



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.



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.



QUESTION 1 : MULTIPLE-CHOICE QUESTIONS

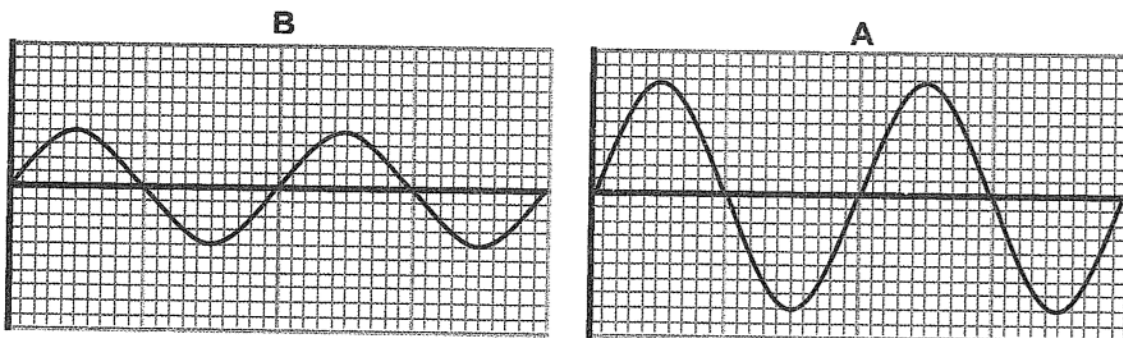
Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A-D) next to the question numbers (1.1-1.6) in the ANSWER BOOK , e.g 1.7 D



- 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)

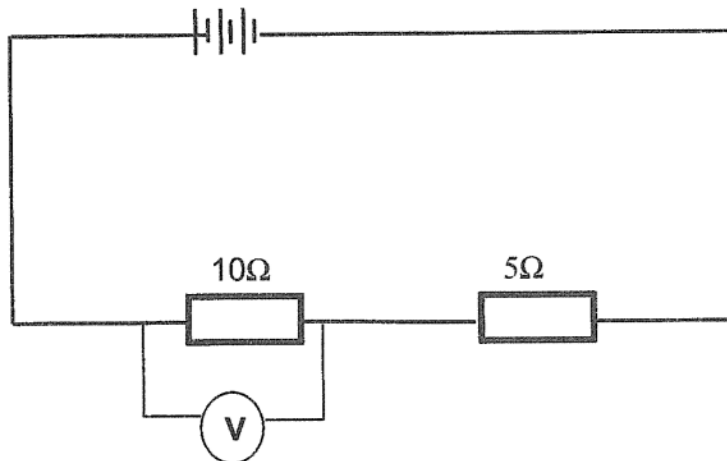
1.4 Which ONE of the following statements best describes the behaviour of an electromagnetic wave?

- 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 $9,6 \times 10^{-19} \text{ C}$
 - B $6,4 \times 10^{-19} \text{ C}$
 - C $4,8 \times 10^{-19} \text{ C}$
 - D $4,0 \times 10^{-19} \text{ C}$
- (2)

1.6 The voltmeter below reads 8V.



The emf of the battery is ...

- A 12V
- B 8V
- C 6V
- D 4V

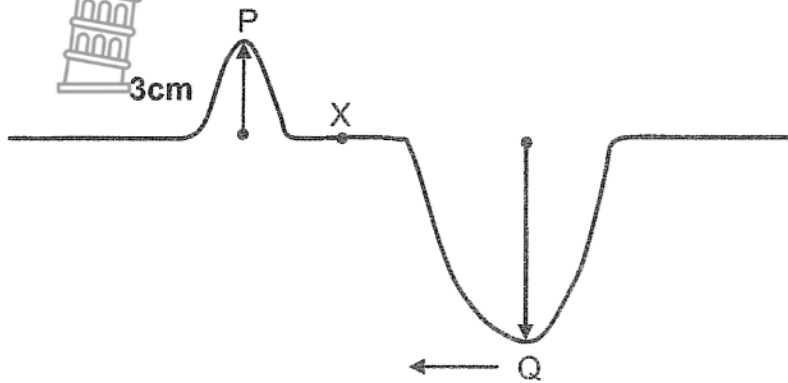


(2)

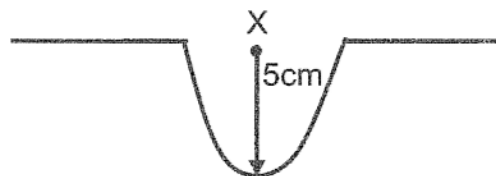
2 x 6 [12]

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.

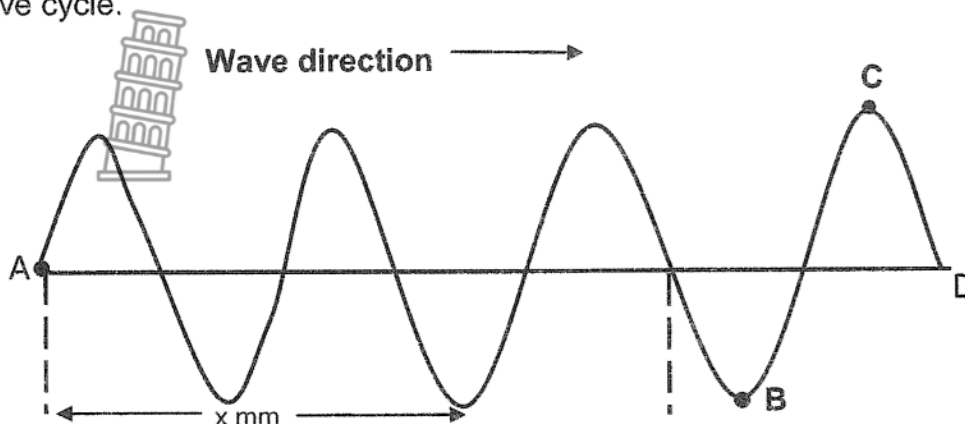


- 2.1 Define *pulse*. (2)
 - 2.2 What type of interference takes place at X? (1)
 - 2.3 Determine the amplitude of Q. (1)
 - 2.4 A learner states that immediately AFTER pulses P and Q meet at point X, pulse P will move TO THE LEFT.
 - 2.4.1 Is the learner's observation correct? Answer YES or NO. (1)
 - 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 $0,08 \text{ m}\cdot\text{s}^{-1}$, 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 $1500 \text{ m}\cdot\text{s}^{-1}$.

- 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]

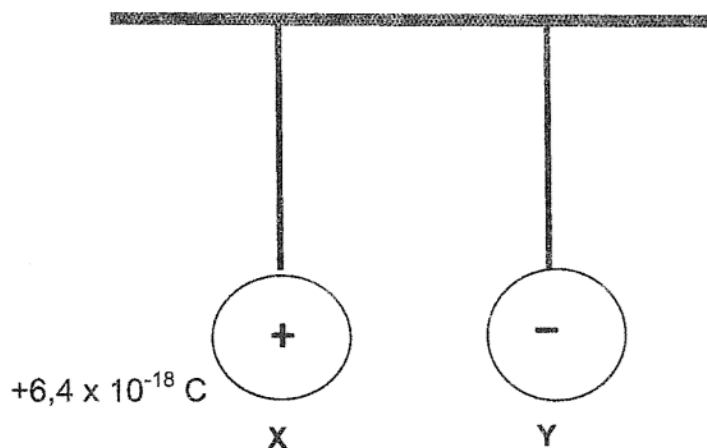
QUESTION 5

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.



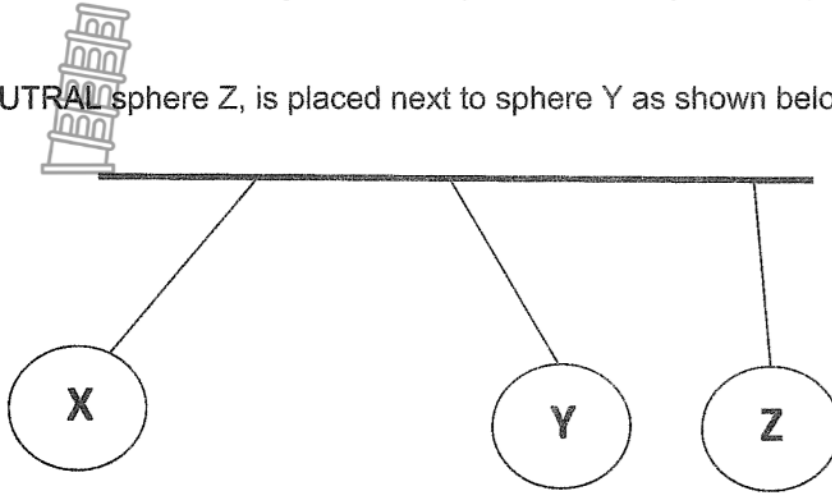
Sphere X carries a charge of $+6,4 \times 10^{-18} \text{ C}$, while sphere Y has an EXCESS of 30 electrons.

- 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)

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)

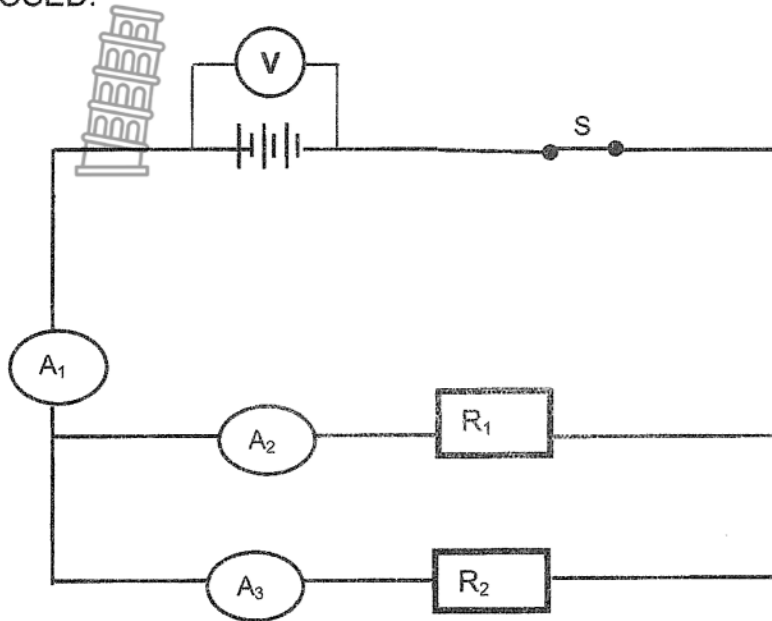
6.3.2 Use a sketch to show how the charges re-arrange themselves inside sphere Z. (2)

[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 A₃ if the reading on ammeter A₁ is 1,62 A and the reading on ammeter A₂ is 0,65A (2)
- 7.4 How will the resistance of R₁ compare to that of R₂? Choose from GREATER THAN, 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]



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

**GEGEWENS VIR FISIESTE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESTE KONSTANTES

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

TABLE 2: FORMULAE/TABEL 2: FORMULES

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

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

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

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





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MARKING GUIDELINE**

TIME: 1 ½ Hour

MARKS: 75

These marking guideline consists of 5 pages.



QUESTION 1

- 1.1 B ✓✓ (2)
- 1.2 D ✓✓ (2)
- 1.3 D ✓✓ (2)
- 1.4 A ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 A ✓✓ (2)
- [12]**



QUESTION 2

- 2.1 A single disturbance in a medium ✓✓ (2)
- 2.2 Destructive ✓ (1)
- 2.3 8 cm ✓ (1)
- 2.4
- 2.4.1 No ✓ (1)
- 2.4.2 According to the principle of superposition ✓
Pulse P will continue moving in its original direction ✓ (2)
- [7]**

QUESTION 3

- 3.1 Transverse ✓ (1)
- 3.2 They are moving in different /opposite direction ✓ (1)
- 3.3
- $f = 1/T$ ✓
- $= 1/2,5$ ✓
- $= 0,4 \text{ Hz}$ ✓
- 3.4
- $v = f \times \lambda$ ✓
- $0,08 = 0,4 \times \lambda$ ✓
- $\lambda = 0,2 \text{ m}$
- $x = 0,35 \text{ m}$ ✓✓ (4)



3.5 8,75 seconds ✓✓ (2)

[11]

QUESTION 4



4.1 A sound wave that is reflected ✓ off a surface ✓ (2)

4.2 $v = f \times \lambda$ ✓
 $1500 = 25000 \times \lambda$ ✓
 $\lambda = 0,06\text{m}$ ✓ (3)

4.3 No. ✓ frequency is beyond range for the human ear ✓ (2)

4.4 speed = $\frac{D}{\Delta t}$ ✓
 $1500 = \frac{D}{5}$ ✓✓
 $D = 7500 \text{ m}$ ✓ (4)
 [11]

QUESTION 5

5.1 Light behaves as a wave ✓ and as a particle ✓ (2)

5.2
 5.2.1 Ultraviolet ✓ (1)
 5.2.2 Radio waves ✓ (1)

5.3 Causes skin cancer ✓ (1)

5.4
 $E = \frac{hc}{\lambda}$ ✓
 $= \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{(700 \times 10^{-9})}$ ✓
 $= 2,84 \times 10^{-10} \text{ J}$ ✓ (5)

5.5 Increases ✓. Energy is inversely proportional to wavelength ✓ (2)
 [12]



QUESTION 6

6.1

$$n_e = \frac{Q}{Q_e} \quad \checkmark$$

$$30 = \frac{Q}{1,6 \times 10^{-19}} \quad \checkmark$$

$$Q = -4,8 \times 10^{-18} \text{C} \quad \checkmark$$

(3)

6.2.1 Total charge in an isolated system remains constant. $\checkmark\checkmark$

(2)

6.2.2 Both spheres carry identical charges \checkmark

(1)

6.2.3 $Q_{new} = \frac{Q_1 + Q_2}{2} \quad \checkmark$

$$= \frac{(6,4 \times 10^{-18}) + (-4,8 \times 10^{-18})}{2} \quad \checkmark$$

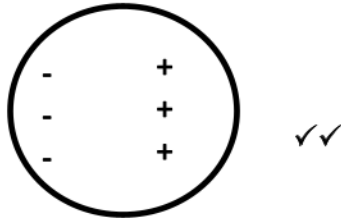
$$= 8 \times 10^{-19} \text{C} \quad \checkmark$$

(3)

6.3.1 The number of electrons is equal to the number of protons $\checkmark\checkmark$

(2)

6.3.2



(2)

[13]

QUESTION 7

7.1 Reading across the terminals \checkmark of a battery when current flows in the circuit \checkmark

(2)

7.2 $V = \frac{W}{Q} \quad \checkmark$

$$= \frac{3 \times 10^4}{2,5 \times 10^3} \quad \checkmark$$

$$= 12 \text{V} \quad \checkmark$$

(3)

7.3 0,97 A $\checkmark\checkmark$

(2)

7.4 GREATER THAN \checkmark

(1)

7.5 emf \checkmark

(1)



TOTAL MARKS: [75] [9]