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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2024

MARKS: 75

TIME: 1½ hours

This question paper consists of 10 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

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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 1.7) in the ANSWER BOOK, e.g.1.8 E.

1.1 Which of the following best defines a transverse wave?

A A wave where the particles of the medium move parallel to the direction of wave propagation.
B A wave where the particles of the medium move perpendicular to the direction of wave propagation.
C A wave where the particles of the medium do not move at all.
D A wave that can only propagate in a solid medium. (2)

1.2 If the frequency of a wave increases while its wavelength remains constant, what happens to the speed of the wave?

A It increases
B It decreases
C It remains constant
D It depends on the amplitude of the wave (2)

1.3 An observer counts four complete water waves passing by the end of a dock every 10 seconds. What is the frequency of the waves?

A 40 Hz
B 4,0 Hz
C 2,5 Hz
D 0,40 Hz (2)

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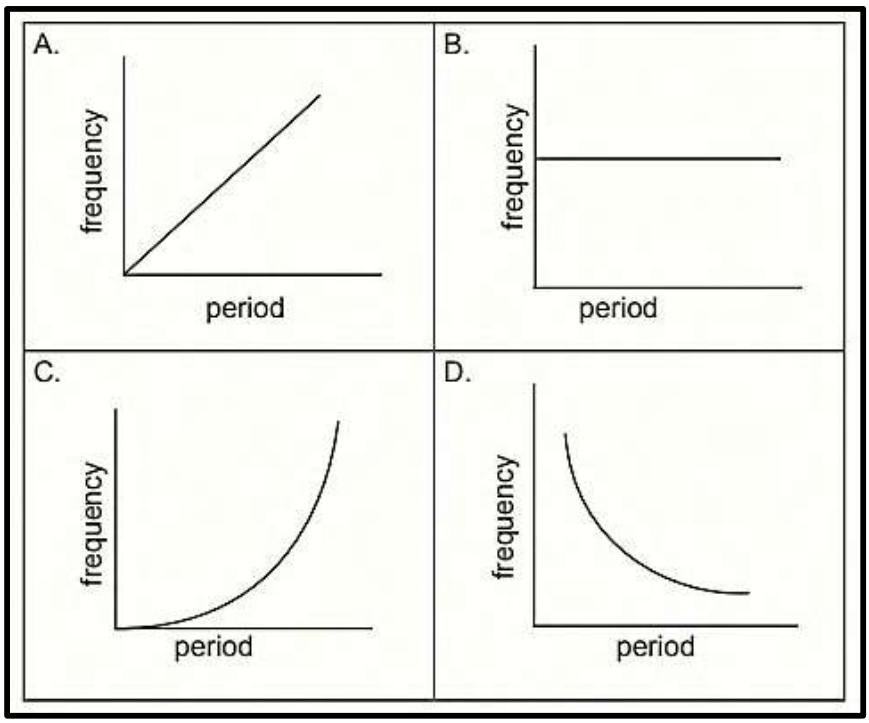
1.4 Which graph represents the relationship between frequency and period of a wave?

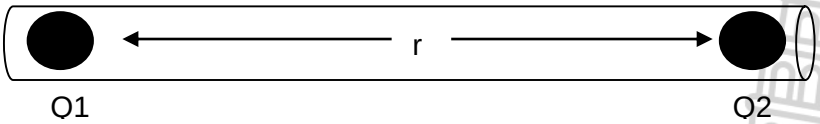


(2)

1.5 Which of the following colours of visible light has the lowest energy?

A Blue
B Green
C Red
D Yellow (2)

1.6 Consider two point charges, Q1 and Q2, placed a distance *r* apart in a vacuum. If the force between the charges is repulsive, which of the following statements is true?



A Q1 and Q2 must have the same charges.
B Q1 and Q2 must have opposite charges.
C The magnitude of Q1 must be greater than the magnitude of Q2.
D The magnitude of Q1 must be less than the magnitude of Q2. (2)

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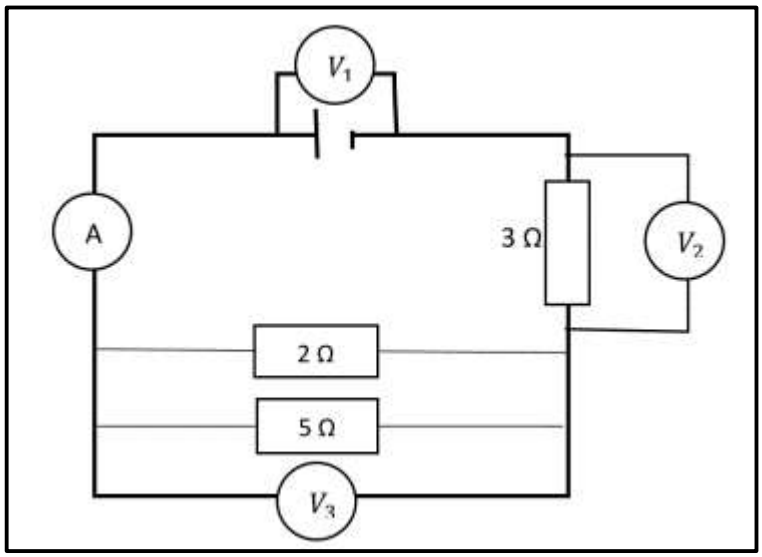
1.7 Consider the circuit diagram with three resistors given below:



How will the readings on voltmeters V_1, V_2 and V_3 compare with each other?

A $V_1 = V_2 = V_3$
B $V_1 = V_2 + V_3$
C $V_1 > V_2 + V_3$
D $V_3 > V_1 + V_2$

(2)
[14]

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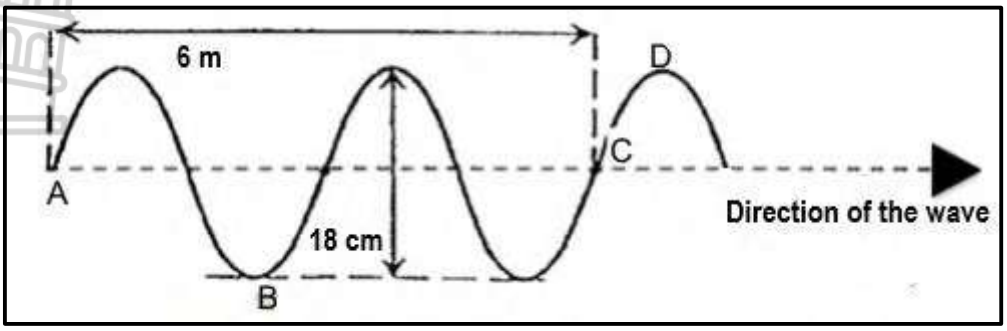
QUESTION 2 (Start on a new page.)

A snapshot of a transverse wave is given below, the wave has a frequency of 0,8 Hz and is moving from left to right.



2.1 Define the term *frequency*. (2)

2.2 Name the following:

2.2.1 Two points that are out of phase. (1)

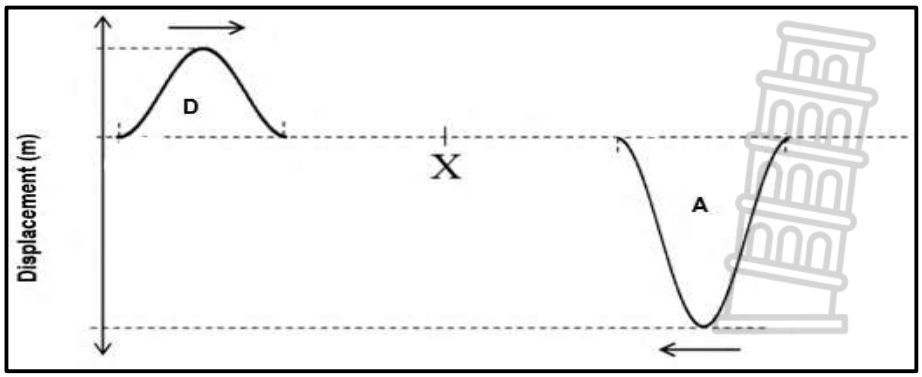
2.2.2 Point D. (1)

2.3 Determine:

2.3.1 Wavelength of this wave. (2)

2.3.2 Amplitude of the wave in meters. (3)

2.4 Look at this diagram of pulse D and pulse A (from a different transverse wave which is moving from right to left). The two pulses will meet at point X and the resultant amplitude will be – 2 m.



2.4.1 Name the type of interference that will take place. (1)

2.4.2 Draw a labelled diagram to show the resultant pulse when the two pulses meet at point X. (2)

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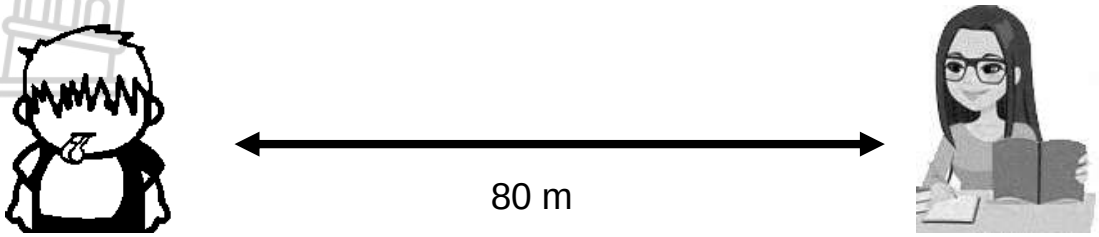
QUESTION 3: (Start on a new page.)

The grade 10 class conducted experiments to investigate the effect of temperature on the speed of sound. One of the learners blew a whistle, while another learner 80 m away recorded the time travelled by the sound.



The experiments were done at different temperatures at different times of the day.
They recorded their findings in the table below:

TEMPERATURE (˚C)	TIME (s)
10	0,240
15	0,238
20	0,237
25	0,236
30	0,235

3.1 For this investigation, write down the:

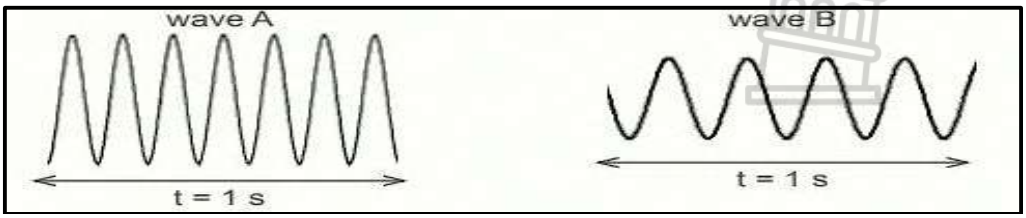
3.1.1 Independent variable. (1)

3.1.2 Dependant variable. (1)

3.2 Calculate the speed of sound at 25˚C. (3)

3.3 Write down a conclusion for this investigation. (2)

3.4 Consider the following diagrams that represent sound waves as shown on an oscilloscope:



3.4.1 Identify the wave with the higher pitch. (1)

3.4.2 Identify the wave that produces the loudest sound. (1)
[9]

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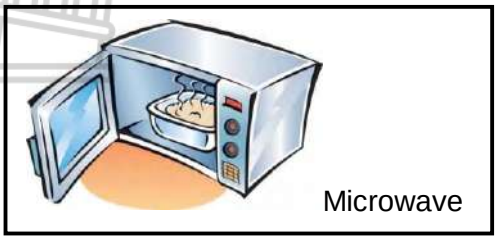
QUESTION 4: (Start on a new page.)

Consider the diagrams below of different electromagnetic radiation and answer the questions that follow:

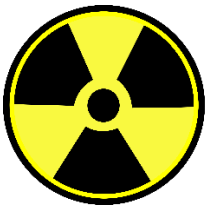

Microwave

Cell phone

TV Remote

X – ray

UV – tanning bed


Gamma rays

4.1 Why are electromagnetic waves unique in comparison to other waves? (2)

4.2 Give the type of electromagnetic waves that are used in:

4.2.1 Cell phone (1)

4.2.2 TV remote (1)

4.3 Looking at the examples of electromagnetic radiation, which one has the highest energy? (1)

4.4. Give a reason for your answer to QUESTION 4.3 (1)

4.5 A photon has a wavelength of 700 nm.

4.5.1 Define the term *photon*. (2)

4.5.2 Calculate the energy of this photon. (4)
[12]

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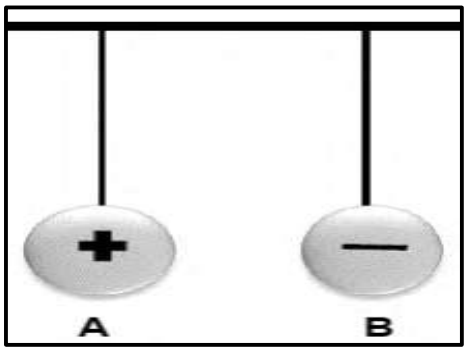
QUESTION 5: (Start on a new page.)

Two identical insulated spheres, A and B, suspended by threads from a ceiling, are held at a small distance apart, as shown in the diagram below.
The spheres carry charges of +5 nC and -2 nC respectively.



5.1 State the Principle of Conservation of Charge. (2)

5.2 Is there a SHORTAGE or EXCESS of electrons on the -2 nC object before contact? (1)

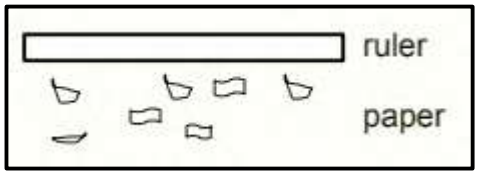
The two spheres are brought into contact and then separated again.

5.3 In what direction will electrons be transferred during contact?
Write only **FROM A TO B** or **FROM B TO A**. (1)

5.4 Apply the principle of conservation of charge in order to calculate the new charge on the objects after separation. (3)

5.5 Calculate how many electrons are on each object after contact. (3)

A charged ruler is brought closer to neutral pieces of paper. The pieces of paper are attracted to the ruler, as shown below.



5.6 Explain why the pieces of paper are attracted to the ruler. (2)
[12]

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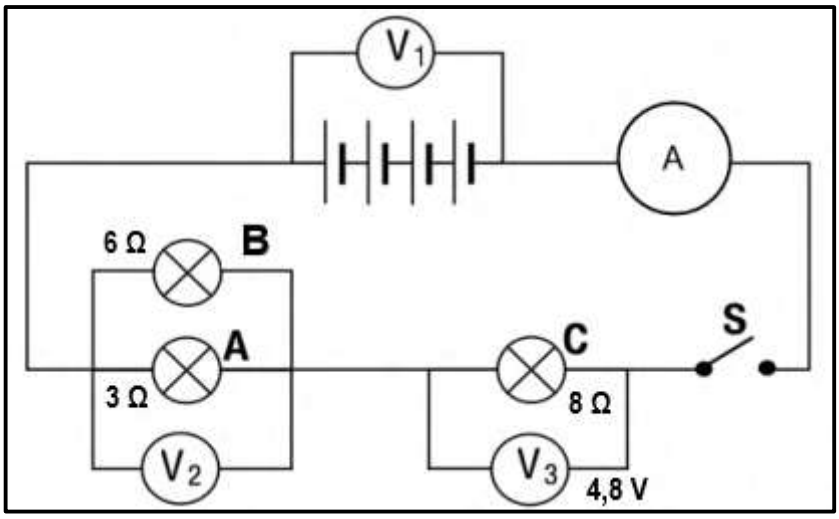
QUESTION 6: (Start on a new page.)

The circuit diagram below consists of four cells each with a voltage of 1,5 V.
The resistance of bulbs **A**, **B** and **C** are 3 Ω, 6 Ω and 8 Ω respectively.
Use the circuit diagram to answer questions that follow:



Switch S is closed.

6.1 Define the term *current strength.* (2)

6.2 Determine the voltmeter readings on:

6.2.1 V_1 (2)

6.2.2 V_2 (2)

6.3 Determine the reading on the ammeter (A). (3)

6.4 Calculate the:

6.4.1 Effective resistance of the circuit. (3)

6.4.2 Amount of charge that is passing through resistor **C** in 20 s. (3)

6.5 If bulb **B** fuses, how will this affect the total current of the circuit?
Write down INCREASES, DECREASES or REMAINS THE SAME. (1)

[16]

TOTAL: 75

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DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
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} $J \cdot s$
Charge on electron	e^-	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE

MOTION

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

WORK, ENERGY AND POWER

$K = E_k = \frac{1}{2}mv^2$	$U = E_P = mgh$
$E_M = E_k + E_p$ or $E_M = K + U$	

WAVES, LIGHT AND SOUND

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or $E = h\frac{c}{\lambda}$	

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ELECTROSTATICS

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS

$R = \frac{V}{I}$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$R_s = R_1 + R_2 + ...$	$Q = I\Delta t$
$V = \frac{W}{Q}$	

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PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2024

MARKING GUIDELINES

MARKS: 75

These marking guidelines consist of 5 pages and a cognitive table.

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QUESTION 1

1.1	B	✓✓	(2)
1.2	A	✓✓	(2)
1.3	D	✓✓	(2)
1.4	D	✓✓	(2)
1.5	C	✓✓	(2)
1.6	A	✓✓	(2)
1.7	B	✓✓	(2)
			[14]

QUESTION 2

2.1 The number of waves/wave pulses ✓ passing a point per second.✓ (2)

2.2. 2.2.1 A&B or A&D or B&C or B&D or C&D ✓ (any one) (1)

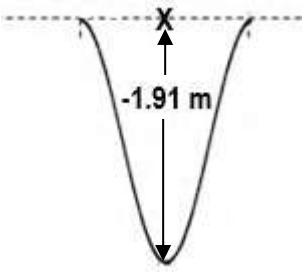
2.2.2 Crest ✓ (1)

2.3 2.3.1 Wavelength = ½ (6) ✓
= 3 m ✓ (2)

2.3.2 Amplitude = 0,5(18) ✓
= 9 cm ✓
= 0,09 m ✓ (3)

2.4 2.4.1 Destructive interference ✓ (1)

2.4.2 **Positive marking from question 2.3.2**



Marking criteria:	
Trough	✓
Correct amplitude	✓

(2)
[12]

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QUESTION 3

3.1 3.1.1 Temperature ✓ (1)

3.1.2 Speed of sound✓ or
Time taken for the sound to travel.✓ (1)

3.2 $V = \frac{\Delta x/d}{\Delta t}$ ✓
$= \frac{80}{0,236}$ ✓
$= 338,98\ m.s^{-1}$ ✓ (3)

3.3 The speed of sound increases/time taken for the sound to travel decreases/as the temperature increases. ✓✓ (2)

3.4 3.4.1 Wave A ✓ (1)

3.4.2 Wave A ✓ (1)
[9]

QUESTION 4

4.1 Wave-particle duality ✓
No need for a medium to propagate. ✓
Speed of EM waves are constant at 3×10^{-8} m.s^{-1} in a vacuum.
Oscillation between alternating accelerating charges cause magnetic waves. (any two) (2)

4.2 4.2.1 Radio waves OR microwaves ✓ (1)

4.2.2 Infrared radiation/waves ✓ (1)

4.3 Gamma rays ✓ (1)

4.4 Gamma rays have the shortest wavelengths or the highest frequencies in the electromagnetic spectrum. ✓ (1)

4.5 4.5.1 Packet of energy found in light. ✓✓ (2)

4.5.2

Option 1	Option 2
$c = f\lambda$ 380 x 10^8 = f (700 x 10^{-9}) ✓ f = 5,428 x 10^{16} Hz E = hf ✓ = 6,63 x 10^{-34} (5,428 x 10^{16})✓ = 3,598 x 10^{-17} J ✓ ≈ 3,60 x 10^{-17} J	$E = h\frac{c}{\lambda}$ ✓ = 6,63 x 10^{-34} ✓$\frac{380 \text{ x } 10^8}{700 \text{ x } 10^{-9}}$ ✓ = 3,598 x 10^{-17} J ✓ ≈ 3,60 x 10^{-17} J

(4)
[12]

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QUESTION 5

5.1 The principle of conservation of charge states that the net charge of an isolated system remains constant during any physical process. ✓✓ (2)

5.2 EXCESS ✓ (1)

5.3 FROM B TO A ✓ (1)

5.4 $Q = \frac{Q_1+Q_2}{2}$ ✓

$= \frac{5\times10^{-9}+(-2\times10^{-9})}{2}$ ✓

$= + 1,5 \times 10^{-9}$ C ✓ (3)

5.5

Option 1	Option 2
$Q = nq_e$ ✓ $1,5 \times 10^{-9} = n \times 1,6 \times 10^{-19}$ ✓ $n = 9,375 \times 10^{9}$ electrons ✓	$n = \frac{Q}{e}$ ✓ $= \frac{1,5\times10^{-9}}{1,6\times10^{-19}}$ ✓ $= 9,375 \times 10^{9}$ electrons ✓

(3)

5.6 When the charged plastic ruler is brought closer to the uncharged pieces of paper, the paper is polarised. ✓ The negative charges on the paper are repelled by the negative charges on the ruler. This leaves the side of the paper closest to the ruler positive. ✓ (2)

[12]

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QUESTION 6

6.1 Current strength: rate of flow of charge ✓✓ (2)

6.2 6.2.1 $V_1 = 1,5 \times 4$
$= 6$ V ✓✓ (2)

6.2.2 **Positive marking from question 6.2.1**

Option 1	Option 2
$V_{Total} = V_2 + V_3$ ✓ $6 = V_2 + 4,8$ ✓ $V_2 = 1,2$ V ✓	$I = \frac{V}{R}$ $= \frac{4,8}{8}$ $= 0,6$ A $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ $= \frac{1}{6} + \frac{1}{3}$ $R_p = 2\ \Omega$ $V_2 = I \times R$ ✓ $= 0,6 \times 2$ ✓ $= 1,2$ V ✓

(2)

6.3 **Positive marking from questions 6.2.1 and 6.2.2**

Option 1	Option 2
$I = \frac{V}{R}$ ✓ $= \frac{4,8}{8}$ ✓ $= 0,6$ A ✓	$I = \frac{V}{R}$ ✓ $= \frac{6}{10}$ ✓ $= 0,6$ A ✓

(3)

6.4 6.4.1 **Positive marking from questions 6.2.1, 6.2.2 and 6.3**

Option 1	Option 2
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ $= \frac{1}{6} + \frac{1}{3}$ $R_p = 2\ \Omega$ $R_T = R_s + R_p$ } Any equation ✓ $= 8 + 2$ ✓ $= 10\ \Omega$ ✓	$R = \frac{V}{I}$ ✓ $= \frac{6}{0,6}$ ✓ $= 10\ \Omega$ ✓

(3)

6.4.2 $Q = I \times t$ ✓
$Q = (0,6)(20)$ ✓
$Q = 12$ C ✓ (3)

6.5 DECREASES ✓ (1)

[16]

TOTAL: 75

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SUBJECT:	Physical Sciences P1					ASSESSMENT TASK:				GRADE 10 - June exams		
QUESTION ANALYSIS GRID										2024		
		Cognitive Levels				Topic				Difficulty Levels		
QUESTION	Mark	1	2	3	4	Waves, Sound and Light	Electrostatics	Electric circuits	TOTAL	Easy	Moderate	Difficult
1.1	2	2				2			2		2	
1.2	2		2			2			2		2	
1.3	2			2		2			2			2
1.4	2		2			2			2			2
1.5	2		2			2			2		2	
1.6	2		2				2		2	2		
1.7	2			2				2	2		2	
Ques 1	**14**	**2**	**8**	**4**	**0**	**10**	**2**	**2**	**14**	**2**	**8**	**4**
2.1	2	2				2			2	2		
2.2.1	1		1			1			1	1		
2.2.2	1		1			1			1	1		
2.3.1	2			2		2			2			2
2.3.2	3			3		3			3		3	
2.4.1	1	1				1			1		1	
2.4.2	2		2			2			2			2
Ques 2	**12**	**3**	**4**	**5**	**0**	**12**	**0**	**0**	**12**	**4**	**4**	**4**
3.1.1	1		1			1			1		1	
3.1.2	1		1			1			1		1	
3.2	3			3		3			3		3	
3.3	2		2			2			2			2
3.4.1	1			1		1			1		1	
3.4.2	1			1		1			1		1	
Ques 3	**9**	**0**	**4**	**5**	**0**	**9**	**0**	**0**	**9**	**0**	**7**	**2**
4.1	2		2			2			2	2		
4.2.1	1	1				1			1		1	
4.2.2	1	1				1			1		1	
4.3	1		1			1			1		1	
4.4	1		1			1			1			1
4.5.1	2	2				2			2	2		
4.5.2	4			4		4			4			4
Ques 4	**12**	**4**	**4**	**4**	**0**	**12**	**0**	**0**	**12**	**4**	**3**	**5**
5.1	2	2					2		2	2		
5.2	1		1				1		1	1		
5.3	1			1			1		1	1		
5.4	3			3			3		3		3	
5.5	3				3		3		3	3		
5.6	2			2			2		2		2	
Ques 5	**12**	**2**	**1**	**6**	**3**	**0**	**12**	**0**	**12**	**7**	**5**	**0**
6.1	2	2						2	2	2		
6.2.1	2			2				2	2		2	
6.2.2	2			2				2	2		2	
6.3	3			3				3	3			3
6.4.1	3				3			3	3			3
6.4.2	3				3			3	3	3		
6.5	1			1				1	1			1
Ques 6	**16**	**2**	**0**	**8**	**6**	**0**	**0**	**16**	**16**	**5**	**4**	**7**
SUMMARY												
QUES 1	**14**	**2**	**8**	**4**	**0**	**10**	**2**	**2**	**14**	2	8	4
QUES 2	**12**	**3**	**4**	**5**	**0**	**12**	**0**	**0**	**12**	4	4	4
QUES 3	**9**	**0**	**4**	**5**	**0**	**9**	**0**	**0**	**9**	0	7	2
QUES 4	**12**	**4**	**4**	**4**	**0**	**12**	**0**	**0**	**12**	4	3	5
QUES 5	**12**	**2**	**1**	**6**	**3**	**0**	**12**	**0**	**12**	7	5	0
QUES 6	**16**	**2**	**0**	**8**	**6**	**0**	**0**	**16**	**16**	5	4	7
Total marks	**75**	**13**	**21**	**32**	**9**	**43**	**14**	**18**	**75**	22	31	22
Norm marks	**75**	**11**	**23**	**34**	**7**	**41**	**15**	**19**	**75**	**23**	**29**	**23**
Total %	**100**	**17**	**28**	**43**	**12**	**57**	**19**	**24**	**100**	**29**	**41**	**31**
Norm %	**100**	**15**	**30**	**45**	**10**	**54**	**20**	**26**	**100**	**30**	**40**	**30**

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