LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

MOGALAKWENA DISTRICT

PHYSICAL SCIENCES

NATIONAL SENIOR CERTIFICATE

TERM 1 CONTROL TEST
07 MARCH 2023
GRADE 10

MARKS : 100 **DURATION: 2 hours**

STARTING TIME: 08H00

This question paper consists of 12 pages including this one

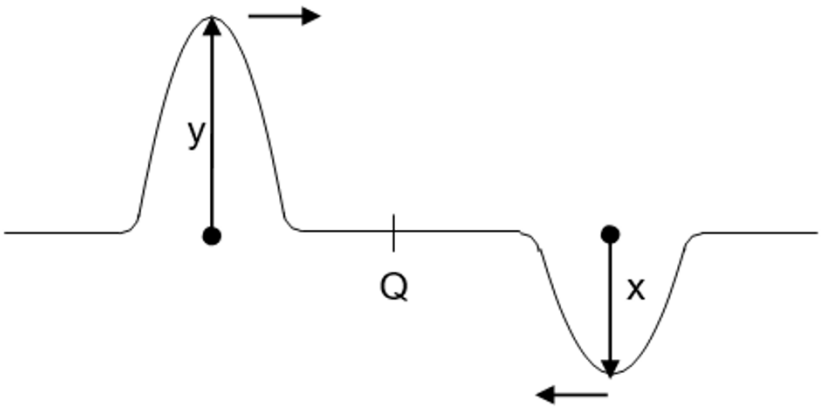
INSTRUCTIONS

1. This question paper consists of 12 pages including the cover page
2. Answer all the questions in the answer book
3. You are advised to use the attached DATA SHEETS.
4. Round off your final answer to a minimum of TWO decimal places
5. Show all your calculations including formulae where applicable.
6. Candidates may use non-programmable calculators.
7. Write neatly and legibly.

QUESTION 1

Four 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 number (1.1–1.10) in the ANSWER SHEET, for example 1.11 E.

1.1 Two pulses are travelling towards each other along a string, as shown in the diagram below.



When the centres of the two pulses meet at Q, the amplitude of the resultant pulse will be ...

A x + y
B 2(x + y)
C y – x
D 2(y – x) (2)

1.2 When two wave crests overlap, the increase in amplitude is due to …

A Cancellation.
B Two waves in phase.
C Destructive interference.
D Constructive interference. (2)

1.3 The frequency of a wave is defined as the …

A Lowest point on a wave.
B Time taken for one complete wave.
C Number of complete waves per second.
D Number of points in phase in a wavelength. (2)

1.4 In which ONE of the following do sound waves travel the FASTEST?

A Air
B Liquids
C Solids
D Vacuum (2)

1.5 Which ONE of the combinations below concerning the pitch and loudness of sound is CORRECT?

The pitch and loudness of sound depend on:

	PITCH	LOUDNESS
A	Frequency	Amplitude of vibration
B	Frequency	Speed of vibration
C	Amplitude of vibration	Frequency
D	Speed of vibration	Frequency

1.6 Consider the following statements concerning ultraviolet radiation:

(i) It cannot be reflected.
(ii) It has a longer wavelength than gamma rays.
(iii) It is radiated from the sun and may be harmful to humans.

A (i) and (ii) only B
B (ii) and (iii) only C
C (i) and (iii)
D (i), (ii) and (iii) (2)

1.7 A rod acquires a negative charge after it has been rubbed with wool.

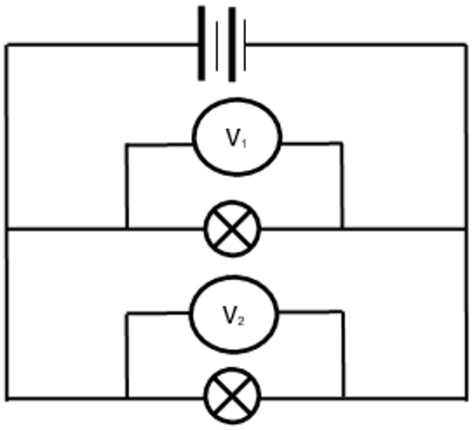
Which ONE of the following best explains why this happens?

A Positive charges are transferred from the rod to the wool.
B Negative charges are transferred from the rod to the wool.
C Positive charges are transferred from the wool to the rod.
D Negative charges are transferred from the wool to the rod. (2)

1.8 A rubber balloon obtains a negative charge after it has been rubbed against human hair.
Which ONE of the statements below best explains why this happens?

A Negative charges are transferred from the rubber balloon to the human hair.
B Positive charges are transferred from the rubber balloon to the human hair.
C Positive charges are transferred from the human hair to the rubber balloon.
D Negative charges are transferred from the human hair to the rubber balloon. (2)

1.9 Two identical light bulbs are connected in parallel, as shown in the circuit diagram below. Voltmeters V_1 and V_2 are connected across each light bulb



A $V_1 = V_2$
B $V_1 = 2V_2$
C $V_1 = ½V_2$
D $V_1 = ¼V_2$ (2)

1.10 For which ONE of the quantities below is the CORRECT unit of measurement given?

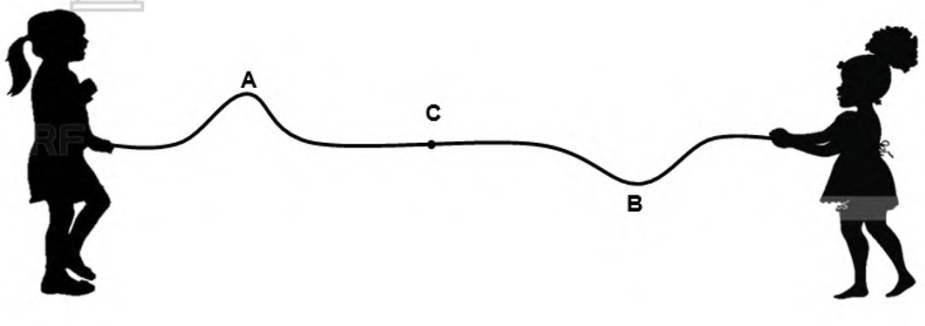
	QUANTITY	UNIT
A	Current	$A \cdot s^{-1}$
B	Energy	kW
C	Potential difference	V
D	Resistance	V·s

(2)

[20]

QUESTION 2

Two girls, standing at opposite ends of a rope, each makes a pulse of the same speed. Pulse **A**, with an amplitude of 4 cm, moves to the right and pulse **B**, with an amplitude of -6 cm, moves to the left. The pulses meet at point **C**.



2.1 State the phenomenon observed when the two pulses meet at point **C**. (3)

2.2 Draw a labelled diagram to show the resultant pulse when the two pulses meet at point **C**. Label the pulses clearly. (2)

2.3 Name the type of interference that takes place when the pulses meet. (2)

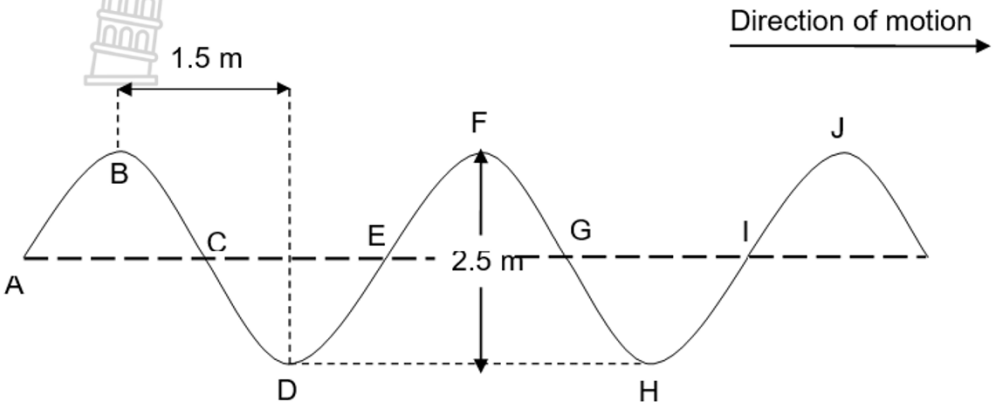
2.4 Determine the resultant amplitude of the pulses at point **C**. (2)

2.5 How will the amplitude of pulse A be affected after passing point **C**? Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

[10]

QUESTION 3

The diagram below represents a water wave moving from left to right. The time between two consecutive crests is 0, 5 s.



3.1	What type of wave is a water wave?	(1)
3.2	Write down the amplitude of the wave.	(2)
3.3	Define the term wavelength.	(2)
3.4	Determine the wavelength of the wave.	(3)
3.5	Name TWO points on the wave form above that are in phase.	(2)

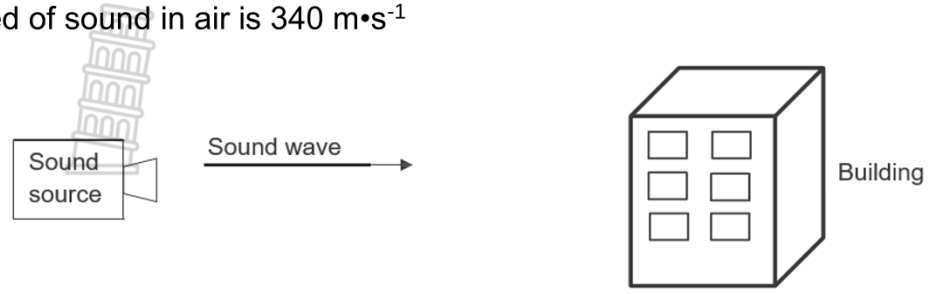
Calculate:

3.6	The time taken for FOUR crests to move past a certain point in the path of the wave	(3)
3.7	The speed of the wave	(4)

[17]

QUESTION 4

A sound wave is produced by a source placed a certain distance from a building as shown below. The echo reaches the source after 8 seconds. The speed of sound in air is 340 m•s^{-1}



4.1 Define the term longitudinal wave. (2)

4.2 Calculate the distance between the sound source and the building. (4)

4.3 Name the property of a sound wave that influences its pitch. (2)

4.4 Above which frequency is a sound wave classified as ultrasound? (2)

4.5 Name ONE use of ultrasound in the medical treatment of patients. (2)

[12]

QUESTION 5

The frequency and corresponding energy of electromagnetic waves are given in the table below.

WAVE	FREQUENCY (Hz)	ENERGY (J)
A	2×10^{9}	$1{,}33 \times 10^{-24}$
B	4×10^{12}	$2{,}65 \times 10^{-21}$
C	$3{,}5 \times 10^{15}$	$2{,}32 \times 10^{-18}$
D	$1{,}8 \times 10^{18}$	$1{,}19 \times 10^{-15}$
E	**f**	$4{,}97 \times 10^{-14}$

5.1 Describe how an electromagnetic wave propagates. (3)

5.2 What is the relationship between frequency and energy of an electromagnetic wave, as shown in the table above? (2)

5.3 Calculate the:

5.3.1 Frequency of wave **E** (4)

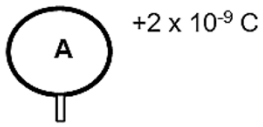
5.3.2 Wavelength of wave **D** (4)

5.4 Which wave, **A** or **B**, has the HIGHER penetrating ability? Give a reason for the answer. (2)

[15]

QUESTION 6

6.1 A small, metal sphere **A** carrying a charge of +2 x 10^{-9} C is placed on an insulated stand.



6.1.1 How does the number of electrons compare with the number of protons in sphere **A**? (1)

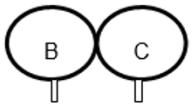
Choose from LESS THAN, GREATER THAN or EQUAL TO

*10^{13} electrons are now added to sphere **A***

6.1.2 Calculate the new charge on sphere **A** (4)

6.2 Two identical metal spheres B and C placed on insulated stands, carry charges +4 x 10^{-6} C and -6 x 10^{-6} C respectively as shown in the diagram below.

The spheres are allowed to touch each other.



After touching the spheres are then separated and brought back to their original positions as shown in the diagram below.

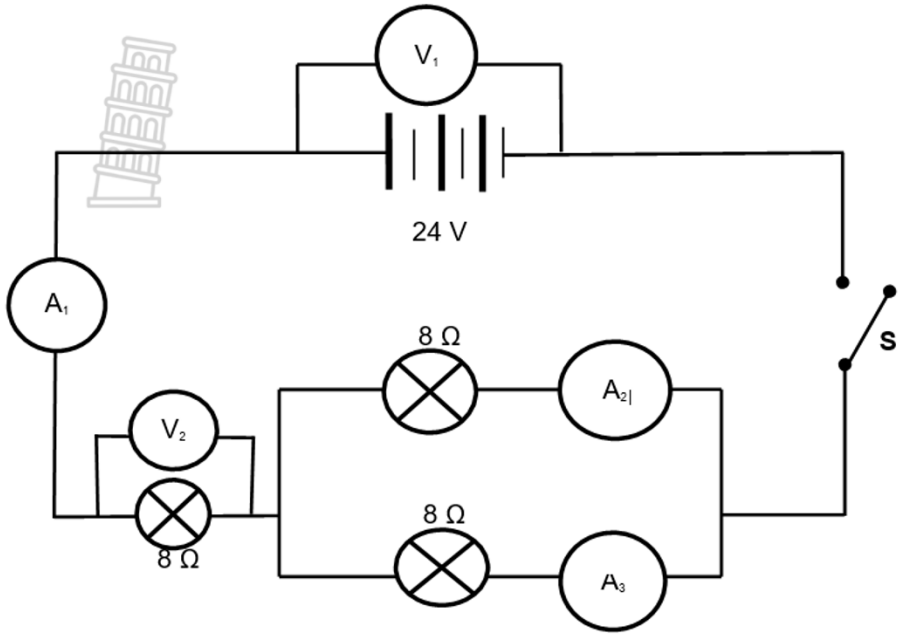
6.2.1 State the principle of conservation of charge. (2)

6.2.2 Calculate the number of electrons transferred between the two spheres during contact. (6)

[13]

QUESTION 7

Consider the circuit diagram below.



Switch S is OPEN

7.1 Write down the reading on the following:

7.1.1 Voltmeter (V_1) (1)

7.1.2 Ammeter (A_1) (1)

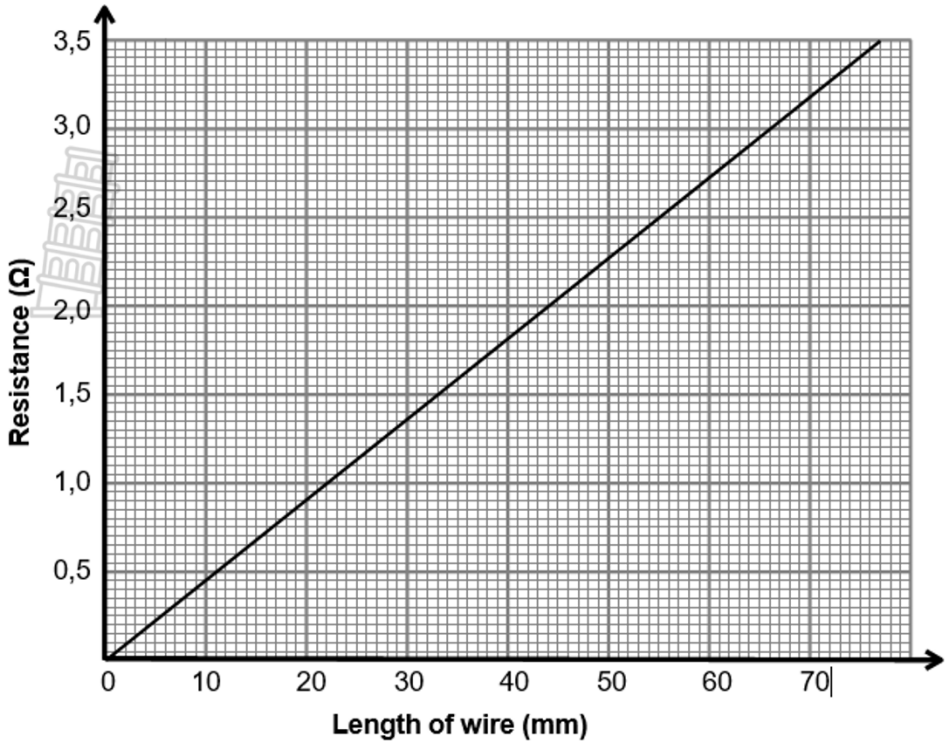
Switch S is now CLOSED.

7.2 Calculate the equivalent resistance of the circuit. (4)

7.3 Calculate the reading on voltmeter V_2. (3)

7.4 How do the readings on ammeters A_2 and A_3 compare with each other? (1)

7.5 The graph below shows the relationship between the resistance and the length of the conducting wire.



7.5.1 Write down the relationship between the resistance and the length of the conducting wire. (1)

7.5.2 Determine the resistance of wire with a length of 30 mm. (2)

GRAND TOTAL: 100 MARKS **[13]**

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m\cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m\cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J\cdot s$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

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

ELECTROSTATICS/*ELEKTROSTATIKA*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

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07 MARCH 2023
GRADE 10

MEMORANDUM

MARKS : 100 **DURATION: 2 hours**

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QUESTION 1

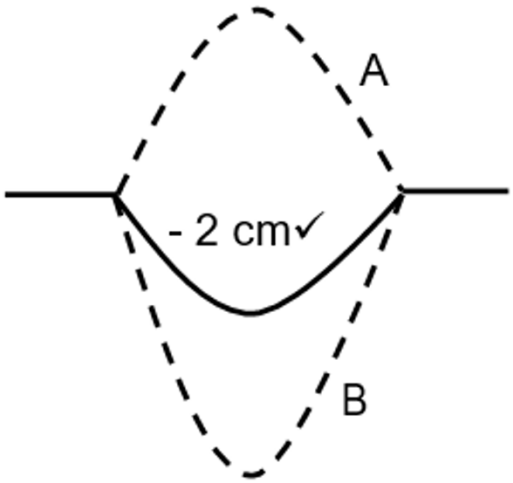
1.1 C✓✓
1.2 D✓✓
1.3 C✓✓
1.4 C✓✓
1.5 A✓✓
1.6 B✓✓
1.7 D✓✓
1.8 D✓✓
1.9 A✓✓
1.10 C✓✓

[20]

QUESTION 2

2.1 Superposition of pulses. ✓Algebraic sum of the amplitudes of two pulses that occupy the same space at the same time. ✓✓ (3)

2.2 (2)



Both (A and B) ✓

2.3 Destructive (interference) ✓✓ (2)

2.4 Amplitude = (+4) + (-6) (2)
= - 2 cm✓✓
(Marks: 2 or/of 0)

2.5 REMAIN THE SAME✓ (1)

[10]

QUESTION 3

3.1 Transverse ✓ (1)

3.2 1,25 m✓✓ (2)

3.3 The distance between two consecutive points in phase✓✓ (2)

OR

The distance between two consecutive crests or two consecutive troughs.

3.4 λ = 3 m ✓✓✓(1.5 m =0,5 wave) (3)

3.5 Any one of: A and C; E and G; B and F; D and H; F and J ✓✓ (2)

3.6 4 crests implies 3 waves (3)

3 ✓x 0,5 ✓= 1,5 s ✓

(3 waves x 0,5 seconds per wave)

3.7 (4)

Speed$=\frac{\text{distance}}{\text{time}}$ ✓ $=\frac{9✓}{1.5✓}$ $=6m\cdot s^{-1}✓$	Positive marking from 3.4 $v=\frac{\Delta x}{\Delta t}$ ✓ $=\frac{3✓}{0.5✓}$ $=6m\cdot s^{-1}✓$	$v=f\lambda✓$ $=\frac{1}{T}\times\lambda$ $=\frac{1}{0,5}✓\times3✓$ **OR** $=(2✓\times3✓)$ $=6m\cdot s^{-1}✓$

[17]

QUESTION 4

4.1 (2)

Marking guidelines
If any of the underlined key words/phrases are omitted: minus 1 mark

A wave in which the <u>particles of the medium vibrate parallel to the direction of motion</u> of the wave. ✓✓

4.2 (4)

OPTION 1	**OPTION 2**
$v=\frac{\Delta x}{\Delta t}$ ✓	$v=\frac{\Delta x}{\Delta t}$ ✓
$340✓=\frac{\Delta x}{4}$ ✓	$340✓=\frac{\Delta x}{8}$
$\Delta x = 1360m✓$	$\Delta x = 2720m$
	$D=2720\div 2✓$
	$=1360m✓$

Marking criteria
• Formula $v=\frac{\Delta x}{\Delta t}$ ✓
• Substitute $340m\cdot s^{-1}$✓
• Divide time or final distance by 2. ✓
• Final answer 1360m✓

4.3 Frequency ✓✓ (2)

4.4 20 KHz ✓✓ (2)

4.5 Diagnosis of medical condition/pregnancy. ✓✓ (2)

[12]

QUESTION 5

5.1 An oscillating electric field in one plane ✓produces an (oscillating) magnetic field ✓at right angles/perpendicular to it. ✓ (3)

5.2 The higher the frequency, the higher the energy of the wave. ✓✓ (2)

OR

Frequency is directly proportional to energy. ✓✓

5.3

5.3.1 $E = hf$ ✓ (4)

$4,97 \times 10^{-14} = 6,67 \times 10^{-34} f$ ✓

$f = 7,5 \times 10^{19}$ Hz ✓✓

5.3.2 (4)

OPTION 1	**OPTION 2**
$c=f\lambda$ ✓ $3\times10^{8}=(1,8\times10^{18})\lambda$ ✓ $\lambda=1,67\times10^{-10}$m✓✓	$F=\frac{hc}{\lambda}$ ✓ $1,8\times10^{8}=\frac{(6,63\times10^{-34})(3\times10^{8})}{\lambda}$ ✓ $\lambda=1,67\times10^{-10}$m✓✓

5.4 B ✓ (2)

Highest frequency/energy✓

[15]

QUESTION 6

6.1

6.1.1 Less than ✓ (1)

6.1.2 (4)

$n=\frac{Q}{e}$

10^{13}✓$=\frac{Q}{-1,6\times10^{-19}}$✓

$Q=-1,6\times10^{-19}$C

Q new = $(-1,6 \times 10^{-19}) + (2 \times 10^{-19})$ ✓ = 4×10^{-20}C✓

6.2

6.2.1 The net charge of an isolated system remains constant. ✓✓ (2)

6.2.2 (6)

$$Q_b = Q_c = \frac{Q_{net}}{2} \quad ✓$$

$$= \frac{(4\times10^{-6})+(-6\times10^{-6})}{2} \quad ✓$$

$$= -1\times10^{-6}\text{C} \ ✓$$

$$n = \frac{\Delta Q}{e}$$

$$= \frac{(-6\times10^{-6}+1\times10^{-6})}{-1.6\times10^{-19}} \ ✓ \ ✓$$

$$= 3{,}13\times10^{13} \text{ electrons} \ ✓$$

[13]

QUESTION 7

7.1

7.1.1 $V_1 = 24$ ✓ (1)

7.1.2 $A_1 = 0$ (A) ✓ (1)

7.2 (4)

OPTION 1	**OPTION 2**
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓	$R_p = \frac{\text{product}}{\text{sum}}$ ✓
$= \frac{1}{8} + \frac{1}{8}$ ✓	$= \frac{1}{8} + \frac{1}{8}$ ✓
$R_p = 4\Omega$	$= 4\Omega$
$R_T = R_s + R_p$	$R_T = R_s + R_p$
$= 8+4$ ✓	$= 8+4$ ✓
$= 12\Omega$ ✓	$= 12\Omega$ ✓

7.3 (3)

OPTION 1

V divide in a ratio 8 : 4 ✓ (series)

$V_2 = \frac{8}{12} \times 24$ ✓

$= 16V$ ✓

OPTION 2

$V = IR$

$24 = I(12)$

$I = 2A$

$V = IR$ ✓

$= (2)(8)$ ✓

$= 16V$ ✓

7.4 $A_2 = A_3$. ✓ (1)

7.5

7.5.1 Resistance is directly proportional to the length of the conducting wire. ✓ (1)

OR

As the length of the wire increases, the resistance increases.

7.5.2 1,35Ω ✓✓ (Range: 1,3 Ω to 1,4 Ω) (2)

[13]

GRAND TOTAL: 100 MARKS