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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

NOVEMBER 2024

MARKS: 100

TIME: 2 hours

This question paper consists of 12 pages and 2 pages information sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 10 A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 9 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 subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Give brief motivations, discussions etc. where required.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

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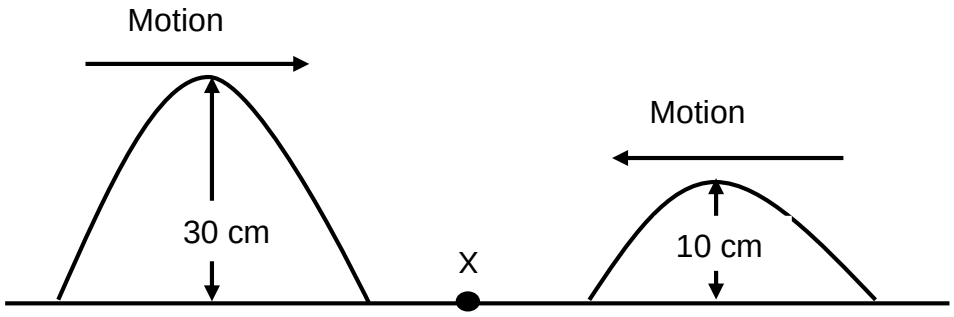
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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 to 1.7) in the ANSWER BOOK, e.g. 1.8 E.

1.1 The number of wave pulses per second is called …

A wavelength
B period
C frequency
D amplitude (2)

1.2 Consider the diagram of two pulses shown below:



When the two pulses in the diagram meet at point **X**, the type of interference and the resultant amplitude of the disturbance will be …

	TYPE OF INTERFERENCE	AMPITUDE (cm)
A	Destructive	40
B	Destructive	20
C	Constructive	40
D	Constructive	20

(2)

1.3 A certain electromagnetic wave has 4,97 x 10^{-14} J of energy. The frequency of the wave is:

A 1,3 x 10^{20} Hz
B 7,5 x 10^{19} Hz
C 3,3 x 10^{-47} Hz
D 1,7 x 10^{-22} Hz (2)

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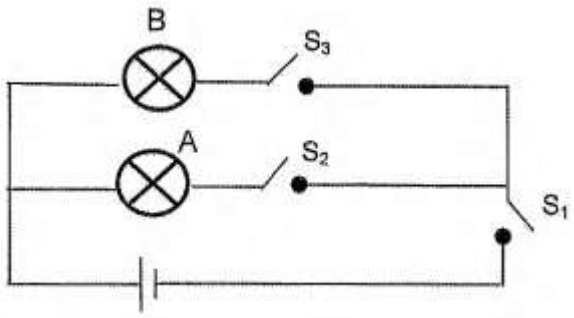
1.4 In the following circuit the light bulbs are identical. Which switches must be closed for bulb **A** only to light up?

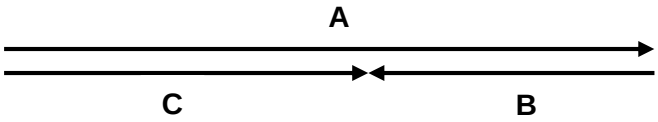


A S_1, S_2 and S_3
B S_1 and S_2
C S_1 and S_3
D S_2 and S_3 (2)

1.5 The straight line difference in position in space is called …

A speed.
B velocity.
C distance.
D displacement. (2)

1.6 Consider the vector diagram given below:



Which ONE of the following CORRECTLY describes the relationship between vectors **A**, **B** and **C**?

A A + B = C
B A + C = B
C B + C = A
D A + B + C = 0 (2)

1.7 The kinetic energy of a moving body will increase the most if its …

A velocity is doubled.
B mass is doubled.
C velocity is halved.
D mass is halved. (2)
[14]

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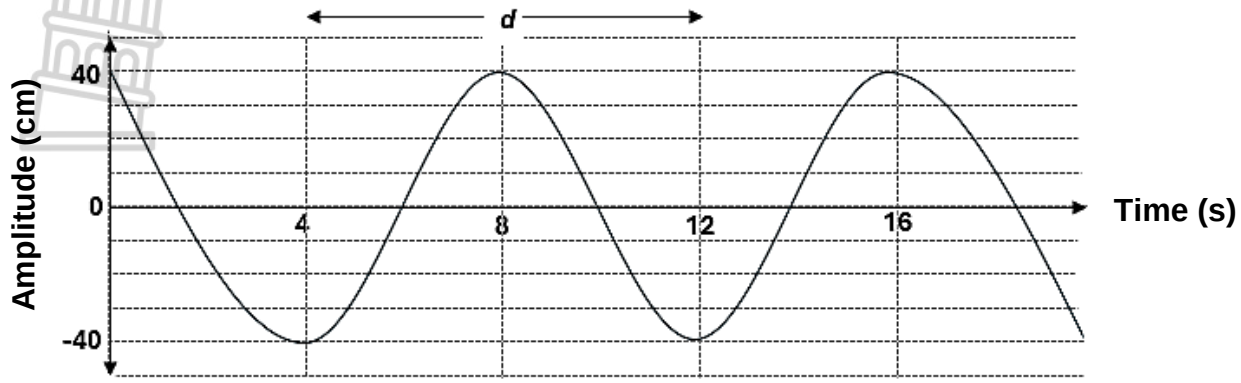
QUESTION 2 (Start on a new page)

The diagram below represents a transverse wave produced by a source.



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

2.2 Write down the amplitude, in meters, of this wave. (1)

2.3 Determine the period of this wave. (1)

2.4 If the distance ***d*** on the diagram is 0,9 m:

2.4.1 What is the name of the physical quantity given to distance ***d***? (1)

2.4.2 Calculate the speed of the complete wave as shown in the diagram above. (5)

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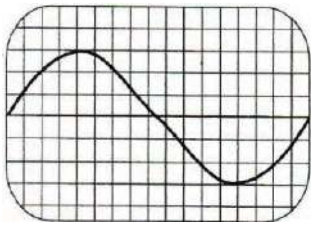
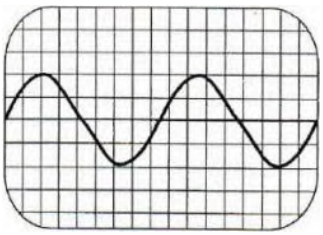
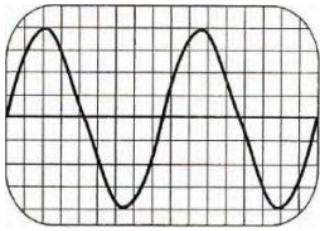
2.5 The following sound wave, produced by a tuning fork, is observed on an oscilloscope:



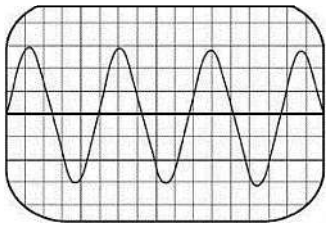
A few more notes are played on different turning forks and the patterns below are observed:



A



B



C

2.5.1 Identify the sound waves as TRANSVERSE or LONGITUDINAL. (1)

2.5.2 Which ONE of the above patterns (**A**, **B** or **C**) represents a LOUDER note than the original note? Give a reason for your answer. (2)

2.5.3 Above which frequency is a sound wave classified as ultrasound? (1)

2.5.4 Name ONE use of ultrasound in the medical treatment of patients. (1)
[15]

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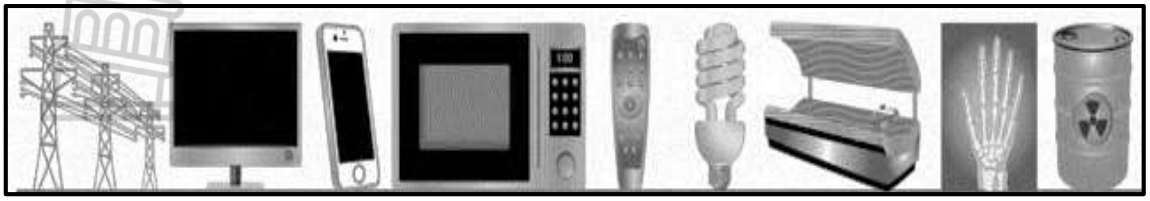
QUESTION 3 (Start on a new page)

The electromagnetic spectrum includes amongst others, radio waves, ultraviolet light, gamma rays, visible light and x-rays.



3.1 How are electromagnetic waves generated? (1)

3.2 Explain what is meant by the *dual nature* of electromagnetic radiation. (2)

3.3 From the information above, name the type of electromagnetic radiation that:

3.3.1 is used in hospitals to identify broken bones (1)

3.3.2 is used in Wi-Fi (Wireless Fidelity) (1)

3.3.3 has the highest energy (1)

3.4 Calculate the energy of a photon of microwaves with a wavelength of $2{,}1 \times 10^{-2}$ m. (3)
[9]

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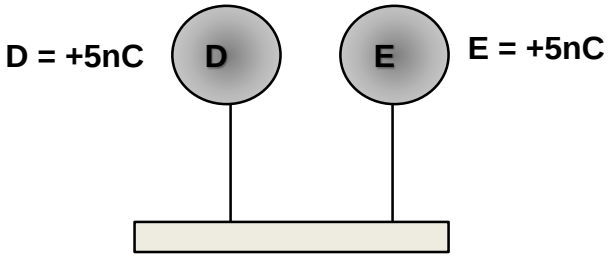
QUESTION 4 (Start on a new page)

The diagram below shows two small identical spheres, **D** and **E**, on an insulated stand. The spheres are brought together to touch and then separated. After touching and separating, the charge on sphere **D** and **E** is +5nC.



4.1 If the charge on sphere **D** was - 2nC BEFORE the sphere's touched, calculate the initial charge on sphere **E**. (3)

4.2 Calculate the number of electrons transferred when the sphere's touched. (4)

4.3 Were electrons transferred from **D to E** or from **E to D** during contact? (1)
[8]

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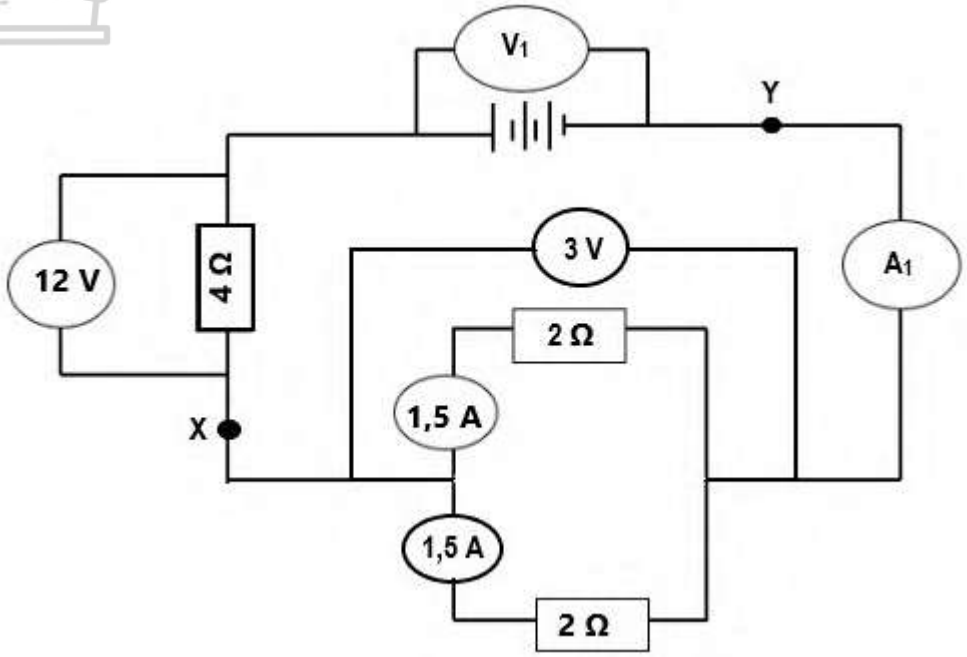
QUESTION 5 (Start on a new page)

The circuit diagram below shows three resistors connected to a battery. The voltmeter over the 4 Ω resistor has a reading of 12 V. Voltmeter V_1 and ammeter A_1 are connected as shown in the diagram below. The resistance of the battery, ammeter and connecting wires can be ignored.



5.1 Define the term *potential difference*. (2)

5.2 Calculate the:

5.2.1 Total resistance of the circuit. (4)

5.2.2 Amount of charge that flows through ammeter A_1 in 120 s. (3)

5.2.3 Reading on V_1, if the voltmeter uses 5 400 J of energy and the same amount of current calculated at QUESTION 5.2.2 flows through it. (3)

5.3 A wire with negligent resistance is now connected from X to Y in the circuit. How will the reading on voltmeter V_1 be affected?

Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

5.4 Explain the answer to QUESTION 5.3 WITHOUT any calculations. (2)
[15]

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QUESTION 6 (Start on a new page)

In the Paris 2024 Olympics, Tatjana Smith won a gold medal in the 100 m breaststroke event, when she completed this event in 65 seconds.

Olympic swimming pools are 50 m in length.

6.1 Define the term *average speed*. (2)

6.2 Calculate the average speed that Tatjana swam to win the 100 m breaststroke event. (3)
[5]

QUESTION 7 (Start on a new page)

A taxi is travelling at a constant speed of 84 $km.h^{-1}$ in a straight and level road where the speed limit is 60 $km.h^{-1}$.

7.1 Define the term *acceleration*. (2)

7.2 Convert 84 $km.h^{-1}$ to $m.s^{-1}$. (1)

A traffic officer starts his car from rest just as the taxi passes him. The traffic car accelerates uniformly at 2 $m.s^{-2}$ until it reaches a maximum velocity of 25 $m.s^{-1}$.

7.3 Calculate the time **t** that it will take the traffic car to reach its maximum velocity. (3)

7.4 Determine by calculation which vehicle (the taxi or the traffic car) is ahead after time **t** seconds has passed.

Assume that the taxi maintains its constant speed. (5)
[11]

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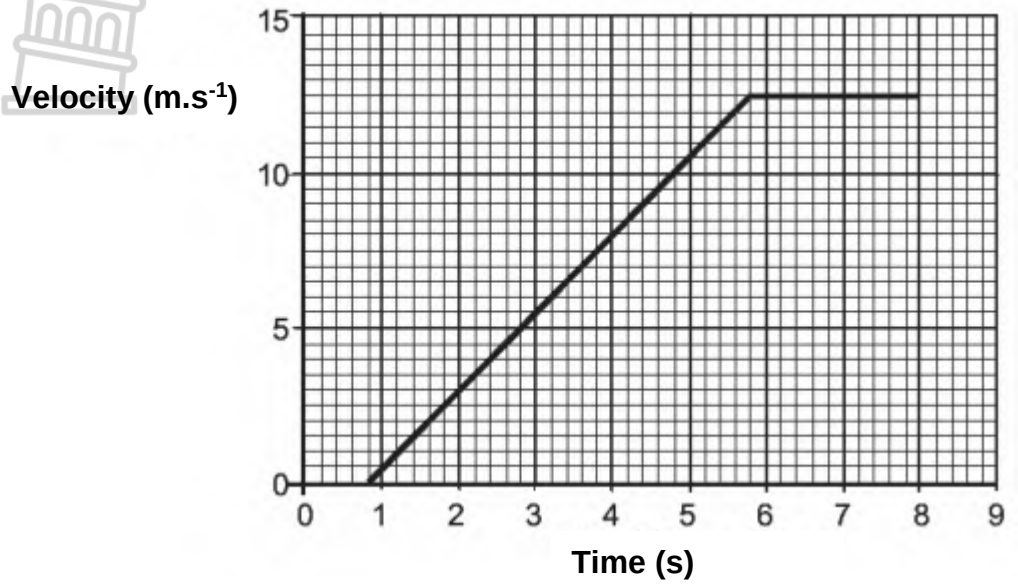
QUESTION 8 (Start on a new page)

A driver stops his car at the red traffic light. The graph of the car's velocity against time shows its motion for 8 s from the time the traffic light turns green.



8.1 The short time interval between the traffic light turning green (for GO) and the driver responding to the signal, is known as "the driver's reaction time".

How long does the driver take to respond when the traffic light changes to green? (1)

8.2 Determine the maximum speed of the car. (1)

8.3 Use the graph only (NO equations of motion) to calculate the average acceleration of the car. (4)

8.4 Use the graph only (NO equations of motion) to determine the displacement of the car over these 8 s. (4)
[10]

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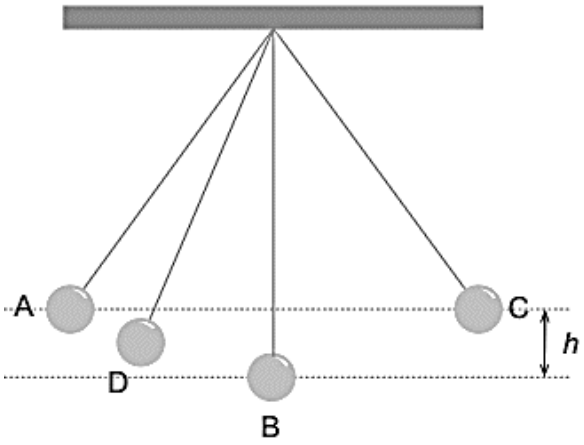
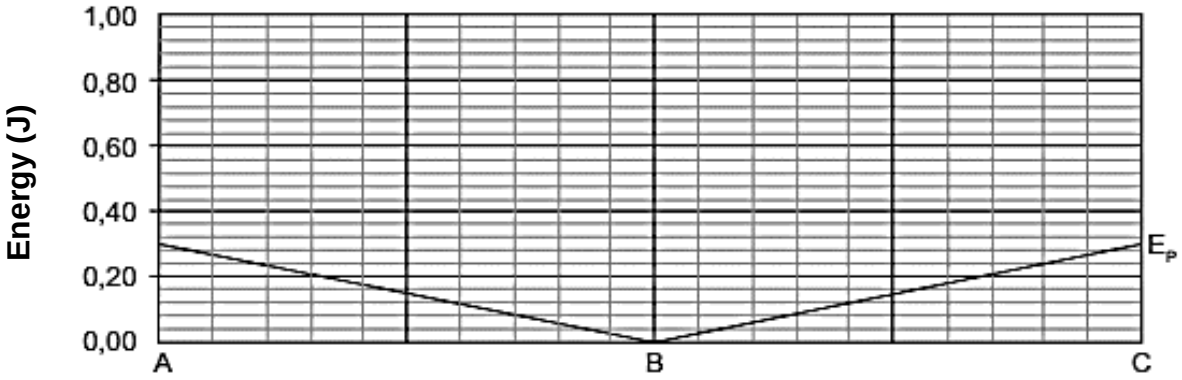
QUESTION 9 (Start on a new page)

The graph below shows energy against position for a pendulum bob (mass 50 g) as it moves from **A** to **B** and to **C**. Air resistance is negligible.



Energy against position for a pendulum bob



9.1 Define *gravitational potential energy*. (2)

9.2 Determine the maximum potential energy of the bob. (2)

9.3 Calculate the maximum gain in height (h) of the bob. (4)

9.4 Calculate the maximum speed of the bob at position **B**. (3)

9.5 State the law of conservation of mechanical energy in words. (2)
[13]

TOTAL: 100

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DATA FOR PHYSICAL SCIENCES GRADE 10 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}$ $J \cdot s$
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE

MOTION

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

WORK, ENERGY AND POWER

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

WAVES, LIGHT AND SOUND

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

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ELECTROSTATICS

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

ELECTRIC CIRCUITS

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

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PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 10

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)
NOVEMBER 2024
MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

These marking guidelines consist of 6 pages.
Hierdie nasienriglyne bestaan uit 6 bladsye.

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QUESTION/*VRAAG* 1

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

QUESTION/*VRAAG* 2

2.1 A wave in which the particles of the medium vibrate at right angles to the direction of motion of the wave. ✓✓
'n Golf waarin die deeltjies van die medium reghoekig tot die bewegingsrigting van die golf vibreer. (2)

2.2 0,4 m ✓ (1)

2.3 T = 8 s ✓ (1)

2.4 2.4.1 Wavelength/*Golflengte* ✓ (1)

2.4.2 **POSITIVE MARKING FROM QUESTION 2.3**
POSITIEWE NASIEN VANAF VRAAG 2.3

Marking guidelines
Nasien riglyne:
- Formula/*Formule*: $f = \frac{1}{T}$ ✓
- Substitute/*Substitusie van* T ✓
- Formula/*Formule*: v = fλ ✓
- Substitute/*Substitusie van* f and/*en* λ ✓
- Final answer/*Finale antwoord*: 0,11 m.s^{-1}✓

$f = \frac{1}{T}$ ✓
$= \frac{1}{8}$ ✓
= 0,125 Hz

v = fλ ✓
= (0,125)(0,9) ✓
= 0,11 m.s^{-1} ✓
(5)

2.5 2.5.1 Longitudinal/*Longitudinaal* ✓ (1)

2.5.2 B ✓ It has a greater amplitude./*Groter amplitude* ✓ (2)

2.5.3 Above/*Bo* 20 kHz ✓ (1)

2.5.4 **Any one/*Enige een:***
- Monitor a fetus/*Monitoring van 'n fetus*.
- Cleaning of medical equipment/*Skoonmaak van mediese toerusting*
- Diagnosis of tumors and/or gallstones/*Diagnoseer gewasse en/of galstene*.
- Evaluate bloodflow/*Evalueer bloedvloei.* (1)

[15]

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QUESTION/*VRAAG* 3

3.1 Accelerating charges/*versnelde lading.* ✓ (1)

3.2 The behaviour of electromagnetic radiation can best be explained using a wave model and some aspects can best be explained using a particle model. ✓✓
Sommige aspekte van die gedrag van elektromagnetiese straling die beste beskryf kan word deur 'n golfmodel te gebruik en ander aspekte kan die beste beskryf word deur 'n deeltjiemodel te gebruik. (2)

3.3 3.3.1 X – rays/*X - Strale* ✓ (1)

3.3.2 Radio waves/*Radiogolwe* ✓ (1)

3.3.3 Gamma rays/*Gamma strale* ✓ (1)

3.4 $E = \frac{h.c}{\lambda}$ ✓
$= \frac{6{,}63\times10^{-34}.\ 3\times10^{8}}{2{,}1 \times 10^{-2}}$ ✓
$= 9{,}47 \times 10^{-24}$ J ✓ (3)
[9]

QUESTION/*VRAAG* 4

4.1 $Q = \frac{Q_D+Q_E}{2}$ ✓
$+5\times10^{-9} = \frac{(-2\times10^{-9})+ Q_E}{2}$ ✓
$Q_E = + 12 \times 10^{-9}$ C ✓ (3)

4.2 $\Delta Q = +5 \times 10^{-9} - (-2 \times 10^{-9})$ ✓ **OR/*OF*** $\Delta Q = +5 \times 10^{-9} - (+12 \times 10^{-9})$ ✓
$= 7 \times 10^{-9}$ C $= - 7 \times 10^{-9}$ C

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

$= \frac{7 \times 10^{-9}\ ✓}{1{,}6 \times 10^{-19}\ ✓}$ **OR/*OF*** $= \frac{-7 \times 10^{-9}\ ✓}{-1{,}6 \times 10^{-19}\ ✓}$

$= 4{,}37 \times 10^{10}$ electrons/*elektrone* ✓ (4)

4.3 D to/*na* E ✓ (1)
[8]

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QUESTION/VRAAG 5

5.1 Potential difference across the ends of a conductor is <u>the energy transferred per unit electric charge</u> flowing through it. ✓✓
Potensiaalverskil oor die ente van 'n geleier as <u>die energie oorgedra per eenheidslading</u> wat daardeur vloei. (2)

5.2 5.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{2} + \frac{1}{2}$ ✓ Rp = 1 Ω R_T = 1+4 ✓ = 5 Ω ✓	Rp = $\frac{R_1R_2}{R_1+R_2}$ ✓ = $\frac{(2)(2)}{2+2}$ ✓ = 1 Ω R_T = 1 + 4✓ = 5 Ω ✓

(4)

5.2.2 Q = IΔt ✓
= (3)(120) ✓
= 360 C ✓ (3)

5.2.3 V = $\frac{W}{Q}$ ✓
= $\frac{5400}{360}$ ✓
= 15 V ✓ (3)

5.3 DECREASE/*AFNEEM* ✓ (1)

5.4 If a wire is connected from X to Y in the circuit, the circuit becomes a series circuit with only one resistor (4 Ω).
Total Resistance will decrease. ✓
Current will increase ✓ and Potential difference (reading on V_1) will decrease.
As 'n draad van X na Y in die stroombaan gekoppel is, word die stroombaan 'n seriestroombaan met slegs een weerstand (4 Ω).
Totale weerstand sal afneem.
Stroomsterkte sal toeneem en Potensiële verskil (lesing op V_1) sal afneem. (2)
[15]

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QUESTION/*VRAAG* 6

6.1 The total distance travelled per total time. ✓✓
Die totale afstand beweeg per totale tyd. (2)

6.2 $v = \frac{x/d}{t}$ ✓
$= \frac{100}{65}$ ✓
$= 1{,}54\ m.s^{-1}$ ✓ (3)
[5]

QUESTION*VRAAG* 7

7.1 The rate of change of velocity. ✓✓
Die tempo van verandering van snelheid. (2)

7.2 $\frac{84}{3{,}6}$ **OR/*OF*** $\frac{84 \times 1000}{3600}$
$23{,}33\ m.s^{-1}$ ✓ (1)

7.3 $v_f = v_i + a\Delta t$ ✓
$25 = 0 + 2t$ ✓
$\Delta t = 12{,}5\ s$ ✓ (3)

7.4 Traffic car/*Verkeersmotor*: $\Delta x = v_i\Delta t + ½\ at^2$ ✓
$= (0)(12{,}5) + ½\ (2)(12{,}5)^2$ ✓
$\Delta x = 156{,}25\ m$ ✓

Taxi: $\Delta x = v_i\Delta t + ½\ at^2$
$= (23{,}33)(12{,}5) + ½\ (0)(12{,}5)^2$
$\Delta x = 291{,}63\ m$ ✓
The taxi is still ahead/*Die taxi is nog steeds voor*. ✓ (5)
[11]

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QUESTION/*VRAAG* 8

8.1 0,8 s ✓ (range: 0,8 – 1 s) (1)

8.2 12,5 $m.s^{-1}$ ✓ (1)

8.3 a = gradient of the graph/*gradient/helling van grafiek* ✓
$= \frac{12,5-0 \checkmark}{5,8-0,8 \checkmark}$ (any other gradient points/*enige ander gradient punte*)
$= 2,5\ m.s^{-2}$ ✓ (4)

8.4 Displacement = area under the graph ✓
Verplasing = oppervlak onder die grafiek
= (½ (5,8 – 0,8) × 12,5) ✓ + (12,5 × (8 – 5,8)) ✓
= 58,75 m ✓ (range: 56,25 – 59 m) (4)
[10]

QUESTION/*VRAAG* 9

9.1 The energy it has because of its position (in the gravitational field relative to some reference point.) ✓✓
Die energie wat dit het as gevolg van sy posisie (in die gravitasieveld met betrekking tot 'n verwysingspunt.) (2)

9.2 E_p = 0,30 J ✓✓ (2)

9.3 mass/*massa* = 50 g = 0,05 kg ✓
E_p = 0,30 J
mgh = 0,30 ✓
0,05 × 9,8 × h = 0,30 ✓
h = 0,61 m ✓ (4)

9.4 $M_{E\ at\ A} = M_{E\ at\ B}$
$(E_k + E_p)_A = (E_K + E_P)_B$ } any one/*enige een* ✓
$0,3 + 0 = 0 + ½\ mv^2$
$0,3 = ½ \times 0,05 \times v^2$ ✓
$v = 3,46\ m{\cdot}s^{-1}$ ✓ (3)

9.5 The total energy of an isolated system remains constant. ✓✓
Die totale energie in 'n geïsoleerde sisteem bly konstant. (2)
[13]

TOTAL/*TOTAAL*: 100

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