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Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

NOVEMBER 2026

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MARKS: 150

TIME: 3 hours

This question paper consists of 16 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your name and surname on the ANSWER BOOK.
2. This question paper consists of EIGHT (8) questions. Answer ALL the questions on 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. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.



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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 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 Which of the following statements are CORRECT?

(i) A vector is a physical quantity that has both magnitude and direction.

(ii) Displacement is defined as the straight-line distance from the starting point to the ending point, including direction.

(iii) Both displacement and distance are vector quantities.

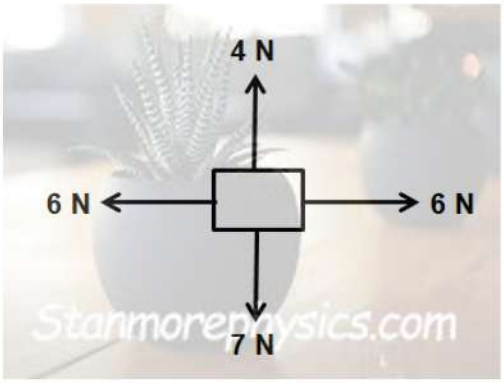
A (i) and (ii)

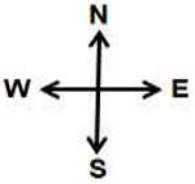
B (ii) and (iii)

C (i) and (iii)

D (i), (ii) and (iii) (2)

1.2 Four forces act on an object, as shown in the diagram below:





What is the magnitude and direction of the resultant force?

A 23 N South

B 11 N South

C 3 N South

D 12 N East (2)

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1.3 A body remains at rest unless acted on by a net force. This is according to …

A Newton's First law.

B no net force acts on it.

C its acceleration increases steadily.

D frictional force must be greater than the driving force. (2)

1.4 If the net force acting on an object is ZERO, the object will …

A experience a constant increase in velocity.

B accelerate in the direction of the largest force.

C move at constant velocity or remain at rest.

D experience a constant decrease in velocity. (2)

1.5 A 2,5 kg object weighs 24,5 N on Earth. What would be the mass of the object on planet Mars, if the acceleration due to gravity on Mars is 3,71 $m.s^{-2}$?

A 6,6 kg

B 2,5 kg

C 7,42 kg

D 9,28 kg (2)

1.6 Two objects of masses 4 kg and 6 kg respectively are placed 2 m apart. What is the magnitude of the gravitational force between the two objects?

A $2,00 \times 10^{-10}$ N

B $4,00 \times 10^{-10}$ N

C $4,00 \times 10^{-11}$ N

D $8,00 \times 10^{-11}$ N (2)

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1.7 The SI unit of the electric field at a point is:

A $N.C^{-1}$

B C

C V

D A (2)

1.8 Two identical charged spheres repel each other with a force **F**. If the distance between them is halved and one sphere loses half its charge, what is the new force?

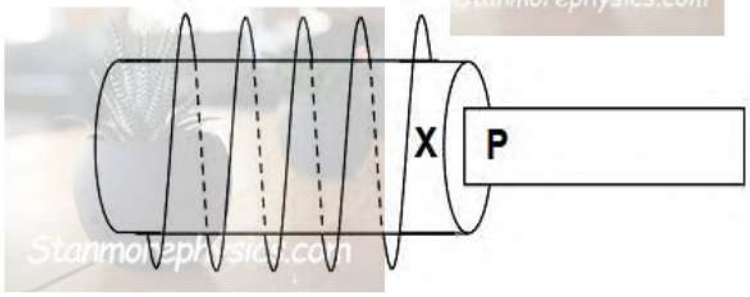
A F

B 2F

C $\frac{1}{2}$F

D 4F (2)

1.9 A bar magnet with pole **P** is moved relative to a coil, as shown in the diagram below. The motion of the magnet causes a magnetic field to be induced in the coil.



Which ONE of the following combinations will result in an induced magnetic field with a SOUTH POLE at point **X** of the coil?

	DIRECTION OF MOTION OF MAGNET	POLARITY OF P
A	Into the coil	North
B	Into the coil	South
C	Up and down inside the coil	North
D	Up and down inside the coil	South

(2)

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1.10 A learner claims that: "Adding more resistors in parallel always increases the total resistance of the circuit."

Which ONE of the following statements regarding the learner's claim is CORRECT?

A True only for identical resistors.

B True only for series circuits.

C Always false.

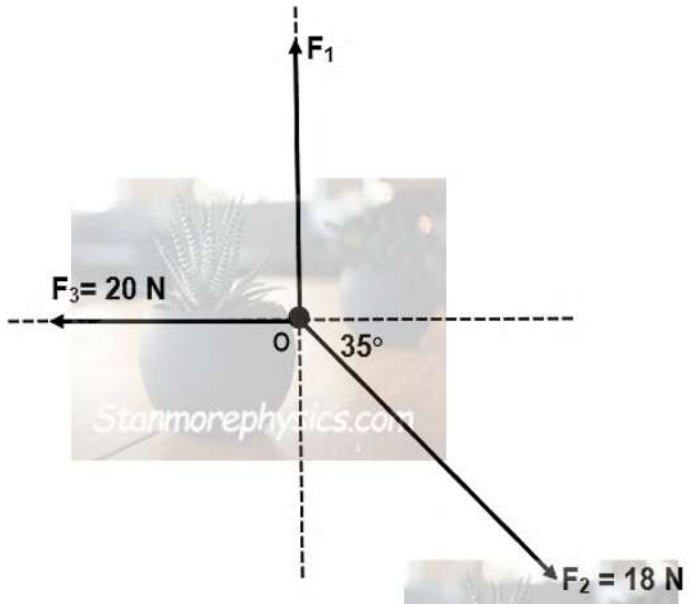
D Always true. (2)
[20]



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QUESTION 2 (Start on a new page.)

Three forces, F_1, F_2 and F_3 are acting on point **O**, as shown in the diagram below.



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

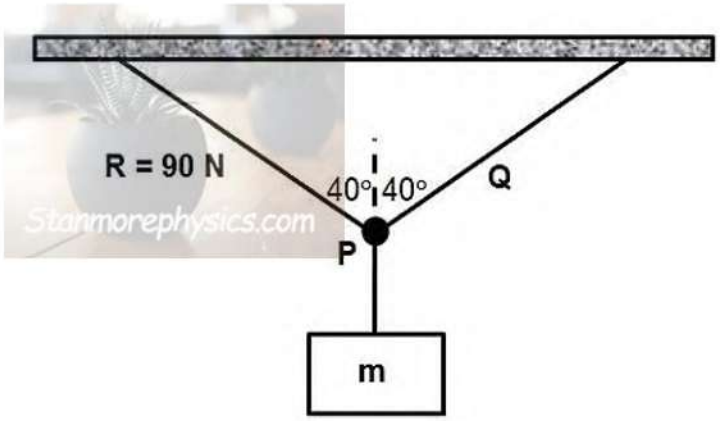
2.2 Calculate the magnitude of the horizontal component of force F_2. (2)

2.3 The resultant force acting on point **O** is 15 N at a bearing of 310°.

Determine the magnitude of F_1. (5)

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2.4 A box of unknown mass **m** is suspended on a string from point **P**. Two light, inextensible strings are attached to **P**, each making an angle of 40° with the vertical. The tension in string **R** is 90 N and the system is in equilibrium.



2.4.1 Explain what is meant by the term *equilibrium.* (1)

2.4.2 Calculate the tension in string **Q**. (2)

2.4.3 Calculate the mass of the box. (4)

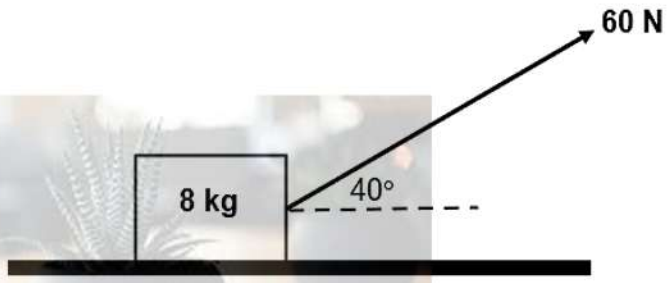
2.4.4 Draw a closed vector diagram of the three forces, **R**, **Q** and weight **w**, using the tail-to-head method. Clearly label all three forces and the relevant angles. (4)
[20]

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QUESTION 3 (Start on a new page.)

A block of mass 8 kg block is pulled at a CONSTANT velocity on a rough horizontal surface. The block is pulled by a force of 60 N acting at an angle of 40° to the horizontal.



3.1 Define the term *inertia*. (2)

3.2 Draw a labelled free-body diagram showing ALL the forces acting on the 8 kg block. (4)

3.3 Calculate the:

3.3.1 magnitude of the frictional force acting on the block (3)

3.3.2 normal force exerted by the surface on the block (3)

3.4 The angle between the applied force and the horizontal is now increased.

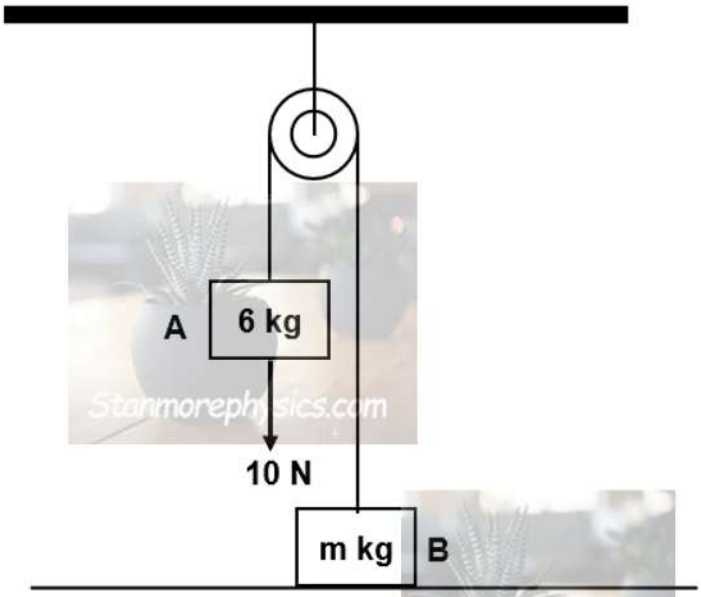
3.4.1 What effect will this change have on the frictional force calculated in QUESTION 3.3.1? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

3.4.2 Give a reason for the answer to QUESTION 3.4.1. (2)
[15]

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QUESTION 4 (Start on a new page.)

Block **A** of mass 6 kg is connected to block **B** of unknown mass **m** by a light inextensible rope passing over a frictionless pulley. Block **A** hangs vertically, while block **B** rests on a horizontal surface, as shown in the diagram below.



When a constant force of 10 N is applied to block **A**, it accelerates downwards at 1,5 $m.s^{-2}$, causing block **B** to move upwards.

Ignore the effects of friction and air resistance.

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

4.2 Draw a labelled FORCE diagram showing ALL the forces acting on block **A**. (3)

4.3 While the system is accelerating calculate the:

4.3.1 tension in the rope (4)

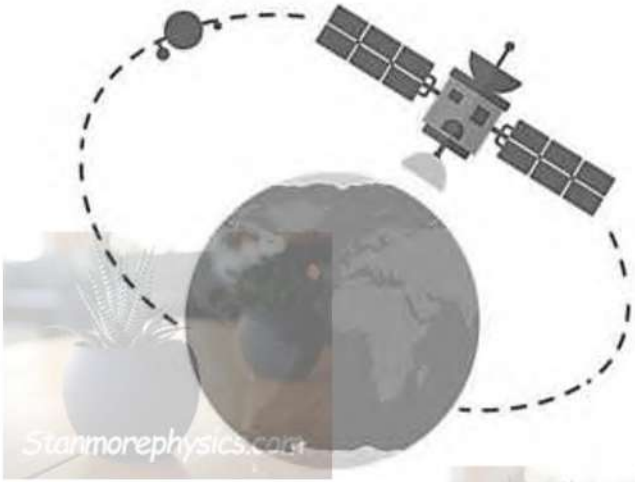
4.3.2 mass **m** of block B (3)

4.4 How would the acceleration change if the pulley had friction? Choose from INCREASE, DECREASE or REMAIN THE SAME. Explain the answer. (3)
[15]

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QUESTION 5 (Start on a new page.)

The international space station (ISS) has a mass of $4,2 \times 10^5$ kg. It orbits the Earth and experiences a gravitational force of $3,71 \times 10^6$ N from Earth while in a stable orbit.



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

5.2 Calculate the distance between the centre of the Earth and the ISS. (3)

5.3 Calculate the height of the ISS above the Earth's surface in kilometres. (2)

5.4 An astronaut on Earth has a weight of 784 N.
Calculate the mass of the astronaut on Earth. (2)

5.5 The ISS fires one of its rockets to move to a higher orbit. Calculate the force the rocket must exert to accelerate the ISS at 0,4 $m.s^{-2}$ away from the Earth. (5)

5.6 After the rocket stop firing in the new higher orbit:

5.6.1 How does the magnitude of the gravitational force on the ISS change? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

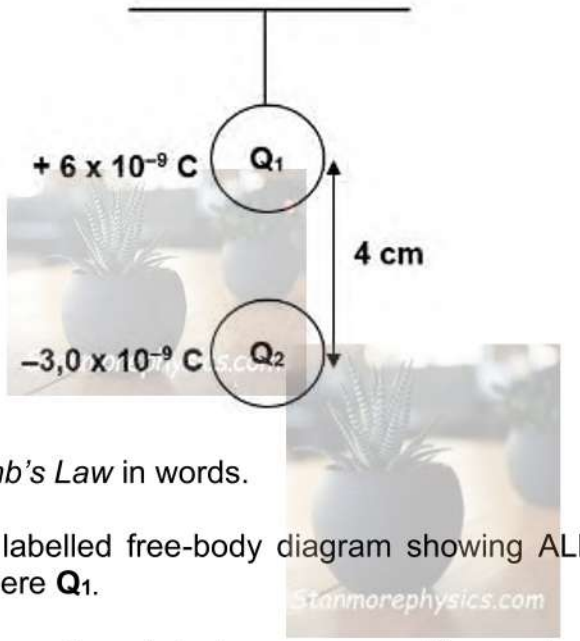
5.6.2 Explain the answer to QUESTION 5.6.1. (2)
[17]

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QUESTION 6 (Start on a new page.)

6.1 Two small identical spheres, each of mass 6 g, are arranged as shown in the diagram below. Sphere Q_1, carries a charge of +6,0 x 10^{-9} C and is suspended from a light, inextensible string attached to a fixed support. Sphere Q_2, carrying a charge of –3,0 x 10^{-9} C, is placed directly below Q_1 so that the centres of the spheres lie on the same vertical line.

The system is in equilibrium when the distance between the centres of the spheres is 4 cm. Ignore the effects of air resistance.



6.1.1 State C*oulomb's Law* in words. (2)

6.1.2 Draw a fully labelled free-body diagram showing ALL the forces acting on sphere Q_1. (3)

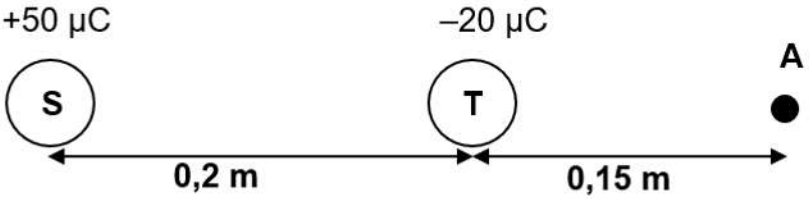
6.1.3 Calculate the number of electrons removed from sphere Q_1 to give the sphere a charge of +6,0 x 10^{-9} C. (3)

6.1.4 Calculate the magnitude of the tension in the string. (5)

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6.2 Two point charges, **S** and **T,** are placed 0,2 m apart on a straight horizontal line. The magnitude of charge **S** is +50 µC, while charge **T** has a magnitude of -20 µC.

Point **A** is located 0,15 m to the right of charge **T**, along the same straight horizontal line.



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

6.2.2 Draw the electric field pattern between charges **S** and **T**. (3)

6.2.3 Calculate the net electric field at point **A** due to charges **S** and **T**. (6)
[24]

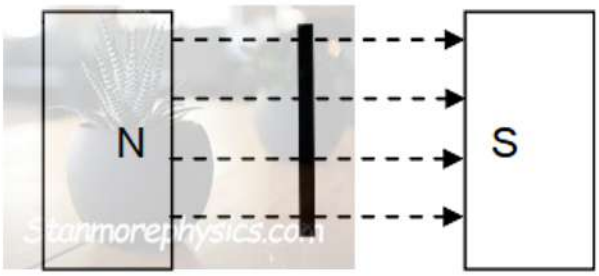


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QUESTION 7 (Start on a new page.)

A square induction coil with a side length of 5 cm and 250 windings is placed in a uniform magnetic field. The plane of the coil is initially perpendicular to the magnetic field. The coil is then rotated through an angle of 60° in 0,10 s.

An emf of 5 V is induced in the coil.



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

7.2 Calculate the change in magnetic flux linkage of the coil. (3)

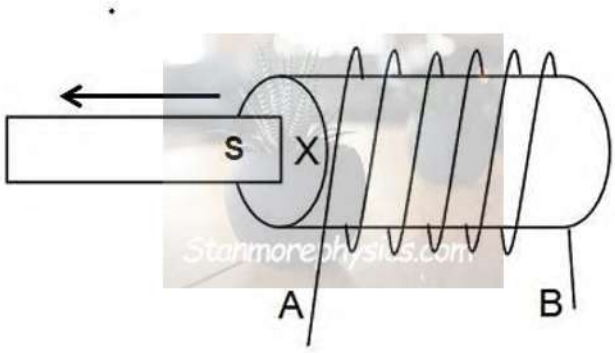
7.3 Calculate the magnitude of the magnetic field strength. (4)

The coil is now rotated through the same angle of 60° in 0,04 s.

7.4 How will the induced emf be affected? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

7.5 Explain the answer to QUESTION 7.4. (2)

7.6 The south pole of a bar magnet is pulled out of a solenoid, as shown in the sketch below.



7.6.1 Which pole will be induced at point X? Write only NORTH or SOUTH. (1)

7.6.2 In which direction will the induced current flow? Write only FROM A TO B or FROM B TO A (1)

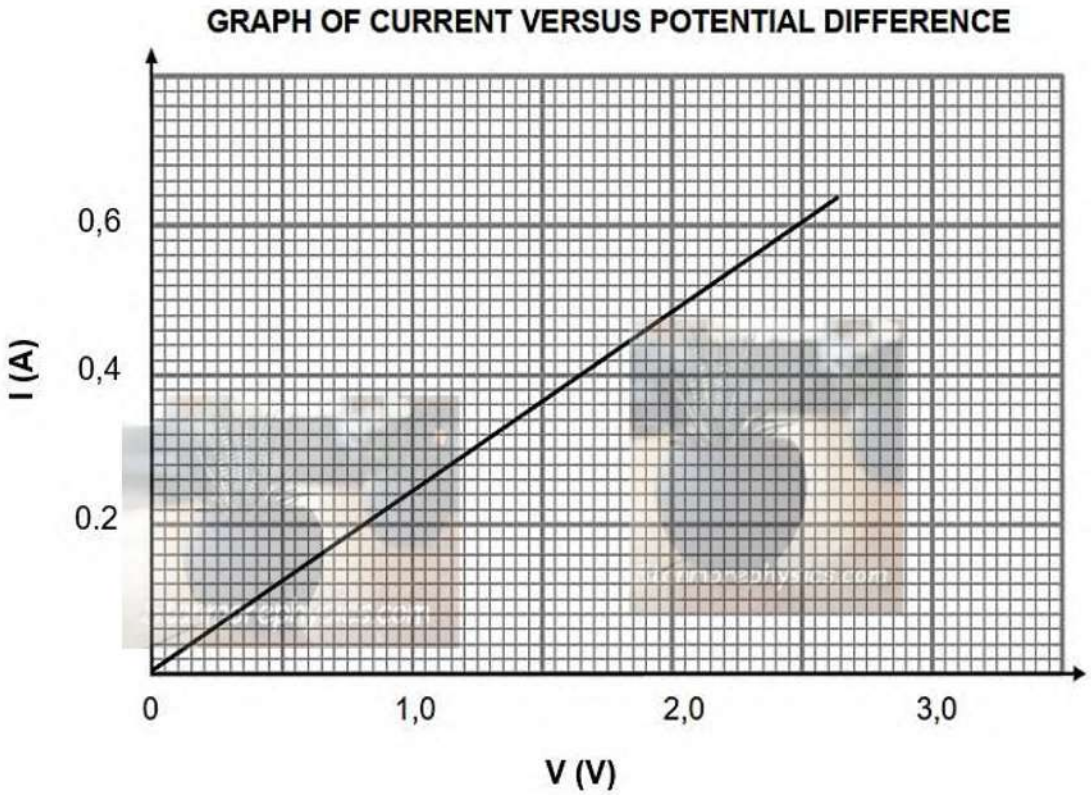
[14]

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QUESTION 8 (Start on a new page.)

A group of Grade 11 learners sets up an electric circuit to investigate the relationship between the current passing through a conductor and the potential difference across it. In their setup, a high-resistance voltmeter is connected in parallel across the conductor. The ammeter and the connecting wires have negligible resistance.

They record their findings and use the data to plot a graph of current versus potential difference, as shown in the graph below.



8.1 State the term O*hm's law* in words. (2)

8.2 State whether the conductor is ohmic or non-ohmic. Give a reason for the answer. (3)

8.3 Write down the:

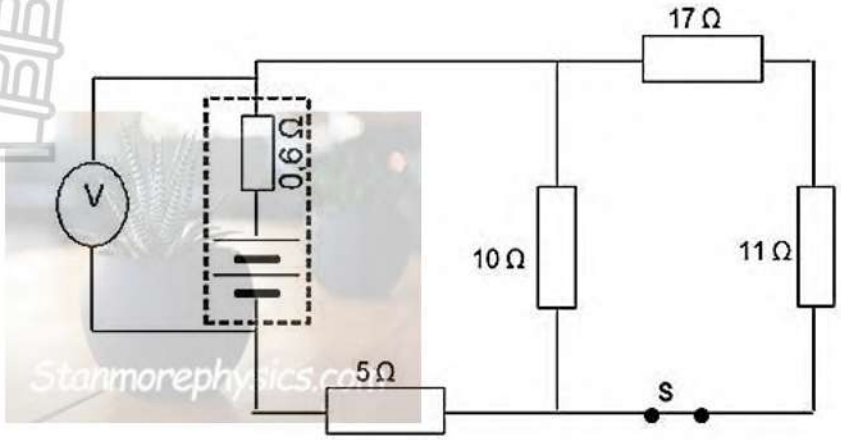
8.3.1 dependent variable (1)

8.3.2 Control variable (1)

8.4 Calculate the gradient of the above graph. (3)

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8.5 The battery used in the circuit has an internal resistance of 0,6 Ω and emf of 12 V. Ignore the resistance of the connecting wires.



8.5.1 Define the term *emf*. (2)

8.5.2 With switch **S** closed, calculate the current that flows through the 5 Ω resistor. (6)

8.5.3 Determine voltmeter reading. (3)

8.6 Switch **S** is now opened.

8.6.1 Will the the voltmeter reading (V), INCREASE, DECREASE or REMAINS THE SAME? (1)

8.6.2 Briefly explain the answer to QUESTION 8.5.1. (3)
[25]

TOTAL: 150

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DATA FOR PHYSICAL SCIENCES GRADE 11
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} $N \cdot m^2 \cdot kg^{-2}$
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 se 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
Radius of the Earth	R_E	6,38 x 10^6 m
Mass of the Earth	M_e	5,98 x 10^{24} kg

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = G\frac{M}{R^2}$
$\mu_k = \frac{f_k}{N}$	$\mu_s = \frac{f_{s(max)}}{N}$

ELECTROSTATICS

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

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ELECTROMAGNETISM

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

ELECTRIC CIRCUITS

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

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PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 11

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

NOVEMBER 2026

MARKING GUIDELINES/*NASIENRIGLYNE*
CORRECTED (FINAL)

MARKS/*PUNTE*: 150

This marking guidelines consists of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

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QUESTION 1/*VRAAG 1*

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 B ✓✓ (2)

1.7 A ✓✓ (2)

1.8 B ✓✓ (2)

1.9 B ✓✓ (2)

1.10 C ✓✓ (2)

[20]

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QUESTION 2/*VRAAG 2*

2.1 A single vector having the same effect as two or more vectors added together. ✓✓

or

The vector sum of two or more vectors.

'n Enkele vektor wat dieselfde effek het as twee of meer vektore tesame.

of

die vektorsom van twee of meer vektore. (2)

2.2 Horizontal component of/ *horisontale komponent van* $\mathbf{F_2}$.

$F_{2x} = F_2 \cos \Theta$ $F_{2x} = 18 \cos 35^\circ$ ✓ $\therefore F_{2x} = 14{,}74$ N ✓ (Right/*regs*)	OR	$F_{2x} = F_2 \sin \Theta$ $F_{2x} = 18 \sin 55^\circ$ $\therefore F_{2x} = 14{,}74$ N (Right/*regs*)

(2)

2.3

Positive marking from/*positiewe nasien vanaf* 2.2.		
OPTION 1/*OPSIE 1*		
Left as Positive/*Links as positief* $F_{Rx} = F_{2x} + F_{3x}$ $F_{Rx} = \underline{(-14{,}74) + (20)}$ ✓ $\therefore F_{Rx} = 5{,}26$ N (Left/*links*) $F_R^2 = F_{Rx}^2 + F_{Ry}^2$ $\underline{(15)^2 = (5{,}26)^2}$ ✓$+ F_{RY}^2$ $\therefore F_{RY} = 14{,}0475$ N ✓		Right as Positive/*regs as positief* $F_{Rx} = F_{2x} + F_{3x}$ $F_{Rx} = \underline{(14{,}74) + (-20)}$ $F_{Rx} = -5{,}26$ N $\therefore F_{Rx} = 5{,}26$ N (Left/*links*) $F_R^2 = F_{Rx}^2 + F_{Ry}^2$ $\underline{(15)^2 = (-5{,}26)^2} + F_{RY}^2$ $\therefore F_{RY} = 14{,}0475$ N
$F_{2Y} = F_2 \sin \Theta$ $F_{2Y} = 18 \sin 35^\circ$ $\therefore F_{2Y} = 10{,}32$ N ✓ (Downwards/*afwaarts*)	OR	$F_{2Y} = F_2 \cos \Theta$ $F_{2Y} = 18 \cos 55^\circ$ $\therefore F_{2Y} = 10{,}32$ N (Downwards/*afwaarts*)

$F_{RY} = F_1 + F_{2Y}$
$14{,}0475 = F_1 + (-10{,}32)$
$\therefore F_1 = 24{,}37$ N ✓ (upwards/*opwaarts*)

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OPTION 2/*OPSIE 2*

$R_x = \underline{14,74 - 20}$ ✓
$R_x = -5,26$ N
$\therefore R_x = 5,26$ N (Left/*links*)

$r^2 = x^2 + y^2$
$\underline{(15)^2 = (5,26)^2}$ ✓ $+ R_Y^2$
$R_Y = 14,0475$ N ✓

$R_Y = F_1 - F_{2Y}$
$14,0475 = F_1 - \underline{18 \sin 35^\circ}$ ✓
$F_1 = 24,37$ N ✓

OPTION 3/*OPSIE 3*

$F_{RY} = 15 \cos 50^\circ$ ✓ or $F_{RY} = 15 \cos 310^\circ$
$F_{RY} = 9,64$ N✓ (upwards/*opwaarts*)

$F_{2Y} = 18 \sin 35^\circ$ ✓
$F_{2Y} = 10,32$ N (Downwards/*afwaarts*)

$F_{RY} = F_1 + F_{2Y}$
$9,64 = F_1 + (-10,32)$ ✓
$\therefore F_1 = 19,96$ N ✓ (upwards/*opwaarts*)

(5)

2.4.1 Net/ resultant force acting on the object is ZERO/ $F_{net} = 0$ ✓
Netto/resultante krag wat op voorwerp inwerk is NUL/$F_{net} = 0$ (1)

2.4.2 $Q_x = R_x$
$Q \sin 40^\circ = 90 \sin 40^\circ$ ✓
$Q = 90$ N ✓

Or/*Of*

$T_{Qx} + T_{Rx} = 0$
$-Q \cos 50^\circ + 90 \cos 50^\circ = 0$ ✓
$Q = 90$ N ✓

Accept/*Aanvaar :* Q = 90 N ✓✓ (2)

2.4.3 **Positive marking from/*Positiewe nasien vanaf* 2.4.2.**

OPTION 1/*OPSIE 1*

$w = R_y + Q_Y$
$w = \underline{90 \cos 40^\circ + 90 \cos 40^\circ}$ ✓
$w = 137,89$ N

$w = mg$ ✓
$137,89 = \underline{m \times 9,8}$ ✓
$\therefore m = 14,07$ kg ✓

OPTION 2/*OPSIE 2*

$T_{QY} + T_{RY} + mg = 0$ ✓
$\underline{90 \sin 50^\circ + 90 \sin 50^\circ}$ ✓$-$
$\underline{9,8m}$ ✓ $= 0$
$m = 14,07$ kg ✓

Option 3/*OPSIE 3*

$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{Fg}{\sin 100^\circ} = \frac{90}{\sin 40^\circ}$ ✓

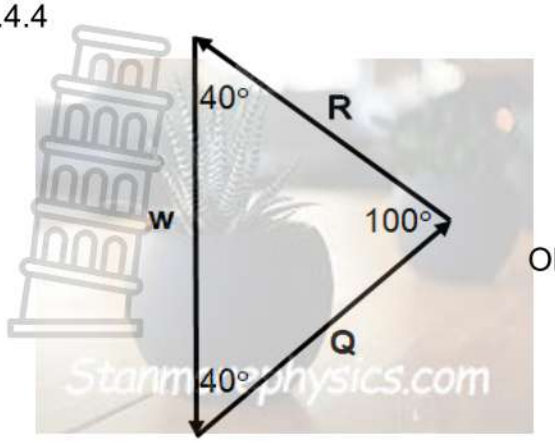
$Fg = 137,89$ N

$Fg = mg$ ✓
$137,89 = \underline{m \times 9,8}$ ✓
$\therefore m = 14,07$ kg ✓

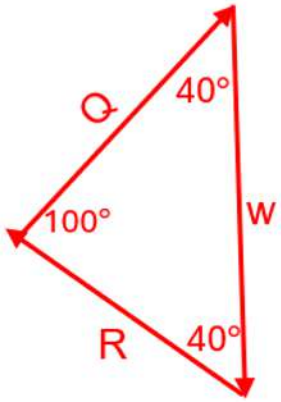
(4)

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2.4.4



OR



Marking criteria/*Nasienkriteria*		
•	All three force vectors join tail-to head (closed triangle shape)/*Al drie kragte vektore verbind kop-tot-stert (geslote driehoek).*	✓
•	Labels on all forces. /Byskrifte vir al die kragte.	✓
•	Relevant angles indicated/*Relevante hoeke aangetoon.* Minimum of 2 angles	✓
•	Correct relative directions/*Korrekte relatiewe rigtings.*	✓
•	**Notes** If arrows are omitted, deduct one mark. *Indien pylpunte uitgelaat is, trek een punt af.*	

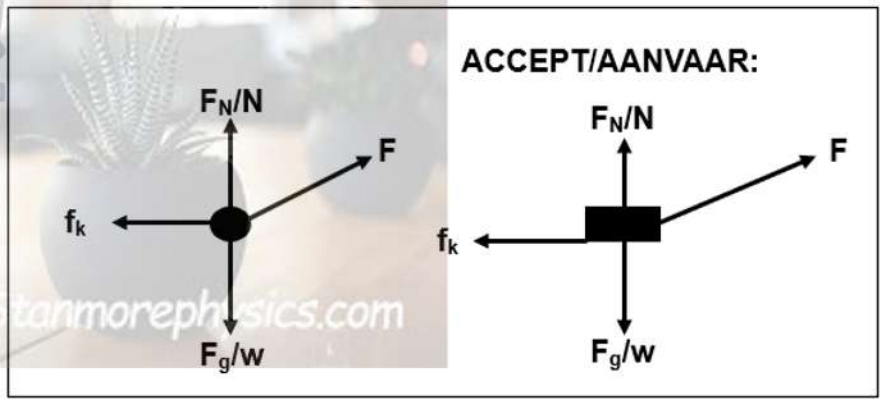
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QUESTION 3/*VRAAG 3*

3.1 The resistance of an object to any change in its state of motion.✓✓
Die weerstand van 'n voorwerp teen enige verandering in sy toestand van beweging. (2 or 0) (2)

3.2



Accepted Labels/*Aanvaarde byskrifte*		**Mark/*Punt***
F_g /w	Weight/GravitationalForce/*Gewig/ Gravitasiekrag*	✓
F_N/N	Normal force/*Normaalkrag* F_N	✓
F	F_a / Applied force/*Toegepaste krag* 60 N	✓
f_k	(kinetic)friction/(*kinetiese) wrywingskrag*/F_f /f	✓
Notes:		
•	Mark is awarded for label and arrow/*Punt toegeken vir byskrif en pyltjie.*	
•	Do not penalise for length of arrows/*Moet nie penaliseer vir lengte van pyle nie*.	
•	If arrows do not touch the dot/I*ndien pylpunte nie kolletjie raak nie*: *Max/Maks* $^3/_4$	
•	Any other additional force (s)/*Enige addisionele kragte*: *Max/Maks* $^3/_4$	
•	If everything is correct but no arrows/*Indien alles korrek maar geen pyltjies*: *Max/Maks* $^3/_4$	

(4)

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3.3.1 $F_{net} = ma$
$F_{net} = 0$
$F_X - f_k = ma$
$F_X = f_k$
Any one/*Enige een* ✓

$\underline{60 \cos 40°}$ ✓ $- f_k = 0$
$\therefore f_k = 45,96$ N✓ (3)

3.3.2 $N = w - Fy$
$N = \underline{(8)(9,8)}$ ✓ $- \underline{60 \sin 40°}$ ✓
$\therefore N = 39,83$ N ✓ (3)

3.4 Decreases/*Afneem*✓ (1)

3.5
- Normal force decreases/*Normaalkrag neem af*✓
- Frictional force is proportional to the normal force/ *Wrywingskrag is direk eweredig aan die normaalkrag* $f \propto N$.✓

NOTE: allocate mark even if learner wrote directly proportional (only in 2026 Grade 11 final exam)/*LET WEL: Ken punt al het leerder direk eweredig geskryf*



(2)
[15]

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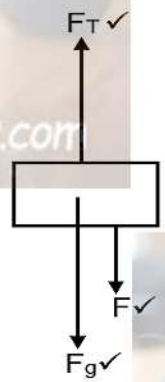
QUESTION 4/*VRAAG 4*

4.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force. The acceleration is directly proportional to the resultant/net 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.

Marking criteria/Nasienkriteria
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** uitgelaat is, trek 1 punt af.*

(2)

4.2



Accepted Labels/*Aanvaarde byskrifte*		**Mark/*Punt***
F_g	F_W/w/weight/gravitational force/*gewig/gravitasiekrag*	✓
F	F_a/F_{app}/F_A/10 N /applied force/*Toegepaste krag/*	✓
T	F_T/Tension/*Spanning*	✓
NOTES/NOTA'S		
•	Mark is awarded for label,arrow and the origin of the force./*Punt toegeken vir byskrif en pyltjie.*	
•	Do not penalise for length of arrows./*Moet nie penaliseer vir lengte van pyle nie*.	
•	Any other additional force(s)/*Enige addisionele krag(te)*: Max/*Maks* $^2/_3$	
•	If everything is correct, but no arrows/*Indien alles korrek maar geen pyltjies*: Max/*Maks* $^2/_3$	
•	If free-body diagram drawn: max $^2/_3$	
•	If force/s do not originate from point of application: $^2/_3$	

(3)

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4.3.1 $F_{net} = ma$
$F_g + F - T = ma$ } any one/*enige een* ✓
$(6)(9,8) + 10 - T$ ✓ $= (6)(1,5)$ ✓
$\therefore$ T = 59,8 N ✓ (4)

4.3.2 **Positive marking from/*Positiewe nasien vanaf* 4.3.1.**
$F_{net} = ma$
$T - F_g = ma$
$59,8 - (m)(9,8)$ ✓ $= (m)(1,5)$ ✓
$\therefore$ m = 5,29 kg ✓ (3)

4.4 Decrease/ *Afneem* ✓
Frictional force opposes motion, reducing the net force/ *Wrywingskrag werk beweging teen, en verminder die netto krag.* ✓
$a \propto F_{net}$ ✓ (3)
[15]

QUESTION 5/ VRAAG 5

5.1 **Marking criteria/Nasienkriteria**
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** uitgelaat is, trek 1 punt af.*

Each particle in the universe attracts every other particle with a force that 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 direk eweredig aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte.

NOTE:
If reference to charges / *If the word FORCE in context omitted* $^0/_2$
NOTA: Indien verwys na lading / *Indien die woord KRAG uitgelaat is* $^0/_2$ (2)

5.2 $F = \frac{Gm_1m_2}{r^2}$

$3,71 \times 10^6$ ✓ $= \frac{(6,67\times10^{-11})(4,2 \times 10^5)(5,98 \times 10^{24})}{(r)^2}$ ✓

$r = 6,72 \times 10^6$ m ✓ (3)

5.3 $h = r - r_e$
$h = 6,72 \times 10^6 - 6,38 \times 10^6$ ✓
$h = 3,4 \times 10^2$ km ✓(340 km) (2)

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5.4 $F_g = mg$
$784 = (m)(9,8)$ ✓
$m = 80$ kg ✓ (2)

5.5 $F_{net} = ma$
$F_{net} = \underline{(4,2 \times 10^5)(0,4)}$ ✓
$F_{net} = 1,68 \times 10^5$ N upwards/*opwaarts*

$F_a = F_{net} + F_g$ ✓
$F_a = \underline{(1,68 \times 10^5) + (3,71 \times 10^6)}$ ✓
$F_a = 3,88 \times 10^6$ N ✓ away from Earth ✓/ *Weg van die aarde af* (5)

5.6.1 Decreases/ *Afneem* ✓ (1)

5.6.2 The gravitational force decreases as the satellite moves away from the earth/ *Die gravitasiekrag neem af soos die satellite weg van die aarde af beweeg.* ✓

Or/ *Of*

The distance between the centre of the earth and the ISS increases/ *Die afstand tussen die middelpunt van die aarde en die ISS vergroot.*
According to the equation/ Volgens die vergelyking:
$F = \frac{Gm_1m_2}{r^2}$, $F \propto \frac{1}{r^2}$ ✓ (2)
[17]

QUESTION 6/*VRAAG 6*

6.1.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is <u>directly proportional to the product of the magnitudes of the charges</u> ✓, and <u>inversely proportional to the square of the distance between them</u>. ✓
Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is <u>direk eweredig aan die produk van die groottes van die ladings</u> en <u>omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.</u>

Marking criteria/Nasienkriteria
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** uitgelaat is, trek 1 punt af.*

NOTE:
If reference to masses / *If the word FORCE in context omitted* $^0/_2$
NOTA: Indien verwys na lading / *Indien die woord KRAG uitgelaat is* $^0/_2$ (2)

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6.1.2



(3)

6.1.3 $n = \frac{Q}{q_e}$ ✓

$n = \frac{6,0 \times 10^{-9}}{1,6 \times 10^{-19}}$ ✓

$n = 3,75 \times 10^{10}$ (electrons/*elektrone*) ✓

(3)

6.1.4 **OPTION 1/*OPSIE 1***

$F_{net} = 0$

$F_{net} = ma$

$T - w - F_E = ma$

$T - w - \frac{kQ_1Q_2}{r^2}$ ✓ $= ma$

$T - \underline{(0,006)\ (9,8)}$ ✓ $- \frac{(9,0 \times 10^9)(6,0 \times 10^{-9})(3,0 \times 10^{-9})}{(0,04)^2}$ ✓ $= 0$

$T = 0,059$ N ✓

OPTION 2/*OPSIE 2*

$F_{21} = \frac{kQ_1Q_2}{r^2}$ ✓

$F_{21} = \frac{(9,0 \times 10^9)(6,0 \times 10^{-9})(3,0 \times 10^{-9})}{(4 \times 10^{-2})^2}$ ✓ ✓

$F_{21} = 1,0125 \times 10^{-4}$ N

$F_{net} = 0$

$T = 1,0125 \times 10^{-4} - \underline{(6,0 \times 10^{-3} \times 9,8)}$ ✓

$T = 5,89 \times 10^{-2}$ N ✓

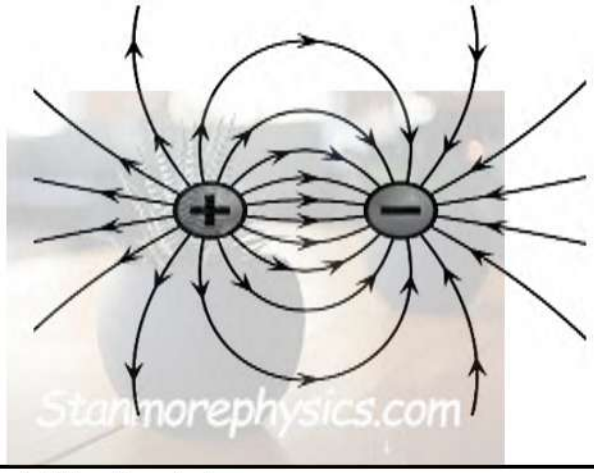
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6.2.1 The electrostatic force experienced per unit positive charge placed at that point. ✓✓
Die elektrostatiese krag wat per eenheidspositiewe-lading *wat by daardie punt geplaas is, ondervind word.* (2)

6.2.2



Marking criteria/*Nasienriglyne*	**Mark/Punt**
Correct direction of field lines/ *Korrekte rigting van veldlyne*.	✓
Correct shape of the electric field lines between charges and on the outside of the charges/ *Korrekte vorm van die elektriese veldlyne binne en buite die ladings*.	✓
No field lines crossing each other. Field lines must touch the charge, but not go inside the charge/ *Geen veldlyne mag mekaar kruis nie. Veldlyne moet die lading raak, maar ook nie in lading gaan nie*.	✓
Note/*Nota:* If learner draws field pattern of two like charges/ I*ndien leerder veld van twee gelyksoortige ladings teken*: $^1/_3$ If only one charge is drawn/ *Indien slegs een lading geteken word*: $^0/_3$	

(3)

6.2.3 $E_1 = \frac{kQ}{r^2}$ ✓

$E_1 = \frac{(9 \times 10^9)(50 \times 10^{-6})}{(0,35)^2}$ ✓

$E_1 = 3,67 \times 10^6$ N·C^{-1} to the right/*na regs*

$E_2 = \frac{(9 \times 10^9)(20 \times 10^{-6})}{(0,15)^2}$ ✓

$E_2 = 8,00 \times 10^6$ N·C^{-1} to the left/*na links*

$E_{net} = E_2 - E_1$
$E_{net} = 8,00 \times 10^6 - 3,67 \times 10^6$ ✓
$E_{net} = 4,33 \times 106$ ✓ N·C^{-1} to the left/*na links* ✓

(6)
[24]

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QUESTION 7/*VRAAG 7*

7.1 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 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)

7.2 $\varepsilon = -\frac{N\Delta\Phi}{\Delta t}$ ✓
$5 = -\frac{250\Delta\Phi}{0,10}$ ✓
$\Delta\Phi = -2,0 \times 10^{-3}$ Wb ✓ (3)

7.3 **POSITIVE MARKING FROM QUESTION 7.2/*POSITIEWE NASIEN VANAF VRAAG 7.2***

$\Delta\Phi = BA\cos\theta$ ✓
$\underline{2,0 \times 10^{-3}}$ ✓ $= B\underline{(2,5 \times 10^{-3})}$✓$\underline{(\cos 60° - \cos 0°)}$ ✓
$B = 1,6$ T ✓

($A = 0,0025/2,5 \times 10^{-3}$ m^2) (4)

7.4 Increase/ *Toeneem* ✓ (1)

7.5 • $\varepsilon \propto \frac{1}{\Delta t}$ / Emf is inversely proportional to time/*EMK omgekeerd eweredig aan tyd.* ✓
• Rotational time decreases/ Δt decreases/ *Rotasietyd verminder/ Δt verlaag* ✓ (2)

7.6.1 North/*Noord* ✓ (1)

7.6.2 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF* 7.6.1.**

From A to B/ *van A na B* ✓ (1)
[14]

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QUESTION 8/*VRAAG 8*

8.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓ (2 or 0)

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2)

8.2 Ohmic conductor/ *Ohmiese geleier*✓
The graph is a straight line through the origin ✓,indicating that, the current is directly proportional to the potential difference across the conductor.✓
Die grafiek is 'n reguitlyn deur die oorsprong, wat aandui dat die stroom direk eweredig is aan die potensiaalverskil oor die geleier. (3)

8.3.1 Current (I)/ *Stroom* ✓ (1)

8.3.2 **ANY ONE/ENIGE EEN**
- Temperature/*Temperatuur* ✓
- Length of conductor/*Lengte van geleier*
- Material/ type of conductor/ *Materiaal/ Tipe geleier* (1)

8.3.3 Gradient/*Gradiënt* = $\frac{\Delta Y}{\Delta X}$
Gradient/*Gradiënt* = $\frac{\Delta I}{\Delta V}$
Gradient/*Gradiënt* = $\frac{0,6-0,2\ ✓}{2,5-0,85✓}$
Gradient/*Gradiënt* = 0,24 ✓ (Ω^{-1})

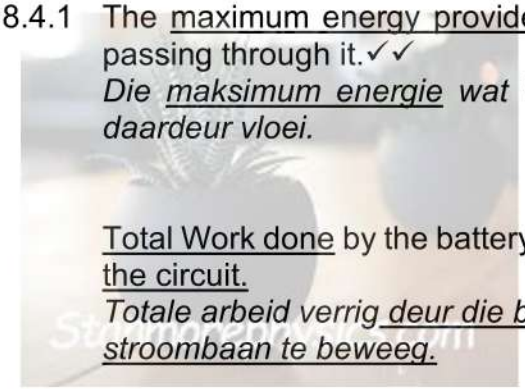


(3)

8.4.1 The maximum energy provided by a battery per coulomb/unit charge passing through it.✓✓
Die maksimum energie wat 'n battery lewer per eenheidslading wat daardeur vloei.

OR/*OF*

Total Work done by the battery to move a unit coulomb of charge across the circuit.
Totale arbeid verrig deur die battery om 'n een coulomb lading deur die stroombaan te beweeg.



Marking criteria/Nasienkriteria
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** uitgelaat is, trek 1 punt af.*

(2)

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8.4.2

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $\frac{1}{R_P} = \frac{1}{10} + \frac{1}{11+17}$ ✓ $R_P = 7,37\ \Omega$ $R_{ext/ekst} = 7,37 + \underline{5}$ ✓ $R_{ext/ekst} = 12,37\ \Omega$ $\varepsilon = I(R + r)$ ✓ $12 = I\ (12,37 + 0,6)$ ✓ $I = 0,93\ A$ ✓	$R_p = \frac{R_1R_2}{R_1+R_2}$ ✓ $R_p = \frac{10 \times 28}{10+28}$ ✓ $R_p = 7,37\ \Omega$ $R_{ext/ekst} = 7,37 + \underline{5}$ ✓ $R_{ext/ekst} = 12,37\ \Omega$ $\varepsilon = I(R + r)$ ✓ $12 = I(12,37 + 0,6)$ ✓ $I = 0,93\ A$ ✓

(6)

8.4.3 **POSITIVE MARKING FROM QUESTION 8.5.2/*POSITIEWE NASIEN VANAF VRAAG* 8.5.2.**

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$V = IR$ ✓ $V = \underline{(0,93)\ (12,37)}$ ✓ $V = 11,50\ V$ ✓	$V_{int} = Ir$ ✓ $V_{int} = \underline{(0,93)(0,6)}$ ✓ $V_{int} = 0,558\ V$ $\varepsilon = I(R + r)$ $12 = V_{ext/eks} + 0,558$ $V_{ext/eks} = 11,44\ V$
OPTION 3/OPSIE 3	
$V_{ext/eks} = V_s + V_p$ ✓ $V_{ext/eks} = IR_s + IR_p$ $V_{ext/eks} = \underline{(0,93)\ (5) + (0,93)\ (7,37)}$ ✓ $V_{ext/eks} = 11,50\ V$ ✓	

(3)

8.5.1 Increases/ *Verhoog* ✓ (1)

8.5.2 The total resistance of the circuit increases/*Die totale weerstand in die stroombaan verhoog* ✓
The total current decreases/*Die totale stroom neem af* ✓
V_{int} / V_{lost} decreases/V_{int}/$V_{verlore}$ *neem* af ✓
V_{ext} increases, since emf is constant/V_{ekst} *verhoog want emk bly konstant.* (3)
[25]

TOTAL/*TOTAAL*: 150

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