



Province of the  
**EASTERN CAPE**  
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo  
Provinsie van die Oos Kaap: Departement van Onderwys  
Porafensie Ya Kapa Botjhabeta: Lefapha la Thuto

# NATIONAL SENIOR CERTIFICATE



**GRADE 11**

## NOVEMBER 2025

# PHYSICAL SCIENCES P1

**MARKS 150**

**TIME: 3 hours**



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This question paper consists of 17 pages including 2 data sheets.

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**INSTRUCTIONS AND INFORMATION**

1. Write your full NAME and SURNAME in the appropriate space in the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, et cetera where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page in the ANSWER BOOK.
11. All diagrams are NOT necessarily drawn according to scale.
12. Write neatly and legibly.



**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

Various options are provided as answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in your ANSWER BOOK, for example, 1.11D.

- 1.1 Vector **B** and vector **–B** are acting on the same point **X**. The angle between the two vectors is ...

A 180°.  
B 90°.  
C 0°.  
D 270°.

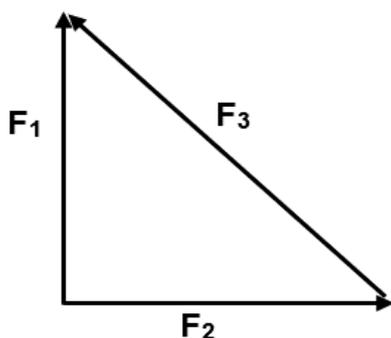
(2)

- 1.2 Two forces, **F<sub>1</sub>** and **F<sub>2</sub>**, act on a point. If **F<sub>1</sub>** and **F<sub>2</sub>** act in the same direction, the maximum resultant has a magnitude of 13 N. If forces **F<sub>1</sub>** and **F<sub>2</sub>** act in opposite directions the magnitude of the minimum resultant force is 7 N. The magnitude of the two forces, in newton, is ...

A 10 and 5.  
B 16 and 10.  
C 3 and 10.  
D 8 and 5.

(2)

- 1.3 In the vector diagram below, the resultant (net) vector is ...



A Zero.  
B **F<sub>1</sub>**.  
C **F<sub>3</sub>**.  
D **F<sub>2</sub>**.

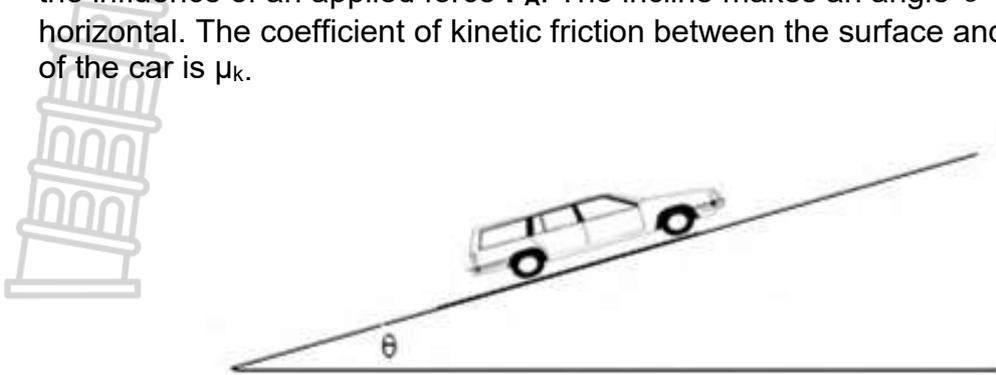
(2)

- 1.4 A boy, who is standing in a lift, observes a 20 N mass piece suspended from a spring balance fixed to the roof of the lift. He sees that the reading on the spring balance is less than 20 N for a short interval. The CORRECT description for the motion of the lift during this short interval is that the lift is ...

A accelerating upwards  
B not moving  
C accelerating downwards  
D moving at a constant velocity

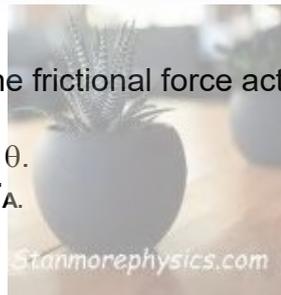
(2)

- 1.5 A car of mass  $m$  moving up a rough incline at a constant acceleration,  $a$ , under the influence of an applied force  $F_A$ . The incline makes an angle  $\theta$  with the horizontal. The coefficient of kinetic friction between the surface and the wheels of the car is  $\mu_k$ .



The magnitude of the frictional force acting on the car, can be calculated as ...

- A  $F_A - \mu_k mg \cos \theta$ .
- B  $\mu_k mg \sin \theta - F_A$ .
- C  $\mu_k mg \sin \theta$ .
- D  $\mu_k mg \cos \theta$ .



(2)

- 1.6 The gravitational force which the earth exerts on the moon is ...

- A directly proportional to the distance between their centers.
- B inversely proportional to the mass of the moon.
- C inversely proportional to the product of the mass of the moon and the mass of the earth.
- D inversely proportional to the square of the distance between their centers.

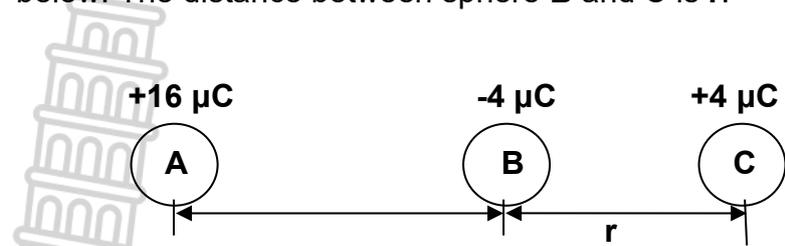
(2)

- 1.7 The centers of two identical metallic spheres, each carrying a charge  $Q$ , are a distance  $r$  apart. Which ONE of the following pairs of changes (made simultaneously) will double the electrostatic force that one charged sphere exerts on the other?

	DISTANCE BETWEEN CENTERS OF SPHERES	MAGNITUDE OF CHARGES
A	decrease the distance to $\frac{r}{2}$	double the charges on both spheres
B	decrease the distance to $\frac{r}{2}$	reduce the charge on one sphere to $\frac{Q}{2}$
C	decrease the distance to $\frac{r}{\sqrt{2}}$	reduce the charges on both spheres to $\frac{Q}{2}$
D	decrease the distance to $\frac{r}{\sqrt{2}}$	double the charges on both spheres

(2)

1.8 Three small identical spheres, **A**, **B** and **C** is charged as shown in the diagram below. The distance between sphere **B** and **C** is  $r$ .



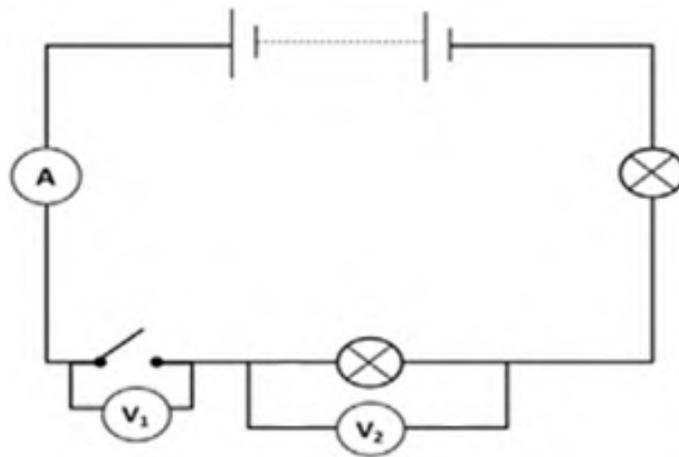
For sphere **B** to experience no resultant electrostatic force, the distance between **A** and **B** must be ...

- A  $\frac{1}{4} r$ .
- B  $\frac{1}{2} r$ .
- C  $2 r$ .
- D  $4 r$ .



(2)

1.9 The battery in the circuit diagram below has a potential difference of 12 V and negligible internal resistance. Two voltmeters,  $V_1$  and  $V_2$ , are connected to the circuit, as shown in the diagram below.

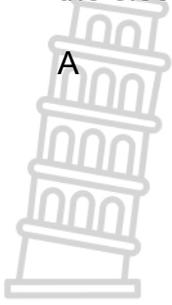


When the switch is open, the CORRECT readings on  $V_1$  and  $V_2$  will be as follows:

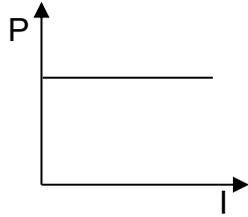
	$V_1$	$V_2$
A	12 V	12 V
B	0 V	12 V
C	12 V	0 V
D	0 V	0 V

(2)

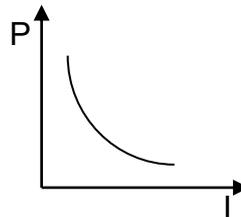
1.10 Which ONE of the following graphs best represents the relationship between the electrical power and the current in a given Ohmic conductor?



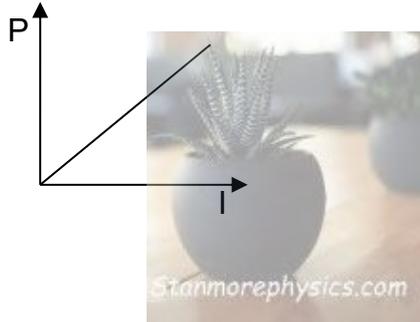
A



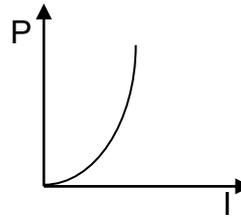
C



B



D

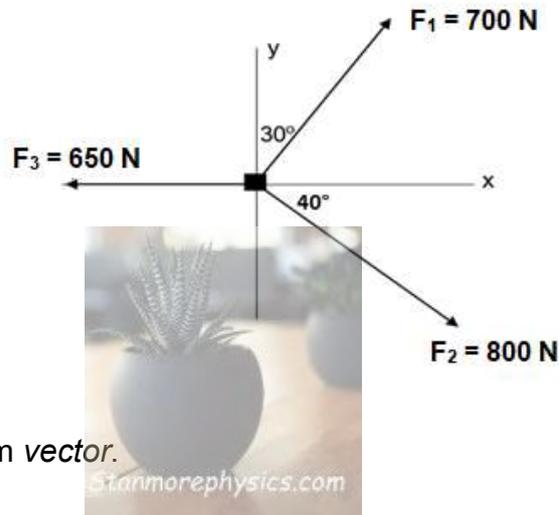


(2)  
[20]



**QUESTION 2 (Start on a new page.)**

Three forces,  $F_1$ ,  $F_2$  and  $F_3$ , NOT DRAWN TO SCALE, are applied to a crate of 25 kg as shown in the diagram below.

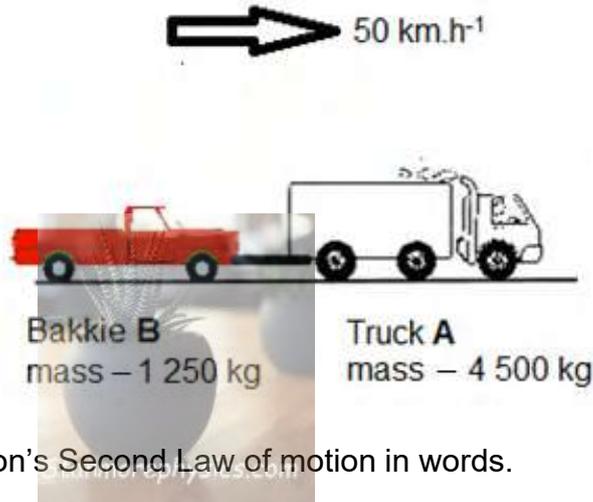


- 2.1 Define the term *vector*. (2)
- 2.2 Calculate the:
- 2.2.1 Magnitude and direction of the resultant of the three forces (9)
- 2.2.2 Magnitude of the gravitational force acting on the crate (2)
- 2.3 Explain why the three forces will not form a closed vector diagram. (2)
- [15]**



**QUESTION 3 (Start on a new page.)**

Truck **A**, of mass 4 500 kg travels at a CONSTANT VELOCITY while towing bakkie **B**, of mass 1 250 kg. The engine of truck **A** produces a force of 11 270 N. The road surface exerts a frictional force of 8 820 N on truck **A**.



- 3.1 Write down Newton's Second Law of motion in words. (2)
- 3.2 Calculate the:
- 3.2.1 Coefficient of kinetic friction for the road surface (3)
- 3.2.2 Frictional force exerted by the road on bakkie **B** (3)
- 3.2.3 Magnitude tension in the tow rope (3)
- [11]**



**QUESTION 4 (Start on a new page.)**

A boy pulls a 10 kg block, that is attached to a 5 kg block by a light, inextensible string of negligible mass, with a force of 50 N at an angle of  $30^\circ$  with the horizontal as shown in the diagram below. The coefficient of kinetic friction between the surface and the 10 kg block is 0,18. The 5 kg block experiences a kinetic frictional force of 9 N.

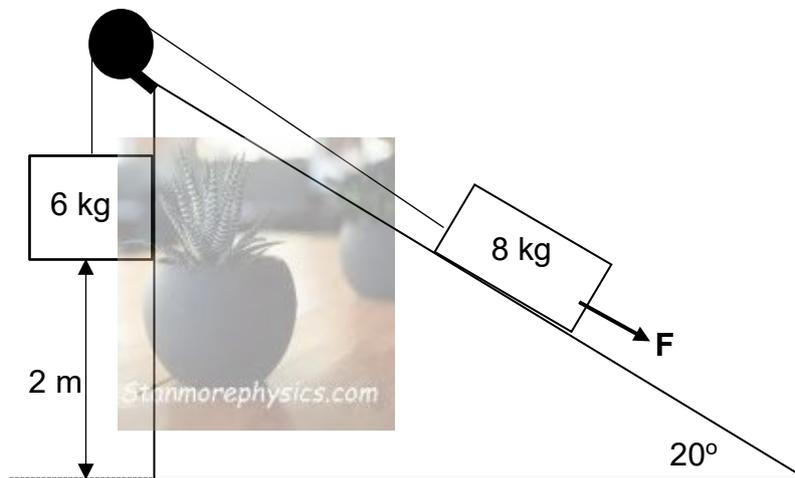


- 4.1 Define *kinetic frictional force* in words. (2)
- 4.2 Draw a labelled free body diagram showing all the forces acting on the 10 kg block. (5)
- 4.3 Calculate the magnitude of the:
- 4.3.1 Normal force exerted on the 10 kg block (3)
- 4.3.2 Acceleration of the blocks (7)
- 4.4 How will the magnitude of the normal force calculated in QUESTION 4.3.1 be affected if the angle between the applied force and the horizontal decreases?  
Choose from INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (3)
- 4.5 Use PHYSICS PRINCIPLES to explain why it is very dangerous when children are not secured in a child's car seat when travelling in a car. (3)

**[23]**

**QUESTION 5 (Start on a new page.)**

A block of mass 8 kg is held at rest on a rough inclined plane which makes an angle of  $20^\circ$  with the horizontal by a force  $F$  that acts down the inclined plane. The block is connected by a light inextensible string which passes over a light frictionless pulley to another block of mass 6 kg. The 6 kg block hangs vertically at 2 m above the ground as shown in the diagram below.



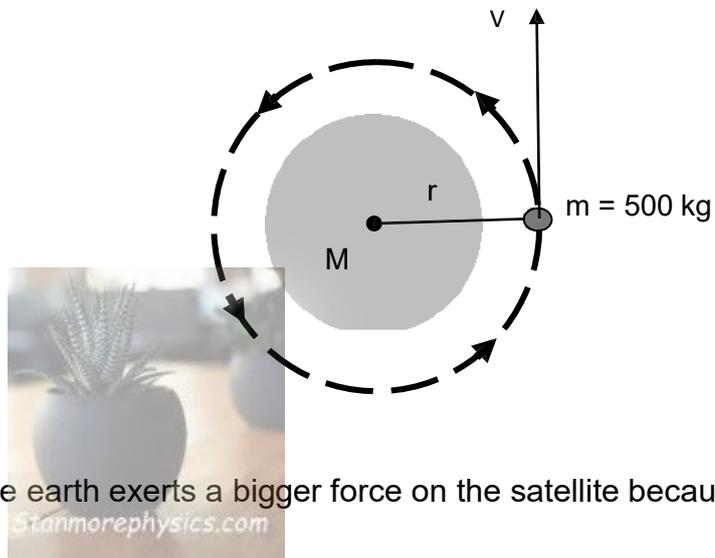
The coefficient of kinetic friction between the 8 kg block and the surface of the inclined plane is 0,25. Ignore the effects of air friction.

- 5.1 State Newton's first law in words. (2)
- 5.2 Draw a free-body diagram showing ALL the forces acting on the 6 kg block before motion. (2)
- 5.3 Calculate the magnitude of:
  - 5.3.1 The frictional force acting on the 8 kg block. (3)
  - 5.3.2 Force  $F$ , that will keep the blocks at rest. (5)
- 5.4 The force  $F$  is now removed, and the blocks accelerate at  $2,6 \text{ m}\cdot\text{s}^{-2}$ . Calculate the speed with which the 6 kg block will strike the ground. (3)

**[15]**

**QUESTION 6 (Start on a new page.)**

A satellite of mass 500 kg orbits the earth as shown in the diagram below. The earth exerts a force of 250 N on the satellite.



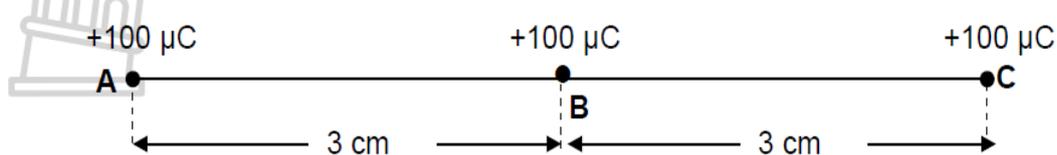
A learner argues that the earth exerts a bigger force on the satellite because it has a larger mass.

- 6.1 Name and state the law that you can use to clarify the learner's misconception. (3)
  - 6.2 Calculate the distance of the satellite above the surface of the earth. (5)
- [8]**



**QUESTION 7 (Start on a new page.)**

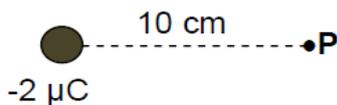
Three identical point charges **A**, **B** and **C**, all of magnitude  $+100 \mu\text{C}$ , are equally spaced on a straight line in a vacuum. The charges are a distance of 3 cm from each other as shown in the diagram below.



7.1 Write down Coulomb's Law in words. (2)

7.2 Calculate the net electrostatic force experienced by point charge **C** due to charge **A** and **B**. (6)

7.3 A negative charge of  $-2 \mu\text{C}$  is positioned 10 cm from point **P**, as shown in the diagram below.



7.3.1 Define *electric field at point* in words. (2)

7.3.2 Draw an electric field pattern around with the  $-2 \mu\text{C}$  charge. (2)

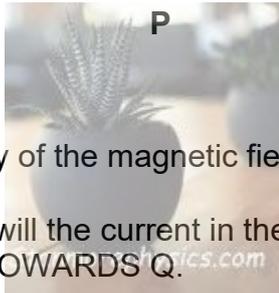
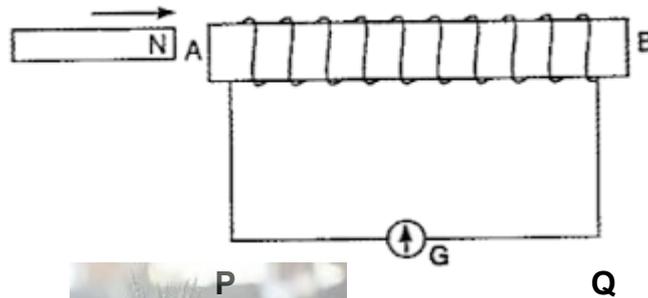
7.3.3 Calculate the electric field strength at point **P**. (3)

**[15]**



**QUESTION 8 (Start on a new page.)**

The north pole of a magnet is pushed into a solenoid as shown in the diagram below.



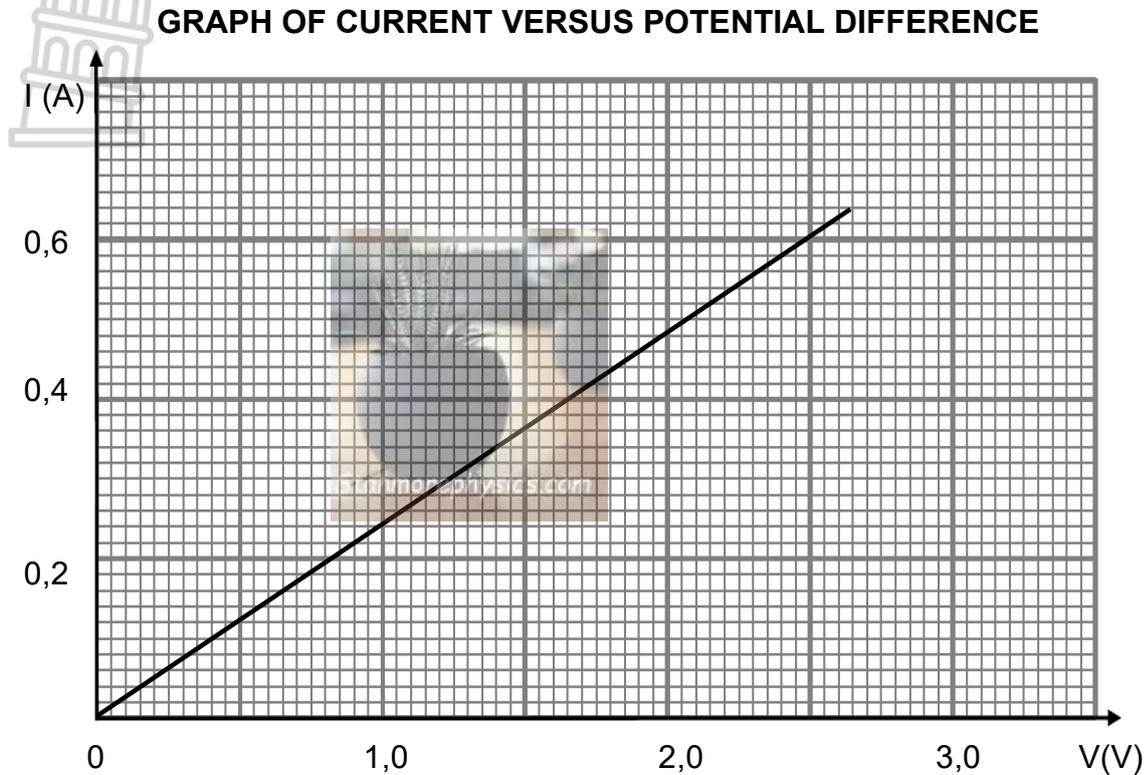
- 8.1 What is the polarity of the magnetic field of the solenoid at point **A**? (2)
  - 8.2 In which direction will the current in the galvanometer deflect? Write down TOWARDS P or TOWARDS Q. (2)
  - 8.3 A coil with 350 turns has an area of 0,08 m<sup>2</sup>. It is held with its axis coinciding with the direction of a magnetic field of strength 0,6 T. In order to induce an emf in the coil, it is pulled out of the magnetic field in 0,25 seconds.
    - 8.3.1 State Faraday's law of electromagnetic induction. (2)
    - 8.3.2 Mention TWO ways in which the magnitude of the induced emf can be increased. (2)
- Calculate the:
- 8.3.3 Magnetic flux linkage (3)
  - 8.3.4 Magnitude of the induced emf (3)

**[14]**



**QUESTION 9 (Start on a new page.)**

Learners investigate the relationship between current in a conductor and the potential differences across the ends of the conductor. The graph below is obtained from their investigation.

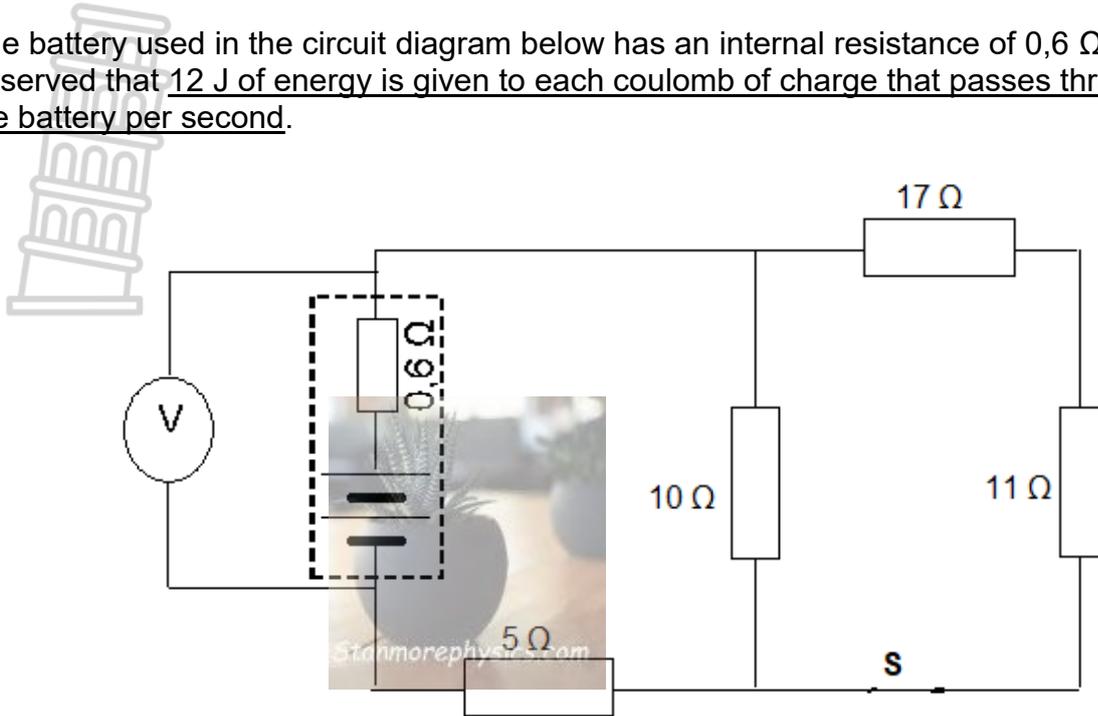


- 9.1 Is the conductor ohmic or non-ohmic? Explain the answer. (3)
- 9.2 Write down the:
- 9.2.1 Dependant variable for this investigation (1)
- 9.2.2 Control variables for this investigation (2)
- 9.3 The learners intend to use the conductor to construct an electric heater that should be rated 150 W and draw a maximum current of 6 A.
- 9.3.1 Calculate the gradient of the above graph. (3)
- 9.3.2 Use a calculation to motivate whether this conductor is suitable to be used for this electric heater. (6)

**[15]**

**QUESTION 10 (Start on a new page.)**

The battery used in the circuit diagram below has an internal resistance of  $0,6 \Omega$ . It is observed that 12 J of energy is given to each coulomb of charge that passes through the battery per second.



The resistance of the connecting wires can be ignored.

- 10.1 Write down the term that is used to describe the underlined words. (1)
- 10.2 Calculate the current that flows through the  $5 \Omega$  resistor. (6)
- 10.3 Determine the reading on the voltmeter. (3)

Switch S is now opened.

- 10.4 Will the reading on the voltmeter, V, INCREASE, DECREASE or REMAIN THE SAME. (1)
- 10.5 Briefly explain the answer to QUESTION 10.4. (3)

**[14]**

**TOTAL: 150**



**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 / <i>Swaartekragversnelling</i>	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Universal gravitational constant / <i>Universelegravitasiekonstant</i>	G	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Speed of light in a vacuum / <i>Spoed van lig in 'n vakuum</i>	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Coulomb's constant / <i>Coulomb se konstante</i>	k	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
Charge on electron / <i>Lading op elektron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass / <i>Elektronmassa</i>	$m_e$	$9,11 \times 10^{-31} \text{ kg}$
Mass of earth / <i>Massa op aarde</i>	M	$5,98 \times 10^{24} \text{ kg}$
Radius of earth / <i>Radius van aarde</i>	$R_E$	$6,38 \times 10^6 \text{ m}$



**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**

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1 m_2}{d^2}$	$f_s^{max} = \mu_s N$
$f_k = \mu_k N$	$g = G \frac{M}{d^2}$

**ELECTROSTATICS/ELEKTROSTATIKA**

$F = \frac{kQ_1 Q_2}{r^2}$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$	$n = \frac{Q}{q_e}$

**ELECTROMAGNETISM/ELEKTROMAGNETISME**

$\Phi = BA \cos \theta$	$\varepsilon = \frac{-N \Delta \Phi}{\Delta t}$
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**ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE**

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



**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE/GRAAD 11**

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**NOVEMBER 2025**

**PHYSICAL SCIENCES P1/ FISIESE WETENSKAPPE V1  
MARKING GUIDELINE/NASIENRIGLYN**

**MARKS/PUNTE: 150**



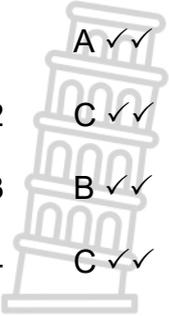
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This marking guideline consists of 12 pages./  
*Hierdie nasienriglyn bestaan uit 12 bladsye.*

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## QUESTION/VRAAG 1

- 1.1 A ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 B ✓✓ (2)
- 1.4 C ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 D ✓✓ (2)
- 1.7 B ✓✓ (2)
- 1.8 C ✓✓ (2)
- 1.9 C ✓✓ (2)
- 1.10 D ✓✓ (2)
- [20]**

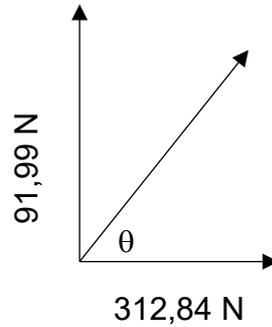


**QUESTION/VRAAG 2**

2.1 A physical quantity having both magnitude and direction. ✓✓  
 'n Fisiese hoeveelheid met beide grootte en rigting. (2)

<p>2.2 2.2.1 <u>For the x-components/</u> <u>Vir die x-komponente</u></p> <p><b>F<sub>1</sub></b>  <math>F_x = 700 \cos 60^\circ \checkmark</math>  <math>F_x = 700 \sin 30^\circ</math>  <math>= 350 \text{ N right / regs}</math></p> <p><b>F<sub>2</sub></b>  <math>F_x = 800 \cos 40^\circ \checkmark</math>  <math>F_x = 800 \sin 50^\circ</math>  <math>= 612,84 \text{ N right / regs}</math></p> <p><b>F<sub>3</sub> = F<sub>x</sub> = 650 N left / links</b>  <math>F_x = 350 + 612,84 - 650 = 312,84 \text{ N right / regs} \checkmark</math></p>	<p><u>For the y-components /</u> <u>Vir die y-komponente</u></p> <p><b>F<sub>1</sub></b>  <math>F_y = 700 \sin 60^\circ \checkmark</math>  <math>F_y = 700 \cos 30^\circ</math>  <math>= 606,22 \text{ N upward/opwaarts}</math></p> <p><b>F<sub>2</sub></b>  <math>F_y = 800 \sin 40^\circ \checkmark</math>  <math>F_y = 800 \cos 50^\circ</math>  <math>= 514,23 \text{ N downward/afwaarts}</math></p> <p><b>F<sub>3</sub> = F<sub>y</sub> = 0 N</b>  <math>F_y = 606,22 - 514,23 = 91,99 \text{ N upward/ opwaarts} \checkmark</math></p>
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$F_{\text{net}}^2 = F_y^2 + F_x^2$   
 $F_{\text{net}}^2 = (312,84)^2 + (91,99)^2$   
 $F_{\text{net}} = 326,08 \text{ N} \checkmark$   
 $\tan \theta = \frac{91,99}{312,84} \checkmark$   
 $\theta = 16,39^\circ$   
 Direction / rigting =  $73,7^\circ \checkmark$



(9)

2.2.2  $W = mg$   
 $W = 25 \times 9,8 \checkmark$   
 $W = 245 \text{ N} \checkmark$  (2)

2.3 The resultant force is not equal to zero. ✓✓  
 Die resulterende krag is nie gelyk aan nul nie. (2)

[15]



## QUESTION/VRAAG 3

- 3.1 The magnitude of the electrostatic force exerted by one point charge (Q1) on another point charge (Q2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them. ✓

*Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa (van die voorwerp).*

## OR/OF

This acceleration is directly proportional to the net force ✓ and inversely proportional to the mass. ✓

*Die versnelling is direk eweredig aan die netto krag en omgekeerd eweredig aan die massa.*

(2)

- 3.2 3.2.1 **Truck / Vragmotor:**  $N = mg = (4\,500)(9,8) = 44\,100\text{ N}$

$$f_k = \mu_k N \checkmark$$

$$8\,820 = \mu (44\,100) \checkmark$$

$$\mu_k = 0,2 \checkmark$$

(3)

3.2.2 **POSITIVE MARKING FROM QUESTION 3.3.1 / POSITIEWE NASIEN VANAF VRAAG 3.3.1**

**Bakkie:**  $N = mg = (1\,250)(9,8) = 12\,250\text{ N} \checkmark$

$$f_k = \mu_k N$$

$$f_k = (0,2)(12\,250) \checkmark$$

$$f_k = 2\,450\text{ N} \checkmark$$

(3)

3.2.3 **OPTION 1 / OPSIE 1**

$$F_{\text{net}} = F - f_k - T \checkmark$$

$$0 = 11\,270 + (-8\,820) - T \checkmark$$

$$T = 2\,450\text{ N} \checkmark$$

**OPTION 2 / OPSIE 2**

$$F_{\text{net}} = T - f_k \checkmark$$

$$0 = T - 2\,450 \checkmark$$

$$T = 2\,450\text{ N} \checkmark$$

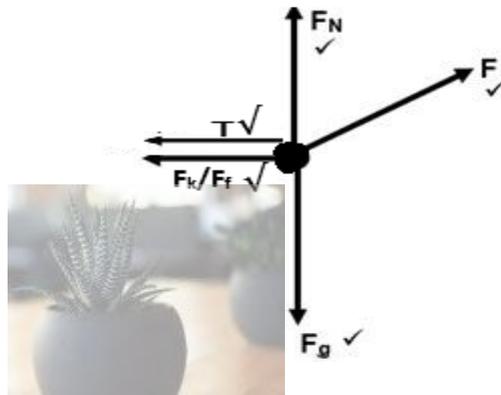
(3)

**[11]**

**QUESTION/VRAAG 4**

4.1 The force that opposes the motion of a moving object relative to a surface. ✓✓  
*Die krag wat die beweging van 'n bewegende voorwerp relatief tot 'n oppervlak teenwerk.* (2)

4.2



$f_k$	$F_f$ , frictional force / <i>Wrywingskrag</i>
T	$F_T$ , tension, tension force / <i>Spanning / spanningskrag</i>
N	$F_N$ , normal force / <i>normaalkrag</i>
F	$F_A$ , $F_{applied}$ / <i>toegepas</i> , $F_{App}$
W	$F_g$ , gravitational force / <i>gravitasiekrag</i>

**NOTE / LET WEL:**

If arrows do not touch the dot deduct 1 mark./ *As pyle nie die kolletjie raak nie, trek 1 punt af.*

Any additional force(s), deduct 1 mark./ *Enige addisionele krag(te), trek 1 punt af.* (5)

4.3 4.3.1  $N = F_g - F \sin \theta$  ✓  
 $N = 10 \times 9,8 - 50 \sin 30^\circ$  ✓  
 $N = 73 \text{ N}$  ✓ (3)

**4.3.2 POSITIVE MARKING FROM QUESTION 4.3.1 / POSITIEWE NASIEN VANAF VRAAG 4.3.1**

$$\begin{aligned}
 F_{net} &= ma \\
 F_{net} &= T - f_k \\
 F_{net} &= F \cos \theta - T - f_k \quad \text{Any one / Enige een } \checkmark \\
 F_{net} &= F_x - T - f_k \quad \text{Any one / Enige een (10a or/of 5a) } \checkmark \\
 T - 9 \checkmark &= 5a \dots\dots\dots 1 \\
 [50 \cos 30^\circ \checkmark - T - (0,18 \times 73) \checkmark] \checkmark &= 10a \dots\dots\dots 2 \\
 a &= 1,41 \text{ m}\cdot\text{s}^{-2} \checkmark \quad (7)
 \end{aligned}$$

4.4 Increases. ✓ The magnitude of the vertical component of the applied force will decrease ✓ (as the weight will remain constant) and hence an increase in the magnitude of the normal force. ✓  
*Toeneem. Die grootte van die vertikale komponent van die toegepaste krag sal afneem (soos die gewig konstant bly) en dus 'n toename in die grootte van die normaalkrag.* (3)

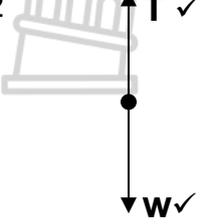
- 4.5 (According to Newton First law, the car will be moving at a constant velocity). When breaks are applied the seat of the child will continue in its state of constant velocity ✓ (in the direction of the windscreen which can be fatal), when the child is secured the belt will exert a net force in opposite direction ✓ that will accelerate the child back to the safety position in the child's seat. ✓  
(Volgens Newton se eerste wet sal die motor teen 'n konstante snelheid beweeg). Wanneer remme toegepas word, sal die kind se sitplek in sy toestand van konstante snelheid bly (in die rigting van die voorruit wat noodlottig kan wees), wanneer die kind vasgemaak is, sal die gordel 'n netto krag in die teenoorgestelde rigting uitoefen wat die kind terug na die veiligheidsposisie in die kinderstoel sal versnel.

(3)  
[23]



**QUESTION/VRAAG 5**

5.1 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 behou, tensy ’n nie-nul resulterende/netto krag daarop inwerk.* (2)

5.2  (2)

5.3 5.3.1  $f_k = \mu_k N$   
 $f_k = \mu_k F_g \cos\theta$   
 $f_k = \mu_k mg \cos\theta$   
 $f_k = (0,25)(8)(9,8)\cos 20^\circ$  ✓  
 $= 18,42 \text{ N}$  ✓ *morephysics.com* } Any one / Enige een ✓ (3)

5.3.2  $F_{\text{net}} = ma$   
 $F_{\text{net}} = F_g - T$   
 $F_{\text{net}} = T - F - f_k - F_{g\parallel}$  } Any one / Enige een ✓  
 $0 = T - 6 \times 9,8$  ✓  
 $T = 58,8 \text{ N}$   
 $0 = [58,8 - F - 18,42 - 8 \times 9,8 \sin 20^\circ]$  ✓  
 $F = 13,57 \text{ N}$  ✓ (5)

5.4  $v_f^2 = v_i^2 + 2a\Delta y$  ✓  
 $= 0^2 + 2(3,6)(2)$  ✓  
 $= 3,79 \text{ m}\cdot\text{s}^{-1}$  ✓ (3)  
**[15]**



**QUESTION/VRAAG 6**

6.1 Newton's third law ✓

When object A exerts a force on object B, object B SIMULTANEOUSLY exerts an oppositely directed force of equal magnitude on object A. ✓✓

*Newton se derde wet*

*Wanneer voorwerp A 'n krag op voorwerp B uitoefen, oefen voorwerp B GELYKTIGDIG 'n teenoorgestelde krag van gelyke grootte op voorwerp A uit.* (3)

6.2  $F = \frac{Gm_1m_2}{r^2}$  ✓

$$250 \checkmark = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(500)}{(d)^2} \checkmark$$

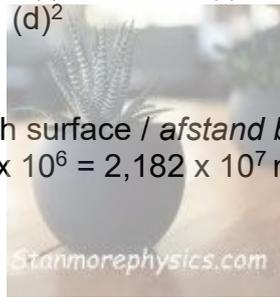
$$d^2 = 7,98 \times 10^{14}$$

$$d = 2,82 \times 10^7 \text{ m } \checkmark$$

distance above earth surface / afstand bo die aarde se oppervlakte

$$= 2,82 \times 10^7 - 6,38 \times 10^6 = 2,182 \times 10^7 \text{ m } \checkmark$$

(5)  
[8]



**QUESTION/VRAAG 7**

7.1. The electrostatic force of attraction or repulsion between two charges is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓

*Die elektrostatiese aantrekkings- of afstotingskrag tussen twee ladings is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.*

(2)

7.2

$F = \frac{kQ_1Q_2}{d^2}$ ✓	$F_2 = \frac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0,03)^2}$ ✓
$F_1 = \frac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0,06)^2}$ ✓	$F_2 = 100\,000\text{ N}$ right / regs
$F_1 = 25\,000\text{ N}$ right / regs	$F_{\text{net}} = F_A + F_B$
	$F_{\text{net}} = 25\,000 + 100\,000$ ✓
	$F_{\text{net}} = 125\,000\text{ N}$ ✓ right / regs ✓

(6)

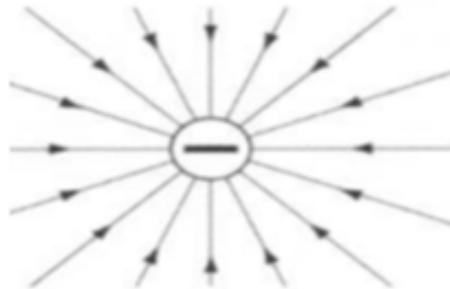
7.3 7.3.1 Electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓

*Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheid positiewe lading wat by daardie punt geplaas word, ervaar word.*

(2)

7.3.2

Negative point charge/Negatiewe puntlading



CRITERIA FOR MARKING/ NASIENKRITERIA	
Correct field direction / Korrekte veldrigting	✓
Lines starting from sphere and not crossing each other / Lyne begin vanaf die sfeer en kruis nie mekaar nie	✓

(2)

7.3.3

$E = \frac{kQ}{r^2}$  ✓

$E = \frac{(9 \times 10^9)(2 \times 10^{-6})}{(0,1)^2}$  ✓

$E = 1,8 \times 10^6\text{ N} \cdot \text{C}^{-1}$  left / links ✓

(3)

[15]

## QUESTION/VRAAG 8

8.1 North pole / Noordpool ✓✓ (2)

8.2 Towards Q / Na Q ✓✓ (2)

8.3 8.3.1 The magnitude of the induced emf across the end of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

*Die grootte van die geïnduseerde emk oor die punt van 'n geleier is direk eweredig aan die tempo van verandering in die magnetiese vloed-koppeling in die geleier.* (2)

8.3.2 Pull the solenoid out of the magnetic field faster.

Increase the number of turns on the coil.

Increase the area of the coil.

Use a stronger magnetic field.

(Any TWO) ✓✓

*Trek die solenoïde vinniger uit die magneetveld.*

*Verhoog die aantal windings op die spoel.*

*Vergroot die oppervlakte van die spoel.*

*Gebruik 'n sterker magnetiese veld.*

(Enige TWEE)

(2)

$$8.3.3 \quad \Phi = BA \cos\theta \quad \checkmark$$

$$= 0,6 (0,08) \cos 0^\circ \quad \checkmark$$

$$= 0,048 \text{ Wb} \quad \checkmark$$

(3)

$$8.3.4 \quad \varepsilon = \frac{-N\Delta\Phi}{\Delta t} \quad \checkmark$$

$$\varepsilon = - \frac{350 (0 - 0,048)}{0,25} \quad \checkmark$$

$$\varepsilon = 67,2 \text{ V} \quad \checkmark$$

(3)

[14]



**QUESTION/VRAAG 9**

9.1. Ohmic conductor. ✓ The graph is a straight line from the origin. ✓ The current is directly proportional to the potential difference across the conductor. ✓  
*Ohmiese geleier. Die grafiek is 'n reguit lyn vanaf die oorsprong. Die stroom is direk eweredig aan die potensiaalverskil oor die geleier.* (3)

9.2 9.2.1 Current / *Stroom* ✓ (1)

9.2.2 Temperature / *Temperatuur* ✓

Length of conductor / *Lengte van die geleier* ✓

Thickness of conductor / *Dikte van geleier*

**Accept** Resistance / *Aanvaar Weerstand*

any TWO/  
enige TWEE

(2)

9.3 9.3.1 Gradient / *gradiënt* =  $\frac{\Delta I}{\Delta V}$  ✓  
 Gradient / *gradiënt* =  $\frac{0,6-0,2}{2,5-0,85}$  ✓  
 Gradient / *gradiënt* = 0,24 ✓ (3)

9.3.2 **POSITIVE MARKING FROM QUESTION 9.3.1 / POSITIEWE NASIEN VANAF VRAAG 9.3.1**

$$R = \frac{1}{0,24} \checkmark$$

$$R = 4,2 \Omega$$

$$P = I^2 R \checkmark$$

$$150 = 6^2 R \checkmark$$

$$R = 4,2 \Omega \checkmark$$

The conductor will be suitable. ✓ Resistance of conductor is equal to the resistance required. ✓

*Die geleier sal geskik wees. Die weerstand van die geleier is gelyk aan die weerstand wat nodig word.*

(6)

[15]



**QUESTION/VRAAG 10**

10.1 Emf / *Emk* ✓ **OR/OF** Electromotive force/*Elektromotoriese krag* (1)

10.2  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$  ✓

$$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{11+17}$$

$$R_p = 7,37 \Omega$$

$$R_{ext} = 7,37 + 5 \checkmark = 12,37 \Omega$$

$$emf = I(R + r) \checkmark$$

$$12 = I(12,37 + 0,6) \checkmark$$

$$I = 0,93 \text{ A} \checkmark$$

(6)

10.3 **OPTION/OPSIE 1**

$$V = IR \checkmark$$

$$V = (0,93)(12,37) \checkmark$$

$$V = 11,50 \text{ V} \checkmark$$

**Range / Gebied (11,44 – 11,50)**

**OPTION/OPSIE 2**

$$V = IR \checkmark$$

$$V = (0,93)(0,6) \checkmark$$

$$V_{int} = 0,558 \text{ V}$$

$$V = 12 - 0,582$$

$$V = 11,44 \text{ V} \checkmark$$

(3)

10.4 Increase / *Verhoog* ✓

(1)

10.5 Total resistance increases, ✓ the total current decreases ✓ so the lost volts decreases.  $V_{ext} = \mathcal{E} - V_{int}$  ✓

*Die totale weerstand neem toe, die totale stroom neem af dus sal die verlore volt / spanning afneem.  $V_{ext} = \mathcal{E} - V_{int}$*

(3)

**[14]****TOTAL/TOTAAL: 150**