Bergvliet High School

GRADE 11

Physical Science

Physics P1

November 2023

MARKS: 150

TIME: 3 hours

EXAMINER: S. van Harte

MODERATOR/S: Z. Booysen/ K. Stuck

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

Detach this sheet and attach it to the front of your answer sheets.

Name: _____ Teacher: Bn / Vh / Sk

For official use only							
Question 1	Marker	**20**	Moderator	**Question 7**	Marker	**14**	Moderator
Question 2	Marker	**13**	Moderator	**Question 8**	Marker	**11**	Moderator
Question 3	Marker	**13**	Moderator	**Question 9**	Marker	**13**	Moderator
Question 4	Marker	**21**	Moderator	**Question 10**	Marker	**16**	Moderator
Question 5	Marker	**13**	Moderator	**Total**	Marker	**150**	Moderator
Question 6	Marker	**16**	Moderator	**Percentage**	Marker	**100**	Moderator
Signature	Marker			**Signature**	Moderator		

INSTRUCTIONS

1. Write your **NAME** and science teacher code (**Bn/Vh/Sk**) in the appropriate space on the Cover Page and all scripts handed in.
2. The question paper consists 10 questions. Answer ALL the questions.
3. Start EACH question on a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable 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, et cetera where required.
12. Write neatly and legibly.

Answer Sheet

Name: _____ **Teacher Code: Bn/Vh/Sk**

Question 1

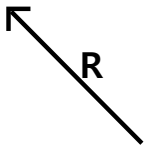
Make a **cross (X)** in the appropriate box next to the relevant question number (1.1 – 1.10)

1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D
		Total		/20

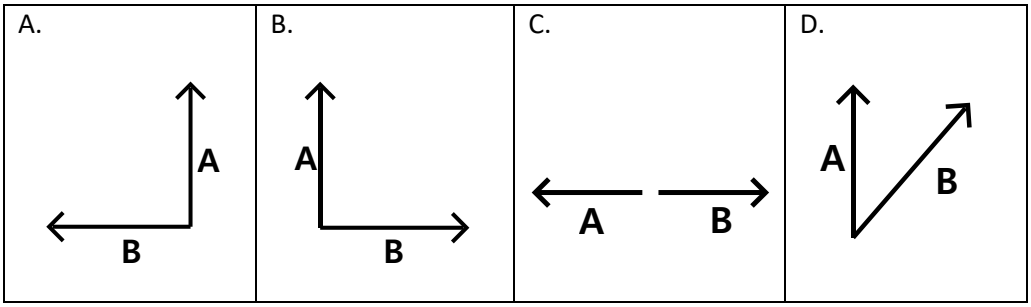
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10), for example 1.10 E.

1.1 The diagram below shows a resultant vector, **R**.



Which diagram best represents a pair of component vectors, **A** and **B**, that would combine to form resultant vector **R**?



(2)

1.2 A force of 1000 N is applied in a bearing direction of 120°.
The magnitude of the y - component of the force is:

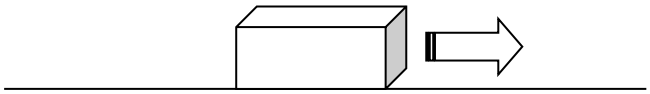
A. 0 N

B. 120 N

C. 500 N

D. 1000 N (2)

1.3 A brick slides over a horizontal surface. Which ONE of the following actions will result in an INCREASE in the frictional force?



A. Reduce the contact area.

B. Increase the contact area.

C. Place a second brick on top.

D. Reduce the mass of the brick. (2)

1.4 Mr. Rimbault catches a cricket ball. Consider the action force to be the contact of the ball against Mr. Rimbault's glove. What is the reaction to this force?

A. Mr. Rimbault's grip on the glove

B. The force the glove exerts on the ball

C. Friction caused by the ground against Mr. Rimbault's shoes

D. The muscular effort in Mr. Rumbault's hand (2)

1.5 An object possessing an excess of 6,0 x 10^6 electrons has a net charge of:

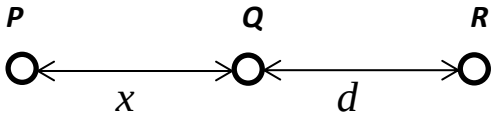
A. 2,7 x 10^{-26} C

B. 5,5 x 10^{-24} C

C. 3,8 x 10^{-13} C

D. 9,6 x 10^{-13} C (2)

1.6 Three charged spheres, **P**, **Q**, and **R**, are placed as shown below.



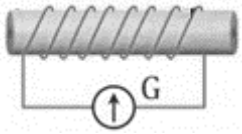
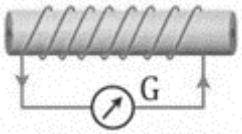
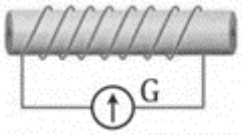
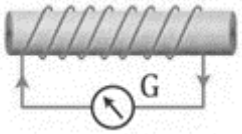
Spheres ***Q*** and ***R*** is a distance ***d*** apart and carry charges of *+q* and *–q* respectively.

The charge on sphere ***P*** is NINE times greater than the charge on sphere **Q**.
Which ONE of the following is correct for the charge on sphere ***P*** and the distance ***x*** between ***P*** and ***Q*** so that charge ***Q*** remains at REST?

	Charge	**Distance (*x*)**
A.	Positive	4,5 *d*
B.	Negative	3 *d*
C.	Negative	4,5 *d*
D.	Positive	3 *d*

(2)

1.7 Choose the combination that represents the CORRECT arrangement for the events being demonstrated.

	Coil with galvanometer	Magnet
A.		
B.		
C.		
D.		

(2)

1.8 The induced emf in a coil is directly proportional to the:

A. Rate of change of magnetic flux inside the coil.

B. Change in magnetic flux inside the coil.

C. Rate of change of magnetic flux outside the coil.

D. Change in magnetic flux outside the coil. (2)

1.9 An electric iron operating at 120 V draws 10 A of current. How much heat energy is delivered by the iron in 30 s?

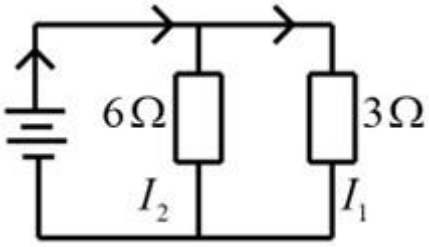
A. $3,0 \times 10^2$ J

B. $1,2 \times 10^3$ J

C. $3,6 \times 10^3$ J

D. $3,6 \times 10^4$ J (2)

1.10 Two resistors of 3 Ω and 6 Ω respectively are coupled as shown in the sketch below. The internal resistance of the battery is negligible. The ratio of $\mathbf{I_1 : I_2}$ of the electrical current in the resistors is:



A. 1:1

B. 1:2

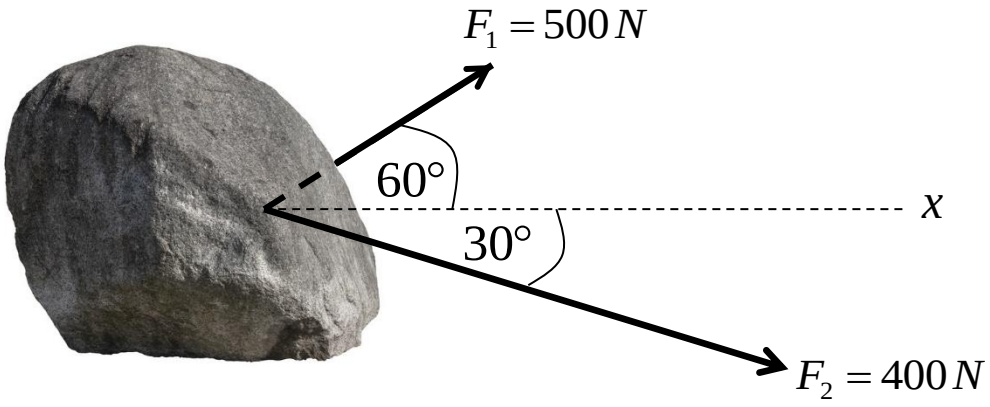
C. 2:1

D. 1:4 (2)

[20]

QUESTION 2 (Start on a new page.)

Two cables are attached to a rock as shown in the diagram. The cables exert a force on the rock, but the rock remains at rest. The angle between the two forces is 90° and the cables are held parallel to the ground and is in the same plane as the x – axis.



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

2.2 Calculate the:

2.2.1 magnitude of the resultant force which the two cables exert on the rock. (5)

2.2.2 angle of the resultant force with respect to the x – axis. (2)

2.3 Provide evidence from the scenario that the rock is in equilibrium. (1)

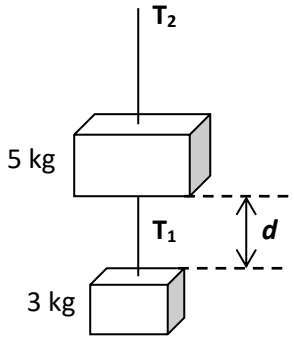
2.4 What is the magnitude of the static frictional force acting on the rock while the cables exert forces as shown? Give a reason for your answer. (2)

2.5 The forces exerted by the cables on the rock are each increased by 200 N, respectively. The rock is still not moving.
How will this change in forces affect the static frictional force?
Write only INCREASES, DECREASES, or UNCHANGED. (1)

[13]

QUESTION 3 (Start on a new page.)

A 5 kg block and a 3 kg block are connected by a light, inextensible string $\mathbf{T_1}$. A second light, inextensible string $\mathbf{T_2}$ is connected to the 5 kg block. The blocks are at rest as shown in the diagram. Ignore all effects of air resistance.



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

3.2 Draw a labelled free body diagram showing ALL the forces acting on the 5 kg block. (3)

3.3 In which string is the tension greater? Choose from $\mathbf{T_1}$ or $\mathbf{T_2}$. (1)

When the force in string $\mathbf{T_2}$ is 120 N, the blocks accelerate upwards. The string $\mathbf{T_1}$ *CAN* experience a maximum tension of 50 N before it breaks.

3.4 Determine by means of a calculation if the string $\mathbf{T_1}$ will break. (6)

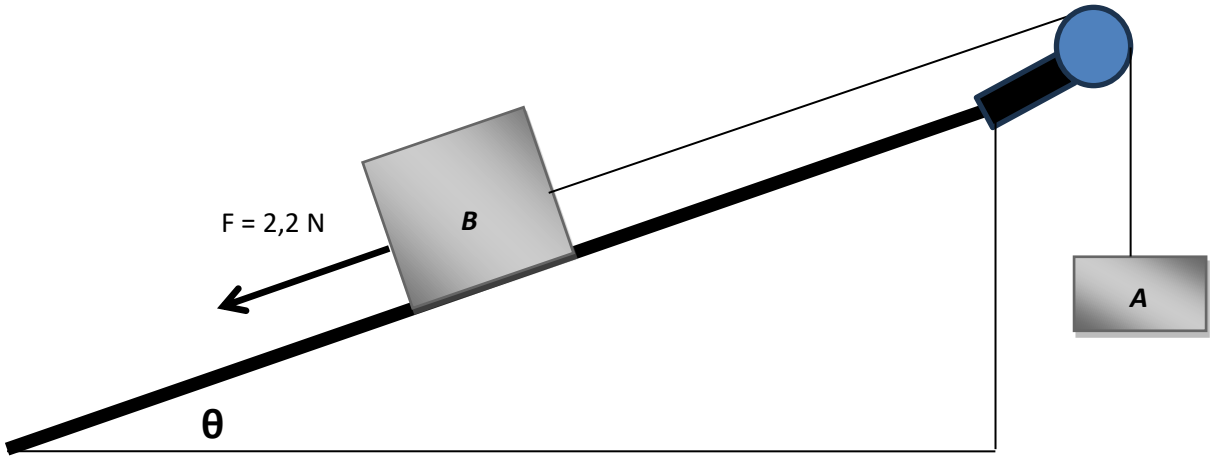
When string $\mathbf{T_2}$ is removed, the blocks fall to the ground. Ignore all effects of air resistance.

3.5 How will the distance ***d*** between the blocks change during the motion?
Write only INCREASES, DECREASES, or REMAINS THE SAME. (1)

[13]

QUESTION 4 (Start on a new page.)

Two objects, ***A*** and ***B***, of mass 4 kg and 10 kg respectively, are connect by an inextensible rope over a frictionless pulley system. Object **B** lies on a plane inclined at **θ** to the horizontal. A force, F, applied parallel to the incline, pushes on the objects as shown in the diagram below. The object ***B*** moves at a constant speed down the inclined plane.



The magnitude of the kinetic frictional force acting on object ***B*** is 26 N.

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

4.2 Draw a labelled free-body diagram of the forces acting on ***B*** as it moves down the inclined plane. (5)

4.3 Calculate the:

4.3.1 Magnitude of tension in the cable. (3)

4.3.2 Magnitude of **θ** if the system moves down the inclined plane at a CONSTANT VELOCITY. (4)

4.3.3 Coefficient of kinetic friction for object ***B***. (3)

4.4 The angle between the incline and the horizontal is increased.

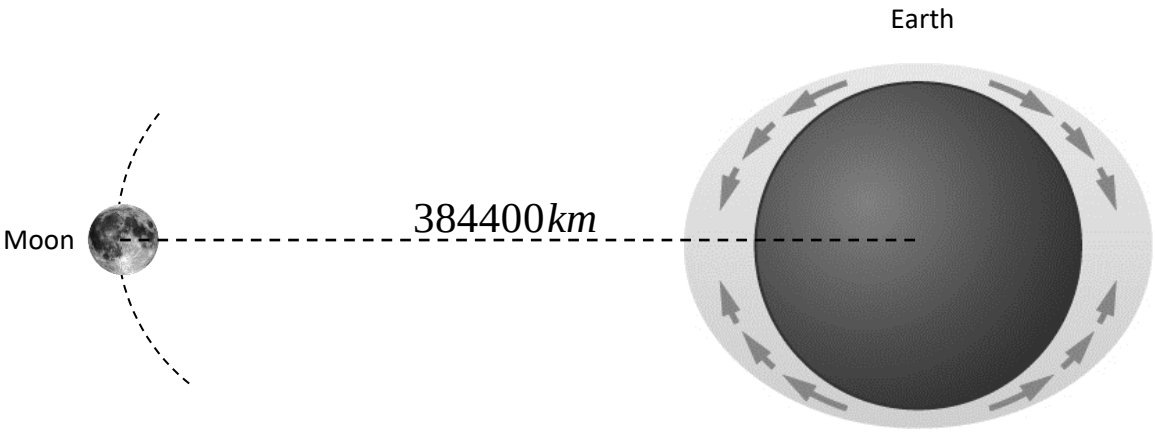
4.4.1 How will the answer in QUESTION 4.3.1 be affected?
Write down INCREASES, DECREASES or REMAIN THE SAME. (1)

4.4.2 How will the magnitude of the kinetic frictional force on object ***B*** be affected?
Write INCREASES, DECREASES or REMAIN THE SAME. Explain your answer. (3)

[21]

QUESTION 5 (Start on a new page.)

The average distance between the moon's centre and the earth's centre is shown in the diagram. The moon's mass is 7,35 x 10^{22} kg.



5.1 State *Newton's Law of universal gravitational* in words. (2)

5.2 Is the magnitude of gravitational force experienced by the moon GREATER THAN, EQUAL TO, OR LESS THAN the gravitational force experienced by the earth? (1)

5.3 State the Physics Law in words that is applicable to the answer given in QUESTION 5.2 above. (2)

5.4 Calculate the magnitude of the gravitational force exerted by the moon on earth. (4)

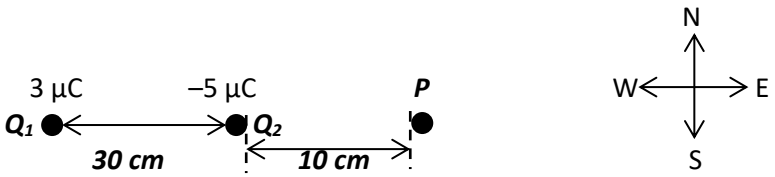
5.5 An object has a weight of 3000N on the moon. What is the mass of the object? (3)

5.6 What everyday evidence is there that the moon does exert a gravitational pull on the earth? (1)

[13]

QUESTION 6 (Start on a new page.)

Two charged particles Q_1 and Q_2 are placed 30 cm apart as shown in the diagram.
Punt ***P*** is 10 cm east of charge Q_2.

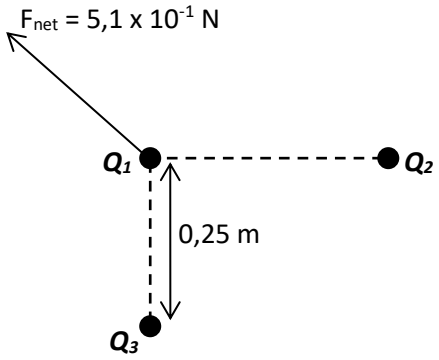


6.1 Calculate the magnitude and direction of the net electric field at point ***P***. (6)

The two charges are brought into contact with each other and placed at their original positions.

6.2 Calculate the charge on each of the particles after contact. (2)

After Q_1 and Q_2 were brought into contact, a charge Q_3 is placed 0,25 m due south of Q_1.
Charge Q_1 experiences a net force of magnitude $5{,}1 \times 10^{-1}$ N due to the other two charges as shown in the diagram.



6.3 What is the nature of the charge on Q_3? Choose from POSITIVE or NEGATIVE. (1)

6.4 Define *Coulomb's law*. (2)

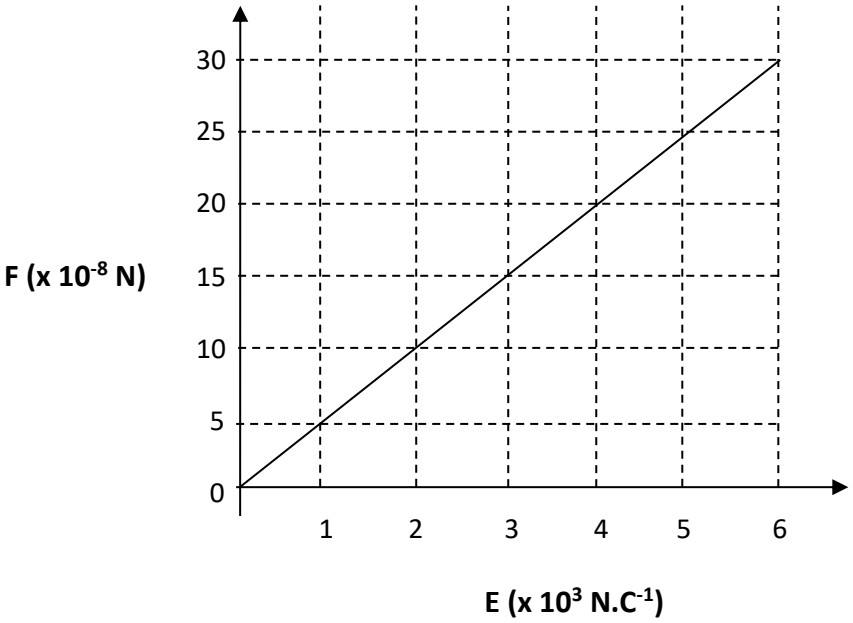
6.5 Calculate the magnitude of the charge on Q_3. (5)

[16]

QUESTION 7 (Start on a new page.)

The relationship between the electrostatic force (**F**) experienced by a test charge and the magnitude of the electric field (**E**) in which the charge is placed, is investigated.

The results obtained are shown in the graph below.



7.1 Define an *electric field*. (2)

7.2 Identify the independent variable of this investigation. (1)

7.3 State, in words, the relationship between **F** and **E** as depicted by the graph. (1)

7.4 Write the NAME of the physical quantity represented by the gradient of this graph. (1)

7.5 Calculate the value of the gradient of the graph. (3)

7.6 Hence, write down the magnitude of the test charge that is used. (1)

7.7 Calculate the number of electrons that are removed or added to obtain this test charge. (3)

7.8 Draw the electric field pattern around this test charge. (2)

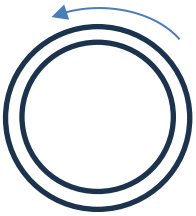
[14]

QUESTION 8 (Start on a new page.)

8.1. A piece of copper wire is connected to a battery in two arrangements. In arrangement **A**, the wire is kept straight, and in arrangement **B**, the wire is looped **ONCE**, as seen in the diagrams below.



Arrangement **A**



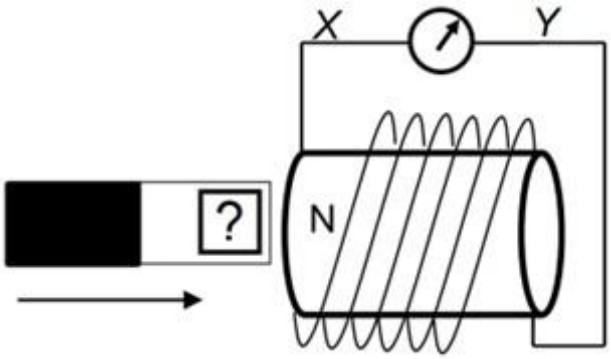
Arrangement **B**

8.1.1. Redraw arrangement **A** and place either a **dot** or an **X** inside sketch if the current is coming out of the page and indicate whether the magnetic field is CLOCKWISE or ANTICLOCKWISE. (2)

8.1.2 If the current flows anticlockwise in arrangement **B**, redraw and indicate with a **dot** or an **X** the magnetic field inside and outside the loop. (2)

8.1.3. Which arrangement will produced the stronger magnetic field?
Only write **A** or **B.** (1)

8.2. The arrangement of apparatus to demonstrate Faraday's law of electromagnetic induction is shown below. A bar magnet is pushed into the coil.



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

8.2.2 State TWO ways in which the deflection on the galvanometer can be increased. (2)

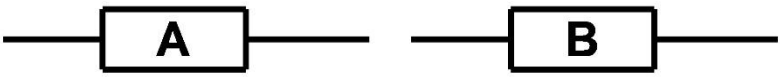
8.2.3 In which direction is the induced current moving **through the galvanometer** as the bar magnet enters the coil?
Write only from **X TO Y** or from **Y TO X**. (1)

8.2.4 Identify the unknown polarity of the bar magnet indicated by a question mark (?). (1)

[11]

QUESTION 9 (Start on a new page.)

A Physical Sciences learner wants to determine the resistance of two resistors.
The learner marks the resistors ***A*** and ***B***.

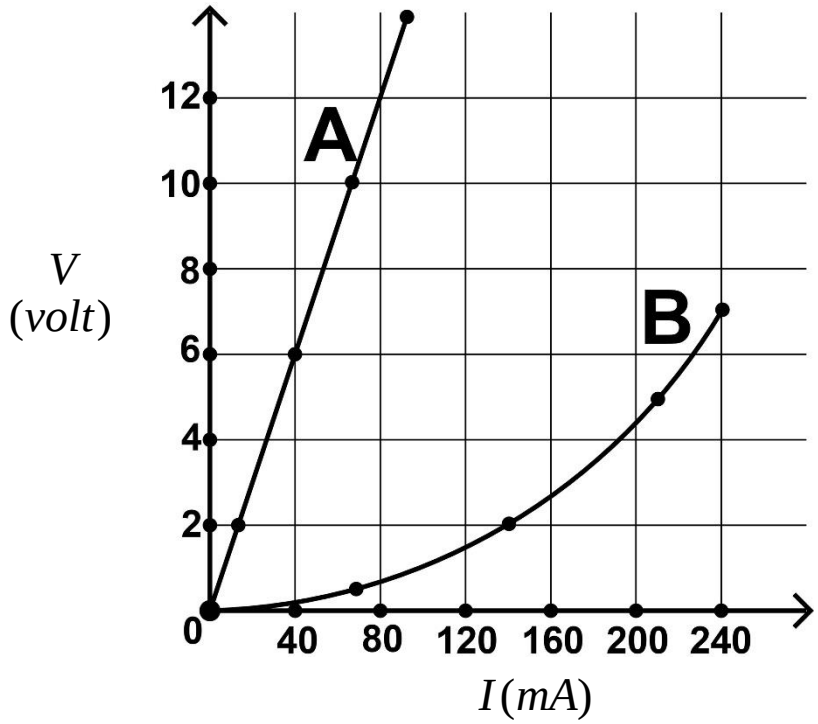


The following equipment is available in the science laboratory:

- Ammeter
- Voltmeter
- 8 V battery
- Switch
- Connecting wires

9.1 Draw a circuit diagram using **all** the equipment listed above when resistor ***A*** and ***B*** are connected in series. (5)

The learner has drawn the following graph using her results from the experiment.



9.2 Which one of the two resistors is a non – ohmic conductor? Motivate your answer. (2)

9.3 According to Ohm's law one variable must be kept constant.
Name this constant variable. (1)

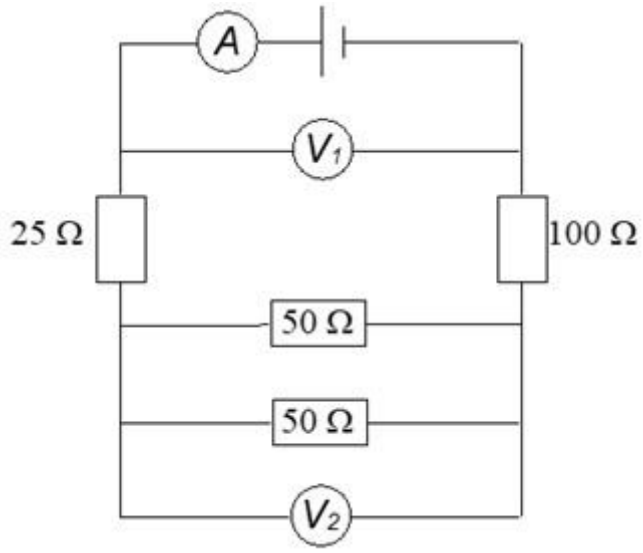
9.4 What physical quantity is represented by the gradient of the graphs? (1)

9.5 Use the graph to calculate the resistance of resistor ***A.*** (4)

[13]

QUESTION 10 (Start on a new page.)

Consider the following circuit diagram. The power dissipated in the 100 Ω resistor is 0,81 W



10.1 Define the term *power*. (2)

10.2 Calculate the:

10.2.1 Current flowing through the 100 Ω resistor. (3)

10.2.2 Reading on voltmeter V_2. (4)

10.2.3 Equivalent resistance of the parallel combination. (2)

10.2.4 Reading on voltmeter V_1. (4)

10.3 How will the reading on the ammeter be affected if one of the 50 Ω resistors is removed. Write only INCREASES, DECREASES or REMAIN THE SAME. (1)

[16]

TOTAL: 150

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9{,}8\ m{\cdot}s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	$6{,}38 \times 10^{6}\ m$
Coulomb's constant *Coulomb se konstante*	k	$9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Mass of the Earth *Massa van die Aarde*	M	$5{,}98 \times 10^{24}\ kg$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

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

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$E = \frac{F}{Q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$V = \frac{W}{Q}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$R = r_1 + r_2 + r_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$