KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

COMMON TEST

MARCH 2023

TIME: 1½ hours

MARKS: 75

This question paper consists of 9 pages and a data sheet.

Stanmorephysics

INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 10A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 7 questions. Answer ALL questions 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, e.g. 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 SHEET.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc where required.
10. Write neatly and legibly.

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QUESTION 1 : MULTIPLE-CHOICE QUESTIONS

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 numbers (1.1-1.6) in the ANSWER BOOK , e.g 1.7 D

1.1 The maximum displacement of a particle from its rest position is known as its …

A wavelength.

B amplitude.

C frequency.

D period. (2)

1.2 Which ONE of the following statements is TRUE?

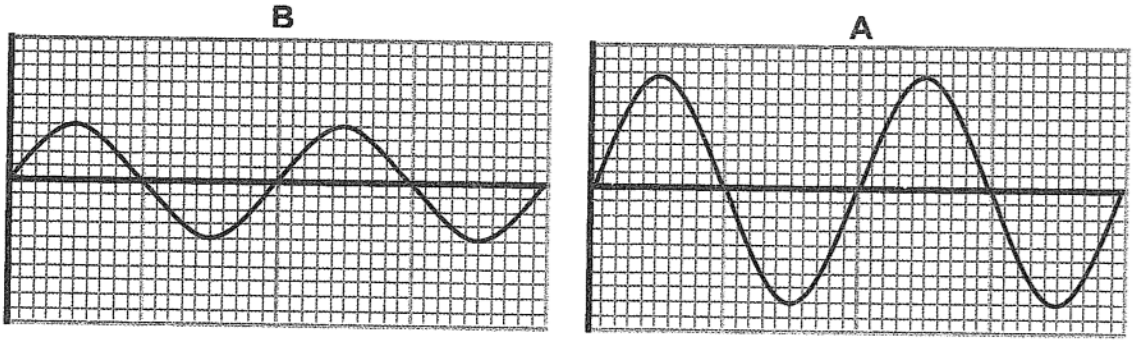
A Sound waves can travel in vacuum

B Sound waves are electromagnetic waves

C The speed of sound waves is always constant

D The pitch of a sound wave is dependent on its frequency (2)

1.3 The diagrams below represent two sound waves A and B.



Which ONE of the following combinations that compares the frequency and loudness of A with B is CORRECT?

	Frequency of A	Loudness of A
A	Less than B	Greater than B
B	Greater than B	Less than B
C	The same as B	Less than B
D	The same as B	Greater than B

(2)

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1.4 Which ONE of the following statements best describes the behaviour of an electromagnetic wave?

A Electric and magnetic fields vibrate perpendicularly to one another

B Electric and magnetic fields vibrate parallel to one another

C The electric field is vibrating and the magnetic field is stationary

D Both the electric and magnetic fields are stationary (2)

1.5 A learner has determined the charges on various objects. Which value has been INCORRECTLY calculated?

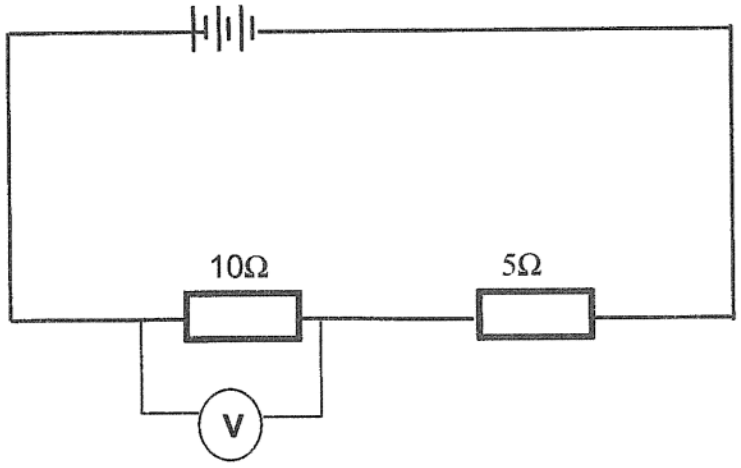
A $9,6 \times 10^{-19}$ C

B $6,4 \times 10^{-19}$ C

C $4,8 \times 10^{-19}$ C

D $4,0 \times 10^{-19}$ C (2)

1.6 The voltmeter below reads 8V.



The emf of the battery is …

A 12V

B 8V

C 6V

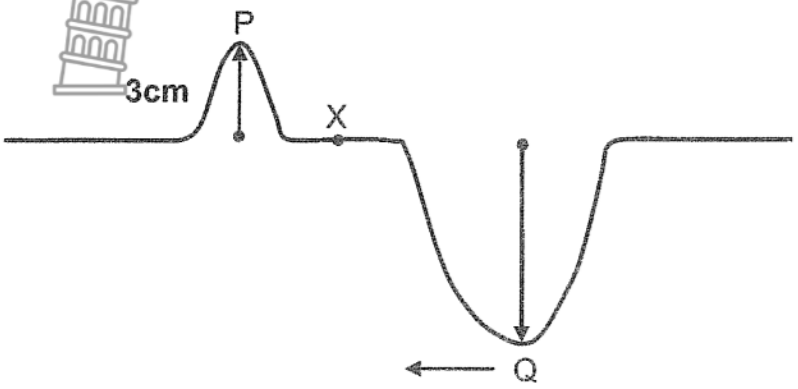
D 4V (2)

2 x 6 [12]

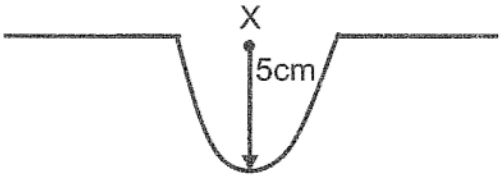
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QUESTION 2

The diagram below shows two pulses P and Q travelling in opposite directions in the same medium. Pulse Q travels to the left.



The amplitude of pulse P is 3cm and that of pulse Q is UNKNOWN. The two pulses meet at point X and the resulting amplitude is shown below.



2.1 Define *pulse*. (2)

2.2 What type of interference takes place at X? (1)

2.3 Determine the amplitude of Q. (1)

2.4 A learner states that immediately AFTER pulses P and Q meet at point X, pulse P will move TO THE LEFT.

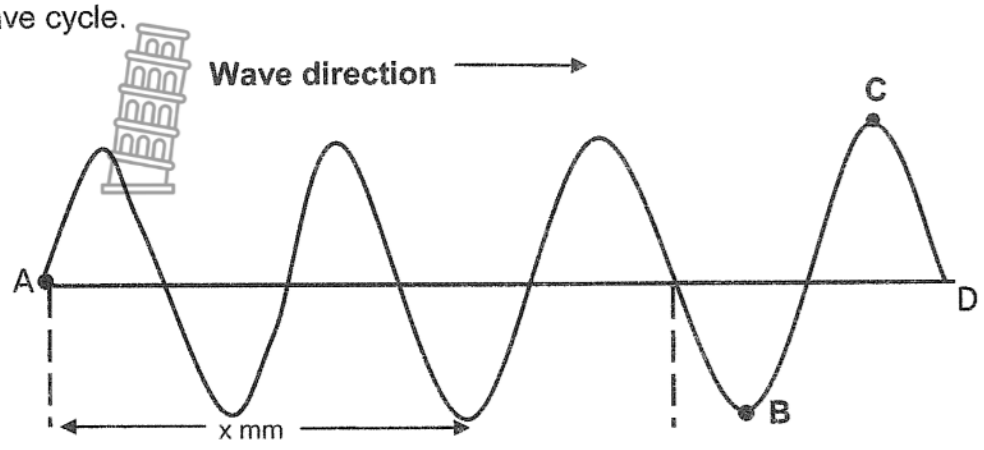
2.4.1 Is the learner's observation correct? Answer YES or NO. (1)

2.4.2 Use a physics principle to explain the answer to Question 2.4.1 (2)

[7]

QUESTION 3

The following wave pattern is produced by a wave that takes 2,5 seconds to complete one wave cycle.



A particle at point B vibrates at 90° to the direction in which the waves are moving.

3.1 What type of wave is indicated in the diagram above? (1)

3.2 Give ONE reason why a particle at B will be OUT OF PHASE with a particle at C. (1)

3.3 Determine the frequency of this wave. (3)

3.4 If the speed of the wave is 0,08 $m.s^{-1}$, calculate the value of x in metres. (4)

3.5 How long (in seconds) does it take for a particle to move from point A to point D? (2)

[11]

QUESTION 4

A wave source on a ship sends out sound waves of frequency 25 kHz to the bottom of the sea. A receiver attached to the ship detects these waves a short while later. The speed of sound in water is 1500 $m•s^{-1}$.

4.1 What is an echo? (2)

4.2 Calculate the wavelength of these waves (3)

4.3 Can these sound waves be heard by the human ear? Give a reason. (2)

4.4 Calculate the depth of the water beneath the ship if the waves are detected by the receiver 10 seconds after being emitted. (4)

[11]

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QUESTION 5

The electromagnetic spectrum includes amongst others, radio waves, ultraviolet waves, gamma rays, visible light and x-rays.

5.1 Briefly explain what is meant by the DUAL nature of electromagnetic radiation. (2)

5.2 Name the type of electromagnetic radiation that:

5.2.1 Is used to sterilize medical instruments. (1)

5.2.2 Has the longest wavelength. (1)

5.3 State ONE danger of ultraviolet light. (1)

5.4 A photon of an electromagnetic wave has a wavelength of 700 nm.

Calculate the energy associated with this photon. (5)

5.5 How will the energy of this photon be affected if its wavelength is decreased?

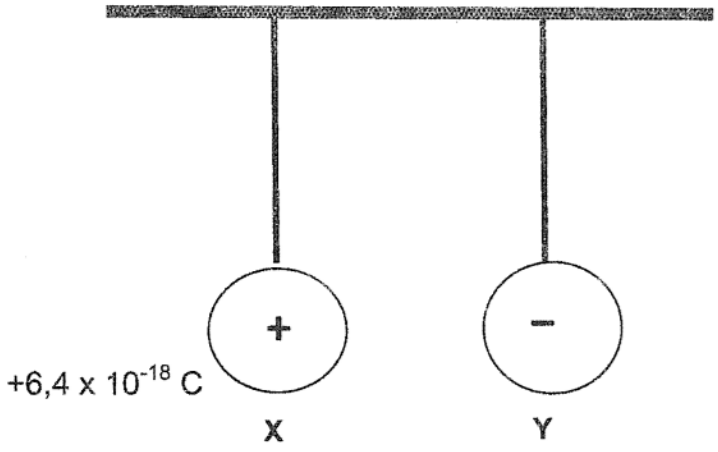
Choose from INCREASES, DECREASES or REMAINS THE SAME.

Give a reason for the answer. (2)

[12]

QUESTION 6

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



Sphere X carries a charge of +6,4 x 10^{-18}C, while sphere Y has an EXCESS of 30 electrons.

6.1 Calculate the magnitude of the charge on sphere Y. (3)

6.2 The spheres are allowed to touch each other. After touching, they move away from each other.

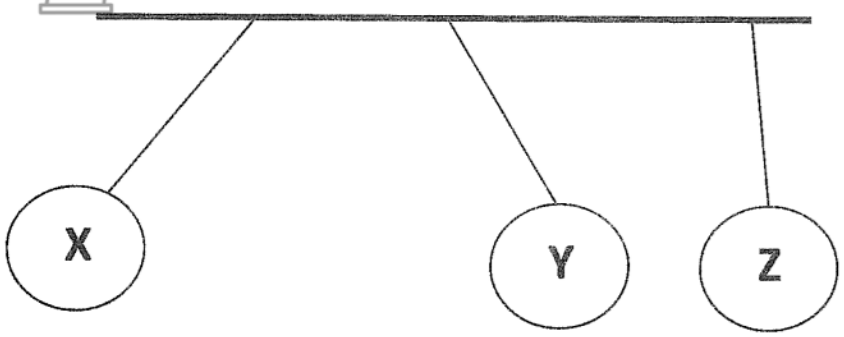
6.2.1 State the principle of conservation of charge. (2)

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6.2.2 Give a reason why the spheres move away from each other after touching. (1)

6.2.3 Calculate the charge on each sphere after they have separated. (3)

6.3 A NEUTRAL sphere Z, is placed next to sphere Y as shown below.



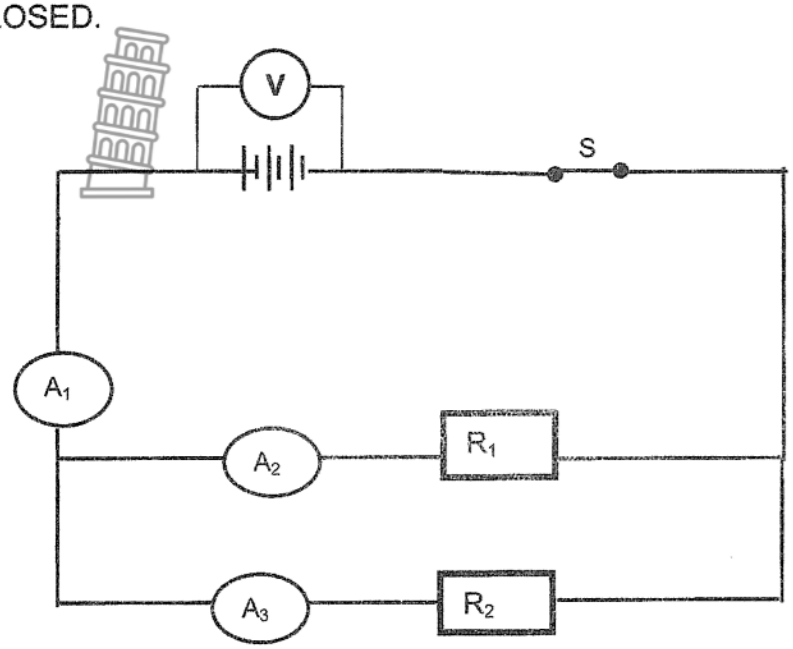
6.3.1 What is meant by a neutral sphere? (2)

6.3.2 Use a sketch to show how the charges re-arrange themselves inside sphere Z. (2)

[13]

QUESTION 7

Study the circuit diagram below. Ignore the resistance of the battery and the wires. Switch S is initially CLOSED.



7.1 Define *terminal potential difference*. (2)

7.2 Calculate the reading on the voltmeter V if the battery transfers 3×10^4 J of energy per every $2,5 \times 10^3$ C of charge that flows through the circuit. (3)

7.3 Determine the reading on ammeter A_3 if the reading on ammeter A_1 is 1,62 A and the reading on ammeter A_2 is 0,65A (2)

7.4 How will the resistance of R_1 compare to that of R_2?
Choose from GREATERTHAN, LESS THAN or EQUAL TO. (1)

7.4 Switch S is now OPENED. What term is used to describe the reading on the voltmeter? . (1)
[9]

TOTAL [75]

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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*
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^{8}\ m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J \cdot s$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$
Electron charge	q_e	$-1,6 \times 10^{-19}\ C$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

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

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

ELECTROSTATICS

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

ELECTRIC CIRCUIT

$Q = I\ \Delta t$	$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$R_s = R_1 + R_2 + ...$	$V = \frac{W}{Q}$

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