LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

MOPANI EAST DISTRICT

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES
CONTROL TEST 1
MARCH 2023

MARKS: 100

TIME: 2 hours

This question paper consists seven (07) questions and twelve (12) pages including this cover page and data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your NAME at the TOP of every ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Give brief motivations, discussions, et cetera where required.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Write neatly and legibly.

SECTION A

QUESTION 1: MULTIPLE – CHOICE QUESTIONS

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 SCRIPT, for example 1.11 E

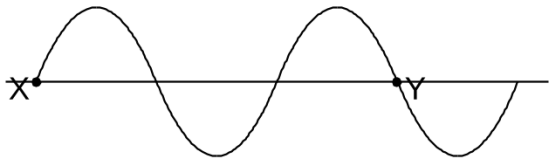
1.1. Which of the following is equal to 1 Herts (1Hz) ? (2)

A 1m
B $1m.s^{-1}$
C 1s
D $1s^{-1}$

1.2. The distance between any two consecutive points that vibrate in phase on a wave is the…. (2)

A period
B wavelength
C amplitude
D frequency

1.3. The diagram below shows two points **X** and **Y** on a wave train



How many wavelengths separate **X** and **Y**? (2)

A 0,75
B 1
C 1.5
D 3

1.4 The period of a transverse wave in a helix spring is 0,1s.The speed of the wave is $4 m.s^{-1}$. The frequency of this wave is ... (2)

A (0,1 x 4) Hz

B $\left(\frac{0,1}{4}\right)$ Hz

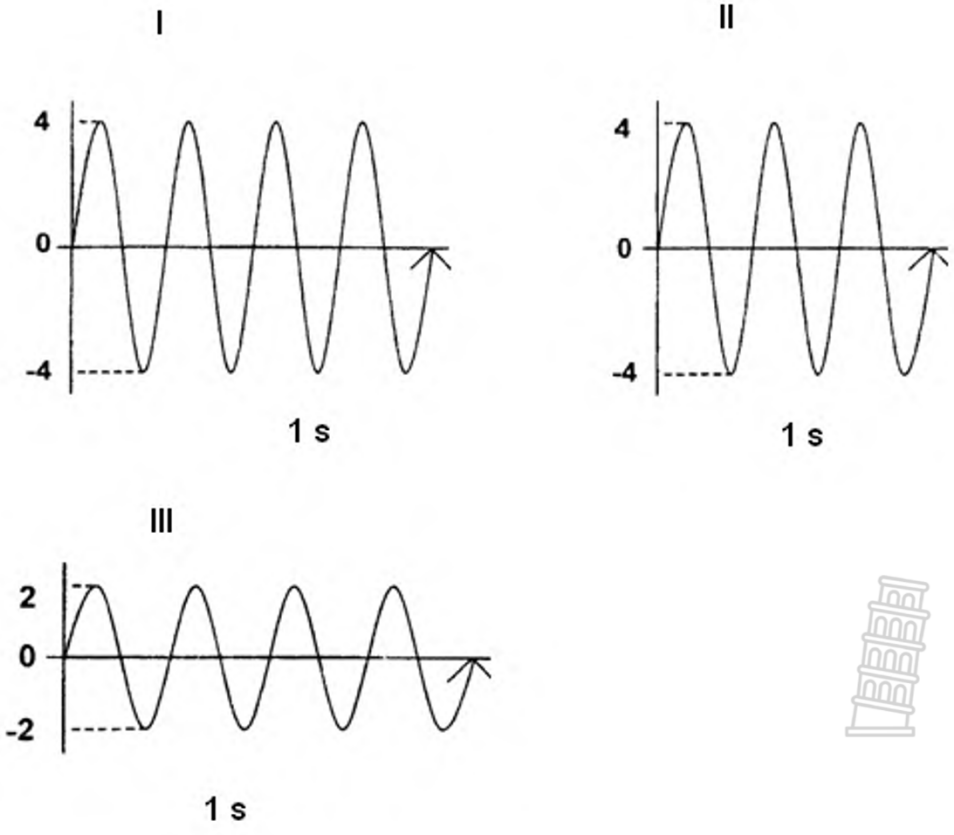
C $\left(\frac{1}{0,1}\right)$ Hz

D $\left(\frac{4}{0,1}\right)$ Hz

1.5 The wavelength of sound is (2)

A the same in all media
B the longest in gasses
C the shortest in liquids
D the longest in solids

1.6



I, II and III are presentations of sound waves on the screen of an oscilloscope.

Which one of the statements below is correct? (2)

A I and II have the same frequency

B II and III have the same loudness

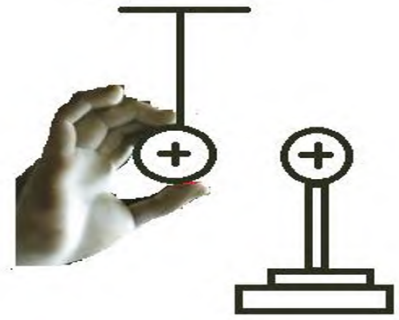
C I and II have the same loudness

D II and III have a higher pitch as I

1.7 The source of electromagnetic radiation is: (2)

A an accelerating charge
B a mechanical vibration.
C an explosion.
D an electromagnetic vibration.

1.8 A charged sphere is placed on an insulating stand. A learner is holding a second charged sphere which is hanging from a string as shown in the picture below. If the learner releases the charged sphere, it will… (2)



A swings away from the charged sphere placed on the stand.

B remains in the same position hanging vertically.

C swings towards the charged sphere placed on the stand.

D becomes neutral.

1.9 An object is positively charged if it has more ……. (2)

A. electrons than protons.

B. electrons than neutrons.

C. protons than electrons.

D. protons than neutrons.

1.10 A charge of magnitude +9 nC is flowing through a circuit in 5s.

The magnitude of its current will be…… (2)

A. 1,8 X 10^{-12} A

B. 18 X 10^{-9} A

C. 1,8 X 10^{-9} A

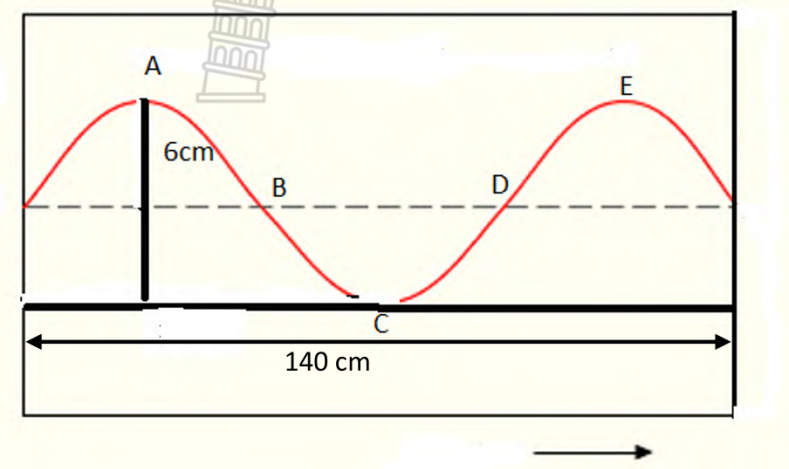
D. 8,1 X 10^{-12} A

[20]

SECTION B

QUESTION 2

Study the diagram below and answer the questions that follow:



2.1 Define the following terms:

2.1.1 Frequency (2)

2.1.2 Transverse wave (2)

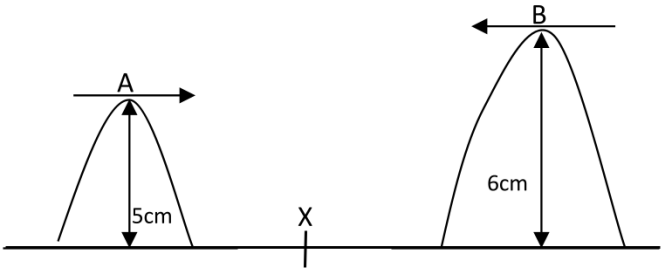
2.2 Use the diagram and the information given to determine values for:

2.2.1 Amplitude (2)

2.2.2 Wavelength (2)

2.2.3 If the speed of the waves is 18m.s^{-1}, calculate the frequency of the waves. (3)

2.2.4 Calculate the period of the waves. (2)



2.3 Two pulses travel towards other as shown in the diagram above:

2.3.1 Draw the shape of the resulting pulse as the two pulses A and B cross each other at point X. indicate the amplitude of the resulting pulse (3)

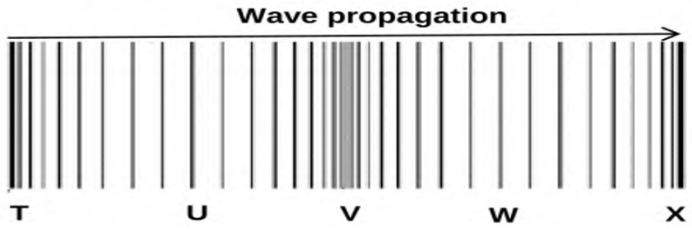
2.3.2 Which property of waves is illustrated in 2.3.1 above? (1)

2.3.3 Name and describe the principle used in 2.3.1. (3)

[20]

QUESTION 3

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



3.1. Define the longitudinal wave. (2)

3.2. Write down the of the parts marked:

3.2.1 **U** (1)

3.2.2 **V** (1)

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

3.4 State whether the following points are IN PHASE or OUT OF PHASE

3.4.1 **T** and **W** (1)

3.4.2 **V** and **X** (1)

3.5.1 Give a reason for the answer in question 3.4.2 (2)

3.5.2 Wave particle at point U make 410 oscillations in 2 seconds

Calculate the frequency of the wave (2)

[12]

QUESTION 4

4. The highest frequency that the human ear ca hear is 20 kHz. A Dolphin produces a sound in order to locate prey in water.

4.1 If the dolphin produces sound waves of wavelength of 5 cm, determine by means of calculations, whether the frequency produced by Dolphin can be heard by human ear.
The speed of sound in water is 1 480 $m.s^{-1}$. (4)

[4]

QUESTION 5

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

5.2 A particle has 3,98 x 10^{-19} J of energy and has a wavelength of 5 x 10^{-13}m

5.2.1 What is a photon? (2)

5.2.2 What is the speed of a photon? (1)

5.2.3 By means of a calculation, show that the above particle is a photon (4)

5.3 Will photon of ultraviolet light have more ENERGY or LESS ENERGY than a photon of gamma rays? Give a reason. (2)

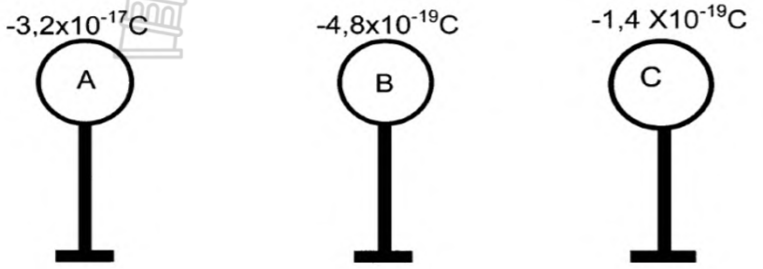
5.4 Name the type of electromagnetic radiation that is used to study animals at night. (2)

[13]

QUESTION 6

6.1 What is meant by triboelectric charging? (2)

6.2 Three metal spheres are placed on an insulated stands carry charges as shown below



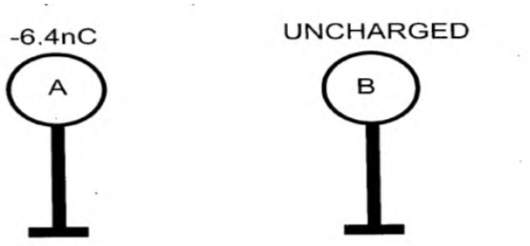
6.2.1 Determine the number of excess electrons found on sphere A. (3)

6.2.2 Is it possible for the charge indicated on sphere C to exist?

State YES or NO. Give a reason for the answer. (2)

6.2.3 Name the principle used to explain your answer to question 7.2.2. (1)

6.3 Two identical metal spheres are placed on insulated stands as shown below.



Spheres A carries a charge of -6.4 nC and sphere B is UNCHARGED.

6.3.1 What is meant by sphere B is uncharged? (2)

Sphere A is now brought CLOSE to sphere B. The spheres DO NOT touch.

6.3.2 Draw a sketch to show the charge distribution that takes place on sphere B. (2)

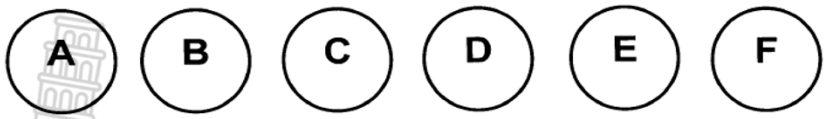
6.3.3 Name the phenomenon as described in question 6.3.2. (1)

The two spheres are now made to TOUCH each other and they are then separated.

6.3.4 State the Law of Conservation of Charge. (2)

6.3.5 Calculate the new charge on each sphere after touching. (3)

6.4 Refer to the six spheres A – F below. Sphere A is POSITIVELY charged. The charges on the other spheres are unknown.



A learner wishes to determine the nature of the charges on the other 5 spheres. She makes the following observations:

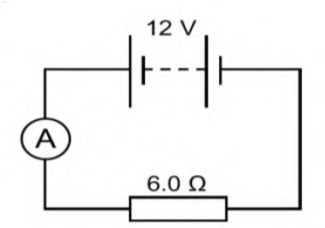
- F attracts both A and B
- D repels C
- E attracts D but repels F
- C attracts B

Use the above information to determine the nature of the charges on spheres B, C, D, E and F. (5)

[23]

QUESTION 7

7. A circuit consists of a battery of emf 12V and a heater with a resistance of 6,0 Ω.



7.1 Define an electric current. (2)

7.2 If the current through the ammeter is 2,0 A. Calculate the amount of charge that passes through the resistor in 2 minutes. (3)

7.3 Calculate the amount of energy transferred by the charge in 2 minutes. (3)

[8]

SECTION B TOTAL [80]

GRAND TOTAL [100]

DATA FOR PHYSICAL SCIENCES – GRADE 10 PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Speed of light in a vacuum	c	$3,0 \times 10^{8}\ m \cdot s^{-1}$
Charge on electron	e	$-1,6 \times 10^{-19}\ C$
Electron mass	m_e	$9,11 \times 10^{-31}\ kg$
Planck's Constant	h	$6,63 \times 10^{-34}\ J.s$

TABLE 2: FORMULAE

Waves, Sound and Light
$c = f\lambda$
$T = \frac{1}{f}$
$E = hf$
$E = \frac{hc}{\lambda}$

Electrostatic		Electric Circuits
$n = \frac{Q}{e}$	$Q_{new} = \frac{Q_1 + Q_2}{2}$	$V = \frac{W}{Q}$
		$I = \frac{Q}{\Delta t}$

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GRADE 10

PHYSICAL SCIENCES
CONTROL TEST 1 MEMO
15 MARCH 2023

MARKS: 100

This memorandum consists six (06) pages.

QUESTION 1

1.1 D ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓
1.5 D ✓✓
1.6 A ✓✓
1.7 A ✓✓
1.8 A ✓✓
1.9 C ✓✓
1.10 C ✓✓ **[20]**

QUESTION 2

2.1.1 Frequency – number of complete vibrations passing through appoint in a second. ✓✓ (2)

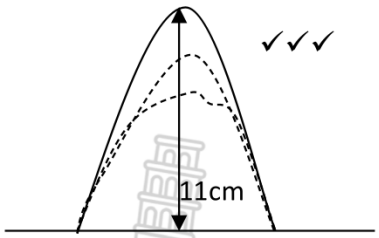
2.1.2 Particles of a vibrating medium are at right angle to the direction of propagation. ✓✓ (2)

2.2.1 Amplitude $= \frac{6}{2}$✓
$= 3cm$✓ (2)

2.2.2 $\lambda = \frac{140}{1.5}$ ✓
$= 93.33cm$✓ (2)

2.2.3 v = f.λ✓ 18
$= f.0.93$✓
f $= 0.05Hz$✓ (3)

2.2.4 T $= \frac{1}{f}$
$= \frac{1}{0.05}$✓
$= 20s$✓ (2)

2.3.1 

✓✓✓ (3)

2.3.2 Constructive interference✓ (1)

2.3.3 Principle of superposition. ✓ When two waves meet, crest to crest/ trough to trough, a bigger wave is formed. ✓✓ (3)

[20]

QUESTION 3

3.1 A wave in which the particle sof the medium vibrate parallel to the direction of motion of the wave.✓✓ (2)

3.2.1 Rarefaction✓ (1)

3.2.2 compression✓ (1)

3.3 The particle moves to the left and right✓✓
OR; The particle moves backwards and forwards (then return to its original position). (2)

3.4.1 OUT OF PHASE✓ (1)

3.4.2 IN PHASE✓ (1)

3.5.1 They are separated by a whole number of (complete) wavelengths.✓✓ (2)

3.5.2 f = number of oscillations per second
f = 410 ÷ 2✓
f = 205 Hz✓ (2)
[12]

QUESTION 4

4.1 $v = f\lambda$ ✓

$1\,480 = f\,(0.05)$ ✓

$f = 29\,600$ Hz

$f = 29.6$ kHz ✓

The human ear cannot hear the frequency produced by the Dolphin ✓ (4)

[4]

QUESTION 5

5.1 The radiation has both wave and particle properties ✓✓ (2)

5.2.1 A packet of energy in which light travels. ✓✓ (2)

5.2.2 $3 \times 10^8\ m.s^{-1}$ ✓ (1)

5.2.3

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

$$3{,}98 \times 10^{-13} \checkmark = \frac{6.63 \times 10^{-34} \times c}{5 \times 10^{-13}} \checkmark$$

$$c = 3 \times 10^8\ m \cdot s^{-1} \checkmark$$ (4)

5.3 Less energy ✓

Ultraviolet rays have a lower frequency compared to gamma rays ✓ (2)

5.4 Infrared ✓✓ (2)

[13]

QUESTION 6

6.1 The process by which objects are charged by contact or rubbing ✓✓ (2)

6.2

6.2.1 $n = \frac{Q}{e}$ ✓

$= \frac{-3{,}2 \times 10^{-17}}{-1{,}6 \times 10^{-19}}$ ✓

$= 200\ electrons$ ✓

(3)

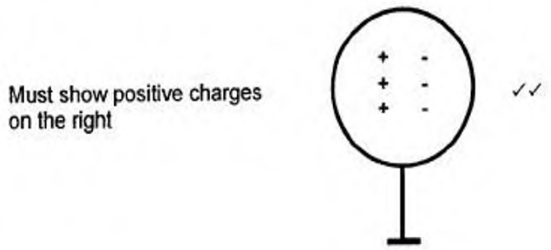
6.2.2 NO ✓, Smallest charge that can exist is $1{,}6 \times 10^{-19}$ C ✓ (2)

6.2.3 Principle of Charge Quantization ✓ (1)

6.3

6.3.1 Number of electrons equals number of protons ✓✓(if neutral, 1 mark) (2)

6.3.2



(2)

6.3.3 Charge Polarisation ✓ (1)

6.3.4 The total/ net charge of an isolated system remains the same/is conserved ✓✓(2)

6.3.5 $Q_{new} = \frac{Q_1+Q_2}{2}$ ✓

$= \frac{-6,4+0}{2}$ ✓

$= -3,2\ nC$ ✓ (3)

6.4 B: neutral ✓
C: positive ✓
D: positive ✓
E: negative ✓
F: negative ✓ (5)

[23]

QUESTION 7

7

7.1 Electric current is defined as the rate of flow of a charge. ✓✓ (2)

7.2 $Q = I\Delta t$ ✓

$= 2,0 \times (2 \times 60)$ ✓

$= 240\ C$ ✓ (3)

7.3 $V = \frac{W}{Q}$ ✓

$12 = \frac{W}{240}$ ✓

$W = 2880\ J$ ✓

(3)

[8]

TOTAL [100]