)(6x9,8\cos 25°)}$✓ $- \underline{(6x9,8\sin 25°)}$✓ $= 6a$
$T - 40,84 = 6a$ …(2)

From (1) and (2)/*Vanaf (1) en (2)*
$a = 1,01\ m{\cdot}s^{-2}$ ✓

RIGHT AS POSITIVE/
REGS AS POSITIEF

10-kg mass/*massa*

$F_{net} = ma$
$T + f - F = ma$ ✓ Any one/*Enige een*

$\underline{T + 8 - 65}$ ✓ $= 10a$
$T - 57 = 10a$ … (1)

✓ Any one/*Enige een*

6-kg mass/*massa*

$F_{net} = ma$
$Fg_{//} + f - T = ma$
$\underline{(6x9,8\sin 25°)}$✓ $+ \underline{(0,3)(6x9,8\cos 25°)}$✓ $- T = 6a$
$40,84 - T = 6a$ …(2)

From (1) and (2)/*Vanaf (1) en (2)*
$a = 1,01\ m{\cdot}s^{-2}$ ✓

(6)

3.4 Remains the same. ✓ Coefficient of kinetic friction depends only on the type of surfaces. ✓
Bly dieselfde. Die koëffisiënt van kinetiese wrywing hang slegs van die tipe oppervlakke af. (2)

[14]

QUESTION 4/*VRAAG 4*

4.1 g is directly proportional to $\frac{M}{R^2}$.✓

g is direk eweredig aan $\frac{M}{R^2}$. (1)

4.2 Any two points from the graph can be used, for example:
Enige twee punte vanaf die grafiek kan gebruik word, byvoorbeeld:

Gradient = $\frac{9-0\checkmark}{1{,}35\times10^{11}-0\checkmark}$
= $6{,}67 \times 10^{-11}\checkmark$

OR/*OF*

Gradient = $\frac{10-0\checkmark}{1{,}5\times10^{11}-0\checkmark}$
= $6{,}67 \times 10^{-11}\checkmark$

OR/*OF*

Gradient = $\frac{20-0\checkmark}{3\times10^{11}-0\checkmark}$
= $6{,}67 \times 10^{-11}\checkmark$

OR/*OF*

Gradient = $\frac{25-0\checkmark}{3{,}75\times10^{11}-0\checkmark}$
= $6{,}67 \times 10^{-11}\checkmark$ (3)

4.3 G/Universal Gravitational constant ✓
G/Universele Gravitasie konstante (1)

4.4 $3{,}75 \times 10^{11}$ $(kg\cdot m^{-2})$ ✓✓
Range/*Gebied:* $3{,}74 - 3{,}76 \times 10^{11} (kg\cdot m^{-2})$ (2)

4.5.1 **POSITIVE MARKING FROM QUESTION 4.4 FOR OPTION 1/**
POSITIEWE NASIEN VANAF VRAAG 4.4 VIR OPSIE 1

OPTION1/*OPSIE 1*	**OPTION2/*OPSIE 2***
$\frac{M}{R^2} = 3{,}75 \times 10^{11}$	$g = \frac{GM}{R^2}$
$\frac{M}{(6{,}99\times10^{7})^2} = 3{,}75\times10^{11}$ ✓	$25 = \frac{6{,}67\times10^{-11}M}{(6{,}99\times10^{7})^2}$ ✓
$M = 1{,}83 \times 10^{27}$ kg ✓	$M = 1{,}83 \times 10^{27}$ kg ✓

(2)

4.5.2 **POSITIVE MARKING FROM QUESTION 4.5.1/ *POSITIEWE NASIEN VANAF VRAAG 4.5.1***

$F = G\frac{m_1 m_2}{r^2}$ ✓

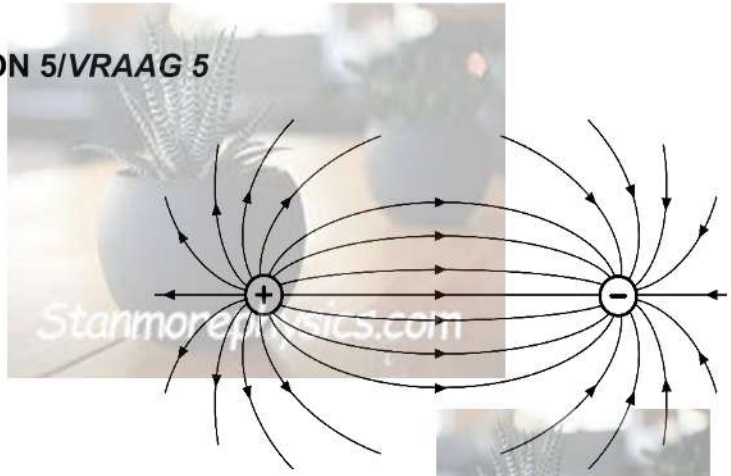
$F = \frac{(6{,}67\times10^{-11})(5{,}98\times10^{24})(1{,}83\times10^{27})}{(5{,}88\times10^{11})^2}$ ✓

$F = 2{,}11 \times 10^{18}$ N✓ (3)

[12]

QUESTION 5/*VRAAG 5*

5.1



Criteria for sketch/*Kriteria vir skets*	Marks/*Punte*
Direction of field lines correct for both spheres/*Rigting van veldlyne vir beide sfere is korrek*	✓
Lines start on the sphere and do not cross/*Lyne begin op die sfeer en kruis nie.*	✓
Two or more field lines inside spheres / not touching spheres / cross each other: deduct 1 mark *Twee of meer veldlyne binne sfere / raak nie aan sfere nie / kruis: trek 1 punt af* If only one charge drawn */Indien slegs een lading geteken:* $^0/_2$	

(2)

5.2 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$F = \frac{(9\times10^{9})(4{,}2\times10^{-6})(3\times10^{-6})}{(0{,}2)^2}$ ✓

F = 2,84 N ✓ (2,835 N) (3)

5.3 The electrostatic force experienced per unit positive charge placed at that point. ✓✓
Die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word.

(2 or/*of* 0)

NOTE: If the electric field is defined: $^0/_2$ *NOTA: Indien elektriese veld gedefinieer is:* $^0/_2$

(2)

5.4

Marking criteria/*Nasienriglyne*

- Appropriate formula/*Geskikte formule*
- Correct substitution for A and B/*Korrekte vervanging van A en B*
- Subtraction of electric fields/*Aftrek van elektriese velde*
- Final anwer/*Finale antwoord:* 3,48 x 10^6 N·C^{-1}

OPTION 1/*OPSIE 1*

Electric field at X due to/*Elektriese veld by X as gevolg van:* +4,2 x 10^{-6} C

$E_{AX} = k\frac{Q}{r^2}$ ✓

$E_{AX} = 9x10^9\frac{(4,2x10^{-6})}{(0,1)^2}$ ✓

= 3,78 x 10^6 N·C^{-1} (to left/*links*)

Electric field at X due to/*Elektriese veld by X as gevolg van:* -3x10^{-6} C

$E_{BX} = k\frac{Q}{r^2}$

$E_{BX} = 9x10^9\frac{(3x10^{-6})}{(0,3)^2}$ ✓

= 3 x 10^5 N·C^{-1} (to right/*regs*)

Net electric field at X/ *Netto elektriese veld by X*

Enet = E_{AX} + E_{BX}

= 3,78 x 10^6 – 3 x 10^5 ✓

= 3,48 x 10^6 N·C^{-1} ✓ (to left/*links*)

OR/*OF*

Net electric field at X/*Netto elektriese veld by X*

Enet = E_{AX} + E_{BX}

= -3,78 x 10^6 + 3 x 10^5 ✓

= -3,48 x 10^6 N·C^{-1}

= 3,48 x 10^6 N·C^{-1} ✓ (to left/*links*)

OPTION 2/*OPSIE 2*

$F_{AX} = \frac{kQ_1Q_2}{r^2} = \frac{(9x10^9)(4,2x10^{-6})Q}{(0,1)^2}$ ✓ = 3,78 x 10^6Q N (to left/*links*)

$F_{BX} = \frac{kQ_1Q_2}{r^2} = \frac{(9x10^9)(3x10^{-6})Q}{(0,3)^2}$ ✓ = 3 x 10^5Q N (to right/*regs*)

F_{net} = 3,78 x 10^6Q + (-3 x 10^5Q) ✓ = 3,48 x 10^6Q

$E = \frac{F}{q}$ ✓ $= \frac{3,48x10^6Q}{Q}$ = 3,48 x 10^6 N·C^{-1} ✓ (to left/*links*)

(5)

5.5 Positive ✓/*Positief* (1)

5.6 **POSITIVE MARKING FROM QUESTION 5.2/*POSITIEWE NASIEN VANAF VRAAG 5.2***

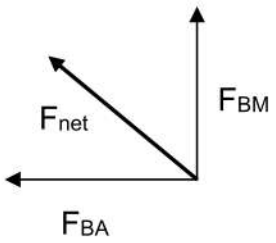
Marking criteria/*Nasienriglyne*

- Correct substitution into Pythagoras's equation/*Korrekte vervanging in Pythagoras se vergelyking* ✓
- *Correct substitution into Coulomb's Law/Korrekte vervanging in Coulomb se wet*✓
- Correct answer/*Korrekte antwoord* ✓

$(F_{net})^2 = (F_{AB})^2 + (F_{BM})^2$

$(3,3)^2 = (2,84)^2 + (F_{BM})^2$ ✓

$F_{BM} = 1,68$ N



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

$1,68 = \frac{(9x10^9)(3x10^{-6})(Q_M)}{(0,3)^2}$ ✓

$Q_M = 5,6 \times 10^{-6}$ C ✓

OR/*OF*

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

$= \frac{(9x10^9)(3x10^{-6})(Q_M)}{(0,3)^2}$ ✓

$= 3 \times 10^5 Q_M$

$(F_{net})^2 = (F_{AB})^2 + (F_{BM})^2$ **OR/*OF*** $F_{net} = \sqrt{F_{AB}^{\ 2} + F_{BM}^{\ 2}}$

$3,3 = \sqrt{2,84^2 + (3x10^5 Q_M)}$ ✓

$Q_M = 5,6 \times 10^{-6}$ C ✓

(3)
[16]

QUESTION 6/*VRAAG 6*

6.1 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. ✓✓ (2 or/of 0)
Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier. (2)

6.2
6.2.1 $\varepsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓

$9 = \frac{-250\Delta\Phi}{0,12}$ ✓

$\Delta\Phi = -4,32 \times 10^{-3}$ Wb✓ (-0,00432 Wb) (3)

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

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\Delta\Phi = BA(\cos\theta_f - \cos\theta_i)$	$\Delta\Phi = BA(\cos\theta_f - \cos\theta_i)$
$-4,32 \times 10^{-3}$ ✓ = B(0,04)² ✓ (cos 60° - cos 0°) ✓	$4,32 \times 10^{-3}$ ✓ = B(0,04)² ✓ (cos 0° - cos 60°) ✓
B = 5,4 T ✓	B = 5,4 T ✓

(4)

6.3 Greater than✓/*Groter as* (1)

6.4 The area of a circular coil with radius 4 cm is greater than the area of a square with equal side length of 4 cm ✓✓
Die oppervlak van 'n sirkelvormige spoel met 'n radius van 4 cm is groter as die oppervlak van 'n vierkantige spoel met sylengtes gelyk aan 4 cm.

OR/*OF*
$\pi 0,04^2 > 0,04^2$ area of circular coil is greater than area of squared coil✓✓/*Oppervlak van 'n sirkelvormige spoel is groter as die oppervlak van 'n vierkantige spoel*

OR/*OF*
Ɛ directly proportional to/*direk eweredig aan A* ✓✓ (2)

[12]

QUESTION 7/*VRAAG 7*

7.1

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

The potential difference/voltage 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)

7.2.1

OPTION 1/*OPSIE 1*

$R = \frac{V}{I}$ ✓

$7 = \frac{V}{1,5}$ ✓

V = 10,5 V ✓

OPTION 2/*OPSIE 2*

Resistors: 3:7 = 1:2,33
$I_7 : I_3$ = 1: 2,33
I_7 = 2,33 x 1,5
= 3,495 A

$R = \frac{V}{I}$ ✓

$3 = \frac{V}{3,495}$ ✓

V = 10,485 V ✓ (10,5V)

(3)

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

OPTION 1/*OPSIE 1*

$R = \frac{V}{I_3}$ ✓

$3 = \frac{10,5}{I_3}$ ✓

$I_3 = 3,5$ A

$I_T = 1,5 + 3,5$ ✓ addition of calculated values/*optel van berekende waardes*

$= 5$ A ✓

OPTION 2/*OPSIE 2*

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_P} = \frac{1}{3} + \frac{1}{7}$ ✓

$R_P = 2,1\Omega$

$R = \frac{V}{I_T}$ ✓

$2,1 = \frac{10,5}{I_T}$ ✓

$I_T = 5$ A ✓

OR/*OF*

$R_P = \frac{R_1 R_2}{R_1 + R_2}$

$R_P = \frac{(3)(7)}{3+7}$ ✓

$R_P = 2,1\Omega$

OPTION 3/*OPSIE 3*

$I_{3\Omega} = \frac{7}{3} \times 1,5$ ✓

$= 3,5$ A ✓

$I_{total} = 3,5 + 1,5$ ✓

$= 5$ A ✓

OPTION 4/*OPSIE 4*

$I_S = (\frac{R_{3\Omega}}{R_{3\Omega} + R_S})$ x I_{total} ✓

$1,5$ ✓ $= (\frac{3}{3+7})$ ✓ x I_{total}

$I_{total} = 5$ A ✓

(4)

7.3 Increases ✓✓/*Toeneem* (2)

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

Marking criteria/*Nasienriglyne*

- Correct equation for emf./*Korrekte vergelyking vir emk.*
- Correct substitution for S_1 and S_2 closed./*Korrekte vervanging vir S_1 en S_2 gesluit.*
- Correct substitution for S_2 closed./*Korrekte vervanging vir S_2 gesluit.*
- Equating emf or internal resistance equations./*Gelykstelling van emf of interne weerstand vergelykings.*
- Correct final answer./*Korrekte finale antwoord:* 12,05 V.
  Range/*Gebied*: 12,04 V to/tot 12,05 V

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_P} = \frac{1}{3} + \frac{1}{7}$$

$R_P = 2{,}1\Omega$

For S_1 and S_2 closed/*Vir S_1 en S_2 gesluit:*

$\varepsilon = I(R + r)$
$\varepsilon = IR + Ir$
$\varepsilon = V_{int} + V_{ext}$
✓ Any one/ *Enige een*

$= \underline{5(2{,}1 + r)}$ ✓… (1)

For S2 closed/*Vir S2 gesluit:*

$\varepsilon = I(R + r)$
$= \underline{3{,}64\ (3 + r)}$ ✓…(2)

(1) = (2)

$5(2{,}1 + r) \overset{✓}{=} 3{,}64(3 + r)$
$r = 0{,}31\ \Omega$

$\varepsilon = 5(2{,}1 + 0{,}31)$
$= 12{,}05$ V ✓ (12,04)

OR/*OF*

$\varepsilon = 3{,}64(3 + 0{,}31)$
$= 12{,}05$ V ✓ (12,04)

(1) = (2):

$$\frac{\varepsilon - 10{,}5}{5} \overset{✓}{=} \frac{\varepsilon - 10{,}92}{3{,}64}$$

$\varepsilon = 12{,}05$ V ✓ (12,04)

(5)

7.5 2,2 x 4 x 7 ✓= 61,6 kWh
Price/*prys* = 61,6 x 2,75 ✓
= R169,40 ✓

(3)
[19]

TOTAL: 100