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education

Department of
Education
FREE STATE PROVINCE

EXAMINATION

GRADE 10

PHYSICAL SCIENCES P1

Stanmorephysics.com

NOVEMBER 2025

MARKS: 100

TIME: 2 HOURS

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INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 9 questions. Answer ALL questions in the 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 pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEET.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. 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 down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 Which ONE of the following terms describes a single disturbance propagating through a medium?

A Amplitude

B Pulse

C Crest

D Wave (2)

1.2 At what speed, in $m \cdot s^{-1}$, do electromagnetic waves propagate through a vacuum?

A 3×10^8

B 2×10^4

C 343

D 340 (2)



1.3 Learners perform an experiment to determine the charges of **Q** and **R**.
They start their experiment using a POSITIVELY charged **P.**
The learners draw their observations as illustrated below:



Based on the results above, what is the charge on **Q** and **R**?

	CHARGE Q	CHARGE R
A	Negative	Negative
B	Positive	Positive
C	Positive	Negative
D	Negative	Positive

(2)

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1.4 The rate of flow of charges is …

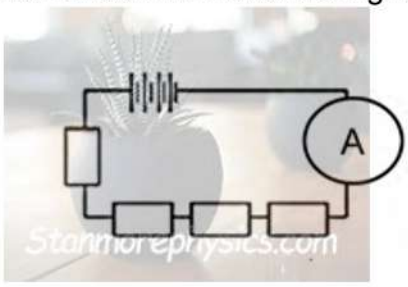
A ohm.

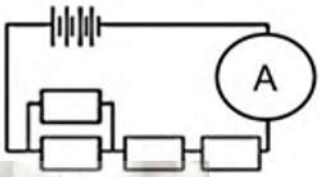
B voltage.

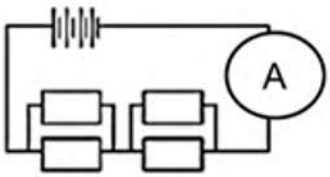
C coulomb.

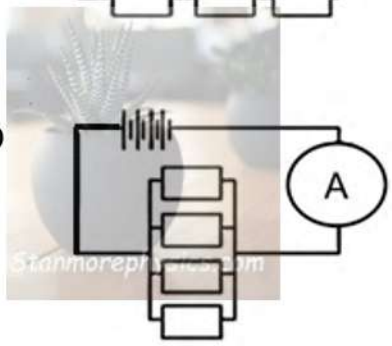
D electric current. (2)

1.5 The following circuits have identical resistors connected to a similer battery. Which circuit will have the highest resistance and the lowest current?

A 

B 

C 

D 

(2)

1.6 If an object is moving from rest, it implies:

(i) Acceleration

(ii) A final velocity of zero

(iii) An initial velocity of zero

Which of the above statement(s) is/are correct?

A (i) and (ii)

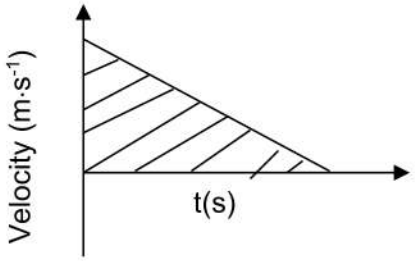
B (i) and (iii)

C (ii) and (iii)

D (i) ,(ii) and (iii) (2)

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1.7 Which physical quantity is represented by the shaded area.



A Speed

B Velocity

C Acceleration

D Displacement (2)

1.8 The instantaneous velocity of a car can be defined as:

A The rate of change of displacement of the car at a particular time.

B The total distance covered by the car divided by the total time.

C The rate of change of distance of the car at a particular time.

D The total displacement of the car divided by the total time. (2)

1.9 Which ONE of the following will be represented by the gradient of a position-time graph?

A Velocity

B Distance

C Acceleration

D Displacement (2)

1.10 A motorbike moving at a speed ***v*** has the kinetic energy **E**. If the speed of the motorbike decreases to $\frac{1}{2}$ **v** the kinetic energy will be:

A 4 *E*.

B 2*E*.

C $\frac{1}{2}$ *E*.

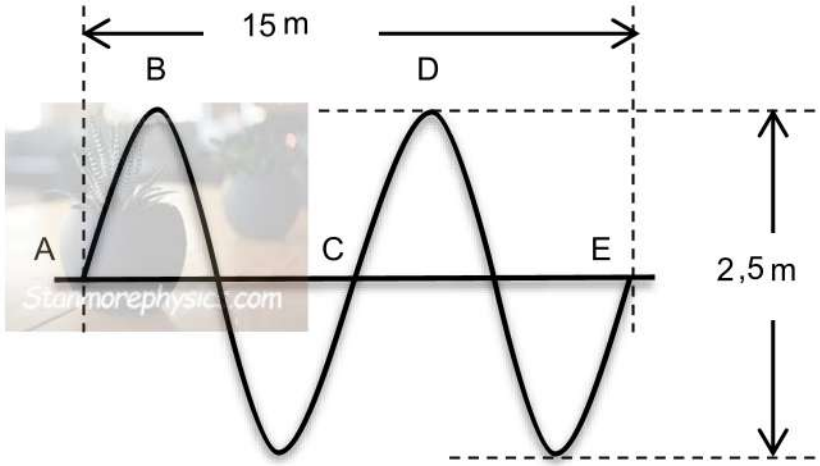
D $\frac{1}{4}$ *E*. (2)

[20]

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QUESTION 2

2.1 The diagram below represents a wave moving from left to right. The time between two consecutive troughs is 2 s.



2.1.1 Define the term *frequency.* (2)

Calculate the:

2.1.2 Amplitude (1)

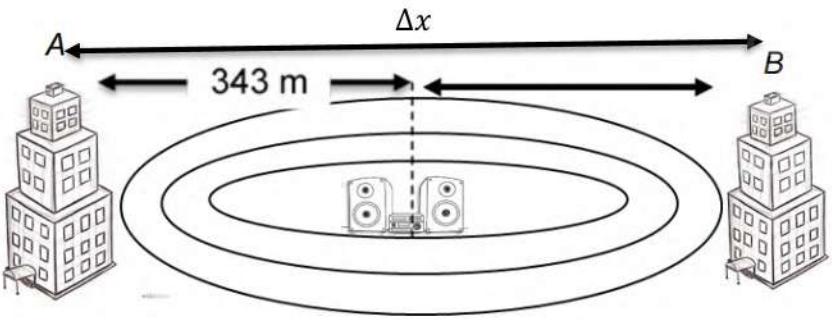
2.1.3 Wavelength (2)

2.1.4 Frequency (3)

2.1.5 Speed (3)

2.2 A sound emitting device is placed between two buildings **A** and **B**, as shown below. The distance from the device to building **A** is 343 m. The sound wave strikes building **B** perpendicularly and returns to the device after 3 s.

The speed of sound in air is 330 $m \cdot s^{-1}$.



Calculate the distance Δx between the two buildings **A** and **B.** (4)
[15]

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QUESTION 3

3.1 Radio waves have a wavelength of 0,15 m.

3.1.1 Give ONE use of radio waves in technology. (1)

3.1.2 Calculate the energy of a photon of these radio waves. (3)

3.2 X-rays emitted by the x-ray machine have a frequency of 2×10^{19} Hz.

3.2.1 Calculate the wavelength. (3)

3.2.2 Explain why X-rays have a highly penetrating ability? (2)
[9]

QUESTION 4

Sphere **A** carries a charge of -2×10^{-9} C, while the charge on Sphere **B** is unknown. The spheres are brought into contact and the charge on each sphere is $1,5 \times 10^{-9}$ C.

4.1 State the principle of conservation of charge. (2)

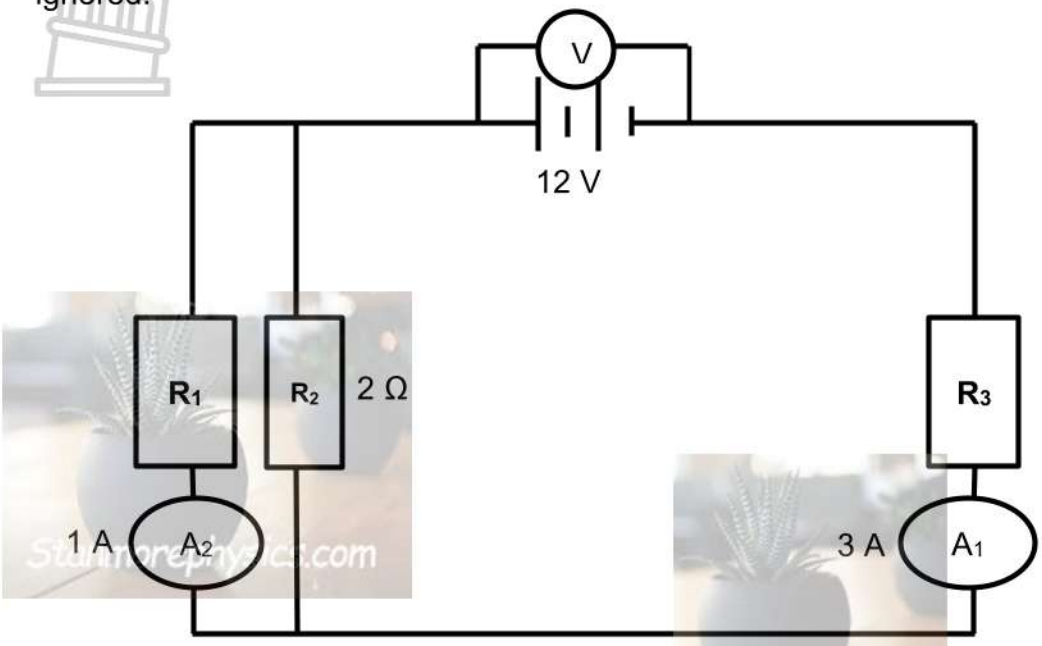
4.2 Calculate the magnitude of the unknown charge on sphere **B**. (3)

4.3 Show by means of calculation that the number of electrons transferred during contact is $4,74 \times 10^{10}$ electrons. (3)
[8]

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QUESTION 5

Three resistors, R_1, R_2 and R_3 are connected to a battery as shown in the diagram below. Resistor R_2 has a resistance of 2 Ω. The ammeter readings on A_1 and A_2 are 3A and 1A respectively. The resistance of the connecting wires and battery can be ignored.



5.1 Define the term *current.* (2)

5.2 Calculate the potential difference of resistor R_2 (5)

5.3 Calculate the resistance of the unknown resistor R_3 (3)

5.4 How does the resistance of R_1 compare to that of R_2?
Write HIGHER THAN, LOWER THAN or THE SAME AS. Explain the answer. (2)

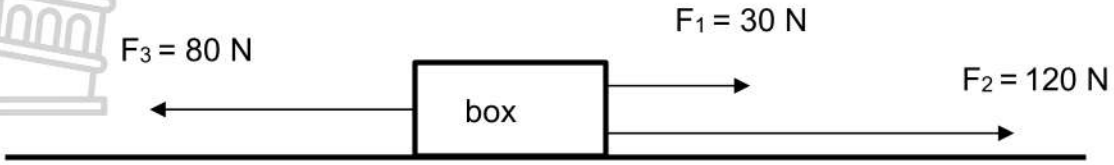
5.5 Calculate the energy transferred to resistor R_2 when 3 C of charge goes through it. (3)

[15]

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QUESTION 6

A box which is on the smooth surface starts moving when three forces **F_1**, **F_2**, and **F_3** act on it as shown in the diagram below.



6.1 Define the term *resultant force.* (2)

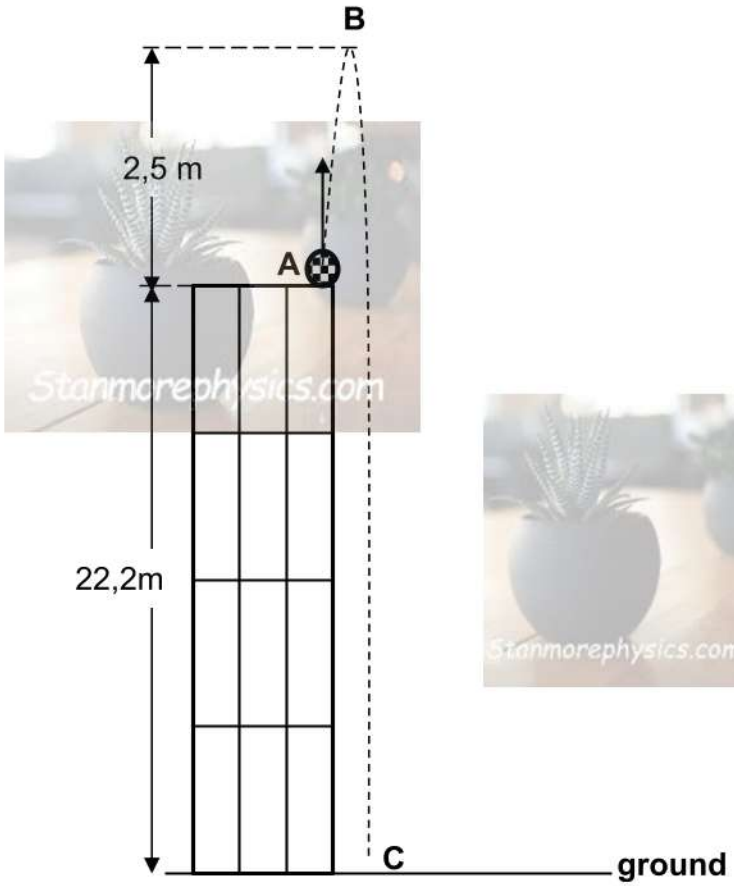
6.2 Calculate the magnitude and the direction of the resultant force acting on the box. (3)
[5]



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QUESTION 7

A ball is thrown vertically upwards from the top edge of a 22,2 m tall building. The ball reaches a maximum height at **B** which is 2,5 m from the point where it was thrown, as illustrated below. The ball falls and reaches the ground at point **C.** The motion from **A** to **C** takes 3 s. Ignore the effects of air resistance.



7.1 Define the term *distance*. (2)

7.2 Determine the total distance of the ball from the moment it is thrown at point **A** until it reaches the ground at point **C**. (2)

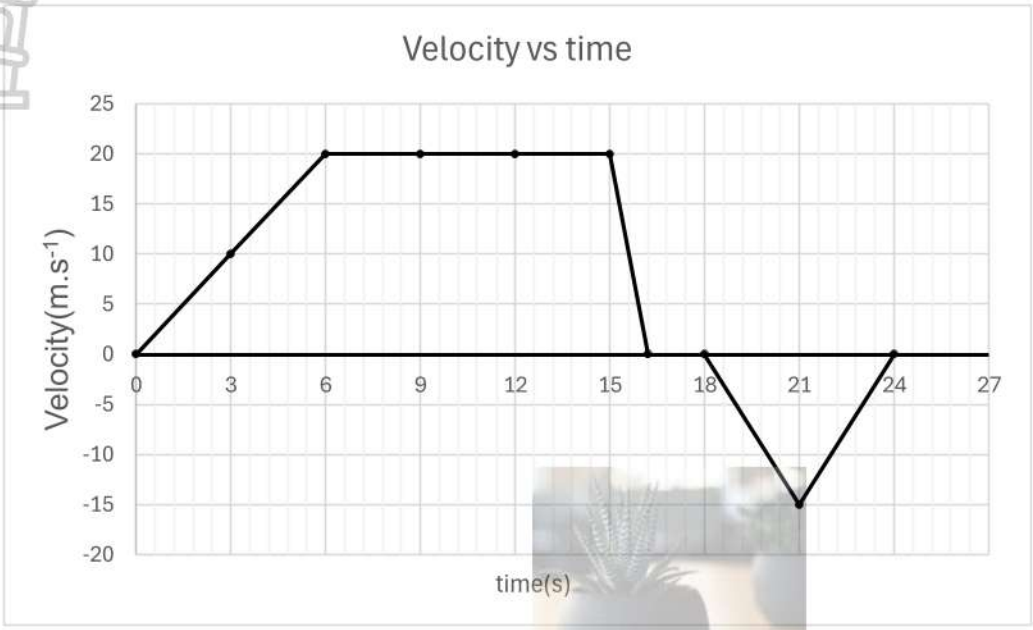
7.3 Determine the displacement of the ball from the moment it is thrown at point **A** until it reaches the ground at point **C.** (2)

7.4 Calculate the average velocity of the ball throughout its entire motion. (3)
[9]

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QUESTION 8

8.1 The velocity-time graph below represents the motion of an electric toy car over a period of 24 s. The car initially travels NORTH.



8.1.1 Describe the motion of the electric toy car during the first 6 s. (2)

8.1.2 Calculate the total displacement of the car during the **FIRST** 12 s of its motion. (WITHOUT USING EQUATIONS OF MOTION) (4)

8.2 A traffic officer travels at a speed of 19 m·s^{-1} when a biker passes him with a constant speed of 22 m·s^{-1}. At the moment when the biker passes him, the traffic officer then accelerates his car at 3 m·s^{-2} for 4 s.



8.2.1 Define the term *acceleration.* (2)

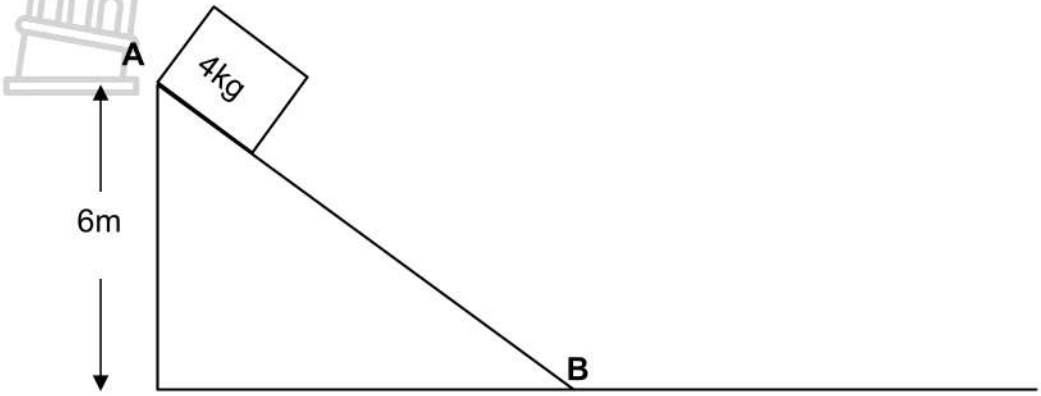
8.2.2 By means of calculations, determine whether the traffic officer will reach the biker in 4 s. (5)
[13]

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QUESTION 9

A 4 kg block is released from REST at point **A** which is 6 m above the ground. The block slides down to point B on an inclined surface as shown in the diagram below. Ignore effects of friction.



9.1 State the principle of conservation of mechanical energy. (2)

9.2 Use ENERGY PRINCIPLES to calculate the magnitude of the velocity of the block at point **B**. (4)
[6]

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DATA FOR PHYSICAL SCIENCES GRADE 10
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10

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·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* $E_k = \frac{1}{2}mv^2$

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

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

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EXAMINATION

GRADE 10

PHYSICAL SCIENCES

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MEMORANDUM
MARKING GUIDELINES P1

NOVEMBER 2025

MARKS: 100

This marking guideline consists of 8 pages.

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QUESTION 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 A ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 A ✓✓ (2)

1.9 A ✓✓ (2)

1.10 D ✓✓ (2)
[20]

QUESTION 2

2.1.1 The number of wave pulses per second.✓✓ **(2 Or 0)** (2)
OR
The number of successive crests (or troughs) passing a given point in per second.

2.1.2 1,25 m ✓ (1)

2.1.3 7,5 m ✓✓ (2)

2.1.4

OPTION 1	OPTION 2	OPTION 3
$f = \frac{1}{T}$ ✓ $f = \frac{1}{2}$ ✓ $f = 0{,}5\text{Hz}$ ✓	$v = \frac{\Delta x}{\Delta t}$ $= \frac{7{,}5}{2}$ $= 3{,}75\ m{\cdot}s^{-1}$ $v = f\lambda$ ✓ $3{,}75 = f \times (7{,}5)$ ✓ $f = 0{,}5\ Hz$ ✓	$f = \frac{\text{number of complete waves}}{\text{time}}$ ✓ $= \frac{1}{2}$ ✓ $= 0{,}5\ Hz$ ✓

(3)

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2.1.5

OPTION 1	OPTION 2
$v = f\lambda$✓ $v = (0{,}5)(7{,}5)$✓ $= 3{,}75\ m \cdot s^{-1}$✓	$v = \frac{\Delta x}{\Delta t}$✓ $= \frac{7{,}5}{2}$✓ $= 3{,}75\ m \cdot s^{-1}$✓

(3)

2.2

Distance from device to building B
$\Delta x = v \times t$ ✓
$\Delta x = 330 \times 1{,}5$✓
$\Delta x = 495$ m
∴ Distance between point A and B: 495 + 343✓ = 838 m ✓

OPTION 2

Distance from device to building B
$\Delta x = v \times t$ ✓
$\Delta x = 330 \times 3$✓
$\Delta x = 990$ m
Distance SB = 0,5 x (990)
= 495 m
∴ Distance between point A and B: 495 + 343✓ = 838 m ✓

(4)

[15]

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QUESTION 3

3.1.1 **ANY ONE**

Radio and TV (broadcast) ✓/ Communication✓ /
Locating information about our universe.✓ (1)

3.1.2 $E = hf$ ✓
$E = \frac{hc}{\lambda}$

$E = \frac{6,63\times10^{-34}}{0,15}(3 \times 10^{8})$ ✓

$E = 1,326 \times 10^{-24}\text{J}$ ✓ (3)

3.2.1 $c = \lambda f$ ✓

$3\times10^{8} = \lambda \cdot 2 \times10^{19}$ ✓

$\lambda = 1,5\times10^{-11}\ m$✓

OPTION 2

$E = hf$
$E = \frac{hc}{\lambda}$ ✓

$1,326 \times 10^{-14} = \frac{6,63\times10^{-34}}{\lambda}(3 \times 10^{8})$ ✓

$\lambda = 1,5 \times 10^{-11}\ m$✓ (3)

3.2.2 It has a high frequency✓
high energy✓ (type of electromagnetic wave) (2)
[9]

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QUESTION 4

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

4.2

$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$1,5 \times 10^{-9} \checkmark = \frac{(-2 \times 10^{-9}) + Q_2}{2} \checkmark$$

$$Q_1 = 5 \times 10^{-9} C \checkmark$$

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$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$1,5 \times 10^{-6} \checkmark = \frac{(-2 \times 10^{-6}) + Q_2}{2} \checkmark$$

$$Q_1 = 5 \times 10^{-6} C \checkmark$$

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(3)

4.3

OPTION 1

$$\Delta Q = 1,5 \times 10^{-9} - (-2 \times 10^{-9}) \checkmark$$
$$= +3,5 \times 10^{-9} C$$

$$n = \frac{Q}{e} \checkmark$$
$$= \frac{+3,5 \times 10^{-9}}{+1,6 \times 10^{-19}} \checkmark$$
$$= 2,1875 \times 10^{10}\ electrons$$

OPTION 2

$$\Delta Q = 1,5 \times 10^{-9} - (+5 \times 10^{-9}) \checkmark$$
$$= -3,5 \times 10^{-9} C$$

$$n = \frac{Q}{e} \checkmark$$
$$= \frac{-3,5 \times 10^{-9}}{-1,6 \times 10^{-19}} \checkmark$$
$$= 2,1875 \times 10^{10}\ electrons$$

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OPTION 1

$\Delta Q = 1,5 \times 10^{-6} - (+5 \times 10^{-6})$ ✓
$= -3,5 \times 10^{-6} C$

$n = \frac{Q}{e}$ ✓
$= \frac{-3,5 \times 10^{-6}}{-1,6 \times 10^{-19}}$ ✓
$= 2,1875 \times 10^{13}\ electrons$

OPTION 2

$\Delta Q = 1,5 \times 10^{-6} - (-2 \times 10^{-6})$ ✓
$= +3,5 \times 10^{-6} C$

$n = \frac{Q}{e}$ ✓
$= \frac{+3,5 \times 10^{-6}}{+1,6 \times 10^{-19}}$ ✓
$= 2,1875 \times 10^{13}\ electrons$

(3)
[8]

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QUESTION 5

5.1 Rate of flow of charge ✓✓ **(2 or 0)** (2)

5.2

$I_{TOTAL} = I_{R1} + I_{R2}$

$3 = 1 + I_{R2}$ ✓

$I_{R2} = 2\ A$ ✓

$R = \frac{V}{I}$ ✓

$2 = \frac{V}{2}$ ✓

$V = 4\ V$ ✓

(5)

5.3 **POSITIVE MARKING FROM 5.2**

$V_S = (12V - 4V) = 8V$ ✓

$R = \frac{V}{I}$

$R = \frac{8}{3}$ ✓

$R = 2{,}67\ \Omega$ ✓

(3)

5.4 HIGHER THAN ✓

R_1 has lower current than R_2 ,therefore R_1 will have higher resistance than R_2 ✓ (2)

5.5 **POSITIVE MARKING FROM 5.2**

$V = \frac{W}{Q}$ ✓

$4 = \frac{W}{3}$ ✓

$W = 12\ J$ ✓

(3)
[15]

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QUESTION 6

6.1 A single force that has the same effect as two or more forces acting together ✓✓
ACCEPT: The sum of two or more forces acting together ✓✓ (2)

6.2 $F_{net} = F_1 + F_2 + F_3$

$F_{net} = 30 + 120 - 80$✓

$F_{net} = 70\ N$✓ $to\ the\ RIGHT$ ✓ (3)
[5]

QUESTION 7

7.1 Distance is the total length of the path taken. ✓✓ (2)

7.2 $Total\ Distance = (2 \times AB) + AC$

$= (2 \times 2{,}5) + 22{,}2$ ✓ $= 27{,}2\ m$ ✓ (2)

7.3 $\Delta x = 22{,}2\ m$ ✓ downwards ✓ (2)

7.4 **POSITIVE MARKING FROM 7.3**

$v_{ave} = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{22{,}2}{3}$ ✓

$= \underline{7{,}4\ m \cdot s^{-1}\ \text{downwards}}$ ✓ (3)
[9]

QUESTION 8

8.1.1 The velocity (of a car) uniformly increased from 0 m·s^{-1} to 20 m·s^{-1} (North) ✓ in 6 seconds at constant acceleration✓ (2)

8.1.2 Displacement = $\frac{1}{2}\ bh + l \times b$

$= \frac{1}{2}(6)(20)$ ✓+ $(20)(6)$ ✓

Displacement = 180 m ✓ North ✓

OPTION 2

area = ½ (sum of parallel sides x perpendicular height)
= ½ (12 +6) ✓ (20) ✓
= 180 m ✓ North ✓

(4)

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8.2.1 The rate of change of velocity. ✓✓**(2 or 0)** (2)

8.2.2

Distance covered by the motorbike in 4 seconds:

$$speed = \frac{distance}{time}$$
$$22 = \frac{\Delta x}{4} \checkmark$$
$$\Delta x = 88\ m$$

OPTION 1

Distance covered by the car in 4 seconds:

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$
$$= (19)(4) + \frac{1}{2}(3)(4)^2 \checkmark$$
$$= 100\ m$$

OPTION 2

Distance covered by the car in 4 seconds:

$$v_f = v_i + a\Delta t$$
$$v_f = 19 + (3)(4)$$
$$v_f = 31\ m \cdot s^{-1}$$

$$\Delta x = \left(\frac{v_i + v_f}{2}\right) \Delta t \checkmark$$
$$\Delta x = \left(\frac{19 + 31}{2}\right) 4 \checkmark$$
$$\Delta x = 100\ m$$

$$v_f^2 = v_i^2 + 2a\Delta x \checkmark$$
$$31^2 = 19^2 + 2(3)\Delta x \checkmark$$
$$\Delta x = 100\ m$$

The distance covered by the car is greater than the distance covered by the bike in 4s **OR** Δx(Car)>Δx(biker) ✓
The traffic officer will reach the biker in less than 4 seconds ✓ (5)

[13]

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QUESTION 9

9.1 The total mechanical energy in an isolated system is conserved ✓✓ (2)

9.2 $Emech\ A = Emech\ B$ ✓ **Any one**

$mgh_A + \frac{1}{2}mv_A^2 = mgh_B + \frac{1}{2}mv_B^2$ ✓ **Any one**

$(4)(9{,}8)(6)✓ + \frac{1}{2}(4)(0)^2 = (4)(9{,}8)(0) + \frac{1}{2}(4)(v)^2$ ✓

$v = 10{,}84\ \text{m·s}^{-1}$ ✓ (4)

[6]

GRAND TOTAL: 100

