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KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

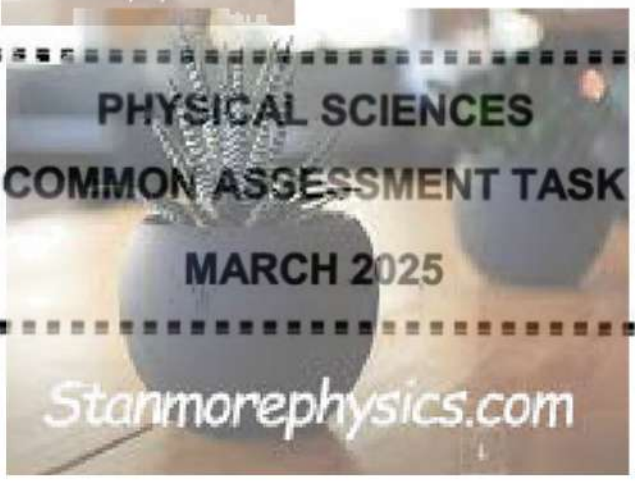
NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

COMMON ASSESSMENT TASK

MARCH 2025



MARKS: 100

DURATION: 2 hours

This question paper consists of 11 pages and a data sheet.

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INSTRUCTIONS AND INFORMATION

1. This question paper consists of SEVEN 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 (1.1–1.6) in the ANSWER BOOK, for example 1.7 E.

1.1 In which ONE of the following combinations is the electromagnetic radiation listed in order of increasing frequency?

A Radio waves, infrared , microwaves.

B Microwaves, radio waves, visible light.

C Microwaves, ultraviolet, infrared

D Radio waves, visible light, ultraviolet (2)

1.2 If the wavelength of a sound wave is decreased, which ONE of the following will also DECREASE when the wave speed is kept constant??

A Amplitude

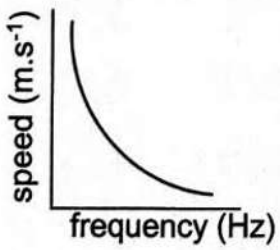
B Period

C Frequency

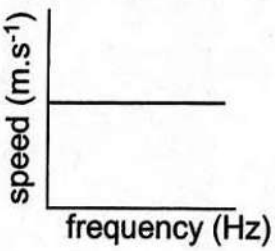
D Pitch (2)

1.3 Which graph represents the relationship between the frequency and speed of a photon of light in a vacuum?

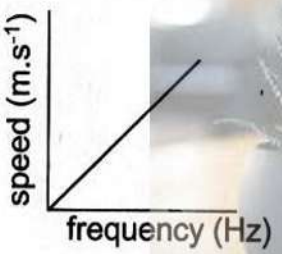
A



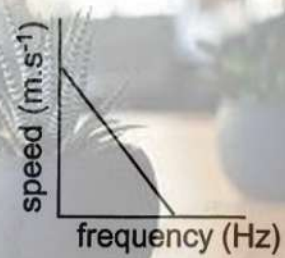
B



C



D



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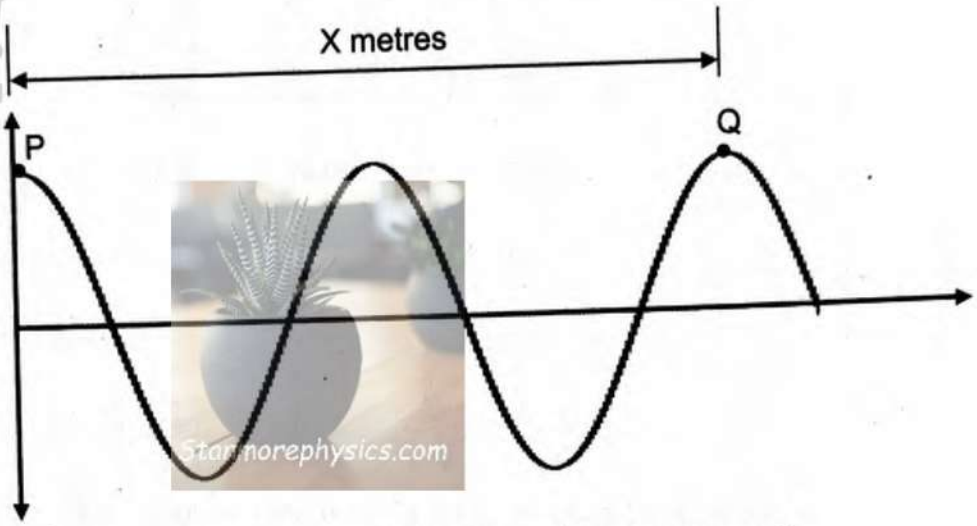
1.4 The wave below is travelling at a speed of **V** m.s^{-1}. The distance between point P and point Q on the wave pattern is **X** metres.



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

A $\frac{2V}{X}$

B $\frac{V}{X}$

C $\frac{V}{2X}$

D $\frac{X}{V}$

(2)

1.5 Which ONE of the following CANNOT be the charge of an object?

A 1.44×10^{-18} C

B 1.12×10^{-18} C

C $1,04 \times 10^{-18}$ C

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

(2)

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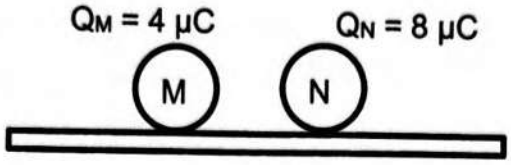
1.6 Two identical spheres, M and N placed on an insulated surface, carry charges of 4μC and 8μC respectively. The spheres are brought into contact.



Which of the following statements is correct?

A Electrons move from sphere M to N.

B Electrons move from sphere N to M.

C Protons move from sphere N to M.

D There is no movement of electrons since both spheres are positively charged. (2)

[2 X 6 = 12]

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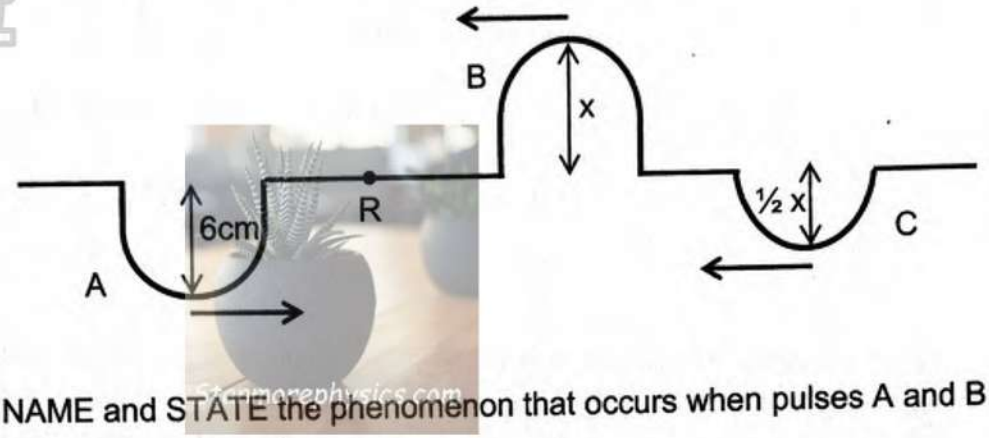
QUESTION 2 (Start on a new page.)

A, B and **C** are three transverse pulses travelling in the same medium. Pulse A is travelling to the right and with an amplitude of 6 cm. Pulses B and C are both travelling left at the same speed. The amplitude of Pulse C is half that of Pulse B.



2.1 NAME and STATE the phenomenon that occurs when pulses A and B meet. (3)

When pulses A and B meet at point R a crest of amplitude 4 cm is formed.

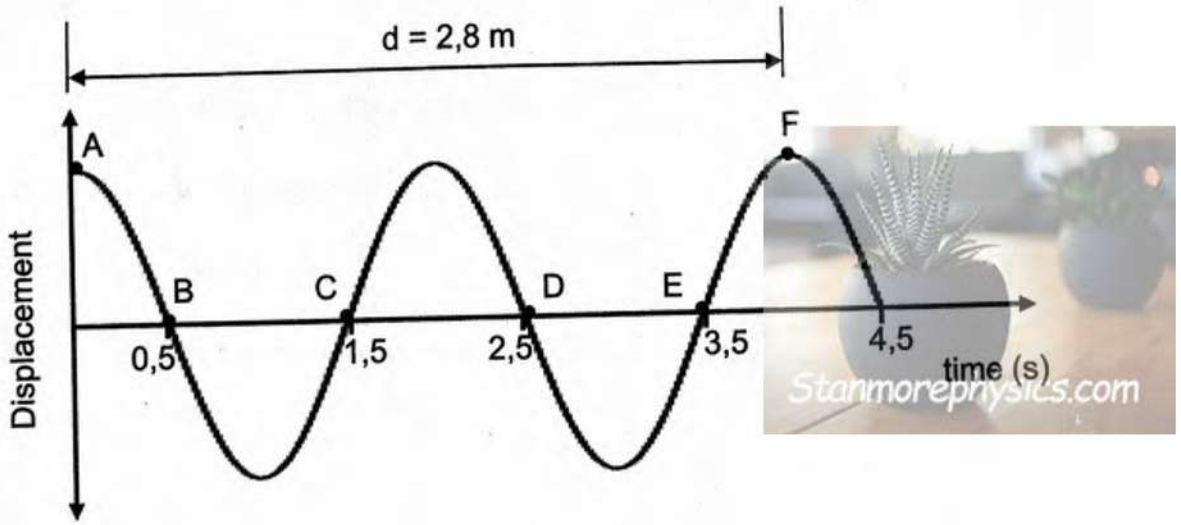
2.2 Determine the amplitude of the pulse formed when pulses A and C meet. (4)

2.3 Draw the resultant pulse when pulses A and B meet at point R. Indicate the amplitude on the diagram. (2)

[9]

QUESTION 3 (Start on a new page.)

3.1 The diagram below represents a transverse wave moving from left to right. The distance "d" between points A and F is 2,8 m.



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3.1.1 Define the term *transverse waves* in words. (2)

3.1.2 Identify a point that is in phase with point E. (1)

3.1.3 Are points B and C IN PHASE or OUT OF PHASE? Give a reason for your answer. (3)

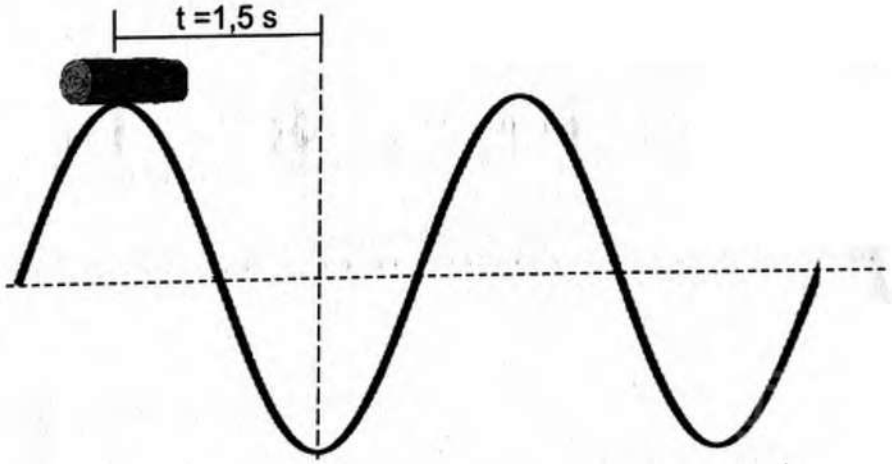
3.1.4 Write down the period of the wave. (1)

For the above wave, calculate:

3.1.5 The frequency of the wave. (3)

3.1.6 The speed of the wave. (4)

3.2 A log moves up and down periodically due to the waves on the surface of the water. It takes 1,5 seconds for the log to move from the highest point to the lowest point on the wave.
The speed of the wave is 4 $m.s^{-1}$.



3.2.1 Determine the period of the wave. (2)

For the water wave above, calculate:

3.2.2 The wavelength. (3)

3.2.3 The distance between four consecutive crests. (2)
[21]

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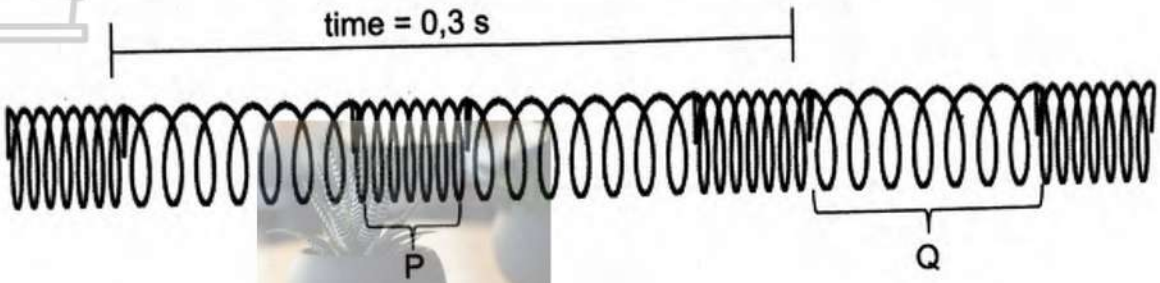
QUESTION 4 (Start on a new page.)

A learner uses a slinky spring to form the wave pattern below.



The speed of the wave is 1,6 $m.s^{-1}$.

4.1 Write down the name of the regions represented by:

4.1.1 The letter P. (1)

4.1.2 The letter Q. (1)

4.2 Define the term *wavelength* in words. (2)

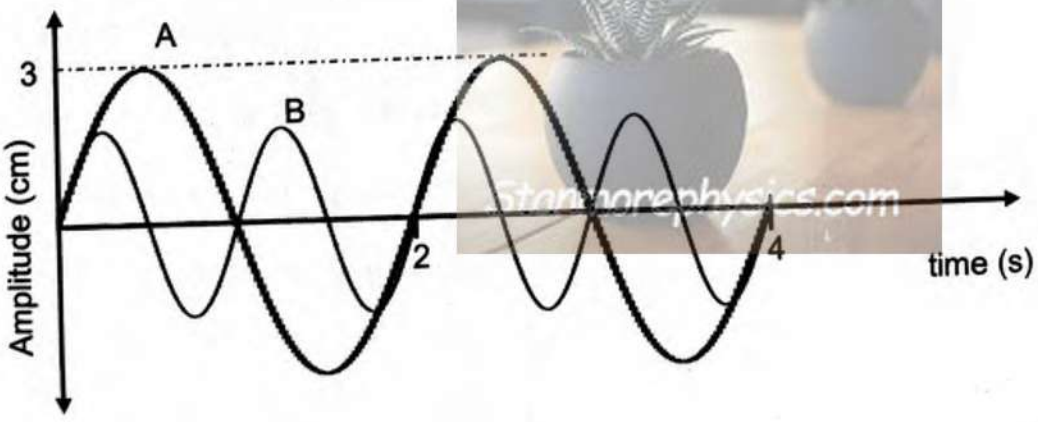
4.3 Calculate the wavelength of the wave above. (4)
[8]

QUESTION 5 (Start on a new page.)

5.1 Are sound waves TRANSVERSE or LONGITUDINAL waves? (1)

5.2 Explain why sound travels faster in iron than in sea water. (1)

5.3 The diagram below represents two sound waves, A and B.



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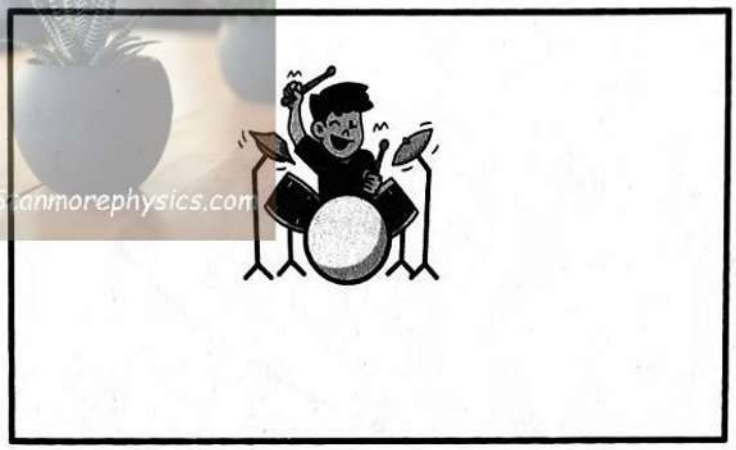
5.3.1 Which sound wave, A or B is louder? Explain the answer. (3)

5.3.2 Draw sound wave C, which has the same loudness but half the pitch of sound wave A, for the complete 4 seconds. Indicate the amplitude of the wave. (2)

5.4 A boy places his drums at a random position in an empty rectangular hall. He beats the drum once, producing a sound wave with a frequency of 250 Hz and a wavelength of 1,36 m.
The drummer notices multiple echos at different times.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5.4.1 Explain why the drummer detects **multiple echos** at **different times**. (2)

5.4.2 Calculate the speed of sound in the hall. (3)

The last echo is detected 0,24 seconds after the boy beats the drum.

5.4.3 Determine the distance between the drummer and the furthest wall in the hall. (4)

[16]

QUESTION 6 (Start on a new page.)

6.1 Write down the two models that are used to explain the behaviour of electromagnetic radiation. (2)

6.2 Identify the type of electromagnetic radiation:

6.2.1 With the longest wavelength. (1)

6.2.2 Used to detect fractured bones. (1)

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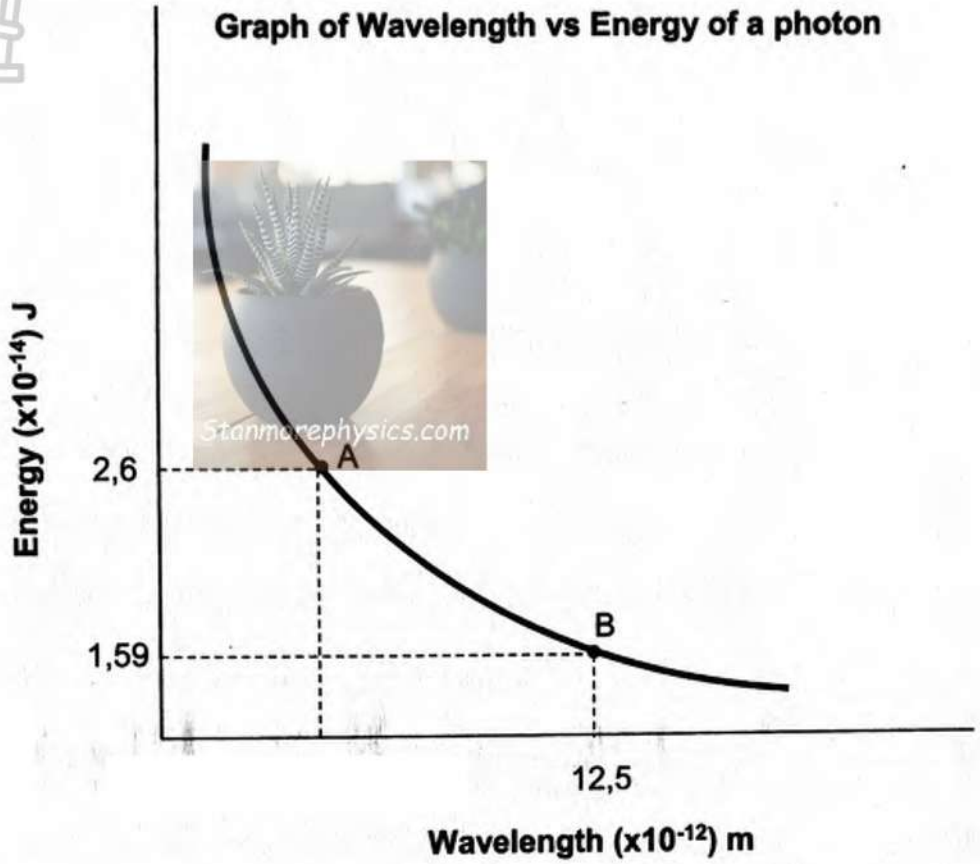
6.3 The graph below, not drawn to scale, shows the relationship between WAVELENGTH and ENERGY OF A PHOTON of light.



6.3.1 Define the term *photon* in word. (2)

6.3.2 What is the mathematical relationship between wavelength and energy of its photon? (1)

6.3.3 Calculate the wavelength of a photon at point A on the graph. (4)

6.3.4 Determine the frequency of a photon at point B on the graph. (3)

6.3.5 At which point, A or B, will a photon have greater penetrating ability? Give a reason for the answer. (3)

6.3.6 Sketch a graph showing the relationship between frequency (x-axis) and energy of a photon (y-axis). No values are required. (2)

[19]

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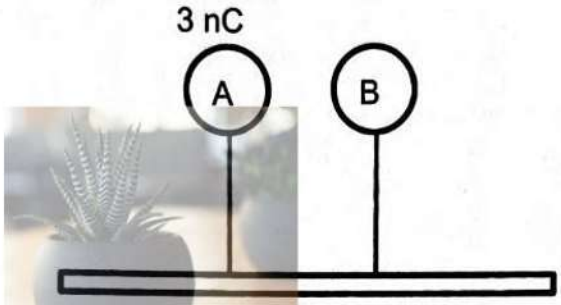
QUESTION 7 (Start on a new page.)

Two small identical spheres, A and B, are placed on insulating stands. Sphere A carries a charge of 3 nC and Sphere B has $4,375 \times 10^{10}$ excess electrons.



7.1 State the *principle of charge quantization* in words. (2)

7.2 Calculate the charge on Sphere B. (4)

The spheres are allowed to touch and are once again separated.

7.3 Calculate the new charge on Sphere A. (3)

Sphere C is identical to Spheres A and B, but is NOT CHARGED.

After Spheres A and B were separated, Sphere B is rubbed with a woollen cloth and thereafter brought into contact with Sphere C. Once separated, both Sphere B and Sphere C have a charge of - 3 nC each.

7.4 Determine the number of electrons that were transferred from the cloth to Sphere B. (6)
[15]

TOTAL: 100

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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·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	$E = \frac{hc}{\lambda}$
speed = $\frac{\text{distance}}{\text{time}}$	

ELECTROSTATICS

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

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GRADE 10

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PHYSICAL SCIENCES

COMMON TEST
MARKING GUIDELINE
MARCH 2025

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MARKS: 100

DURATION: 2 hours

This marking guideline consists of 7 pages.

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QUESTION 1

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

QUESTION 2

2.1 Destructive Interference. ✓ The phenomenon that occurs when the crest of one pulse overlaps with the trough of another✓ resulting in a pulse of reduced amplitude. ✓ (3)

Accept if the learner missed the word *crest* for resultant amplitude (max. 2 marks)

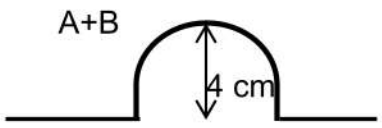
2.2

$x - 6 = 4$ ✓	$6 - x = 4$ (No mark)
$x = 10$ cm	$x = 2$ cm
Amplitude of C = ½ (10) ✓	Amplitude of C = ½ (2) ✓
= 5 cm	= 1 cm
Amplitude$_{(A+C)}$ = 6 + 5 ✓	Amplitude$_{(A+C)}$ = 6 + 1 ✓
= 11 cm ✓	= 7 cm (No Mark for answer)

(4)

POSITIVE MARKING FROM QUESTION 2.2

2.3 Criteria
Shape: Pulse drawn as crest ✓
Amplitude of pulse = 4 cm ✓
(2)



[9]

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QUESTION 3

3.1

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

3.1.2 (point) C ✓ (1)

3.1.3 Out of phase✓
Points B and C are not separated by a whole number multiple of complete wavelengths. ✓✓
OR
Points B and C are only half a wavelength apart. ✓✓
OR
Points B and C are not moving in exactly the same direction at the same time.✓✓
OR
Particle in point B is not moving in the same direction as particle in point C.✓✓ (3)

3.1.4 2 s ✓ (1)

3.1.5 **POSITIVE MARKING FROM QUESTION 3.1.4**

OPTION 1	**OPTION 2**
$f = \frac{1}{T}$ ✓	$f = \frac{2,25\ ✓}{4,5\ ✓}$
$f = \frac{1}{2}$ ✓	f = 0,5 Hz ✓
f = 0,5 Hz ✓	

(3)

3.1.6 **POSITIVE MARKING FROM QUESTION 3.1.5**

OPTION 1	**OPTION 2**
$speed = \frac{distance}{time}$ ✓	$\lambda = \frac{2,8}{2} = 1,4\ m$
$speed = \frac{2,8✓}{4\ ✓}$	v = f × λ ✓
= 0,7 m.s^{-1} ✓	= 0,5 ✓ x 1,4 ✓
	= 0,7 m.s^{-1} ✓

(4)

3.2

3.2.1 T = 2 x 1,5 ✓
= 3 s ✓ (2)

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3.2.2 **POSITIVE MARKING FROM QUESTION 3.2.1**

OPTION 1

speed = $\frac{\text{distance}}{\text{time}}$

4 ✓ = $\frac{\lambda}{3}$ ✓

λ = 12 m ✓

OPTION 2

f = $\frac{1}{T}$

f = $\frac{1}{3} = 0{,}33\ Hz$

v = f × λ

4 ✓ = 0,33 ✓ × λ

λ = 12,12 m ✓ (3)

3.2.3 **POSITIVE MARKING FROM QUESTION 3.2.2**

OPTION 1

Distance = 12 x 3 ✓

= 36 m ✓

OPTION 2

Distance = 12,12 x 3 ✓

= 36,36 m ✓ (2)

[21]

QUESTION 4

4.1

4.1.1 Compression ✓ (1)

4.1.2 Rarefaction ✓ (1)

4.2 The distance between two successive points in phase. ✓ ✓ (2)

4.3 **OPTION 1**

speed = $\frac{\text{distance}}{\text{time}}$

1,6 ✓ = $\frac{\text{distance}}{0{,}3}$ ✓

Distance = 0,48 m

$\lambda = \frac{0{,}48}{2}$ ✓

λ = 0,24 m ✓

OPTION 2

f = $\frac{2}{0{,}3}$ ✓

f = 6,67 Hz

v = f × λ

1,6 ✓ = 6,67 ✓ × λ

λ = 0,24 m ✓

OPTION 3

T = $\frac{0{,}3}{2}$

= 0,15 s

f = $\frac{1}{T}$

f = $\frac{1}{0{,}15}$ ✓

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$f = 6{,}67\ Hz$
$v = f \times \lambda$
1,6 ✓ = 6,67✓ × λ (4)
λ= 0,24 m ✓ **[8]**

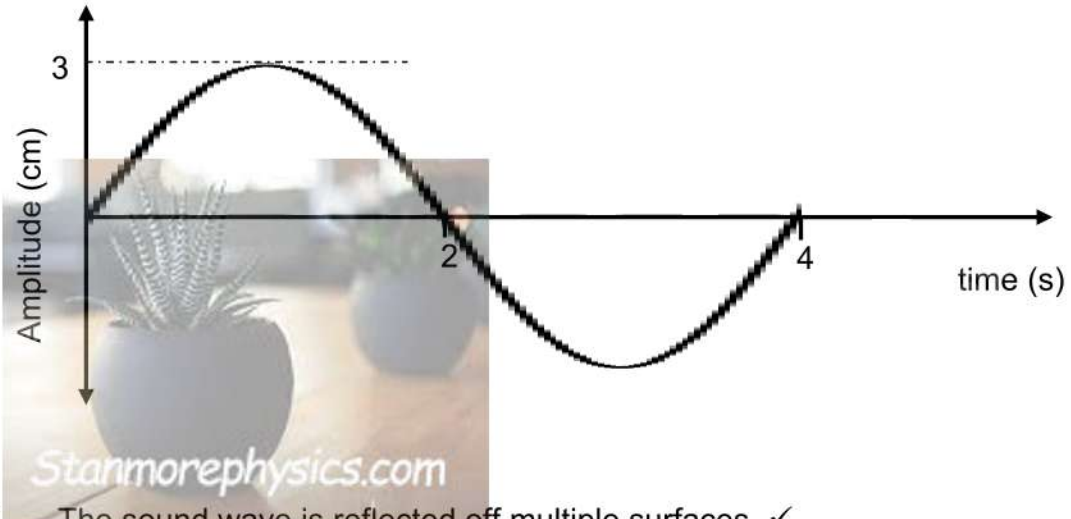
QUESTION 5

5.1 Longitudinal (waves) ✓ (1)

5.2 The particles are closer in iron than sea water. ✓
OR (1)
Iron is more dense than sea water. ✓

5.3
5.3.1 A ✓
Sound wave A has a higher amplitude ✓
A larger amplitude results in a louder sound ✓ (3)

5.3.2 Criteria:
Sound wave drawn with same amplitude of 3 cm ✓
One wave drawn for the 4 second interval ✓ (2)



5.4
5.4.1 The sound wave is reflected off multiple surfaces. ✓
The distance between the drummer and each surface isn't the same. ✓ (2)

5.4.2 $v = f \times \lambda$ ✓
$= 250 \times 1{,}36$ ✓
$= 340\ m.s^{-1}$ ✓ (3)

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5.4.3 **POSITIVE MARKING FROM QUESTION 5.4.2**

$\Delta t = \frac{0,24}{2}$ ✓

= 0,12 s

speed = $\frac{\text{distance}}{\text{time}}$

340 ✓ = $\frac{\text{distance}}{0,12}$ ✓

Distance = 40,8 m ✓ (4)

[16]

QUESTION 6

6.1 Wave model ✓
Particle model ✓ (2)

6.2.1 Radio waves ✓ (1)

6.2.2 X-ray ✓ (1)

6.3

6.3.1 A packet of energy found in light. Or A particle of light that contains energy.✓✓ (2)

6.3.2 Inversely proportional ✓ (1)

6.3.3

E= $\frac{hc}{\lambda}$ ✓

2.6×10^{-14} ✓ = $\frac{6,63 \times 10^{-34} \times 3 \times 10^{8}}{\lambda}$ ✓

$\lambda = 7,65 \times 10^{-12}$ m ✓ (4)

6.3.4

OPTION 1	**OPTION 2**
E = h x f ✓	c = f x λ ✓
$1,59 \times 10^{-14} = 6,63 \times 10^{-34} \times f$ ✓	$3 \times 10^{8} = f \times 12,5 \times 10^{-12}$ ✓
$f = 2,4 \times 10^{19}$ Hz ✓	$f = 2,4 \times 10^{19}$ Hz ✓

(3)

6.3.5 (Point) A ✓
The energy of a photon at point A is higher than point B ✓
Photons with higher energy have a greater penetrating ability. ✓ (3)

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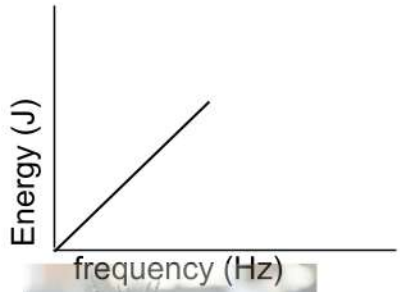
6.3.6 Criteria:
Shape: Straight line ✓
Line starts from the origin ✓ (2)



[19]

QUESTION 7

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

7.2 $Q = n \times q_e$ ✓
$Q = 4{,}375\times10^{10}$ ✓ x $-1{,}6\times10^{-19}$ ✓
$Q = -7\times10^{-9}$ C✓ (4)

POSITIVE MARKING FROM QUESTION 7.2

7.3
$$Q = \frac{Q_1 + Q_2}{2}$$ ✓
$$Q = \frac{3\times10^{-9} + (-7\times10^{-9})}{2}$$ ✓
$= -2 \times 10^{-9}$ C ✓ (3)

POSITIVE MARKING FROM QUESTION 7.3

7.4
$$Q = \frac{Q_1 + Q_2}{2}$$
-3×10^{-9}✓ $= \frac{Q_B + 0}{2}$ ✓
$Q_B = -6 \times 10^{-9}$ C
$n = \frac{\Delta Q}{q_e}$ ✓
$$= \frac{-6\times10^{-9} - (-2\times10^{-9})}{-1{,}6\times10^{-19}}$$ ✓
$= 2{,}5 \times 10^{10}$ electrons ✓ (6)

[15]

TOTAL: 100

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