education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING

GRADE 10

PHYSICAL SCIENCES P1

JUNE 2025

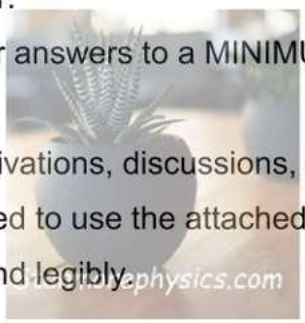
MARKS: 100

TIME: 2 HOURS

This question paper consists of 12 pages including data sheets and formulae sheets

INSTRUCTIONS AND INFORMATION

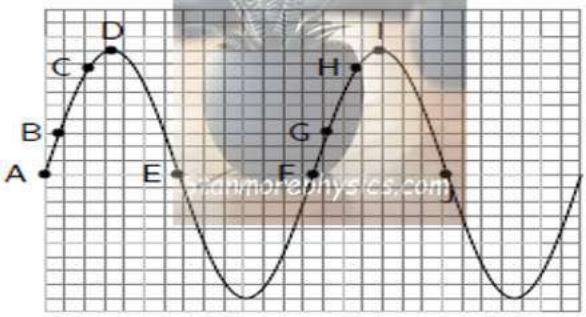
1. Write your NAME and GRADE on the answer book.
2. Answer ALL questions in the ANSWER BOOK
3. Non-programmable calculators may be used.
4. Show ALL formulae and substitutions in ALL calculations
5. Number the questions correctly according to the number system used in this question paper.
6. Round off your answers to a MINIMUM of TWO decimal places, where applicable.
7. Wherever motivations, discussions, et cetera are required be brief.
8. You are advised to use the attached DATA SHEETS.
9. Write neatly and legibly.



QUESTION 1

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 number (1.1–1.7) in the ANSWER BOOK, for example 1.11 E

1.1 The wave diagram below indicates points on the waves that are in phase and out of phase.



The letters below indicate points of the waves that are in phase.

A CG
B EJ
C AE (2)
D AB

1.2 ….is subjective term describing the strength of the ear's perception of a sound.

A Pitch
B Tone (2)
C Frequency
D Loudness

1.3 Ultrasound can be described by frequencies that are ...

A Higher than 100 kHz
B Lower than 20 kHz (2)
C Higher than 20 kHz but lower 100 kHz
D Higher than 100 kHz but lower than 1000 kHz

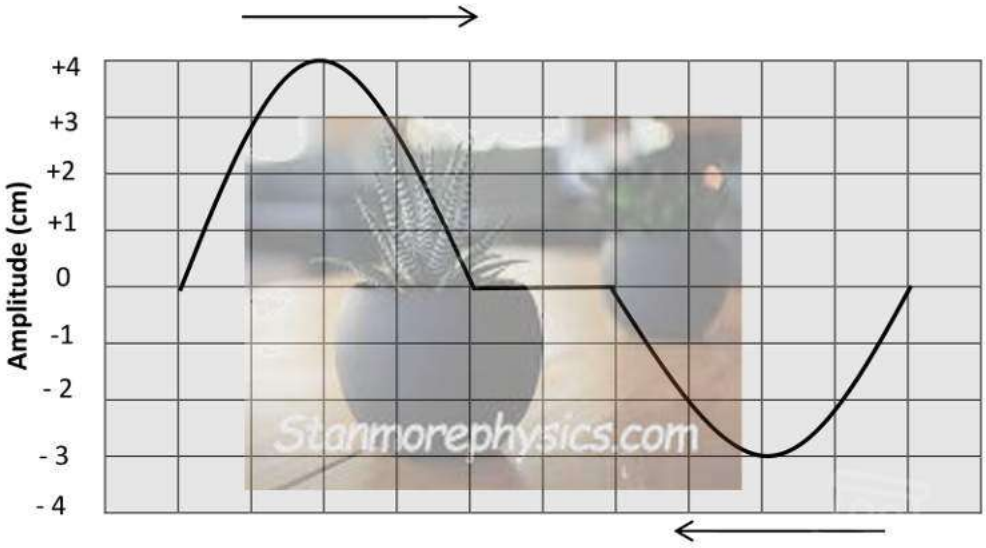
1.4 An electromagnetic wave with energy, **E**, has frequency, ***f***. if the frequency of an electromagnetic wave is now, **2*f***, what would be the energy of this electromagnetic wave?

A E
B 2E (2)
C ½ E
D 4E

1.5 The wavelength of gamma rays is, λ. The wavelength of x-rays is likely to be…..

A Greater than λ.
B Equal to λ. (2)
C Less than λ.
D ½ λ

1.6 The two wave pulses are approaching each as shown below.



The resultant amplitude for the waves pulses when they interfere with each other is . . .

A +7 cm
B -3 cm
C +1 cm (2)
D -1 cm

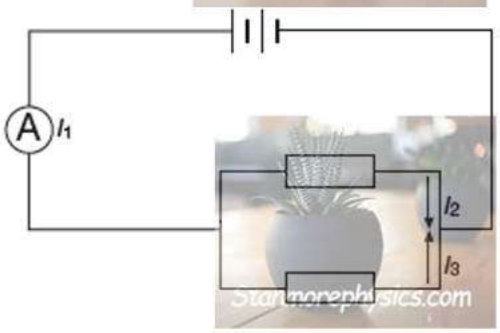
1.7 The partial or complete polar separation of positive and negative electric charge in a system is known as . . .

A Tribo-charging
B Polirisation
C Charge quantization (2)
D Attraction

1.8 A sphere carries a charge, Q, which corresponds with number of $1,25^{13}$ electrons. 2Q will correspond with …….

A $2,5^{13}$ electrons
B $1,25^{13}$ electrons (2)
C $6,25^{12}$ electrons
D $2,25^{12}$ electrons

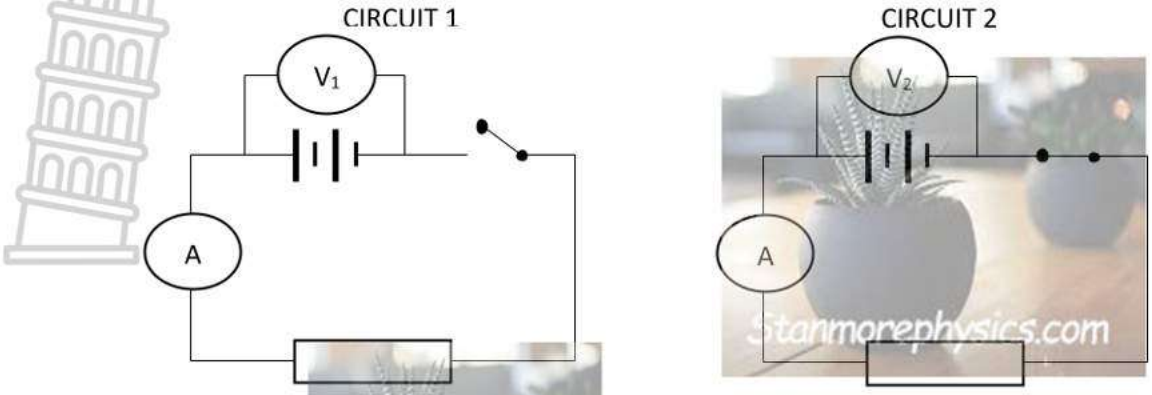
1.9 Consider the following circuit diagram.



The correct equation to calculate the total current in the circuit is……

A $I_2 = I_1 + I_3$
B $I_1 = I_2 + I_3$
C $I_3 = I_2 + I_1$ (2)
D $I_1 = I_2 - I_3$

1.10 Consider the two circuit diagrams below.



The emf of the battery is represented by the readings on:

A $V_1 - V_2$

B $V_2 - V_1$ (2)

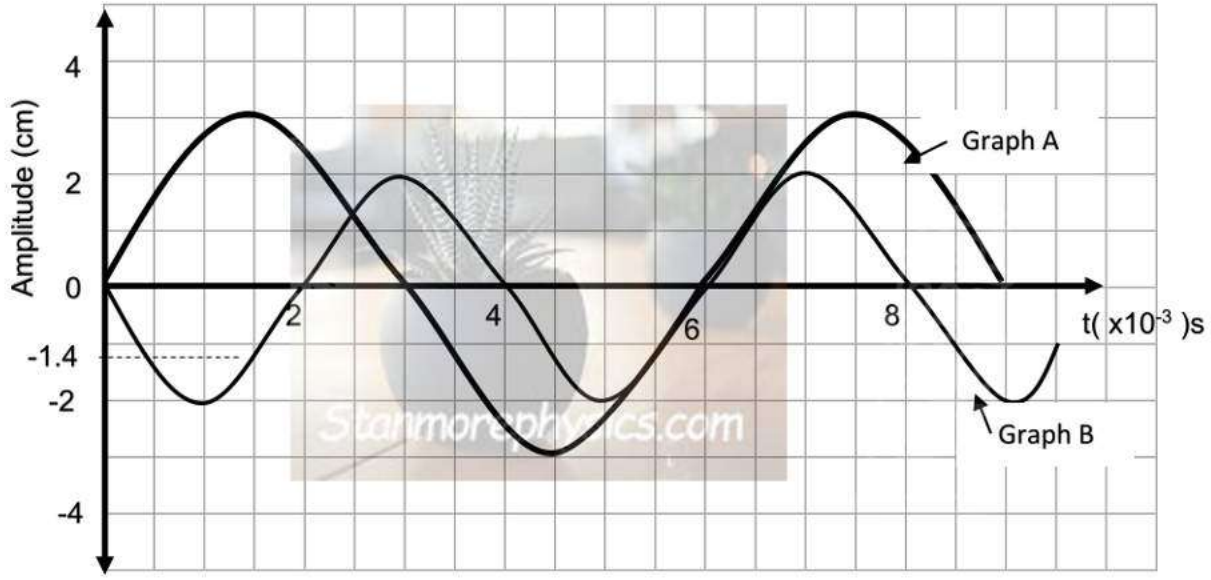
C V_1

D V_2

[20]

QUESTION 2

Two transverse waves interfere with each other as per the graphs drawn below.



2.1 Explain the meaning of points that out of phase in waves. (2)

2.2 Write down:

2.2.1 The number of waves represented by graph A (1)

2.2.2 The period of graph B (1)

2.2.3 The graph with the highest frequency. Choose from graph A or graph B (1)

2.2.4 The amplitude of graph A (1)

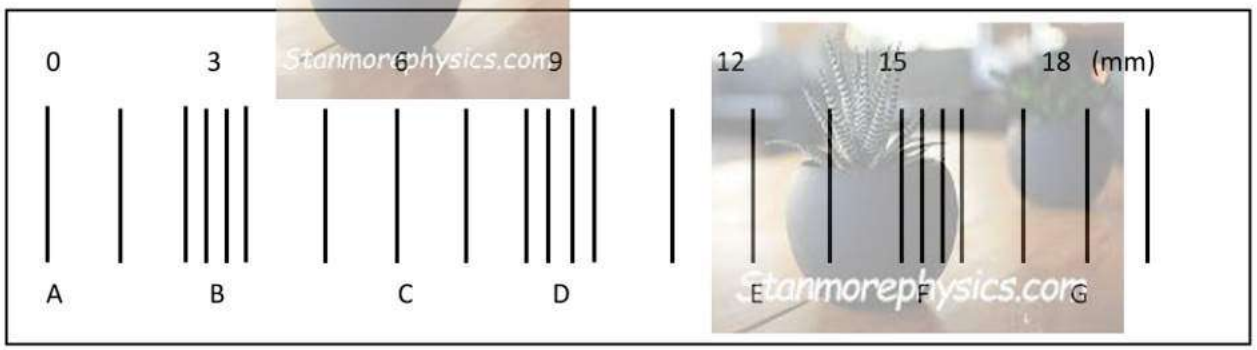
2.2.5 The type of interference when the time is 1,5 x10^{-3} s. (2)

2.3 Calculate the frequency of the waves in graph A (3)

[11]

QUESTION 3

The wave fronts on the sketch below represents areas of compression and rarefaction of a longitudinal waves with frequency of 800 Hz. The distance in (mm) between compressions and rarefaction is indicated on the sketch.



3.1 Define the term longitudinal wave (2)

3.2 Considering only the two points C and D, write down the point that:

3.2.1 Represents compression of wave fronts. (1)

3.2.2 Represent a crest on a wave diagram. (1)

3.3 Use the sketch to determine the wavelength of the waves (2)

3.4 Calculate speed of the waves (3)

3.5 Consider the above sketch and draw the transverse wave diagram. Indicate the point B, C and D on the graph (5)

[14]

QUESTION 4

A bat hovering at the same point sends sound waves with a frequency of 12 000 Hz towards a hovering moth and receives the same frequency back. The bat receives the sound same frequency 1,8 s later, from the moment it sent the sound waves

4.1 Explain the meaning of the words 'pitch of sound' (2)

4.2 The speed of the sound waves in air is 340 $m \cdot s^{-1}$. Calculate:

4.2.1 The wavelength of the waves produced by the bat (3)

4.2.2 The distance between the bat and the moth (3)

[8]

QUESTION 5

5.1 Electromagnetic spectrum includes amongst others, radio waves, gamma rays, ultraviolet light and x-rays.

5.1.1 List the above-mentioned rays in order of increasing frequency (2)

5.1.2 Write down the type of electromagnetic radiation that produces the highest energy (1)

5.2 A certain radio station broadcast at a frequency of 92,5 MHz.

5.2.1 What type of electromagnetic radiation corresponds with this frequency? (1)

5.2.2 Briefly explain the dual nature of electromagnetic radiation (2)

5.2.3 Calculate the wavelength that correspond with this frequency (4)

5.3 Over exposure to X-ray scans that are beyond $6x10^{18}$ Hz on a human body damages the skin and other organs in the body. A radiographer specialist wants to conduct an x-ray scan on a human body.

Two x-ray instruments are available for use.

x-rays machine	Corresponding energy
x-ray machine 1	$5{,}304 \times 10^{-15}$ J
x-ray machine 2	$5{,}967 \times 10^{-16}$ J

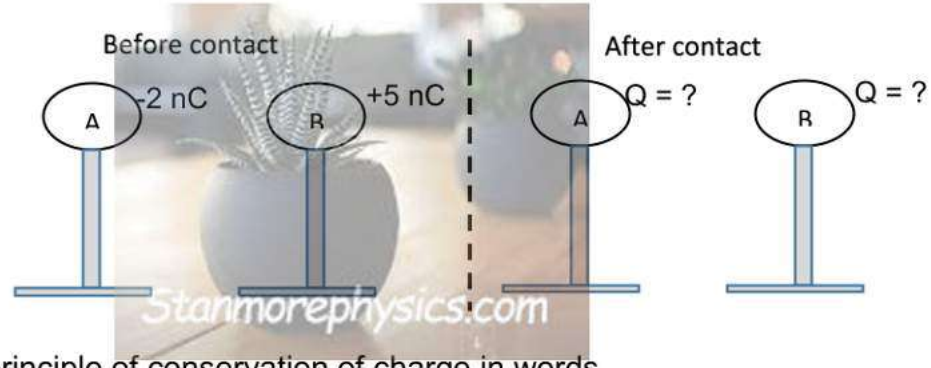
5.3.1 Write down TWO uses of x-rays. (2)

5.3.2 Use a suitable calculation to determine a safe X-ray machine for the scan. (5)

[17]

QUESTION 6

Two identical conducting spheres A and B carrying charges of - 2 nC and +5 nC respectively come into contact with each other and then separated back to their original positions



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

6.2 Calculate the number of excess electrons on sphere A (3)

6.3 Do sphere B gains or losses electrons during the process (1)

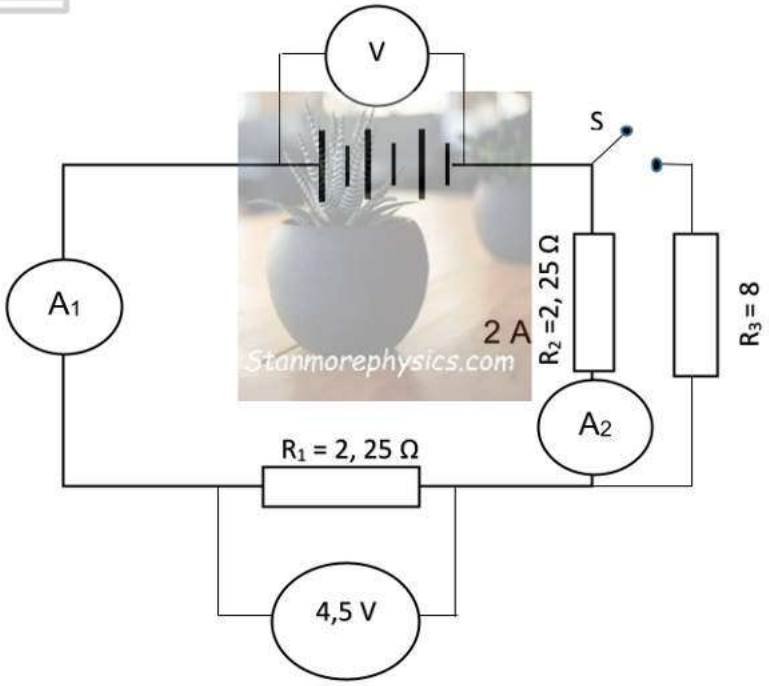
6.4 Determine the number of electrons gained or lost by sphere B during the process (5)

6.5 When pieces of papers are brought nearer to sphere A, they are attracted to the sphere. Explain why the papers are attracted to the sphere. (3)

[14]

QUESTION 7

The circuit below has three resistors, with each resistor having resistance of 2,25 Ω and 2,25 Ω and 8 Ω respectively. A battery with a number of cells has an unknown 'emf' measured by the voltmeter V.



Switch, s, is initially open and the current passing through R_2 is 2A. The internal resistance of the battery and resistance of the conducting wires is negligible.

7.1 Define the term emf of battery (2)

7.2 Write down the:

7.2.1 current in resistor R_1 (1)

7.2.2 current in resistor R_3 (1)

7.3 Calculate the:

7.3.1 reading on the voltmeter V. (2)

7.3.2 The emf of each cell (2)

Switch, S, is now closed, the potential difference across R_1 changes from 4,5 V to 5,06 V and the current on ammeter, A_1, is now 2,25 A

7.4 When switch, S, is closed, how does the current in resistor R_2 and the current on ammeter, A_1, compared? Write down HIGHER THAN, LOWER THAN or EQUAL TO. Explain your answer. (3)

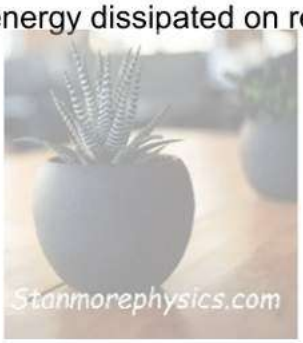
7.5 Calculate:

7.5.1 The effective resistance of the parallel connection. (3)

7.5.2 The energy dissipated on resistor, R_1, in 4 minutes. (4)

[16]

GRAND TOTAL: 100



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*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J{\cdot}s$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^{\,2} = v_i^{\,2} + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$
$E_M = E_k + E_p$. or/*of* $E_M = K + U$	

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

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

ELECTROSTATICS/*ELEKTROSTATIKA*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

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FURTHER EDUCATION AND TRAINING
VERDERE ONDERWYS EN OPLEIDING

GRADE 10
GRAAD 10

PHYSICAL SCIENCES P1/*FISIESE WETENSKAPPE V1*

JUNE 2025/*JUNIE 2025*

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

This marking guidelines consists of 8 pages/*Hierdie nasienriglyne bestaan uit 8 bladsye*

QUESTION 1 / *VRAAG 1*

1.1 C✓✓ (2)
1.2 D✓✓ (2)
1.3 C✓✓ (2)
1.4 B✓✓ (2)
1.5 A✓✓ (2)
1.6 **C**✓✓ (2)
1.7 B✓✓ (2)
1.8 **A**✓✓ (2)
1.9 B✓✓ (2)
1.10 **C**✓✓ (2)
[20]

QUESTION 2 / *VRAAG 2*

2.1 Out of phase: Points that are not separated by a whole number multiple of complete wavelengths. ✓✓ (2)
Uit fase: Punte wat nie geskei word deur 'n heelgetal veelvoud van volledige golflengtes nie.

2.2.1 1.5 waves or 1 ½ waves✓ / *1.5 golwe of 1½ golwe* (1)
2.2.2 4 s✓ (1)
2.2.3 Graph B✓ / *Grafiek B* (1)
2.2.4 3 cm✓ (1)
2.2.5 Destructive interference ✓✓ / *Destruktiewe interferensie* (2)

2.3

Option 1 / *Opsie 1*	**Option 2 / *Opsie 2***	**Option 3 / *Opsie 3***
$f=\frac{1}{T}$ ✓ $=\frac{1}{6x10^{-3}}$ ✓ f=166,67 Hz✓	$f=\frac{\text{No. of waves}}{\text{time taken}}$ ✓ $=\frac{1,5}{9x10^{-3}}$ ✓ f=166,67 Hz✓	$f=\frac{\text{No. of waves}}{\text{time taken}}$ ✓ $=\frac{0,5}{3x10^{-3}}$ ✓ f=166,67 Hz✓

(3)

[11]

QUESTION 3 / *VRAAG 3*

3.1 Define a longitudinal wave: a wave in which the particles of the medium vibrate parallel to the direction of motion of the wave. ✓✓ (2)

Definieer 'n longitudinale golf: 'n golf waarin die deeltjies van die medium parallel met die bewegingsrigting van die golf vibreer.

3.2.1 B/D/F✓ (1)

3.2.2 B/D/F ✓ (1)

3.3 λ=9-3✓=6 cm✓

or

λ=6-0=6 cm (2)

Accept any two successive compressions or two successive rarefactions

Aanvaar enige twee opeenvolgende kompressies of twee opeenvolgende verdunnings.

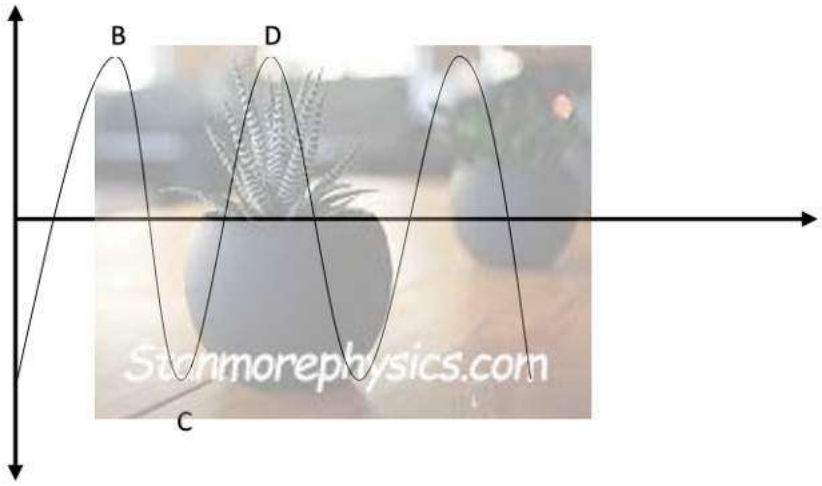
3.4 **POSITIVE MARKING FROM 3.3 / *POSITIEWE NASIEN VANAF 3.3***

v=fλ ✓ (3)

=(800)(0,06)✓

∴v=48 m·s^{-1}✓

3.5



(5)

Marking criteria / *Nasienkriteria*	**Marks / *Punte***
Correct labels for B,C and D */ Korrekte byskrifte vir B,C en D*	✓✓✓
Correct shape of the graph starting at y - intercept / *Korrekte vorm van die grafiek begin by y - snysnit*	✓✓

[14]

QUESTION 4 / *VRAAG 4*

4.1 Pitch is the effect produced in the ear due to the sound of a particular frequency. ✓✓ (2)

Toonhoogte is die effek wat in die oor geproduseer word as gevolg van die klank van 'n spesifieke frekwensie.

4.2.1 $v=f\lambda$ ✓

$340=12\ 000\lambda$ ✓ (3)

$\therefore\lambda=0,0283$ Hz✓/ $\lambda=0,03$ Hz

4.2.2

Option A / *OPSIE A*	**Option B / *OPSIE B***
$v=\frac{D}{\Delta t}$ ✓	$v=\frac{D_{total}}{\Delta t}$ ✓
$340=\frac{D}{0,9}$ ✓	$340=\frac{D_{total}}{1,8}$ ✓
$D=306$ m✓	$D_{total}=612$ m
	$D=\frac{612}{2}$
	$=306$ m✓

(3)

[8]

QUESTION 5 / *VRAAG 5*

5.1.1 Radio waves, ultraviolet light, x-rays, gamma rays✓✓ (2)

Radiogolwe, ultravioletlig, x-strale, gammastrale

5.1.2 Gamma rays✓ */ gammastrale* (1)

5.2.1 Radio waves✓ */ radiogolwe* (1)

5.2.2 Electromagnetic radiation has both the wave nature✓ and particle nature✓ (2)

Elektromagnetiese straling het beide die golfaard en deeltjieaard.

5.2.3 $c=f\lambda$ ✓

$3x10^8=92,5x10^6\lambda$ ✓ (4)

$\therefore\lambda=3,243$ m✓

5.3.1
- diagnosis of fractures and injuries✓
- identification of infections in the body like pneumonia✓
- dental check-ups
- cancer detection
- to detect foreign objects in the body

Any other two correct answers.

(2)

- *diagnose van frakture en beserings*
- *identifikasie van infeksies in die liggaam soos longontsteking*
- *tandheelkundige ondersoeke*
- *kanker opsporing*
- *om vreemde voorwerpe in die liggaam op te spoor*

Enige ander twee korrekte antwoorde.

5.3.2

Option 1 / *Opsie 1*	**Option 2 / *Opsie 2***
E=hf✓ E=(6,63x10^{-34})(6x10^{18})✓ ∴E=3,978x10^{-15}J✓ 5,304x10^{-15} J> 3,978x10^{-15}J 5,967x10^{-16} J< 3,978x10^{-15}J ✓ x-ray machine 2 is safe to use. ✓	E=hf✓ 5,304x10^{-15}=6,63x10^{-34}f✓ ∴f=8x10^{18}Hz 8x10^{18}Hz>6x10^{18}Hz E=hf 5,967x10^{-16}=6,63x10^{-34}f✓ ∴f=9x10^{17}Hz 9x10^{17}Hz< 6x10^{18} ✓ x-ray machine 2 is safe to use✓

(5)

[17]

QUESTION 6/ *VRAAG 6*

6.1 Principle of conservation of charge: The net charge of an isolated system remains constant during any physical process✓✓ (2)

Beginsel van behoud van lading: Die netto lading van 'n geïsoleerde sisteem bly konstant gedurende enige fisiese proses

6.2

Option 1 / *Opsie 1*	**Option 2 / *Opsie 2***
$n=\frac{Q}{q_e}$ ✓ $=\frac{-2\times10^{-9}}{-1,6\times10^{-19}}$ ✓ $=1,25\times10^{10}$ ✓electrons	$n=\frac{Q}{q_e}$ ✓ $=\frac{2\times10^{-9}}{1,6\times10^{-19}}$ ✓ $=1,25\times10^{10}$ ✓ electrons

(3)

6.3 Gains electrons✓ */ Verkry elektrone* (1)

6.4

Option 1 / *Opsie 1*	**Option 2 / *Opsie 2***
$Q_{each}=\frac{Q_1+Q_2}{2}$ $=\frac{(-2\times10^{-9})+5\times10^{-9}}{2}$ ✓ $=+1,5\times10^{-9}C$ $n=\frac{Q}{q_e}$ ✓ $=\frac{(5\times10^{-9})-(1,5\times10^{-9})}{1,6\times10^{-19}}$ ✓ $=2,188\times10^{10}$ ✓electrons (gained)	$Q_{each}=\frac{Q_1+Q_2}{2}$ $=\frac{(-2\times10^{-9})+5\times10^{-9}}{2}$ ✓ $=+1,5\times10^{-9}C$ $n=\frac{Q}{q_e}$ ✓ $=\frac{(-2\times10^{-9})-(1,5\times10^{-9})}{-1,6\times10^{-19}}$ ✓ $=2,188\times10^{10}$ ✓ electrons (lost)

(5)

6.5
- pieces of paper is attracted to the sphere due to polarization✓
- positive charges of the sphere attract negative of the paper✓
- The paper becomes slightly positive on the far end and slightly negative near the sphere. ✓

(3)

/

- *stukkies papier word na die sfeer aangetrek as gevolg van polarisasie*
- *positiewe ladings van die sfeer trek negatief van die papier aan*
- *Die papier word effens positief aan die verste punt en effens negatief naby die sfeer.*

[14]

QUESTION 7 / *VRAAG 7*

7.1 emf of a battery: the (maximum) work done per unit charge by the source (battery). ✓✓ (2)

emk van 'n battery: die (maksimum) werk verrig per eenheidlading deur die bron (battery).

7.2.1 2 A✓ (1)

7.2.2 0 (A) ✓ (1)

7.3.1 $V=V_1+V_2$

$=4,5+4,5$✓ (2)

$=9$ V✓

7.3.2 $emf=\frac{9}{3}$✓$=3$ V✓ (2)

7.4 LOWER THAN✓

- The ammeter A_1 reads the total current in the circuit✓ (3)
- The current is divided in the parallel connection✓

LAER AS

- *Die ammeter A_1 lees die totale stroom in die stroombaan*
- *Die stroom word in die parallelle verbinding verdeel*

7.5.1

OPTION 1 / *OPSIE 1*	OPTION 2 / *OPSIE 2*
$\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_2}$ ✓ $=\frac{1}{2,25}+\frac{1}{8}$ ✓ $\therefore R_P=1,756\ \Omega$ ✓	$R_P=\frac{R_1+R_2}{R_1R_2}$ ✓ $=\frac{2,25+8}{2,25\times 8}$ ✓ $\therefore R_P=1,756\ \Omega$ ✓

(3)

7.5.2

OPTION 1 / *OPSIE 1*	OPTION 2 / *OPSIE 2*
$Q=I\Delta t$ $= 2,25x240$ ✓ $=540$ C $V=\frac{W}{Q}$ ✓ $5,06=\frac{W}{540}$ ✓ $W=2\ 732,4$ J ✓	$W=VI\Delta t$ ✓ $=5,06x2,25$ ✓ $x240$ ✓ $=2\ 732,4$ J ✓
OPTION 3 / *OPSIE 3*	**OPTION 4 / *OPSIE 4***
$W=\frac{V^2}{R}\Delta t$ ✓ $=\frac{5,06^2}{2,25}$ ✓(240) ✓ $=2\ 731,05$ J ✓	$W=I^2R\Delta t$ ✓ $=(2,25^2x2.25)$ ✓(240) ✓ $=2\ 733,75$ J ✓

(4)

[16]

GRAND TOTAL/*GROOTTOTAAL* 100