KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P1

COMMON TEST

JUNE 2024

MARKS: 75

DURATION: 1,5 hours

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INSTRUCTIONS AND INFORMATION

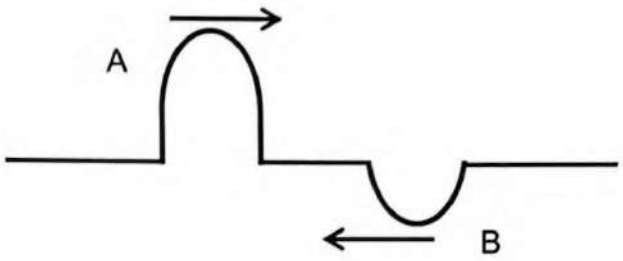
1. This question paper consists of SIX questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. You are advised to use the attached DATA SHEET.
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 et cetera where required.
11. Write neatly and legibly.

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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 (1.1–1.5) in the ANSWER BOOK, for example 1.6 E.

1.1 Pulse A, moving to the right, with an amplitude of Y metres overlaps with Pulse B, moving to the left, with an amplitude of ½ Y metres.



Which of the following combinations will be CORRECT when the pulses meet at the same point in the medium?

	Type of interference	Amplitude
A	Constructive	1,5Y
B	Destructive	1,5Y
C	Constructive	0,5Y
D	Destructive	0,5Y

(2)

1.2 Which ONE of the following is CORRECT for sound waves?

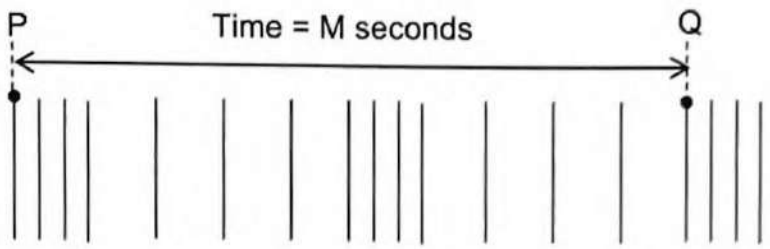
A Travels faster in gases than solids.

B Are longitudinal waves.

C Travels faster at lower temperatures.

D Travels through a vacuum. (2)

1.3 The time taken for the wave to move from point P to point Q on the wave pattern below is M seconds.



Which ONE of the following is the frequency of the wave?

A 0,5M

B M Hz

C $\frac{2}{M}$ Hz

D $\frac{1}{M}$ Hz

(2)

1.4 Which ONE of the following will result in an object becoming positively charged?

A Gains electrons

B Loses electrons

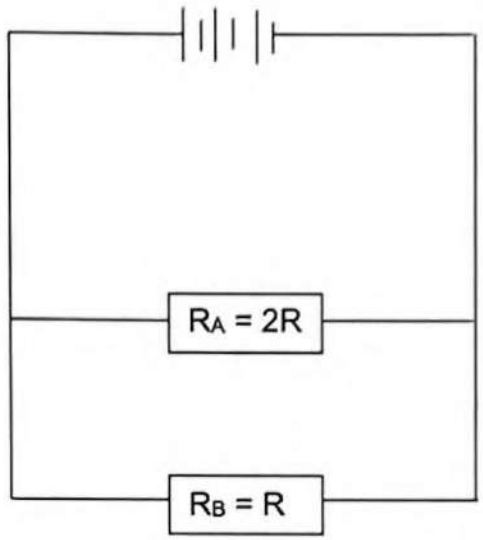
C Gains protons

D Loses protons

(2)

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1.5 In the circuit diagram below, the resistance of Resistor A is double that of Resistor B.



Which will be the correct relationship between the charge through Resistor A and the charge through Resistor B, in the same time?

A The charge through resistor A is double the charge through resistor B.

B The charge through resistor A is half the charge through resistor B.

C The charge through resistor A is equal to the charge through resistor B.

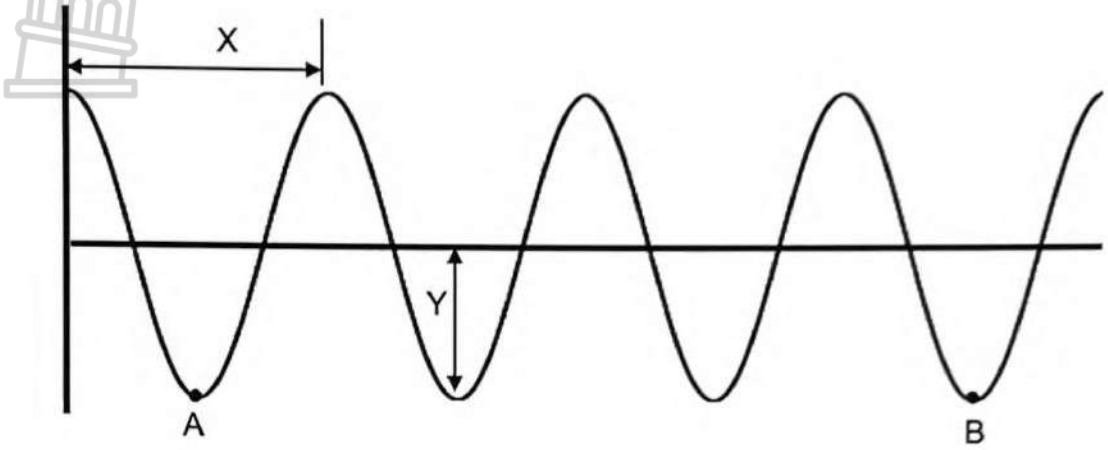
D The charge through resistor A is four times larger than the charge through resistor B.

(2)

[2 X 5 = 10]

QUESTION 2 (Start on a new page.)

The diagram below represents a transverse wave of frequency 20 Hz, moving from left to right at a speed of 10 $m.s^{-1}$.



2.1 Define the term *transverse wave* in words. (2)

2.2 Provide the labels of:

2.2.1 X (1)

2.2.2 Y (1)

2.3 For the above wave, calculate:

2.3.1 The wavelength. (3)

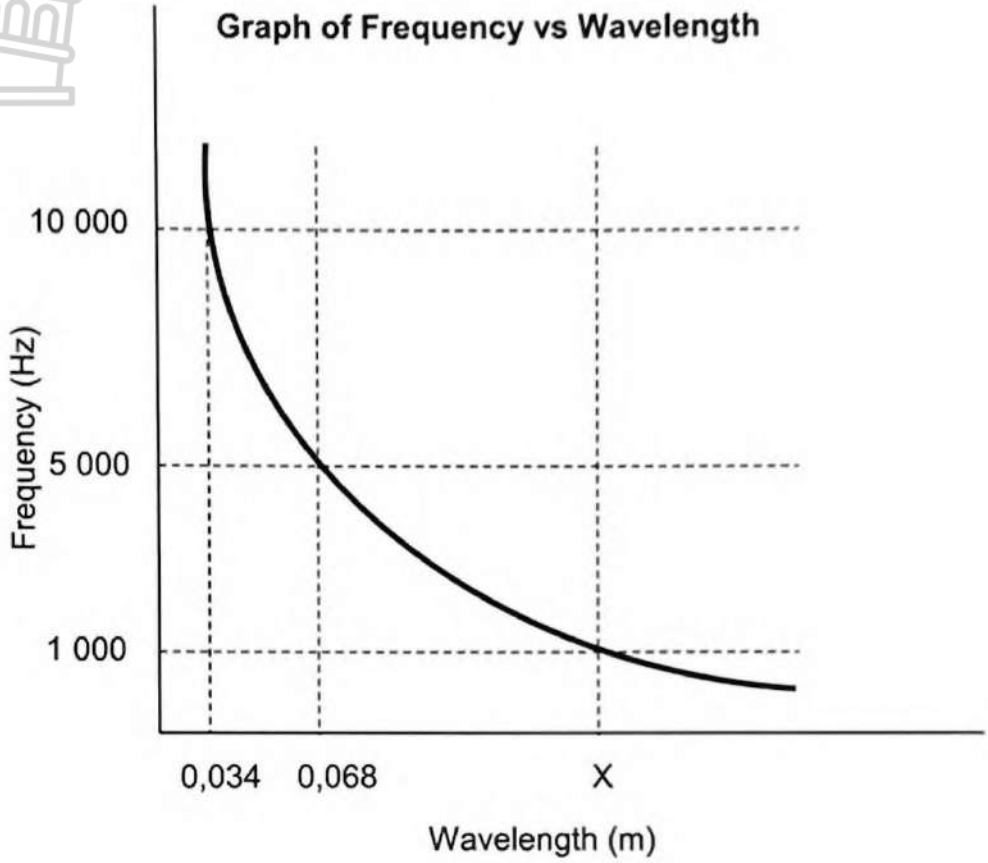
2.3.2 The time between Point A and Point B on the graph. (5)

[12]

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QUESTION 3 (Start on a new page.)

3.1 An investigation is conducted to determine the relationship between FREQUENCY and WAVELENGTH of a sound wave in air, at a constant temperature. The results obtained is shown in the graph below.



3.1.1 Write down a suitable investigative question for this investigation. (2)

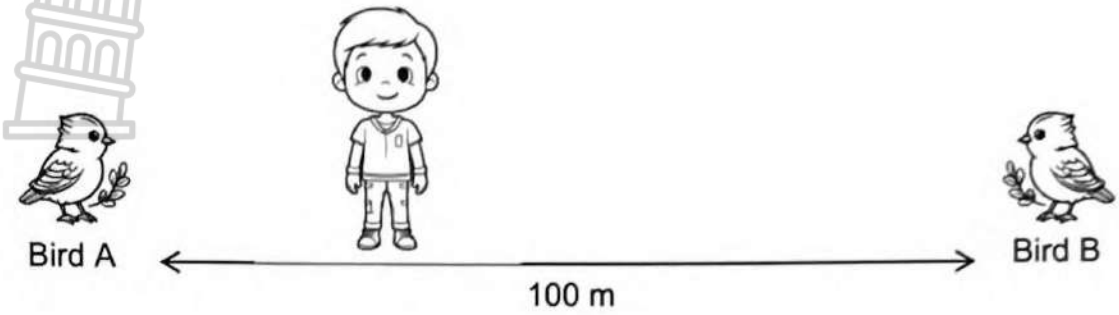
3.1.2 What is the mathematical relationship between frequency and wavelength of the sound wave? (1)

3.1.3 Why is it important that the investigation be conducted at a constant temperature? (1)

3.1.4 Calculate the speed of sound in air (3)

3.1.5 Determine the value if "X" on the graph. (2)

3.2 A boy stands between two birds that are 100 metres apart, and blows a whistle, as shown in the diagram below. The sound wave reaches Bird A after 0,074 seconds.



The boy and both birds are on the same plane and in a straight line.
Take the speed of sound in air as 340 $m.s^{-1}$.

3.2.1 Calculate the distance between the boy and Bird A (3)

3.2.2 Determine the time taken for Bird B to hear the sound. (4)

[16]

QUESTION 4 (Start on a new page.)

4.1 Identify the type of electromagnetic radiation used:

4.1.1 By television stations for broadcasting their signal. (1)

4.1.2 To detect counterfeit bank notes. (1)

4.2 Explain why gamma rays are the preferred type of radiation in sterilization of medical equipment. (3)

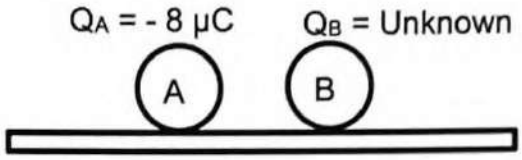
4.3 A photon with $6,79 \times 10^{-23}$ joules of energy is located in the microwave range of the electromagnetic spectrum. Calculate the wavelength of this microwave. (4)

[9]

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QUESTION 5 (Start on a new page.)

Two small identical spheres A and B are placed on an insulated surface.
Sphere A has a charge of – 8 μC whereas the charge of Sphere B is unknown.



The spheres are brought into contact and thereafter separated.
Each sphere now has 1,25 x 10^{13} excess electrons.

5.1 State the *principle of quantization of charge*. (2)

5.2 Calculate the charge of Sphere A after the spheres were brought into contact. (3)

5.3 Determine the:

5.3.1 Number of electrons transferred in this process. (4)

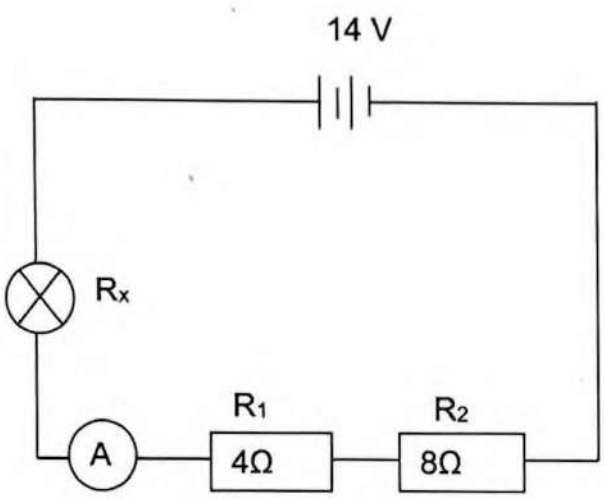
5.3.2 Initial charge of Sphere B. (4)

[13]

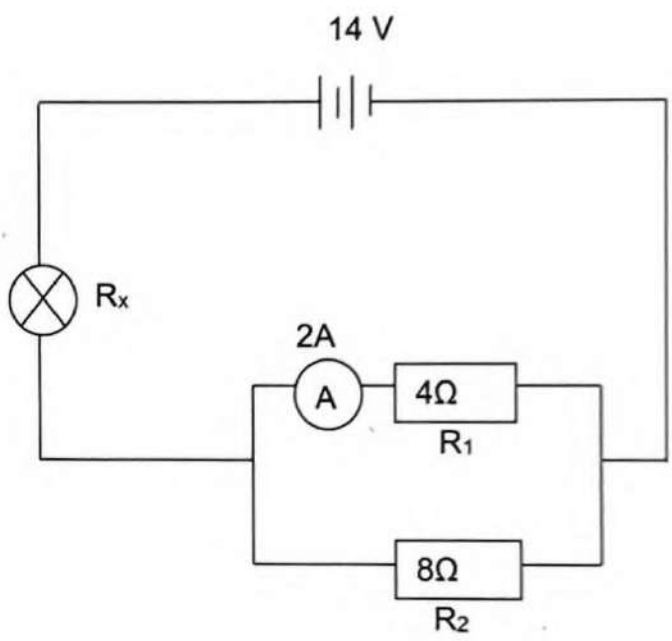
QUESTION 6 (Start on a new page)

Circuit 1 and Circuit 2 consist of two resistors of resistance 4Ω and 8Ω respectively, a bulb of resistance Rx and an ammeter of negligible resistance connected to a 14V battery as shown below.

CIRCUIT 1



CIRCUIT 2



The ammeter reading in CIRCUIT 2 is 2A.

6.1 Define the *term current* in words. (2)

6.2 Calculate the potential difference across the parallel combination in Circuit 2. (3)

6.3 Determine the :

6.3.1 Resistance of the bulb, Rx. (5)

6.3.2 Charge passing through the bulb in 3 minutes, in Circuit 1. (5)

[15]

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 $m.s^{-2}$
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	q_e	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE

WAVES, SOUND AND LIGHT

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

ELECTROSTATICS

$Q = n \times q_e$	$Q = \frac{Q1 + Q2}{2}$

ELECTRIC CIRCUITS

$Q = I \times \Delta t$	$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$
$R_s = R_1 + R_2 + \cdots$	$V = \frac{W}{Q}$
V = I x R	

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MARKING GUIDELINE

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QUESTION 1:

1.1 D ✓✓ (2)
1.2 B ✓✓ (2)
1.3 C ✓✓ (2)
1.4 B ✓✓ (2)
1.5 B ✓✓ (2)
[10]

QUESTION 2

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

2.2

2.2.1 Wavelength ✓ (1)

2.2.2 Amplitude ✓ (1)

2.3

2.3.1 $v = f \times \lambda$ ✓
$10 = 20 \times \lambda$ ✓
$\lambda = 0,5$ m ✓ (3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1**

OPTION 1

$T = \frac{1}{f}$ ✓
$= \frac{1}{20}$ ✓
$= 0,05$ s
time = 3✓ x 0,05✓
= 0,15 s ✓

OPTION 2

Distance = 3 ✓ x 0,5✓
= 1,5 m
$\text{speed} = \frac{\text{distance}}{\text{time}}$ ✓
$10 = \frac{1,5}{\text{time}}$ ✓
time = 0,15 s ✓

OPTION 3

$\text{speed} = \frac{\text{distance}}{\text{time}}$ ✓
$10 = \frac{0,05}{\text{time}}$ ✓
time for 1 wave = 0,05 s
time = 3✓ x 0,05✓
= 0,15 s ✓ (5)

[12]

QUESTION 3

3.1

3.1.1 What is the relationship between frequency and wavelength of sound waves (in air)? ✓✓ (2)

3.1.2 Frequency is inversely proportional to wavelength ✓
OR
Inverse proportion ✓ (1)

3.1.3 The speed of sound in air depends on temperature ✓ (1)

3.1.4 $v = f \times \lambda$ ✓
$= 10\,000 \times 0{,}034$ ✓ OR $= 5000 \times 0{,}068$ ✓
$= 340\ m.s^{-1}$ ✓ (3)

3.1.5 **POSITIVE MARKING FROM QUESTION 3.1.4**
$v = f \times \lambda$
$340 = 1000\ (X)$ ✓
$X = 0{,}34$ m ✓ (2)

3.2

3.2.1 $\text{speed} = \frac{\text{distance}}{\text{time}}$
340 ✓ $= \frac{\text{distance}}{0{,}074}$ ✓
Distance = 25,16 m ✓
(3)

3.2.2 **POSITIVE MARKING FROM QUESTION 3.2.1**
Distance = 100 – 25,16 ✓
$= 74{,}84$ m
$\text{speed} = \frac{\text{distance}}{\text{time}}$
340 ✓ $= \frac{74{,}84✓}{\text{time}}$
time = 0,22 s ✓ (4)

[16]

QUESTION 4

4.1

4.1.1 Radio waves ✓ (1)

4.1.2 Ultraviolet ✓ (1)

4.2 Gamma rays have the highest energy. ✓
This allows it to easily penetrate through medical equipment ✓ and kill viruses and bacteria ✓. (3)

4.3

OPTION 1

$E = \frac{hc}{\lambda}$ ✓

$6,79 \times 10^{-23}$ ✓ $= \frac{6,63 \times 10^{-34} \times 3 \times 10^{8}}{\lambda}$ ✓

$\lambda = 2,93 \times 10^{-3}$ m ✓

OPTION 2

$E = h \times f$ ✓

$6,79 \times 10^{-23} = 6,63 \times 10^{-34} \times f$ ✓

$f = 1,024 \times 10^{11}$ Hz

$c = f \times \lambda$

$3 \times 10^{8} = 1,024 \times 10^{11} \times \lambda$ ✓

$\lambda = 2,93 \times 10^{-3}$ m ✓ (4)

[9]

QUESTION 5

5.1 All charges in the universe consist of an integer multiple ✓ of the charge of one electron ✓ (2)

5.2 $Q = n \times q_e$ ✓

$= 1,25 \times 10^{13} \times -1,6 \times 10^{-19}$ ✓

$= -2 \times 10^{-6}$ C ✓ (3)

5.3 **POSITIVE MARKING FROM QUESTION 5.2**

5.3.1 $n = \frac{\Delta Q}{q_e}$ ✓

$= \frac{-2 \times 10^{-6} - (-8 \times 10^{-6})}{1,6 \times 10^{-19}}$ ✓ ✓

$= 3,75 \times 10^{13}\ e^{-}$ ✓ (4)

5.3.2 $Q = \frac{Q1 + Q2}{2}$ ✓

-2×10^{-6} ✓ $= \frac{-8 \times 10^{-6} + Q_B}{2}$ ✓

$Q_B = 4 \times 10^{-6}$ C ✓ (4)

[13]

QUESTION 6

6.1 The rate of flow of charge. ✓✓ (2)

6.2 $V = IR$ ✓
$= 2 \times 4$ ✓
$= 8\ V$ ✓ (3)

6.3 **POSITIVE MARKING FROM QUESTION 6.2**

6.3.1

OPTION 1

$V_{8\Omega} = IR$
$8 = I_{8\Omega} \times 8$ ✓
$V_{Bulb} = 14 - 8$ ✓
$= 6V$
$V_{Bulb} = IR$
$6 = 3 \times R_{Bulb}$ ✓
$R_{Bulb} = 2\Omega$ ✓

OR

OPTION 2

$I_{8\Omega} = ½\ I_{4\Omega}$
$= 0,5(2)$ ✓
$I_{8\Omega} = 1A$
$I_T = 1A + 2A$ ✓
$= 3A$
$V_T = IR$
$14 = 3 \times R_T$ ✓
$R_T = 4,67\ \Omega$
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$
$\frac{1}{R_P} = \frac{1}{4} + \frac{1}{8}$
$R_P = 2,67\ \Omega$
$R_{Bulb} = 4,67 - 2,67\Omega$ ✓
$= 2\ \Omega$ ✓ (5)

6.3.2
$R_T = 2 + 4 + 8$ ✓
$= 14\ \Omega$
$V_T = IR$
$14 = I_T \times 14$✓
$I_T = 1A$
$Q = I\ \Delta t$ ✓
$= 1 \times 180$ ✓
$= 180\ C$ ✓ (5)

[15]

TOTAL: 75

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