



Province of the
EASTERN CAPE
DEPARTMENT OF EDUCATION

BUFFALO CITY METRO DISTRICT

GRADE 10

**PHYSICAL SCIENCES
CONTROLLED TEST**

13 MARCH 2025
Stanmorephysics.com

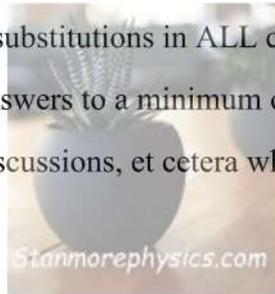
MARKS: 75

TIME: 1 HOUR 30 MINUTES

THIS QUESTION PAPER CONSISTS OF 10 PAGES INCLUDING THE COVER PAGE.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly



QUESTION 1

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 number (1.1 – 1.7). For example: 1.11 B

1.1 What is the term used for the distance between two successive points in phase?

- A amplitude
- B wavelength
- C frequency
- D period

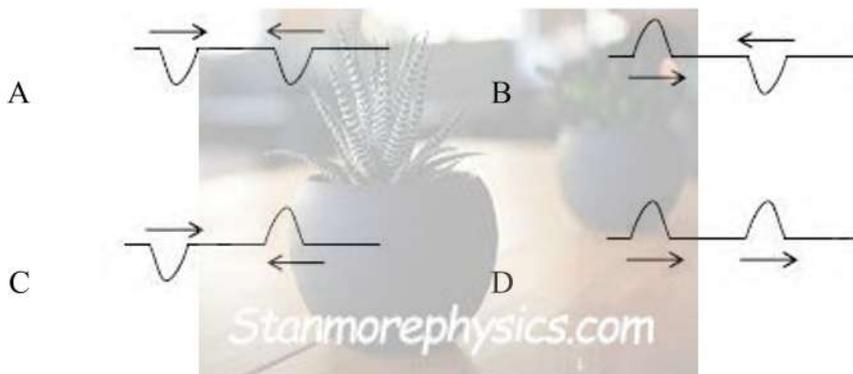
(2)

1.2 The speed of a pulse is determined by the:

- A Pulse length of the pulse
- B Amplitude of the pulse
- C Medium through which the pulse travels
- D Distance the pulse travels.

(2)

1.3 Which of the following diagrams best illustrates pulses which will interfere constructively when they meet up with each other?



(2)

1.4 When the frequency of vibration of a wave with a period **T** is doubled, then its period is ...

- A T
- B 2 T
- C 0,5 T
- D 4 T

(2)

1.5 Which Electromagnetic wave has the highest energy?

- A X-rays
 - B Infrared
 - C Ultraviolet
 - D Gamma rays
- (2)

1.6 Three charges **X**, **Y** and **Z** are arranged in a straight line. **X** is positively charged and it is repelled by **Y** and **Z** is attracted by **Y**. What is the nature of charges **Y** and **Z**?

	CHARGE Y	CHARGE Z
A	Positive	Positive
B	Negative	Positive
C	Negative	Negative
D	Positive	Negative

(2)

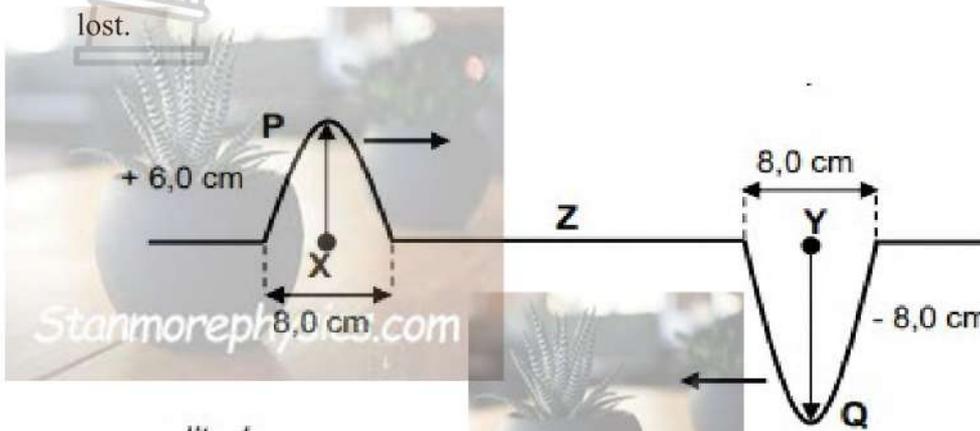
1.7 The SI unit of Volt is the same as ...

- A $C \cdot s^{-1}$
 - B $A \cdot s$
 - C $J \cdot s$
 - D $J \cdot C^{-1}$
- (2)

[14]

QUESTION 2

Two pulses, **P** and **Q** travel along a string, and approach each other at the same speed. Both pulses have a pulse length of 8 cm. Pulse **P** has an amplitude of +6 cm when it is at position **X**. Pulse **Q** has an amplitude of -8 cm when it is at position **Y**. Position **X** and **Y** are at the same distance from point **Z**. Pulse **P** and **Q** meet at position **Z**. Assume that no energy is lost.

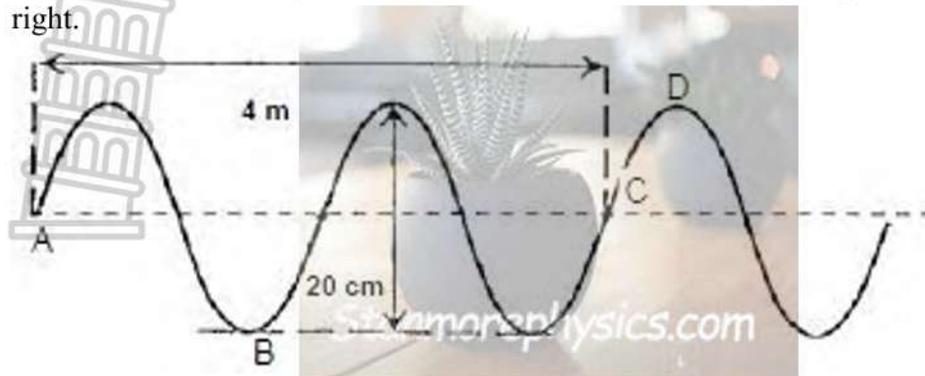


- 2.1 Define the *principle of superposition*. (2)
- 2.2 What kind interference will happen when these pulses **P** and **Q** meet at point **Z**.
Choose CONSTRUCTIVE or DESTRUCTIVE. Explain your answer. (2)
- 2.3 Calculate the amplitude of the resulting pulse during interference (2)

[6]

QUESTION 3

The diagram below represents a transverse wave with a frequency of 1,5 Hz, moving to the right.



3.1 Define the term *transverse wave* (2)

3.2 Write down the names of the following:

3.2.1 two points that are in phase. (1)

3.2.2 point B (1)

3.2.3 point D (1)

3.3 Determine the following in meters:

3.3.1 wavelength (2)

3.4 Calculate the:

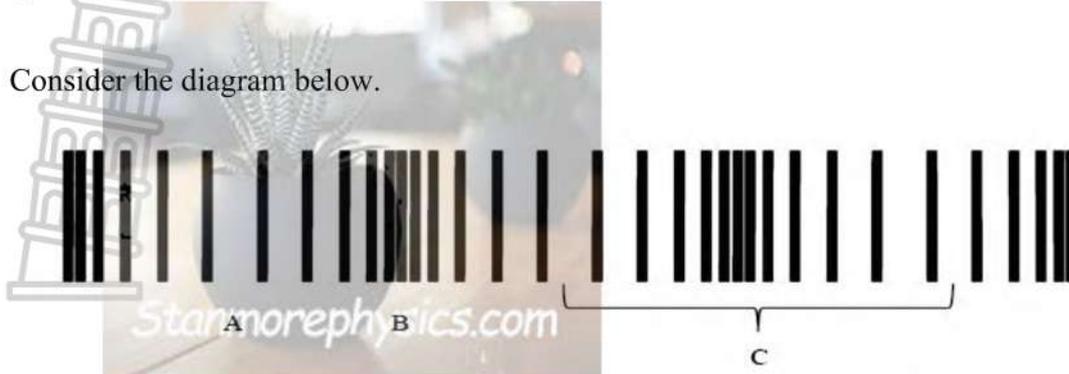
3.4.1 period of the wave (3)

3.4.2 speed of the wave (3)

[13]

QUESTION 4

Consider the diagram below.



4.1 Define the term *longitudinal wave*. (2)

4.2 write down the name of labels:

4.2.1 A (1)

4.2.2 B (1)

4.2.3 C (1)

The diagram below shows a boat which emits ultrasound to detect the depth of the sea.

The boat emitted a sound of frequency 30 000 Hz and a return signal is received in the boat 10 seconds later. Take the speed of sound waves in water to be $1500 \text{ m}\cdot\text{s}^{-1}$.



4.3 Calculate the:
4.3.1 wavelength of the ultrasound in water. (3)

4.4 Give 2 other uses of ultrasound in the field of medicine (2)

[10]

QUESTION 5

Consider the electromagnetic spectrum below and answer the questions that follow:

Radio waves	Micro waves	Infrared	A	Ultraviolet	B	Gamma rays
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Use the table to answer the questions that follows

5.1 Define the term *photon*. (2)

5.2 Give the names of the electromagnetic radiations **A** and **B** (2)

5.3 For radiation **A**, with a frequency of $2,5 \times 10^{16}$ Hz, calculate the energy of its photon. (3)

5.4 Explain why electromagnetic radiation **B** is best suitable to scan bones and not radiation **A**? (2)

5.5 Calculate the wavelength of radiation **B** if its photons have an energy of $7,25 \times 10^{-13}$ J (4)

[13]

QUESTION 6

Two identical metal spheres, **A** and **B**, on an insulated surface, carry charges of $-5,3 \times 10^{-6} \text{ C}$ and $+4,7 \times 10^{-6} \text{ C}$ respectively. The spheres are brought into contact with each other.

6.1 State the *principle of charge quantisation*. (2)

6.2 Calculate the number of excess electrons in sphere B. (3)

6.3 Give a reason why we place charged spheres on insulated stands. (1)

6.4 Will the electrons be transferred from A TO B or B TO A?

Give a reason for the answer. (2)

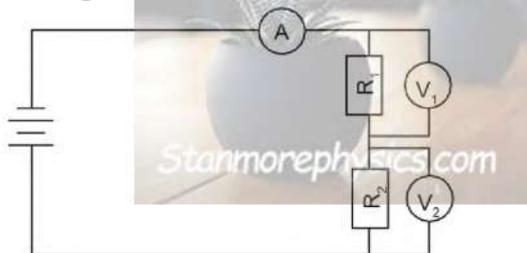
6.5 Calculate the new charge on each sphere after it has moved away from each other. (3)

6.6 Calculate the number of electrons transferred from one sphere to the other during contact. (3)

[14]

QUESTION 7

Consider the following circuit below. The reading on voltmeter V_1 is 6 V. The ammeter reading is 1,5 A.



7.1. Define *potential difference*. (2)

7.2 Calculate the magnitude of the reading on V_2 if 8,000 J of energy is used by 735 C of charge. (3)

[5]

TOTAL= 75 marks

DATA FOR PHYSICAL SCIENCES GRADE 10

TABLE 1: PHYSICAL CONSTANTS



NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 m.s ⁻²
Speed of light in a vacuum	c	3,0×10 ⁸ m.s ⁻¹
Planck's Constant	h	6,63×10 ⁻³⁴ J.s
Charge of electron	e or q _e	-1,6×10 ⁻¹⁹ C

**TABLE 2: FORMULAE
WAVES, SOUND AND LIGHT**

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

ELECTRICITY AND MAGNETISM

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$R = \frac{V}{I}$
$Q = \frac{Q_1 + Q_2}{2}$	$n = \frac{Q}{e}$



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MEMORANDUM

MARKS: 75

THIS MEMORANDUM CONSISTS OF 6 PAGES INCLUDING THE COVER PAGE.

QUESTION 1

- 1.1 B ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 C ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 D ✓✓ (2)
- 1.7 D ✓✓ (2)

[14]



QUESTION 2

- 2.1 The algebraic sum of the amplitudes of two pulses that occupy the same space at the same time. ✓✓ (2)
- 2.2 Destructive interference. ✓
Interference between a crest and a trough leading to a reduced amplitude. ✓ (2)
- OR They sum up to a smaller amplitude. ✓
- 2.3 $A = 6 + (-8) \checkmark = -2\text{cm} \checkmark$ **Answer only: full marks** (2)

[6]

QUESTION 3

3.1 A wave in which the particles of the medium vibrate at right angles to the direction of motion of the wave. ✓✓ (2)

3.2.1 A and C ✓ (1)

3.2.2 Trough ✓ (1)

3.2.3 Crest ✓ (1)

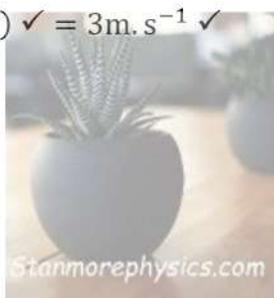
3.3 $4 \div 2 = 2$ m. ✓ (2)

3.4.1 $T = \frac{1}{f} = \frac{1}{1,5} = 0,67$ s ✓ (3)

Positive marking from 3.3

3.4.2 $v = f \cdot \lambda = (1,5)(2) = 3$ m. s⁻¹ ✓ (3)

[13]



QUESTION 4

4.1 A wave in which the particles of the medium vibrate parallel to the direction of motion of the wave. ✓✓ (2)

4.2.1 Rarefaction ✓ (1)

4.2.2 Compression ✓ (1)

4.2.3 Wavelength ✓ (1)

4.3.1 $v = f \cdot \lambda$ ✓

$1500 = 30\,000 \times \lambda$ ✓ (3)

$\lambda = 0,05$ m ✓

4.4 • To check the health of unborn babies in their mother's womb. ✓ (2)

- To diagnose and treat various conditions (tumours). ✓

(Any other additional uses)

[10]

QUESTION 5

5.1 A photon is a packet of energy found in light. ✓✓ (2)

5.2 A = visible light ✓

B = X-rays ✓ (2)

5.3 $E = hf$ ✓

$$= 6,63 \times 10^{-34} \times 2,5 \times 10^{16} \checkmark$$

$$= 1,6575 \times 10^{-17} \text{J} \checkmark \quad (3)$$

5.4 Because B has a higher frequency / energy ✓ hence a higher penetrating ability ✓ OR X-rays are absorbed by bones to appear bright white ✓ but visible light is deflected by soft tissues of the body. ✓ (2)

5.5 $E = \frac{hc}{\lambda} \checkmark$

$$7,25 \times 10^{-13} \checkmark = \frac{6,63 \times 10^{-34} \times 3,0 \times 10^8}{\lambda} \checkmark$$

$$\lambda = 2,74 \times 10^{-13} \text{m}. \checkmark \quad (4)$$

[13]

QUESTION 6

6.1 Every charge in the universe consists of an integer multiple of the charge of one electron. ✓✓ (2)

In 6.2, two options have been provided to accommodate the wrong choice of sphere with excess electrons.

6.2	OPTION 1	OPTION 2
	$n = \frac{Q}{e} \checkmark$ $= \frac{4,7 \times 10^{-6}}{1,6 \times 10^{-19}} \checkmark$ $= 2,9375 \times 10^{13} \text{ electrons} \checkmark$	$n = \frac{Q}{e} \checkmark$ $= \frac{-5,3 \times 10^{-6}}{-1,6 \times 10^{-19}} \checkmark$ $= 3,3125 \times 10^{13} \text{ electrons} \checkmark$

6.3 To prevent the loss of electrons or charges. ✓
OR To prevent leakage of charges. ✓ (1)

6.4 A to B. ✓
A has excess electrons. ✓ (2)

6.5
$$Q = \frac{Q_1 + Q_2}{2} \checkmark$$

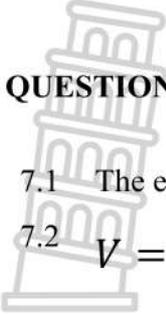
$$= \frac{4,7 \times 10^{-6} + (-5,3 \times 10^{-6})}{2} \checkmark$$

$$= -3 \times 10^{-7} \text{ C} \checkmark$$
 (3)

Positive marking from 6.5

6.6	OPTION 1	OPTION 2
	$\Delta Q = -3 \times 10^{-7} - (-5,3 \times 10^{-6}) \checkmark$ $= 5 \times 10^{-6} \text{ C}$ $n = \frac{5 \times 10^{-6}}{1,6 \times 10^{-19}} \checkmark$ $n = 3,125 \times 10^{13} \text{ electrons.} \checkmark$	$\Delta Q = -3 \times 10^{-7} - 4,7 \times 10^{-6} \checkmark$ $= -5 \times 10^{-6} \text{ C}$ $n = \frac{-5 \times 10^{-6}}{-1,6 \times 10^{-19}} \checkmark$ $n = 3,125 \times 10^{13} \text{ electrons.} \checkmark$

[14]

**QUESTION 7**

7.1 The energy transferred per unit electric charge (flowing through it) ✓✓ (2)

7.2 $V = \frac{W}{Q}$ ✓

$$= \frac{8000}{735} \checkmark \quad (3)$$

$$= 10,88 \text{ V} \checkmark$$

[5]

TOTAL [75]

