Province of the
EASTERN CAPE
EDUCATION

JOE GQABI DISTRICT

GRADE 10

PHYSICAL SCIENCES CONTROLLED TEST

TERM 1

08 MARCH 2024

MARKS : 100

TIME : 2 hours

INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 11A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of SEVEN 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 between two sub questions, 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. 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, etc. where required.
12. Write neatly and legibly.

QUESTION 1

Four options are provided as possible answers for the questions below. Each question has only ONE correct answer. Choose the answer and write only the letter next to the question number, for example 11.1 E.

1.1 When two pulses meet at a point and sum up to a bigger pulse, at that point there is….

A constructive interference
B superposition of pulses
C destructive interference
D none of the above (2)

1.2 The distance between two consecutive points that vibrate in phase on a wave is the……

A period
B wavelength
C amplitude
D frequency (2)

1.3 A wave in which the particles of the medium vibrate at right angles to the the path along which the wave travels through the medium, is produced by …

A a bat
B a car's hooter
C an ambulance
D an X-ray machine (2)

1.4 The amplitude of a sound wave is increased without changing the frequency. How does this change affect the loudness and the pitch of the sound?

	LOUDNESS	**PITCH**
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Unchanged
D	Increases	Increases

(2)

1.5 Which one of the combinations below is the correct order of electromagnetic waves in INCREASING WAVELENGTH?

A Gamma ray, X-ray, ultraviolet, visible light, infrared, microwave.
B Radio wave, microwave, infrared, visible light, ultraviolet, X-ray.
C X-ray, ultraviolet, infrared, visible light, radio wave, microwave.
D Gamma ray, X-ray, visible light, ultraviolet, infrared, microwave. (2)

1.6 An object is positively charged if it has more …

A electrons than protons
B protons than electrons
C protons than neutrons
D electrons than neutrons (2)

1.7 The UNIT in which the rate of flow of charge I measured, is called ….

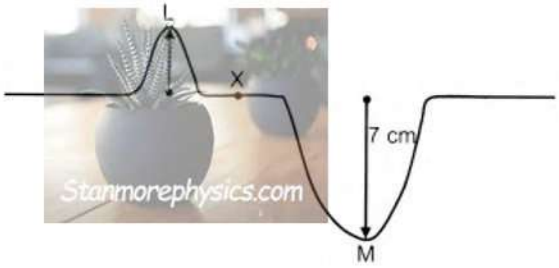
A ampere
B coulomb
C volt
D watt (2)

[14]

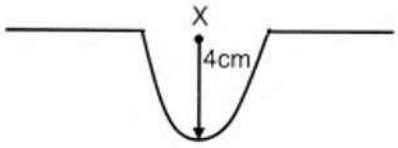
QUESTION 2

2.1 Define the term *pulse* (2)

2.2 The diagram below shows two pulses **L** and **M**, travelling in opposite direction in a rope. The amplitude of pulse **L** is UNKOWN and that of pulse **M** is **7 cm**.



The two pulses meet at point **X** and the resulting amplitude is shown below.



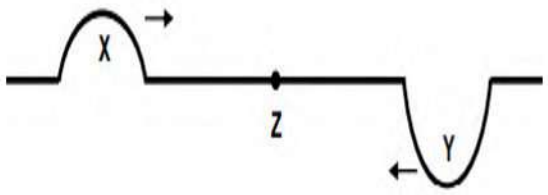
2.2.1 What type of interference takes place at point **X** (1)

2.2.2 Define the type of interference mentioned in question 2.2.1 (2)

2.2.3 Determine the amplitude of pulse **L** (2)

2.2.4 In which direction does pulse **M** move after the two pulses pass each other? Write either TO THE RIGHT or TO THE LEFT. (1)

2.3 Two transverse pulses **X** and **Y** are moving towards each other as shown in the diagram below.



The two pulses **X** and **Y** with the amplitudes of **+5 cm** and **-8 cm** respectively meet at point **Z**.

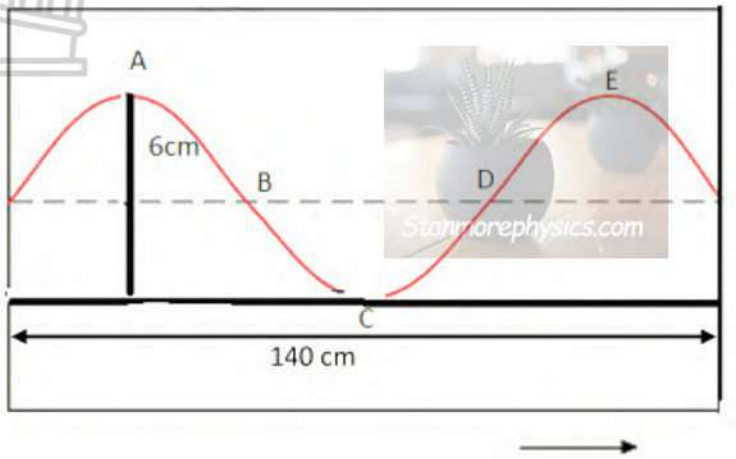
2.3.1 Write down and state the phenomenon observed at point **Z** (3)

2.3.2 Determine the resulting amplitude and draw a labelled diagram to show the resultant when two pulses meet at point **Z** (3)

[14]

QUESTION 3

3.1 Study the diagram below and answer the questions that follow:



3.1.1 Define a *transverse wave* (2)

3.1.2 identify two points that are in phase (1)

3.2 Use the diagram and the information given to determine the:

3.2.1 Amplitude (2)

3.2.2 Wavelength (2)

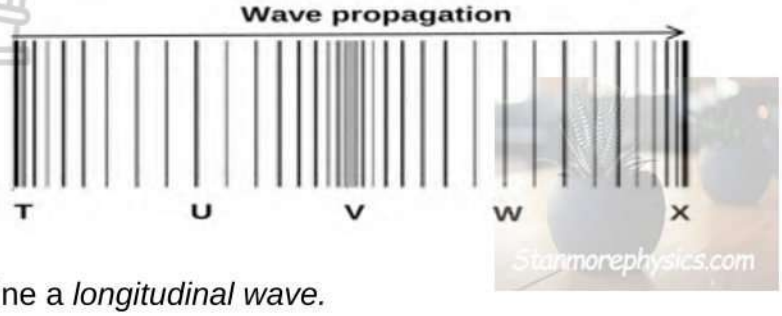
3.2.3 If the speed of the wave is $18\,m.s^{-1}$, calculate the frequency of the wave. (3)

3.2.4 Calculate the period of the wave. (3)

[13]

QUESTION 4

The diagram below shows a longitudinal wave produced from a musical instrument.



4.1 Define a *longitudinal wave.* (2)

4.2 Write down the name and define the parts marked:

4.2.1 **U** (3)

4.2.2 **V** (3)

4.3 Describe the motion of the particle at point **U** as the wave propagates to the right. (2)

4.4 **T** and **V** are two points that are in phase and the distance between them is 5 cm. Wave particle at point **U** make 410 vibrations in 2 seconds. Calculate the:

4.4.1 frequency of the wave (3)

4.4.2 speed of the wave particle (3)

4.5 Dolphins communicate through the emission and reception of sounds. A young dolphin was separated from its mother and started whistling at a frequency of 130kHz to call her. The speed of sound in seawater is $1\,480\,ms^{-1}$.

4.5.1 Explain the term *ultrasound* (2)

4.5.2 Calculate the wavelength of the young dolphin (4)

[22]

QUESTION 5

5.1 What is meant by the term: DUAL NATURE of electromagnetic radiation (2)

5.2 A particle of light has a wavelength of 5×10^{-13}m

5.2.1 What is a photon (2)

5.2.2 What is a speed of a photon (1)

5.2.3 Calculate the energy of a photon (4)

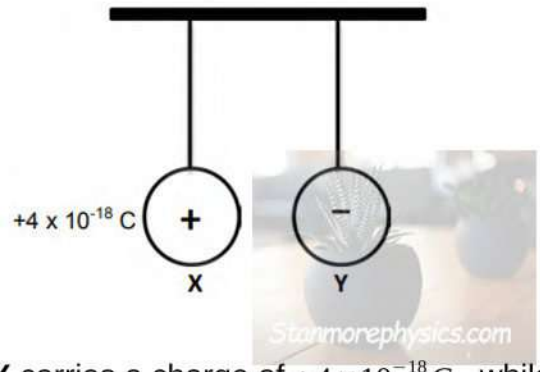
5.3 will a photon of ultraviolet light have HIGHER ENERGY or LOWER ENERGY than a photon of gamma rays? Give a reason for the answer. (2)

5.4 Name the type of electromagnetic radiation that is used to study animals at night. (1)

[12]

QUESTION 6

Two identical insulated sphere **X** and **Y** are suspended by threads from a ceiling, are help small distance apart, as shown in the diagram below.



6.1 Sphere **X** carries a charge of $+4\times10^{-18}C$, while sphere **Y** has excess of 30 electrons.

6.1.1 Calculate the charge on sphere **Y** (3)

6.1.2 Identify and define the principles used to answer question 6.1.1 (3)

6.2 The two sphere are now released and they move towards each other.

6.2.1 Give a reason why spheres **X** and **Y** move towards each other. (1)

6.3 After touching the two sphere **X** and **Y** are observed to move away from each other.

6.3.1 Explain why the two sphere move away from each other after touching. (2)

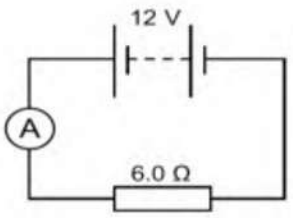
6.3.2 State the principle of conservation of charge. (2)

6.3.3 Calculate the number of electrons transferred. (4)

[15]

QUESTION 7

7.1 A circuit consist of a battery of emf 12 V and a heater of resistance 6,0 Ω



7.1.1 Define *emf* (2)

7.1.2 Define an electric current (2)

7.2 If the current passing through the ammeter in 2 minutes is 2 A. Calculate the:

7.2.1 charge that pass through the resistor (3)

7.2.2 energy transferred by the charge (3)

[10]

TOTAL : 100

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	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Planck's constant *Planck se konstante*	h	$6{,}63 \times 10^{-34}\ J{\cdot}s$

TABLE 2: FORMULAE/ *TABEL 2: FORMULES*

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

$v = \lambda f$	$T = \frac{1}{f}$
$E = hf$	$E = \frac{he}{\lambda}$

ELECTROSTATICS/ ELEKTROSTATIKA

$n = \frac{Q}{q_{e^-}}$ or/*of* $n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/ *ELEKTRIESE STROOMBANE*

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

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MOMARANDUM

QUESTION 1

1.1 A√ √

1.2 B√ √

1.3 D√ √

1.4 C√ √

1.5 B√ √

1.6 B√ √

1.7 A√ √

[14]

QUESTION 2

2.1 Pulse is a single disturbance in a medium√ √ (2)

2.2

2.2.1 Destructive interference√ (1)

2.2.2 Two pulses meet at a point and sum up to no pulse or smaller pulse√ √ (2)

2.2.3 amplitude of pulse L + (-7 cm) = -4 cm√

amplitude of pulse L = 3 cm√ (2)

2.2.4 TO THE LEFT√ (1)

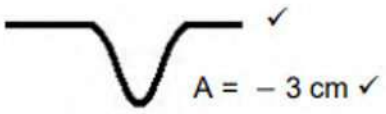
2.3

2.3.1 principle of superposition of pulses√

The algebraic sum of the amplitudes of two pulses that occupy the same space at the same time √ √

(3)

2.3.2 +5 cm + (-8 cm) = -3 cm√



(3)

[14]

QUESTION 3

3.1

3.1.1 A wave in which the disturbance of particles is at right angle to the direction of propagation of wave.√ √ (2)

3.1.2 AE√ (1)

3.2

3.2.1 3 cm√ √ (2)

3.2.2 93,33 cm√ √ (2)

3.2.3 $v = f\lambda$ √

$f = \frac{18}{93,33}$ √ positive marking from Q. 3.2.2

$f = 0,19\ Hz$ √ (3)

3.2.4 $T = \frac{1}{f}$ √

$T = \frac{1}{0,19}$ √ positive marking from Q. 3.2.3

$T = 5,18\ s$ √ (3)

[13]

QUESTION 4

4.1 a pulse in which the disturbance of particles is parallel to the direction of propagation.√ √ (2)

4.2

4.2.1 Rarefaction√

The region of low pressure in a longitudinal wave.√ √ (3)

4.2.2 Compression√

The region of high pressure in a longitudinal wave.√ √ (3)

4.3 The particles move forward and backward. (parallel to direction of propagation)√ √ (2)

4.4

4.4.1 $f=\frac{1}{T}$√

$f=\frac{410}{2}$√

$f=205\,Hz$√ (3)

4.4.2 $v=f\lambda$√

$v=205\times0,05$√ positive marking from Q. 4.2.1

$v=10,25\,m.s^{-1}$√ (3)

4.5

4.5.1 sound with frequencies higher than 20 000 Hz√ √ (2)

4.5.2 $v=f\lambda$√

$1\,480$√$=130\,000$√$\times\lambda$

$\lambda=0,01m$√ (4)

[22]

QUESTION 5

5.1 light has wave and particle nature√ √ (2)

5.2

5.2.1 An energy packet of electromagnetic radiation√ √ (2)

5.2.2 $c = 3 \times 10^{8}\, m.s^{-1}$ √ (1)

5.2.3 $E = hf$ √

$$E = 6{,}63 \times 10^{-34}\ \frac{3 \times 10^{8}\ \surd}{5 \times 10^{-13}\ \surd}$$

$E = 3{,}98 \times 10^{-13}\, J$ √ (4)

5.3 LOWER ENERGY√

Ultraviolet light have lower frequency than gamma rays√ (2)

5.4 infrared waves√ (1)

[12]

QUESTION 6

6.1.1 $Q = nqe$ √

$Q = 30 \times -1,6 \times 10^{-19}$ √

$Q = -4 \times 10^{-18} C$ √ (3)

6.1.2 principle of charge quantisation√

All charges in the universe have a multiple integer of charge of an electron

$-1,6 \times 10^{-19}$ √ √ (3)

6.2

6.2.1 unlike charges attract√ (1)

6.3

6.3.1 when the two charges sphere are in contact they:

- Share electrons evenly.√
- Acquire a new charge that is the same.√ (2)

6.3.2 The net charge of an isolated system remains the same during any physical process.√ √ (2)

6.3.3 $Q_{new} = \frac{Q_x + Q_y}{2}$

$Q_{new} = \frac{+4 \times 10^{-19} + (-4,8 \times 10^{-18})}{2}$ √

$Q_{new} = -2,2 \times 10^{-18} C$

$Q_f - Q_i = nqe$ √

$-2,2 \times 10^{-18} - 4 \times 10^{-19} = n \times -1,6 \times 10^{-19}$ √

$n = 16\, electrons$ √ (4)

[15]

QUESTION 7

7.1

7.1.1 Maximum energy provided by a battery per unit charge passing through it.√ √ (2)

7.1.2 rate of flow of charge√ √ (2)

7.2

7.2.1 $I=\frac{Q}{\Delta t}\sqrt{}$

$2=\frac{Q}{120}\sqrt{}$

$Q=240C\sqrt{}$ (3)

7.2.2 $V=\frac{W}{Q}\sqrt{}$

$12=\frac{W}{240}\sqrt{}$

$W=2\,880J\sqrt{}$ (3)

[10]