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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**

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**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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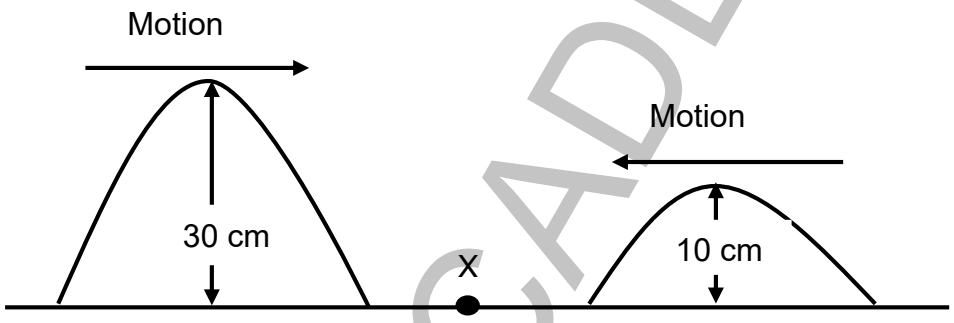
## QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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:

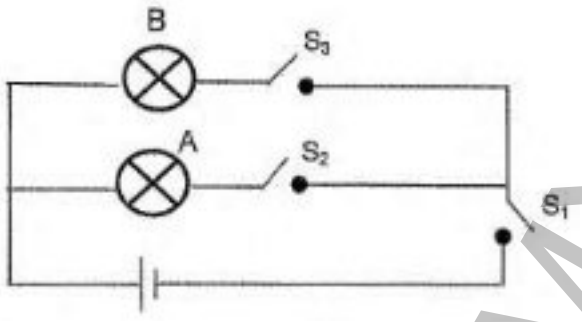
A 1,3 x $10^{20}$ Hz
B 7,5 x $10^{19}$ Hz
C 3,3 x $10^{-47}$ Hz
D 1,7 x $10^{-22}$ Hz (2)

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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?

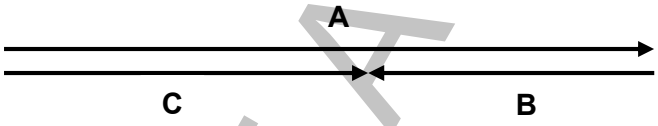



A $S_1$, $S_2$ and $S_3$
B $S_1$ and $S_2$
C $S_1$ and $S_3$
D $S_2$ and $S_3$ (2)

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]**

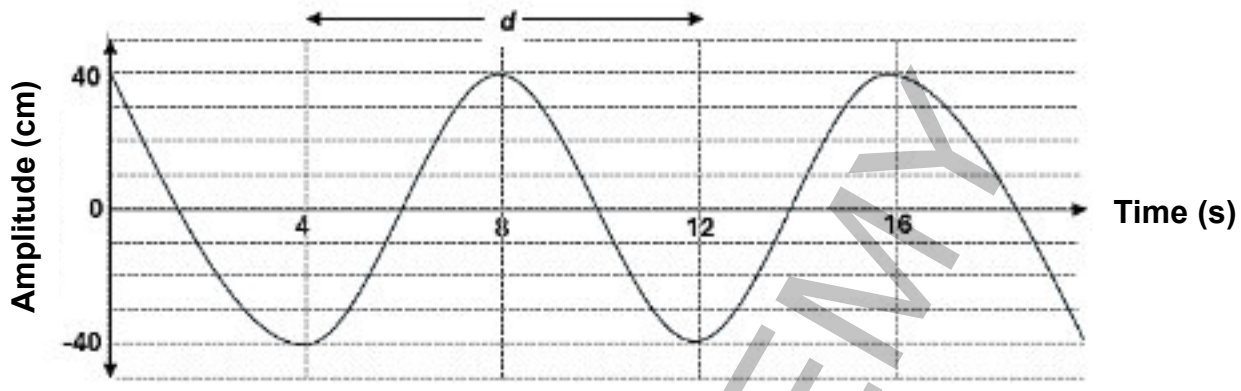
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**QUESTION 2 (Start on a new page)**

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)

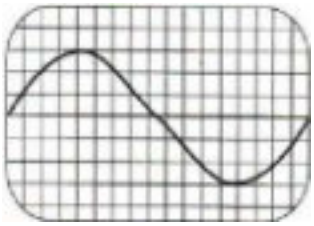
2.4.2 Calculate the speed of the complete wave as shown in the diagram above. (5)

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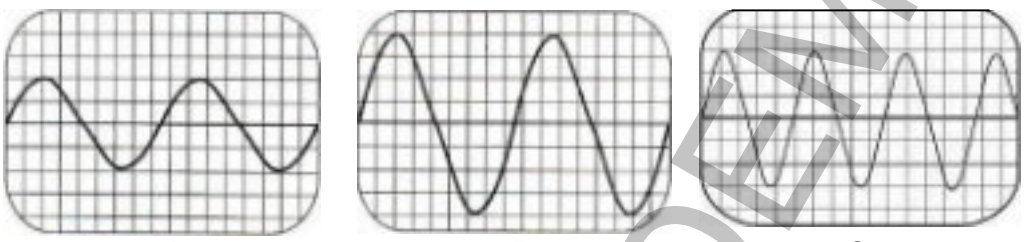
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2.5 The following sound wave, produced by a tuning fork, is observed on an oscilloscope:



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)

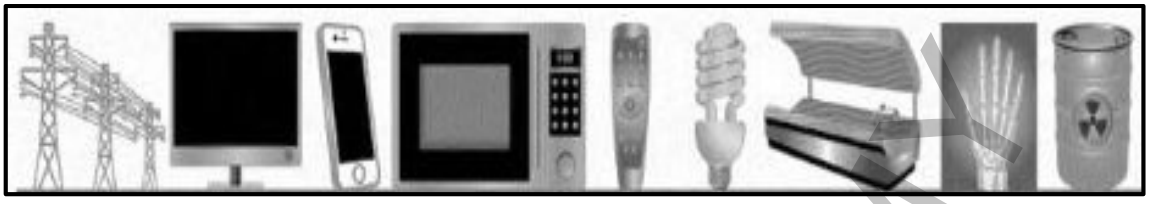
2.5.4 Name ONE use of ultrasound in the medical treatment of patients. (1)
**[15]**

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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]**

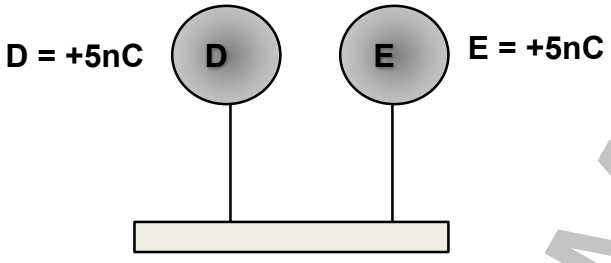
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**QUESTION 4 (Start on a new page)**

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]**

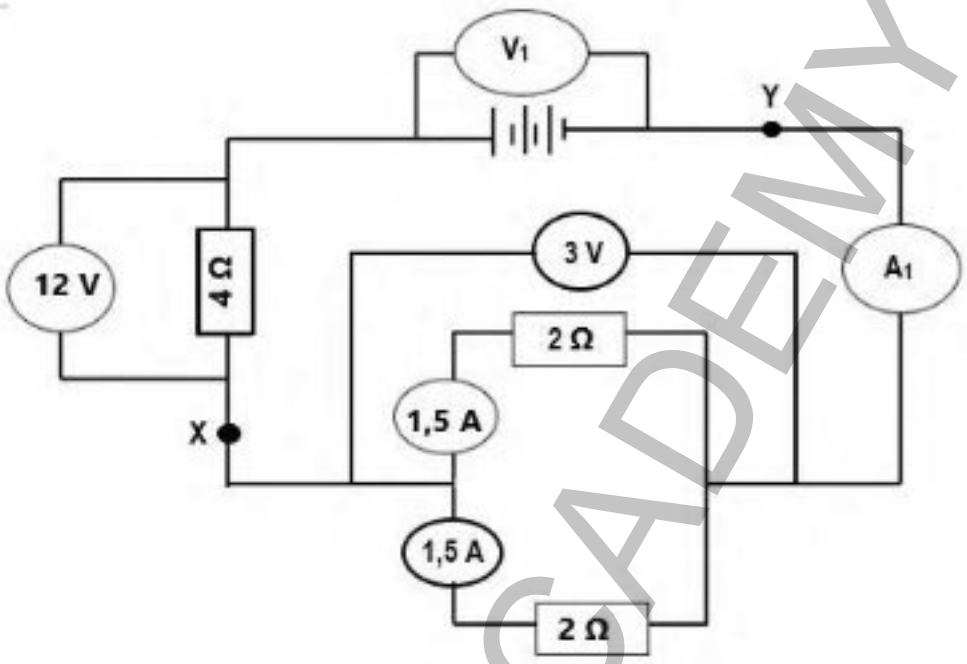
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**QUESTION 5 (Start on a new page)**

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]**

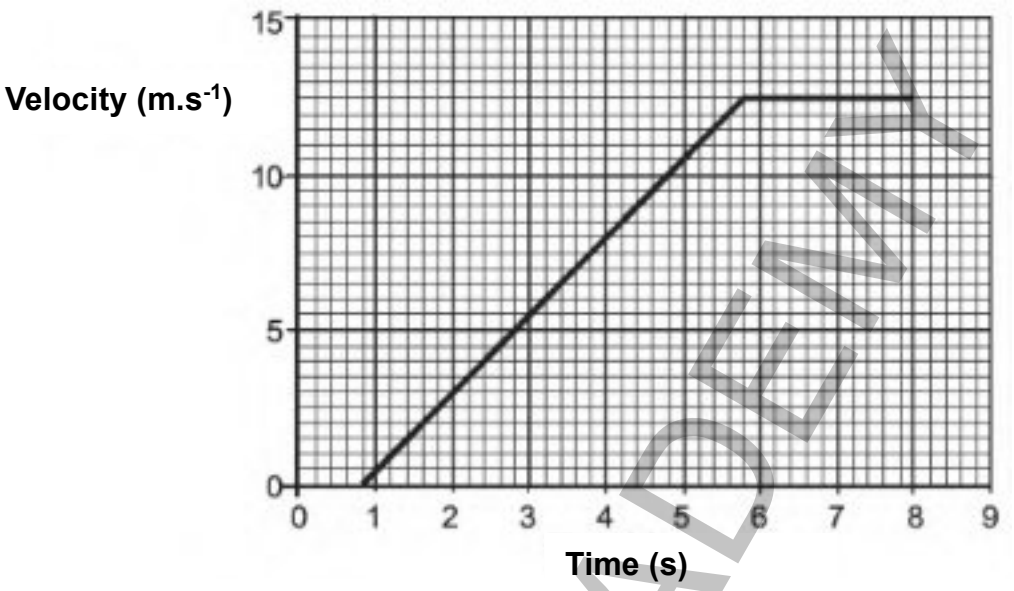
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**QUESTION 8 (Start on a new page)**

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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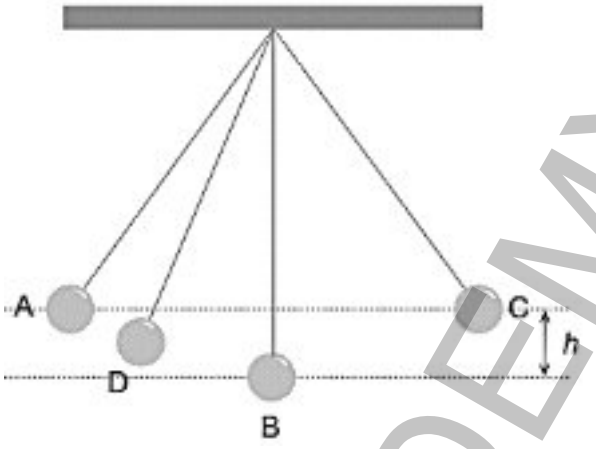
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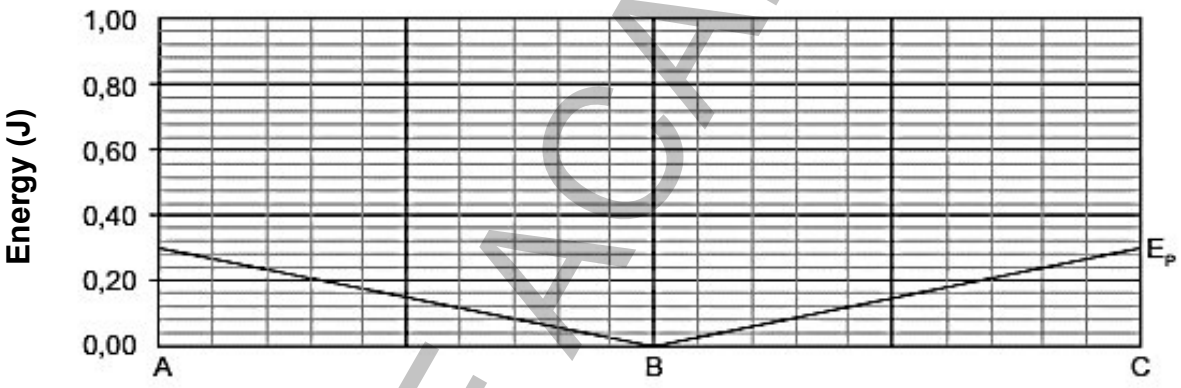


**QUESTION 9 (Start on a new page)**

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 x $10^{8}$ $m \cdot s^{-1}$ |
| Planck's constant | h | 6,63 x $10^{-34}$ $J \cdot s$ |
| Charge on electron | e | -1,6 x $10^{-19}$ C |
| Electron mass | $m_e$ | 9,11 x $10^{-31}$ 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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