LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2025

MARKS: 100
TIME: 2 hours

This Question paper consists of 16 pages including the cover page, answer sheet and data sheet.

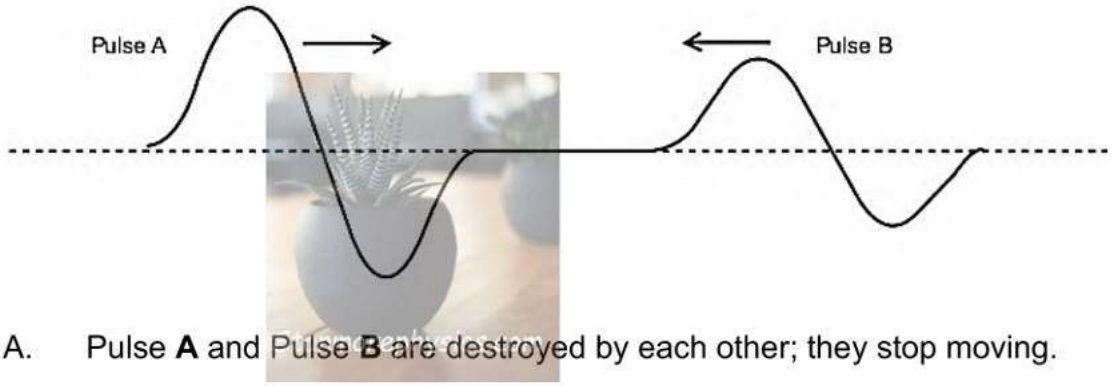
INSRUCTIONS AND INFORMATION

1. The question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
2. Answer question 5.3 using the provided graph paper on p. 15. **Attach it to your answer book**
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions et cetera where required.
12. Write neatly and legibly.

QUESTION 1

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.8) on the answer book. E.g. 1.9 A

1.1 Pulse **A** meets Pulse **B** as they travel in opposite directions along a slinky. After they have crossed over each other, what happens to Pulse **A** and Pulse **B**?



A. Pulse **A** and Pulse **B** are destroyed by each other; they stop moving.

B. Pulse **A** and Pulse **B** continue to move in the same direction as they were moving before they met up with each other.

C. Pulse **A** and Pulse **B** reflect; they move back down the slinky in opposite directions.

D. Pulse **A** and Pulse **B** continue to interfere with one another. (2)

1.2 A wave of wavelength 3 m is generated by a vibration with a frequency of 20 Hz. What is the period and the speed of this wave?

	PERIODS (s)	**SPEED($m.s^{-1}$)**
A.	$\frac{1}{20}$	3 x 20
B.	$\frac{1}{20}$	$\frac{20}{3}$
C.	20	$\frac{20}{3}$
D.	20	$\frac{3}{20}$

(2)

1.3 Which electromagnetic waves have more energy than visible light?

A. microwaves

B. Ultraviolet rays

C. Infrared rays

D. ultrasound (2)

1.4 The speed of sound in air is 330 $m.s^{-1}$. If the frequency of sound is doubled,

A the speed of sound is doubled.

B the speed of sound is halved.

C the wavelength of sound is doubled.

D the wavelength of sound is halved. (2)

1.5 Which of the following are arranged in order of increasing wavelength.

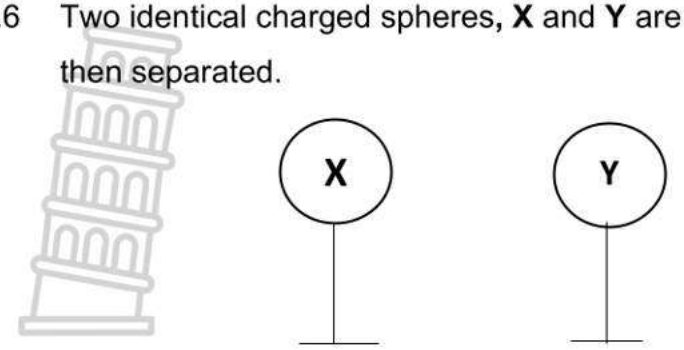
A. Microwaves, visible light, x-rays.

B. X-rays, visible light, microwaves

C. Microwaves, x-rays, visible light

D. Visible light, x-rays, microwaves (2)

1.6 Two identical charged spheres, **X** and **Y** are made to touch each other and are then separated.

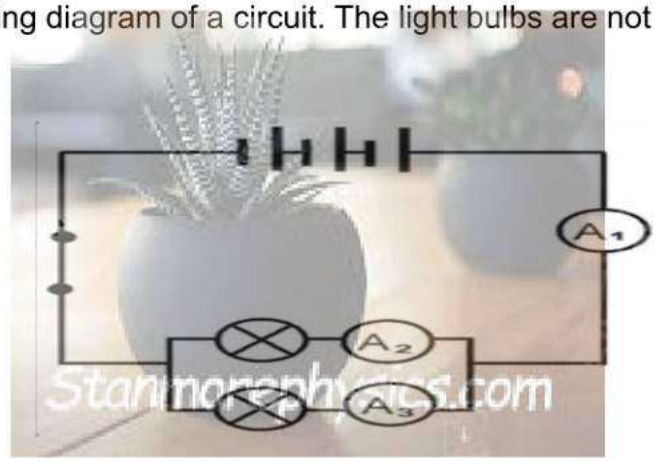


Which one of the following is most probable for these two charges?

	BEFORE TOUCHING		AFTER TOUCHING and SEPARATED
	X	**Y**	
A	+5,2C	Neutral	**X** gained electrons
B	$-3C$	$-7C$	**Y** gained electrons
C	$-3C$	$-7C$	**X** lost electrons
D	+5,2C	Neutral	**X** lost electrons

(2)

1.7 Consider the following diagram of a circuit. The light bulbs are not necessarily identical



The reading on A_2 will be equal to …

A. the reading on A_1.

B. half the reading on A_1

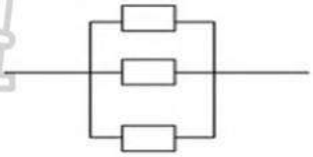
C. the reading on A_3 minus the reading on A_1.

D. the reading on A_1 minus the reading on A_3. (2)

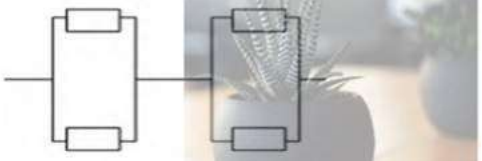
1.8 Which of the following arrangements will result in a total resistance of 4 Ω if the resistance of each resistor is 4 Ω?

A.

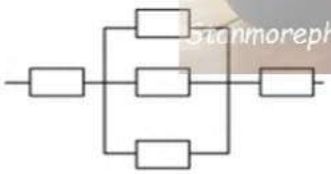
B.



C.



D.

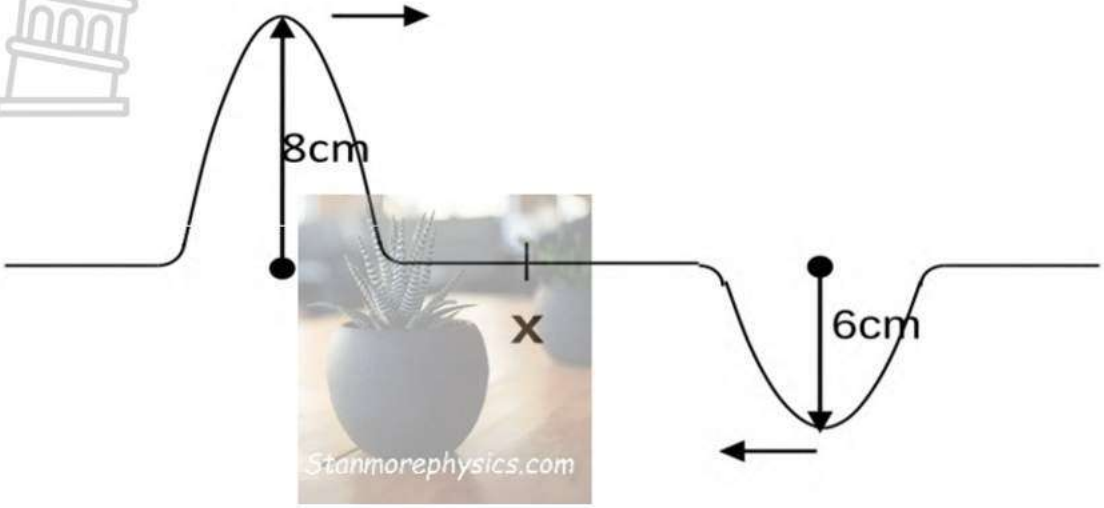


(2)

[16]

QUESTION 2 (Start on a new page)

Two pulses are travelling towards each other along a spring, as shown in the diagram below. The centres of the two pulses meet and cross at point **X.**



2.1 Which wave property do the two pulses illustrate at point **X**? (1)

2.2 Name the principle used to answer QUESTION 2.1. (1)

2.3 When the two pulses cross at point **X**, the resulting amplitude is different from the amplitudes of the individual pulses.

2.3.1 Define the term *amplitude*. (2)

2.3.2 Calculate the magnitude of the resulting amplitude at **X** in meters. (3)

[7]

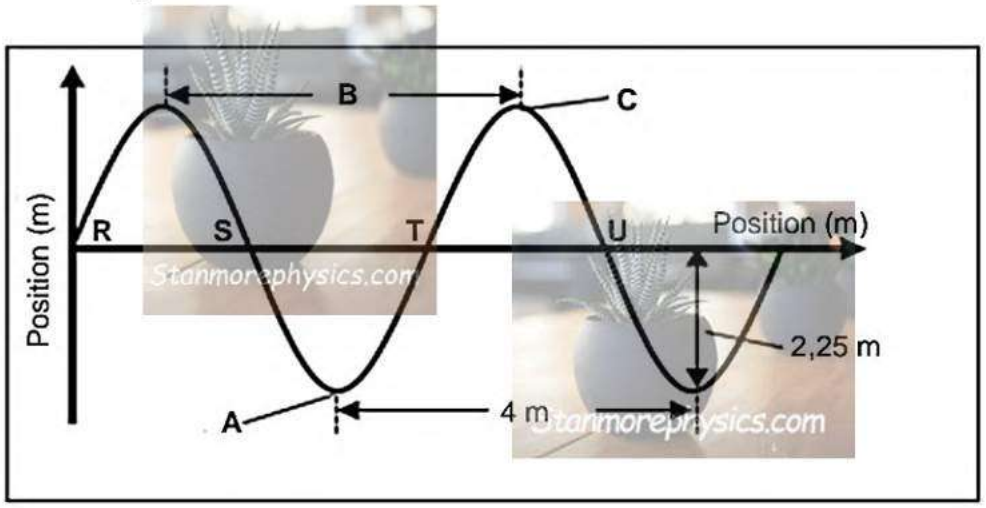
QUESTION 3 (Start on a new page)

3.1 In a ripple tank the crest of a wave travels 1, 260 m in 3 seconds and the distance between 21 consecutive crests is 0, 240 m.

3.1.1 Calculate the wavelength of the wave. (2)

3.1.2 Calculate the period of the wave. (5)

3.2 The diagram represents the pattern of waves with frequency 30 Hz, moving from the left to right.



3.2.1 Define the term *transverse wave.* (2)

3.2.2 Label points **B** and **C**. (2)

3.2.3 How much time has lapsed while the wave moved from **R** to **T**? (2)

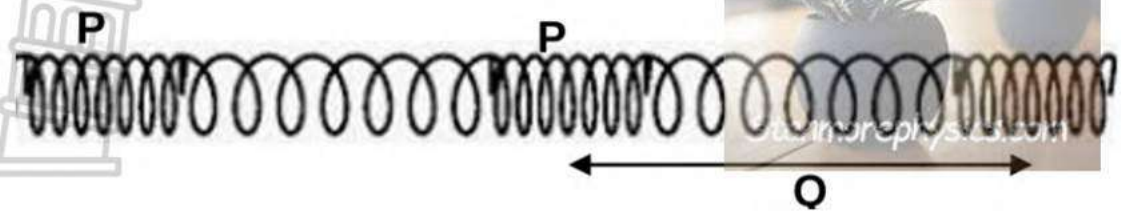
3.2.4 Are points **R** and **S** on the wave in phase? Explain your answer. (2)

3.2.5 Calculate the speed of the wave. (3)

[18]

QUESTION 4 (Start on a new page)

The string shown below can be used to demonstrate the wave produced by the sound.



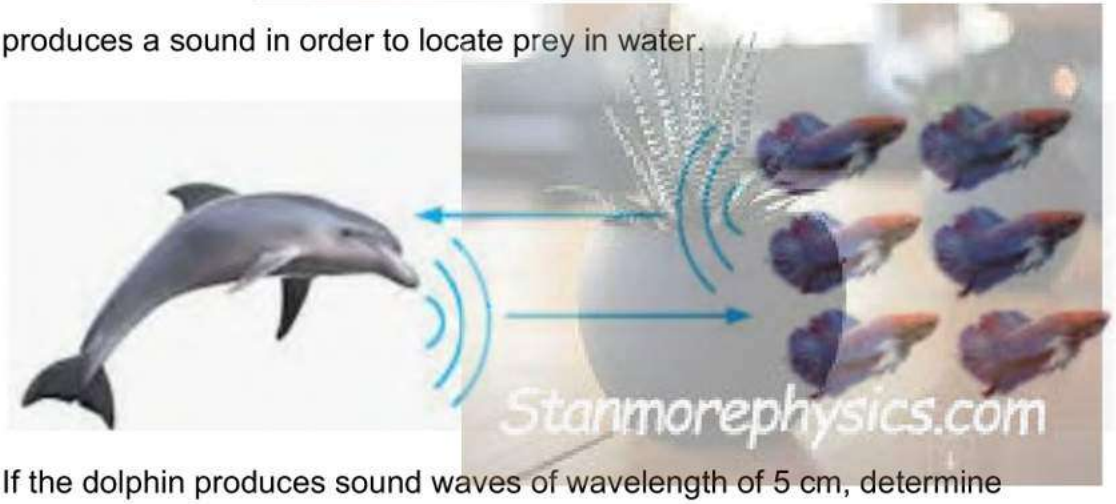
4.1 Name the type of wave produced in the string (1)

4.2 Identify the components of the wave labelled:

4.2.1 **P** (1)

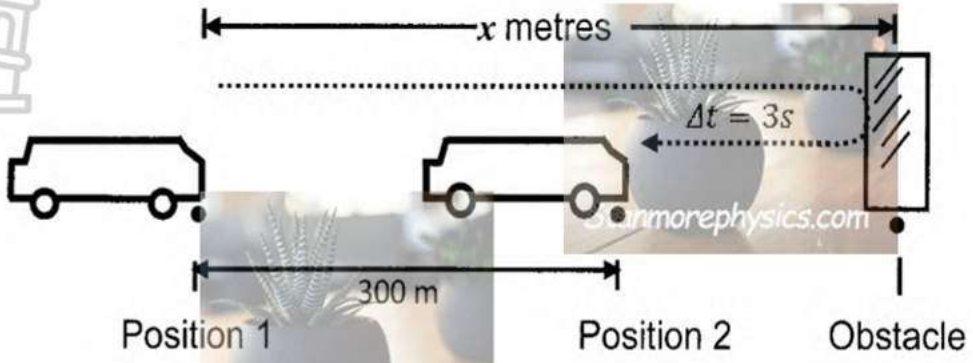
4.2.2 **Q** (1)

4.3 The highest frequency that the human ear can hear is 20 kHz. A Dolphin produces a sound in order to locate prey in water.



If the dolphin produces sound waves of wavelength of 5 cm, determine by means of calculations, whether the frequency produced by Dolphin can be heard by human ear.
The speed of sound in water is 1480 $m.s^{-1}$. (4)

4.4 A motorist of a moving car sees an obstacle on the road ahead when he is at position **1** as indicated in the diagram below. Position **1** is ***x*** metres away from the obstacle. He sounds the car hooter while at position **1** and receives an echo 3 seconds later at position **2**. The distance between position **1** and position **2** is 300m.



If the speed of sound in air is 340 $m.s^{-1}$ SHOW BY CALCULATION that the distance between position **2** and the obstacle is 360m.

(5)

[12]

QUESTION 5 (Start on a new page)

A group of learners decide to perform an experiment to determine the relationship between the wavelength and frequency of different sound notes. Specific sound notes are produced using a musical instrument. The frequency of the sound notes is measured and recorded in the table below.

Note played by learner	Wavelength (m)	Frequency (Hz)
A	4	84
B	5	68
C	7,69	44

5.1 Write down the investigative question for this experiment. (2)

5.2 Identify the controlled variable. (1)

5.3 Use the information from the table above to draw an accurate frequency versus $\frac{1}{wavelength}$ graph on page 15. (3)

5.4 What conclusion can be drawn from the graph in QUESTION 5.3? (1)

5.5 Calculate the gradient of this graph. (3)

5.6 What physical quantity does the gradient represent? (1)

[11]

QUESTION 6 (Start on a new page)

The three appliances which emit different types of electromagnetic radiation are shown below.

Television remote control	Red laser pointer	Microwave oven
		

6.1 Name one characteristic that makes electromagnetic waves unique when compared to other waves. (1)

6.2 Explain how electromagnetic waves originate. (2)

6.3 State the type of electromagnetic radiation that is emitted by:

6.3.1 Television remote control (1)

6.3.2 Laser pointer (1)

6.4 The following table shows several electromagnetic waves and their corresponding wavelengths.

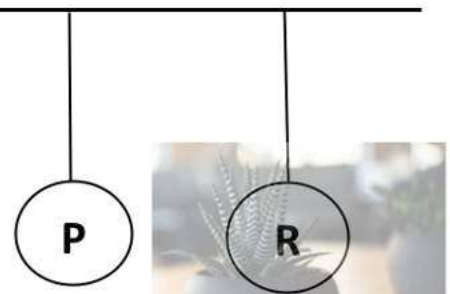
Radiation	Wavelength(m)
X – rays	$2{,}11 \times 10^{-10}$
Ultraviolet light	$3{,}00 \times 10^{-7}$
Visible light	$5{,}13 \times 10^{-6}$
Infrared	$4{,}05 \times 10^{-5}$
Medium – wave radio waves	$6{,}21 \times 10^{2}$

Electromagnetic waves from an unknown source are received and it is discovered that a photon of this radiation has an energy of $6{,}63 \times 10^{-19}$ J. Use a calculation to determine what kind of electromagnetic wave this is. (5)

[10]

QUESTION 7 (Start on a new page)

Two small identical spheres, **P** and **R**, are suspended on long silk threads, as shown i the sketch below. Sphere **P** is initially neutral, and the initial charge of **R** is unknown.



Sphere **P** is rubbed with a cloth and gains 2×10^{13} electrons.

7.1 Determine the new charge of sphere **P**. (3)

7.2 State the *principle of conservation of charge* in words. (2)

7.3 Sphere **P** is now brought into contact with Sphere **R** and the two spheres are then separated. Both spheres have a charge of 6,4 µC after they are separated

Calculate:

7.3.1 the initial charge on Sphere **R**. (4)

7.3.2 the number of electrons transferred from sphere **P** to sphere **R**. (3)

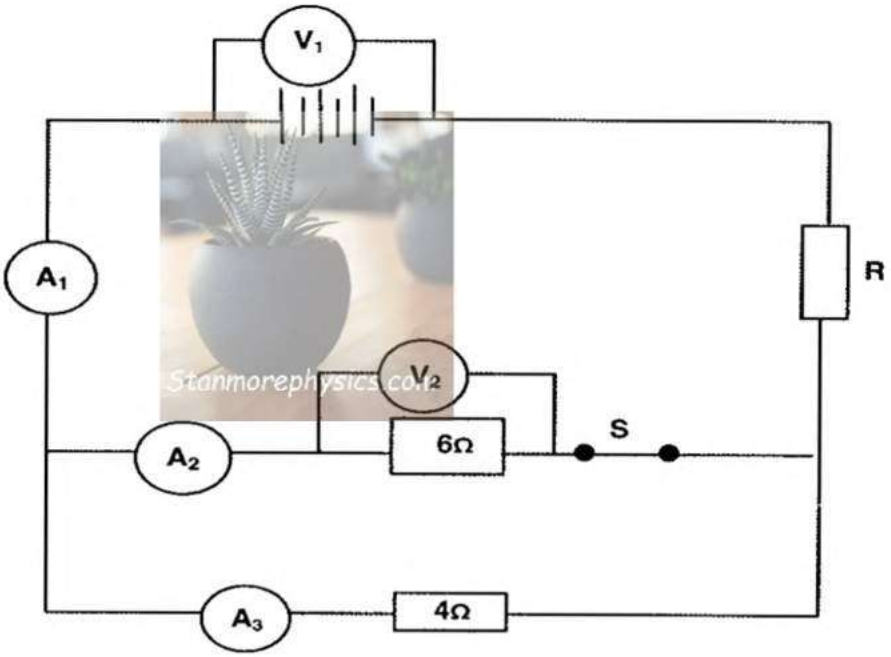
[12]

QUESTION 8 (Start on a new page)

Study the circuit diagram below. Ignore the resistance of the battery and the wires.

Switch **S** is initially closed.

The battery transfers 3×10^4J of energy for every $2{,}5 \times 10^3$C that flows through the circuit.



8.1 Define the term *emf*. (2)

8.2 Determine the reading on **V_1** (3)

8.3 Determine the reading on ammeter **A_1** if 3,24 C of charge flows through it in 2 seconds. (3)

8.4 If the reading on ammeter **A_2** is 0,65 A then determine the reading on ammeter **A_3**. (1)

8.5 If the total resistance of the circuit is 7,4 Ω then determine the resistance of resistor **R**. (4)

Switch **S** is now OPENED

8.6 What will be the reading on voltmeter **V_2**? (1)

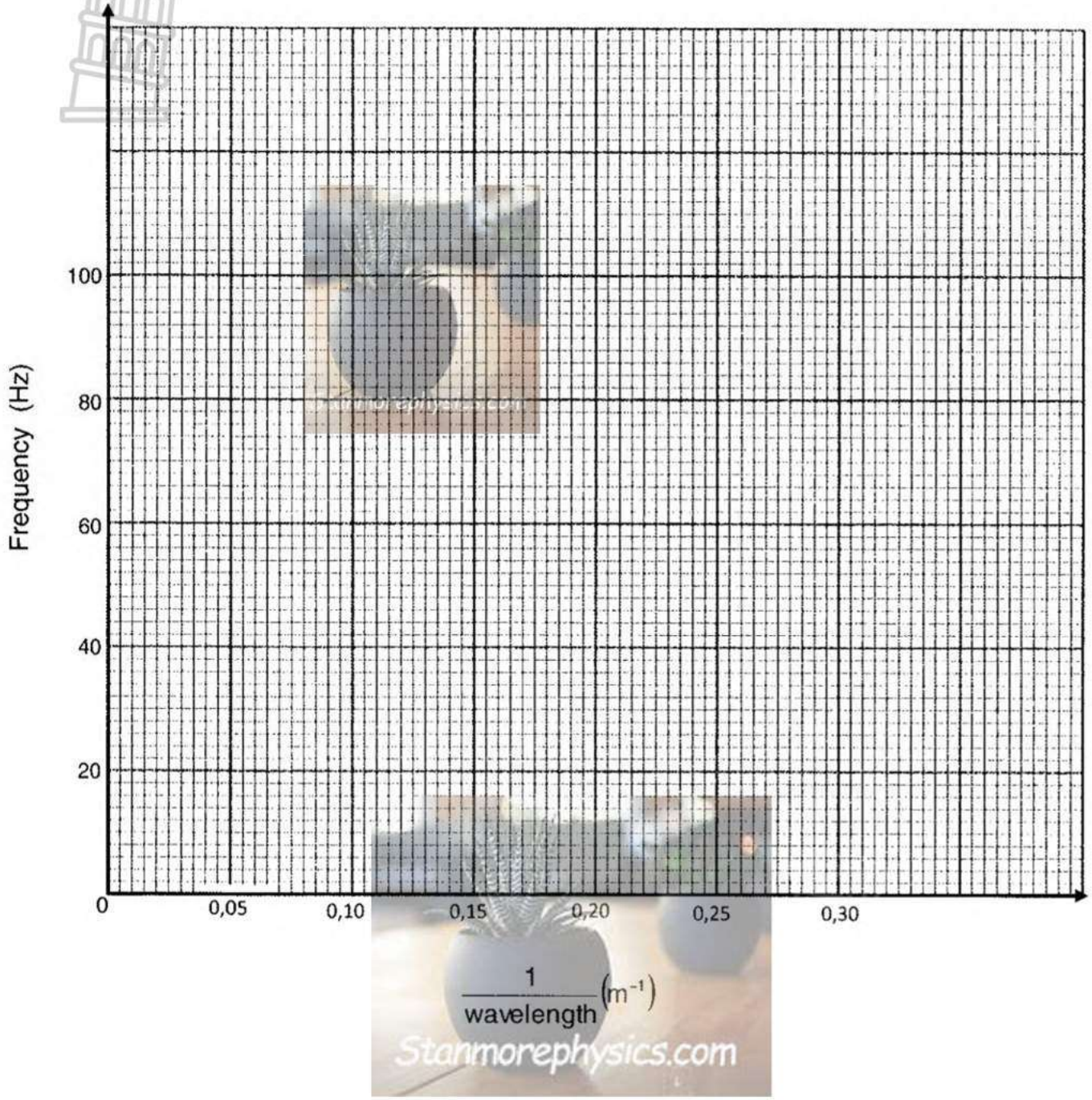
[14]

TOTAL: 100

ANSWER SHEET

Name of learner: _____

Question 5.3



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 vacuum	c	$3,0 \times 10^{8}\ m.s^{-1}$
Plank's constant	h	$6,63 \times 10^{-34}\ J.s$
Charge on electron	E	$-1,6 \times 10^{-19}\ C$
Electron mass	me	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE

WAVES SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/of $E = h\frac{c}{\lambda}$	

ELECTROSTATIC

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

ELECTRIC CIRCUITS

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

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GRADE/GRAAD 10

PHYSICAL SCIENCES: PHYSICS (P1) / *FISIESE WETENSKAPPE: FISIKA (V1)*

ERRATA MARKING GUIDELINES/*ERRATA NASIENRIGLYNE*

JUNE 2025/*JUNIE 2025*

13 JUNE 2025

MARKS/*PUNTE*: 100

These MARKING GUIDELINES consists of 12 pages including the cover page/*Hierdie NASIENRIGLYNE bestaan uit 12 bladsye, die voorblad ingesluit.*

QUESTION 1/*VRAAG 1*

1.1 B✓✓ (2)

1.2 A ✓✓ (2)

1.3 B✓✓ (2)

1.4 D✓✓ (2)

1.5 B✓✓ (2)

1.6 A✓✓ (2)

1.7 D✓✓ (2)

1.8 C✓✓ (2)

[16]

QUESTION 2/*VRAAG 2*

2.1 Destructive interference✓/ *Destruktiewe interferensie* (1)

2.2 Principle of superposition of pulses✓/ *Beginsel van superposisie van pulse* (1)

2.3.1 Amplitude is the maximum disturbance of a particle from its rest (equilibrium) position. ✓✓/ *Amplitude is die maksimum versteuring van 'n deeltjie vanaf sy rusposisie (ewewigsposisie).* **(2 or/*of* 0)** (2)

2.3.2 Amplitude(X) = 8 + (-6) ✓

= 2 cm✓

= 0,02 m✓ (3)

[07]

QUESTION 3/*VRAAG 3*

3.1.1 $20\lambda = 0,240$

$\lambda = \frac{0.240}{20}$ ✓ (Any one/*enige een*)

= 0.012 m ✓ (2)

3.1.2 **Positive marking from question 3.1.1/*Positiewe nasien vanaf vraag 3.1.1***

$v = \frac{d}{\Delta t}$

$= \frac{1,260}{3}$✓

= 0.42 m.s^{-1}✓

v = f λ✓

$v = \frac{\lambda}{T}$

$0,42 = \frac{0,012}{T}$✓

T = 0.029 s✓ (5)

3.2.1 Transverse wave is a wave in which the particles of the medium vibrate at right angles to the direction of motion of the wave. ✓✓/ *'n Transversale golf is 'n golf waarin die deeltjies van die medium reghoekig met die bewegingsrigting van die golf vibreer.* **(2 or/*of* 0)**

Accept: A transverse wave is a succession of transverse pulses / ***Aanvaar:*** *'n Transversale golf is 'n opeenvolging van transversale pulse*

(2)

3.2.2 B – Wavelength✓/*B – Golflengte*

C – Crest ✓/*C – Kruin* (2)

3.2.3 $T = \frac{1}{f}$

$= \frac{1}{30}$✓

= 0,033 s✓ (2)

3.2.4 No, ✓ because two points in phase are separated by a complete number of wavelengths. ✓/ *Nee, omdat twee punte in fase deur 'n volledige aantal golflengtes geskei word.*

OR/*OF*

They are not separated by wavelength. ✓/ *Hulle word nie deur golflengte geskei nie*

(2)

3.2.5 $v = f\lambda$✓

$v = 30 \times 4$ ✓

$= 120\ m \cdot s^{-1}$ ✓

(3)

[18]

QUESTION 4/*VRAAG 4*

4.1 Longitudinal wave✓/ *Longitudinale golf* (1)

4.2.1 P – Compression ✓/*P - Verdigting* (1)

4.2.2 Q – Wavelength ✓/ *Q - Golflengte* (1)

4.3 $v = f\lambda$✓

$1480 = f \times 0{,}05$✓

$f = 29600$ Hz✓

It cannot be heard since it is greater than 20KHz✓/ *Dit kan nie gehoor word nie, aangesien dit groter as 20 kHz is.* (4)

4.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
The distance covered in/ *Die afstand afgelê in* $3s = (2x - 300)m$ ✓ $v = \frac{d}{\Delta t}$✓ 340✓ $= \frac{2x-300}{3}$✓ $x = 660\ m$ Distance/*afstand* = 660 – 300✓ = 360 m Note: If only the answer of 360 m is given without calculations (660 – 300), still award 1 mark./*As slegs die antwoord van 360 m gegee is, sonder bewerkings (660 – 300), gee nogsteeds 1 punt*	Δt for sound to travel from position 1 to position 2/Δt *vir klank om van posisie 1 na posisie 2 te beweeg*. $v = \frac{d}{\Delta t}$✓ 340✓ $= \frac{300}{\Delta t}$ $\Delta t = 0{,}8823529412\ s$ ✓ Δt for sound to travel from position 2 to obstacle/Δt *vir klank om van posisie 2 na hindernis te beweeg* $= \frac{3-0{,}8823529412}{2}$✓ $= 1{,}058823529s$ Distance/*afstand* = $v\Delta t$ $= 340 \times 1{,}058823529$✓ = 360 m (Do not penalise if a learner round of Δt to minimum of two decimals./*Moenie penaliseer as 'n leerder* Δt *tot 'n minimum van twee desimale afrond nie.)*

OPTION 3/*OPSIE 3*

Distance covered/ *Afstand afgelê*

= (300 + 2d✓)✓

$v = \frac{d}{\Delta t}$✓

340✓ $= \frac{300+2}{3}$✓

$d = 360\ m$

(5)

[12]

QUESTION 5/*VRAAG 5*

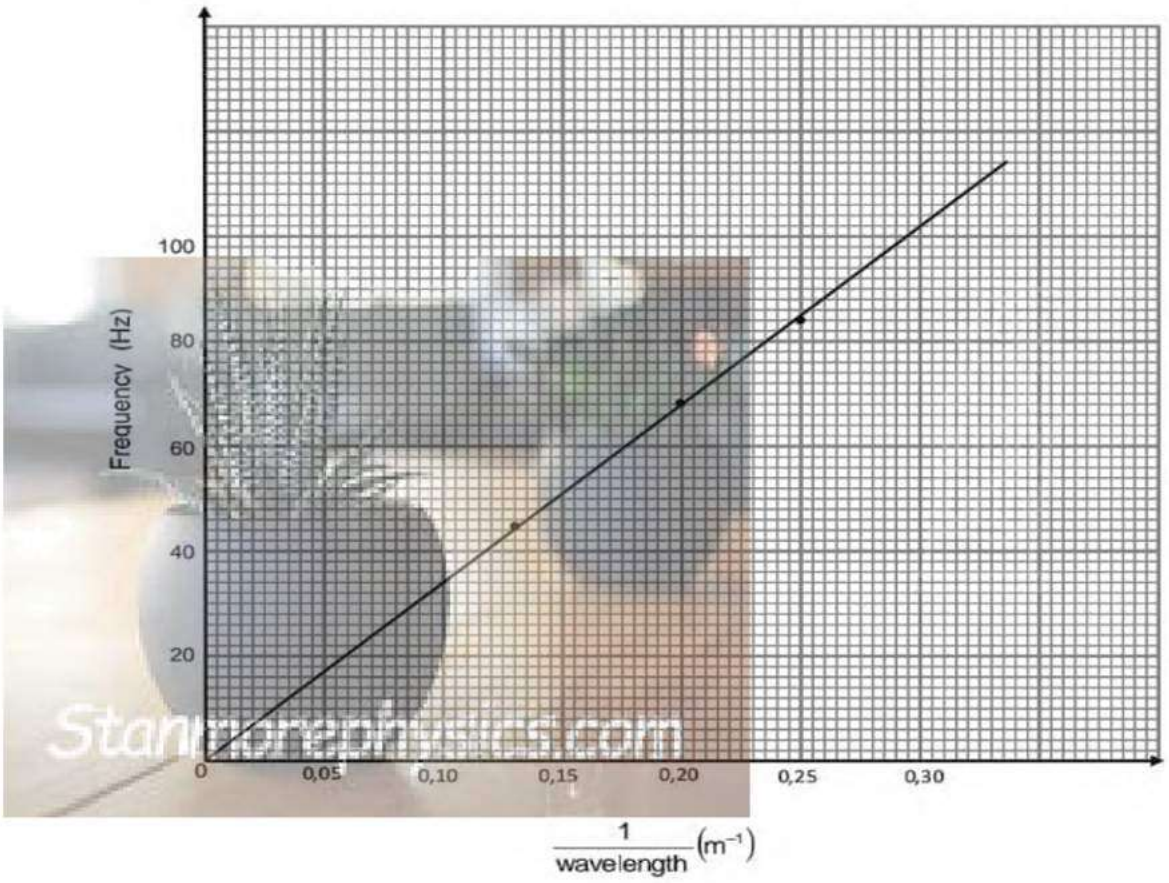
5.1 What is the relationship between the wavelength and frequency of different soun notes? ✓✓/ *Wat is die verband tussen die golflengte en frekwensie van verskillende klanknote?*
OR/*OF*
How does an increase in frequency affect wavelength? ✓✓/ *Hoe beïnvloed 'n toename in frekwensie die golflengte?* (2)

5.2 Temperature ✓ (of the surrounding air) Accept: Instrument/*Temperatuur (van die omliggende omgewing)Aanvaar: Instrument* (1)

5.3

Marking criteria/nasien kriteria :	
Plotting all 3 points correctly/*plot al 3 punte korrek*	✓✓
Plotting two points correctly/*plot twee punte korrek*	✓
Straight line graph passing through the origin/*reguitlyn deur die oorsprong*	✓

(3)



5.4 Frequency is inversely proportional to wavelength✓/ *Frekwensie is omgekeerd eweredig aan golflengte*

OR/*OF*

Frequency is directly proportional to inverse of wavelength. ✓/ *Frekwensie is direk eweredig aan die inverse van die golflengte*

OR/*OF*

As the frequency increases, the wavelength decreases. ✓/ *Soos die frekwensie toeneem, neem die golflengte af* (1)

5.5 $gradient = \frac{84 - 44\checkmark}{0{,}25 - 0{,}13\checkmark}$

= 333,33✓

OR/*OF*

Any other suitable co-ordinates/ *Enige ander geskikte koördinate* (3)

5.6 Speed ✓ (of sound)/*Spoed (van klank)* (1)

[11]

QUESTION 6/*VRAAG 6*

6.1 **ANY ONE/*ENIGE EEN***

- Wave-particle duality ✓/ *Dubbele aard van deeltjies*
- No need for a medium to propagate✓/ *Geen medium nodig om voort te plant nie*
- Speed of EM waves are constant at 3 x 10^8m.s^{-1} in a vacuum✓/ *Die spoed van elektromagnetiese golwe is konstant teen 3 x 10^8 m.s^{-1} in 'n vakuum.*
- Oscillation between alternating accelerating charges cause magnetic waves✓/ *Ossillasie tussen afwisselende versnellende ladings veroorsaak magnetiese golwe* (1)

6.2 Originate from an accelerating electric charge. ✓✓/ *Ontstaan uit 'n versnellende elektriese lading.* (2)

6.3.1 Infrared radiation✓/*Infrarooi radiasie/straling* (1)

6.3.2 Visible light✓/*Sigbare lig* (1)

6.4 $E = \frac{hc}{\lambda}$✓

$6{,}63 \times 10^{-19}$ ✓ $= \frac{6{,}63\times10^{-34}\times3\times10^{8}}{\lambda}$✓

$\lambda = 3{,}00 \times 10^{-7}$ m✓

∴ Ultraviolet light✓/*Ultraviolet lig* (5)

[10]

QUESTION 7/*VRAAG 7*

7.1 $Q = nq_e$ ✓
$= 2 \times 10^{13} \times (-1{,}6 \times 10^{-19})$ ✓
$= -3{,}2 \times 10^{-6}$ C✓ (3)

7.2 The net charge of an isolated system remains constant during any physical process. ✓✓/ *Die netto lading van 'n geïsoleerde stelsel bly konstant tydens enige fisiese proses* (2)

7.3.1 **POSITIVE MARKING FROM QUESTION 7.1/POSITIEWE NASIEN VANAF VRAAG 7.1**

$Q_f = \frac{Q_1+Q_2}{2}$✓

$6{,}4 \times 10^{-6}$✓ $= \frac{-3{,}2\times10^{-6}+Q_2}{2}$✓

$Q_2 = 1{,}6 \times 10^{-5}C$✓ (4)

7.3.2 ***POSITIVE MARKING FROM QUESTION 7.3.1/POSITIEWE NASIEN VANAF VRAAG 7.3.1***

OPTION 1/*OPSIE1*

$\Delta Q = nq_e$✓

$\underline{6{,}4 \times 10^{-6} - 1{,}6 \times 10^{-5} = n \times (-1{,}6 \times 10^{-19})}$ ✓

$n = 6 \times 10^{13}\ electrons$✓

OPTION 2/*OPSIE 2*

$\Delta Q = nq_e$✓

$\underline{6{,}4 \times 10^{-6} - (-3{,}2 \times 10^{-6}) = n \times 1{,}6 \times 10^{-19}}$✓

$n = 6 \times 10^{13}\ electrons/elektrone$✓ (3)

[12]

QUESTION 8/*VRAAG 8*

8.1 Emf is the work done per unit charge by the source (battery). ✓✓/ *Emk is die werk wat per eenheidslading deur die bron (battery) verrig word.* (2)

8.2 $V_1 = \frac{w}{Q}$✓

$= \frac{3\times10^4}{2{,}5\times10^3}$✓

= 12 V✓ (3)

8.3 $I_1 = \frac{Q}{\Delta t}$✓

$= \frac{3{,}24}{2}$✓

= 1,62 A✓ (3)

8.4 **POSITIVE MARKING FROM QUESTION 8.3/POSITIEWE NASIEN VANAF VRAAG 8.3**

A_3 = 1,62 – 0,65

= 0,97 A✓ (1)

8.5 **OPTION 1/*OPSIE 1***

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$= \frac{1}{6} + \frac{1}{4}$ ✓

$\therefore R_p = 2.40\ \Omega$

$R_t = R_p + R_R$

$7{,}40 = 2{,}40 + R_R$✓

$R_R = 5\ \Omega$ ✓

Carry over mark in multi-step question. Award the mark for substitution of R_p, even if wrongly calculated. BUT then the (wrong) answer of R_R is not marked. / *Oordrag punt in multi-stap vraag. Gee die punt vir die substitusie van Rp, al is dit verkeerdelik uitgewerk, MAAR dan word die (verkeerde) antwoord van RR nie gemerk nie.*

OPTION 2/*OPSIE 2 (*POSITIVE MARKING FROM QUESTION 8.3/*POSITIEWE NASIEN VANAF VRAAG 8.3)*

$V_1 = 12$ V

$V_2 = 0,65 \times 6$

$= 3,9$ V

$V_R = 12 - 3,9$✓

$= 8,1$ V

$R = \frac{V}{I}$✓

$= \frac{8,1}{1,62}$✓

$= 5\ \Omega$ ✓ (4)

8.6 $V_2 = 0$ V✓/zero (1)

[14]

TOTAL/*TOTAAL* = 100