KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

STANDARDISED PROVINCIAL ASSESSMENT

MARCH 2026

MARKS: 100

DURATION: 2 hours

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

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.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number(1.1 to 1.7) in your ANSWER BOOK, for example 1.8 D

1.1 The term given to distance between two successive points in phase
A amplitude
B period
C wavelength
D frequency (2)

1.2 Sound waves cannot travel through a vacuum because sound waves :

A have low frequencies
B are transverse waves
C require a medium to transfer energy
D have small amplitudes (2)

1.3 Ultrasound can be described by frequencies that are
A Higher than 100kHz
B Higher than 20kHz but lower than 100kHz
C Lower than 20kHz
D Higher than 100kHz but lower than 1000kHz (2)

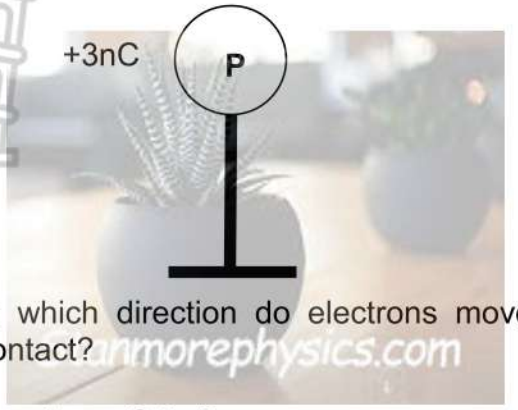
1.4 When the frequency of vibration of a wave with a period **T** is doubled, then its period is
A T
B 2T
C 4T
D 0.5T (2)

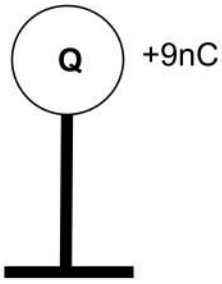
1.5 Which ONE of the following statements is CORRECT
A Loudness of sound depends on the frequency of the sound
B Pitch of sound depends on the amplitude of the sound
C Speed of sound waves is always constant
D All electromagnetic waves travel faster than sound waves (2)

1.6 A radio station transmits radio signals with a frequency range from 3MHz to 6MHz.The maximum wavelength of the radio signal transmitted is :

A 100m
B 200m
C 0,02m
D 0,01m (2)

1.7 Two identical spheres, **P** and **Q,** placed on insulated stands consist of charges of +3nC and +9nC respectively as shown below





In which direction do electrons move when the spheres are brought into contact?

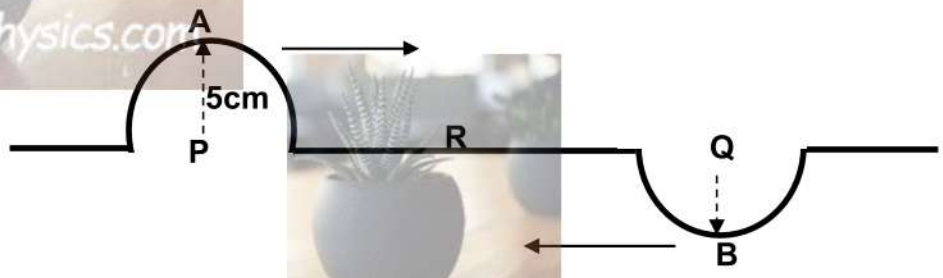
A From Q to P
B From P to Q
C No movement, electrons remain in Q
D No movement as both spheres are positively charged (2)

[14]

QUESTION 2 (Start on a new page.)

Two pulses, **A** and **B** travel along a string in opposite directions and approach each other at the same speed as shown in the diagram below. Pulse **A** has an amplitude of **5cm** when it is at position **P**. Pulse **B** has an **UNKNOWN** amplitude when it is at position **Q.** Pulses **A** and **B** meet at position **R** resulting in a pulse that has an amplitude of **+3cm** from the rest position. Points **P** and **Q** are the same distance from point **R**.

NOTE: Diagrams are NOT drawn to scale



2.1 Define the term *amplitude* (2)

2.2 What type of interference occurs at point **R**? Explain your answer. (3)

2.3 Calculate the amplitude of pulse **B** at point **Q** (2)

2.4 **After the two pulses pass each other:**

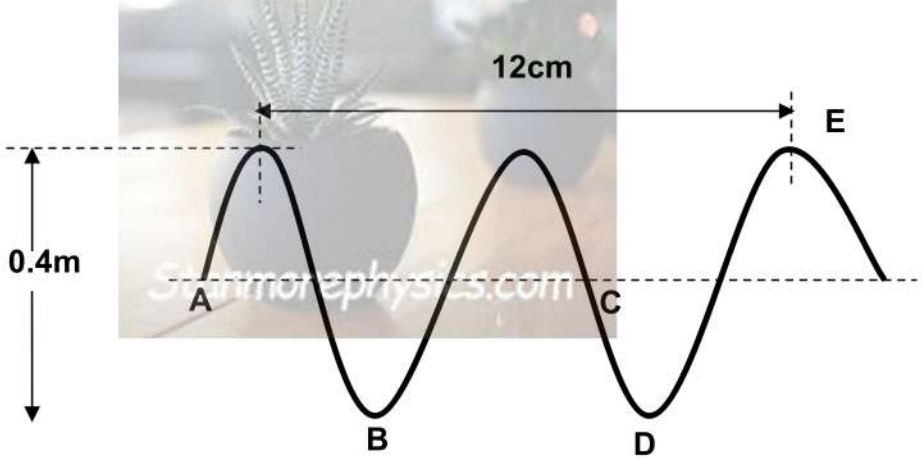
2.4.1 In which direction will pulse **B** move ?Write to the RIGHT or to the LEFT (1)

2.4.2 How will the amplitude of pulse **A** change after the pulses meet compared to before they met? Write INCREASES,DECREASES OR REMAINS THE SAME (1)

[9]

QUESTION 3 (Start on a new page.)

The diagram below represents a transverse wave.



The speed of the transverse wave is $3 m.s^{-1}$.

3.1 Define the term *frequency* in words (2)

3.2 Write down the :

3.2.1 letters of two points in phase (1)

3.2.2 name given to point D (1)

3.3 Determine the following :

3.3.1 amplitude (2)

3.3.2 wavelength (2)

3.4 Calculate the:

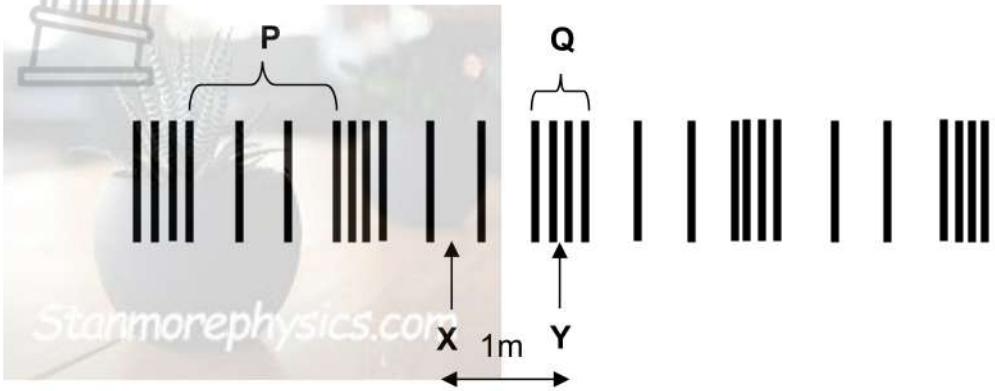
3.4.1 frequency of the wave (3)

3.4.2 time taken for one wave to pass a fixed point (2)

[13]

QUESTION 4 (Start on a new page.)

Consider the wave below.
The distance between points X and Y is 1m. It takes 0.5s for a particle of the medium to complete one full vibration from the rest position and back again.



4.1 Define the term *longitudinal wave* (2)

4.2 What term is given to the underlined statement above? (1)

4.3 Write down the name of the label

4.3.1 **P** (1)

4.3.2 **Q** (1)

4.4 Determine the wavelength of the wave above. (2)

4.5 Calculate the speed of the wave (4)

4.6 The wave is propagated through a slinky spring .If length of the spring is 20m, calculate the time it takes for the wave to move through the spring (3)

4.7 The medium is changed so that the wave now travels **faster**, but the **source of the wave remains the same**

4.7.1 State whether the frequency CHANGES or REMAINS THE SAME (1)

4.7.2 Give a reason to the answer in 4.7.1 (2)

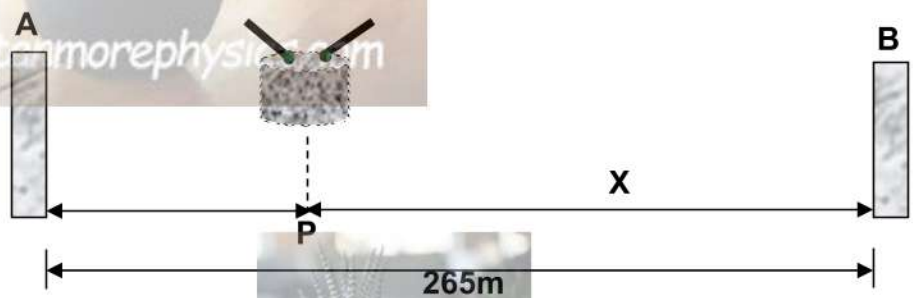
4.7.3 What happens to wavelength? Choose INCREASES, DECREASES or REMAINS THE SAME.
Explain the answer. (3)

[20]

QUESTION 5 (Start on a new page.)

Mary stands at point **P**, between two high buildings **A** and **B**, and hits a drum once. Two sound waves travel from the drum in opposite directions toward the buildings. The distance between Mary and building B is **X** metres, and the buildings are 265 m apart.

A sound detector at building **B** records the sound 0,22 s after it is detected at building **A**. Mary and both buildings are on the same plane and in a straight line..



5.1 Define the term *echo* (1)

5.2 How would the time taken to detect the sound at each building change if the same activity was repeated on a **hotter** day?
Choose from INCREASES,DECREASES or REMAINS THE SAME (1)

5.3 Give a reason for the answer in 5.2 (2)

5.4 Calculate the distance **X**, between Mary and building **B**. (5)
The speed of sound in air is 340m.s^{-1}.

Ultrasound is used to detect depths of seas. In one occasion, a boat emitted a sound and a return signal was received in the boat 10 seconds later. **Take the speed of sound waves in water to be 1500m.s^{-1}.**

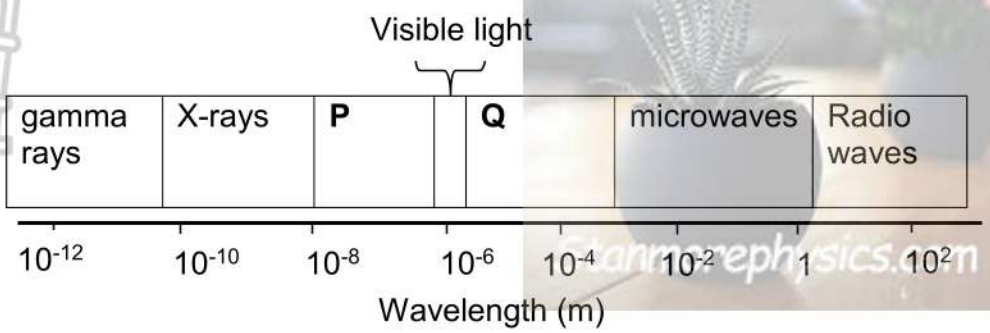
5.5 Calculate the distance of the **midway point** between the boat and the sea floor. (3)

5.6 Ultrasound is also often used in the medical field to examine the insides of the human body.
Explain why this method is often preferred to other types of body scanning (2)

[14]

QUESTION 6 (Start on a new page.)

The diagram below shows the electromagnetic spectrum in order of increasing wavelength.



6.1 Define the term *photon* (2)

6.2 Name the electromagnetic radiation represented by the letter:

6.2.1 **P** (1)

6.2.2 **Q** (1)

6.3 Which radiation has the highest penetrating ability? Write GAMMA RAYS or RADIO WAVES. (2)
Explain your answer.

Electromagnetic radiation has many applications in everyday life.

6.4 Wireless headphones receive electromagnetic waves with a frequency of 2.42 GHz from an audio device.

6.4.1 Show, by a calculation that the wavelength of these waves is 0.12 m. (2)

6.4.2 Identify the part of the electromagnetic spectrum that these waves belong to. (1)

X-rays are used in dental procedures to examine the condition of a patient's teeth. During this procedure the patient's head is exposed to X-rays.

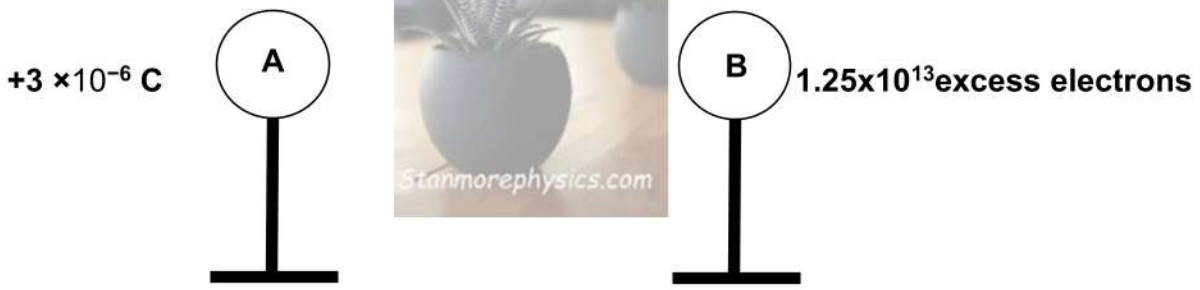
6.5 Calculate the energy of a photon of the radiation absorbed by the patient's head if X-rays radiation of wavelength **0.3nm** is used (4)

6.6 How will the energy you calculated in 6.5 change if the wavelength of the radiation was decreased. Choose from INCREASES,DECREASES OR REMAINS THE SAME (2)

[15]

QUESTION 7 (Start on a new page.)

Two identical metal spheres, **A** and **B**, are on insulated surfaces. Sphere **A**, carries a charge **of +3 ×10^{-6} C** while sphere B has **an excess of 1.25x10^{13} electrons**.



7.1 State the *principle of conservation of charge* . (2)

7.2 Give a reason why we place charged spheres on insulated stands (1)

7.3 Calculate the charge of sphere **B** (3)

The two spheres are brought into contact and then separated again. When the spheres get into contact, sphere **A** gains electrons.

7.4 Give a reason why sphere A gains electrons and not sphere B. (1)

7.5 Sketch a graph of **net charge on sphere A** (Y-axis) versus **number of electrons transferred to charge A**(X-axis) (2)

7.6 Calculate the :

7.6.1 new charge on each sphere after the spheres have separated again (3)

7.6.2 number of electrons transferred during contact (3)

[15]

TOTAL: 100

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

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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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MARKING MEMORANDUM
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QUESTION 1

1.1	C ✓✓	(2)
1.2	C ✓✓	(2)
1.3	B ✓✓	(2)
1.4	D ✓✓	(2)
1.5	D ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
		[14]

QUESTION 2

2.1 Maximum displacement of particles from the rest/equilibrium position ✓✓ (2)
(2 or 0)

2.2 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)

x + 5 = 3 ✓

2.3 x = -2 cm
Amplitude of **B** = (-)2cm ✓ (2)

2.4.1 Left ✓ (1)

2.4.2 Remains the same ✓ (1)

[9]

QUESTION 3

3.1 The number of (full)waves/cycles (passing a fixed point) per second.✓ ✓
(2)

3.2.1 B and D ✓ (1)

3.2.2 Trough ✓ (1)

3.3.1 Amplitude $= \frac{0,4}{2}$ ✓
$= 0.2$ m ✓ (2)

NOTE: Award full marks for correct answer

3.3.2 Wavelength $= \frac{0,12}{2}$ ✓
$= 0.06$ m✓
Accept: 6cm ✓✓ (2)

NOTE: Award full marks for correct answer

3.4.1

POSITIVE MARKING FROM 3.3.2

$v = f \times \lambda$ ✓

$3 = f \times 0.06$ ✓

$f = 50$ Hz ✓

(3)

3.4.2

POSITIVE MARKING FROM 3.4.1

OPTION 1

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

$= \frac{1}{50}$ ✓

$= 0.02$ s ✓

OPTION 2

50 waves in 1s ✓
1 wave in T s
T = 0.02 s ✓

(2)

OPTION 3

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

$3 = \frac{0,06}{time}$ ✓

time = 0,02s ✓

[13]

QUESTION 4

4.1 A wave in which the particles of the medium vibrate parallel to the direction of motion of the wave. ✓✓ (2)

4.2 Period ✓ (1)

4.3.1 Rarefaction ✓ (1)

4.3.2 Compression ✓ (1)

4.4 Wavelength = 1×2 ✓
= 2m ✓

NOTE: Award full marks for correct answer

(2)

POSITIVE MARKING FROM 4.4

4.5

OPTION 1

$f = \frac{1}{0,5}$ ✓

$= 2$ Hz

$v = f \times \lambda$ ✓

$= 2 \times 2$ ✓

$= 4\ m.s^{-1}$ ✓

(4)

Speed = $\frac{distance}{time}$ ✓ **OPTION 2**

= $\frac{2✓}{0,5✓}$

= $4ms^{-1}$ ✓

4.6 **POSITIVE MARKING FROM 4.5** (3)

Speed = $\frac{distance}{time}$ ✓

4 = $\frac{20}{time}$ ✓

time = 5s ✓

4.7.1 Remains the same ✓ (1)

4.7.2 Frequency depends only on the source of the wave ✓✓ (2)

4.7.3 Increases ✓ (3)
Because v = f × λ and if v increases while f is constant ✓, λ increases✓

[20]

QUESTION 5

5.1 Reflection of/reflected sound waves✓ (1)

5.2 Decreases ✓ (1)

5.3 Sounds travels faster when temperature of the medium increases/the higher the temperature of the medium, the faster sound travels✓✓ (2)

MARKING CRITERIA

Use of correct equation	✓
Correct substitution (for building A)	✓
Correct substitution (for building B)	✓
Subtraction of times/calculation of total time for B or time for A	✓
Answer within the correct range(1,69m-1,70m)	✓

(5)

OPTION 1

Time for sound to reach building B :

Speed $= \frac{distance}{time}$ ✓

Accept v= $\frac{\Delta x}{\Delta t}$

$340 = \frac{X}{time\ B}$ ✓

$time\ B = \frac{X}{340}$

Time for sound to reach building A :

$340 = \frac{265-X}{time\ A}$ ✓

$time\ A = \frac{265-X}{340}$

time B – time A = 0,22

$\frac{X}{340} - \frac{265-X}{340} = 0{,}22$ ✓

X = 169,9 m ✓

OPTION 2

Distance to building B:

Speed $= \frac{distance}{time}$ ✓

Accept v= $\frac{\Delta x}{\Delta t}$

$340 = \frac{X}{t+0{,}22}$ ✓

X = 340t +74,8……(i)

Distance to building A:

$340 = \frac{265-X}{t}$ ✓

X = 265 -340t ……(ii)

340t +74,8=265 -340t✓

t =0,28s

X =169,8m✓

OPTION 3

Let the distance from A to P be Y:

Speed $= \frac{distance}{time}$ ✓

$340 = \frac{Y}{t}$ ✓

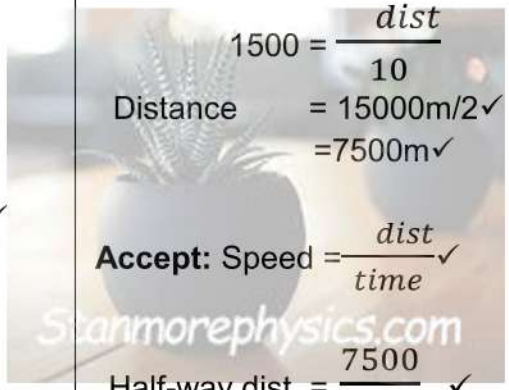
Y= 340t
Let the distance from P to B be X:
$340 = \frac{X}{t+0,22}$ ✓

X= 340(t+0,22)
X+Y= 265m✓

340(t+0,22) + 340t= 265m
t= 0,28s
X= 340(0,28+0,22)
= 170m✓

5.5

OPTION 1	OPTION 2
Speed = $\frac{dist}{time}$ ✓	Speed = $\frac{dist}{time}$ ✓
$1500 = \frac{dist}{5}$ ✓ Distance = 7500 m✓	$1500 = \frac{dist}{10}$ Distance = 15000m/2✓ =7500m✓
Accept: Speed = $\frac{dist}{time}$ ✓	**Accept:** Speed = $\frac{dist}{time}$ ✓
Half-way dist. = $\frac{7500}{2}$ ✓ = 3750m✓	Half-way dist. = $\frac{7500}{2}$ ✓ = 3750m✓



(3)

5.6 It does not damage the soft tissues of human organs (which could be a danger in X-rays) ✓✓ (2)
OR : Ultrasound has less energy than Gamma Rays or X Rays✓✓

[14]

QUESTION 6

6.1 A packet of energy found in light. Or A particle of light that contains energy.✓✓ **(2 or 0)** (2)

6.2.1 Ultraviolet/UV (radiation)✓ (1)

6.2.2 Infrared/IR (light) ✓ (1)

6.3 Gamma rays ✓ (2)
It has the highest frequency/energy ✓

6.4.1 $c = f \times \lambda$ ✓
$3 \times 10^8 = 2{,}42 \times 10^9 \times \lambda$ ✓
$\lambda = 0.12\text{m}$

Accept $v = f \times \lambda$

Final answer of 0.12 m must be shown, otherwise MAX (1) (2)

6.4.2 Microwaves ✓ (1)

6.5
$E = \frac{hc}{\lambda}$ ✓
$= \frac{6{,}63 \times 10^{-34} \times 3 \times 10^8}{0.3 \times 10^{-9}}$ ✓ ✓
$E = 6{,}63 \times 10^{-16}$ J ✓

OR: $v = f\lambda$ ✓ : $3 \times 10^8 = f \times 0{,}3X\ 10^{-9}$
$f = 1\text{x } 10^{18}$ Hz✓
$E = hf$ ✓
$E = 6{,}63 \times 10^{-34} \text{ x } 1\text{x } 10^{18}$
$E = 6{,}63 \times 10^{-16}$ J ✓ (4)

6.6 Increases ✓✓ (2)
[15]

QUESTION 7

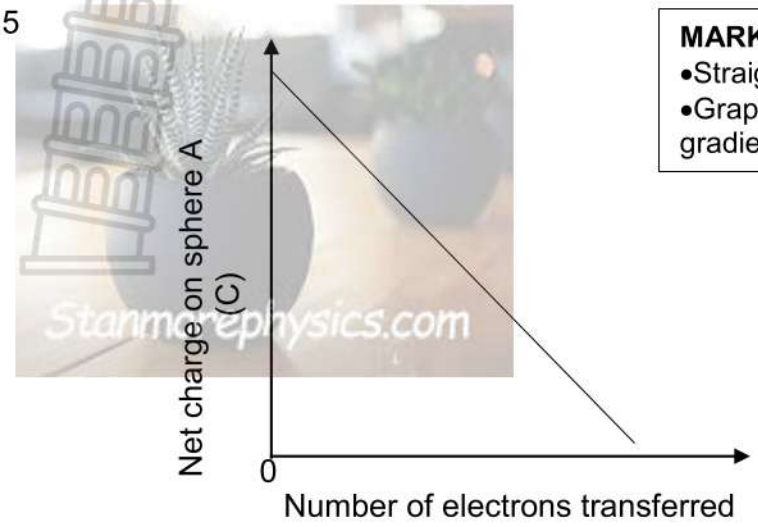
7.1 The net charge of an isolated system remains constant during any physical process. ✓✓ **(2 or 0)** (2)

7.2 To prevent the loss of electrons or charges. ✓
OR To prevent leakage of charges. ✓
OR To prevent transfer of charges✓ (1)

7.3 $Q = n \times q_e$ ✓
$Q = 1{,}25 \times 10^{13} \times -1{,}6 \times 10^{-19}$ ✓
$Q = -2 \times 10^{-6}$ C✓ (3)

7.4 It has a deficiency of electrons / is more positively charged (than sphere B) ✓
OR Charges are transferred from a negatively charged sphere to a positively charged sphere✓ (1)

7.5



MARKING CRITERIA
- Straight line ✓
- Graph slopes downwards/has negative gradient✓

(2)

POSITIVE MARKING FROM QUESTION 7.3

7.6.1

$$Q = \frac{Q_1 + Q_2}{2} \checkmark$$

$$Q = \frac{3\times10^{-6} + (-2\times10^{-6})}{2} \checkmark$$

$= +5 \times 10^{-7}$ C ✓ (3)

POSITIVE MARKING FROM QUESTION 7.3

7.6.2

$$n = \frac{\Delta Q}{q_e}$$

$$= \frac{5\times10^{-7} - (-2\times10^{-6})\checkmark}{+1{,}6\times10^{-19}\checkmark}$$

$= 1{,}56 \times 10^{13}$ electrons ✓

OR

$$= \frac{5\times10^{-7} - 3\times10^{-6}\checkmark}{-1{,}6\times10^{-19}\checkmark}$$

$= 1{,}56 \times 10^{13}$ electrons ✓ (3)

[15]

TOTAL: 100