



GAUTENG PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**GAUTENG DEPARTMENT OF EDUCATION
PROVINCIAL EXAMINATION
NOVEMBER 2020**

GRADE 10

PHYSICAL SCIENCES (PHYSICS)

PAPER 1

TIME: 1½ hours

MARKS: 80

10 pages + 1 data sheet

INSTRUCTIONS AND INFORMATION

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

SECTION A

QUESTION 1: MULTIPLE CHOICE QUESTIONS

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 to 1.5) in the answer book.

1.1 Which one of the following types of electromagnetic waves has the LONGEST wavelength?

- A Gamma rays
- B Ultraviolet rays
- C microwaves
- D X rays

(2)

1.2 Which one of the following is equivalent to a frequency of 20 Hz?

- A 20 s
- B $20 \text{ C} \cdot \text{s}^{-1}$
- C $20 \text{ J} \cdot \text{s}^{-1}$
- D 20 s^{-1}

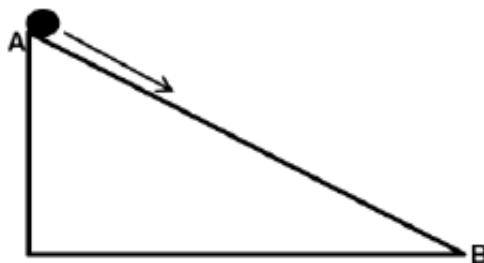
(2)

1.3 Which one of the following quantities will give the gradient of a velocity vs time graph?

- A Change in velocity
- B Rate of change in velocity
- C Change of position
- D Rate of change of position

(2)

1.4 An object of mass, m , is released from rest from the top of a frictionless inclined plane as shown below.

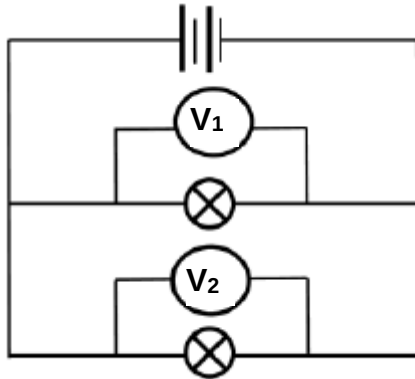


Which one of the following is correct regarding the total mechanical energy of the object?

- A $(E_p + E_k)_A > (E_p + E_k)_B$
- B $(E_p + E_k)_A < (E_p + E_k)_B$
- C $(E_p + E_k)_A = (E_p + E_k)_B$
- D $(E_p + E_k)_A = - (E_p + E_k)_B$

(2)

- 1.5 Two identical light bulbs are connected in parallel, as shown in the circuit diagram below. Voltmeters V_1 and V_2 are connected across each bulb.



Which one of the following regarding the voltmeter readings is correct?

- A $V_1 = 2V_2$
- B $2V_1 = V_2$
- C $V_1 = V_2$
- D $4V_1 = V_2$

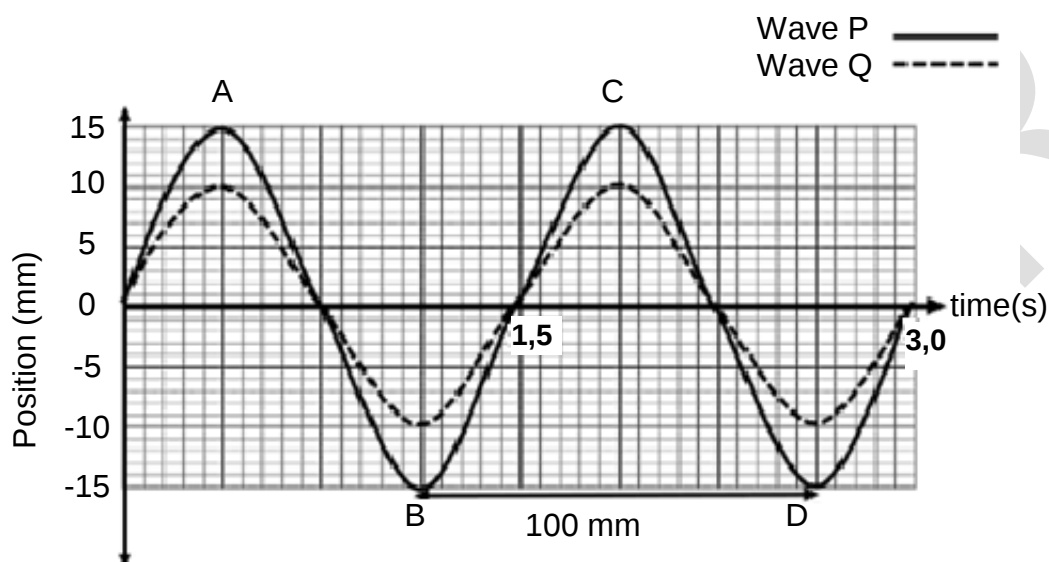
(2)
[10]

TOTAL SECTION A: 10

SECTION B

QUESTION 2 (Start on a new page.)

Below is a representation of two waves. Study it carefully and answer the questions that follow.

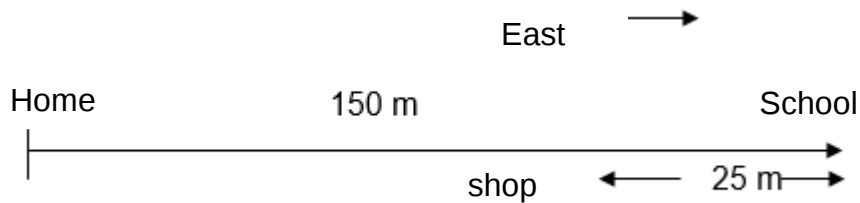


- 2.1 Identify the type of waves illustrated above as TRANSVERSE or LONGITUDINAL. Give a reason for your answer. (3)
- 2.2 Which one of the two waves, P or Q, has the greatest amplitude? (1)
- 2.3 For Wave Q:
 - 2.3.1 What is the magnitude of its wavelength in metres? (1)
 - 2.3.2 What is the magnitude of its period? (1)
 - 2.3.3 Calculate the wave speed. (3)

[9]

QUESTION 3 (Start on a new page.)

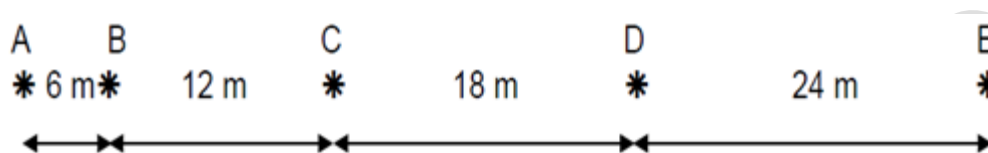
A girl walks 150 m from home to school in an easterly direction. She then turns and walks 25 m to a shop.



- 3.1 What distance did the girl walk? (1)
- 3.2 What is the displacement of the girl? (1)
- 3.3 Define the following:
- 3.3.1 displacement of an object. (2)
- 3.3.2 vector. (2)
- 3.4 By means of a vector diagram (using a scale of 1 cm:25 m), determine the displacement of the girl. (4)
- [10]**

QUESTION 4 (Start on a new page.)

A boy on a skateboard, starting from rest, slides down an inclined plane from point A. He drops ink on the surface every 2 seconds as he slides down. Each time he drops the ink it leaves a mark (*) on the surface. The distances between the marks on the surface are shown below for a section of his motion.



4.1 Calculate the magnitude of his average velocity during the following intervals:

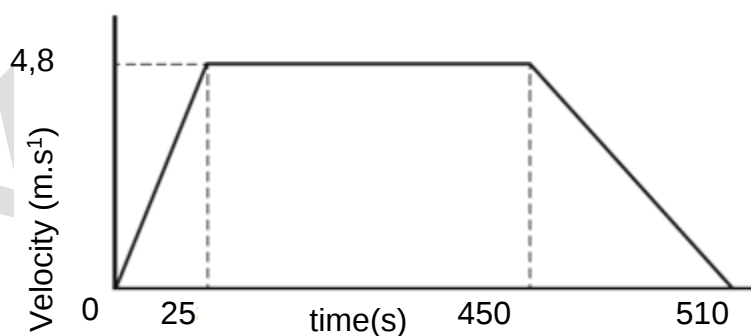
4.1.1 AB (3)

4.1.2 CD (2)

4.2 Calculate the magnitude of his acceleration for the interval A – D. (4)

4.3 What evidence can you present from the given data to indicate that the acceleration is probably constant during interval AE? (2)

4.4 The following graph represents the motion of a car along a straight road.



4.4.1 Describe, in words, the motion of the car between 25 s and 450 s. (1)

4.4.2 Use the graph to find the acceleration of the car during the first 25 s. (3)

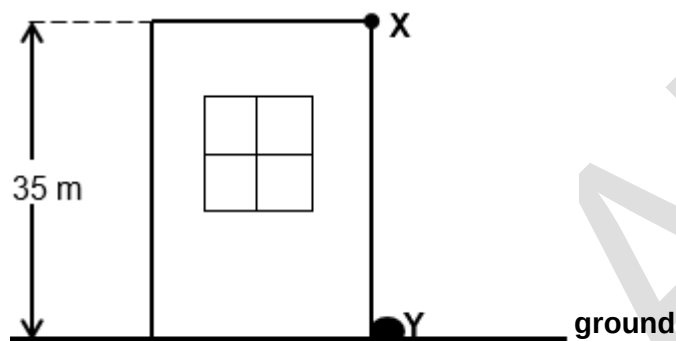
4.4.3 Between which time interval(s) is the car accelerating? (2)

[17]

QUESTION 5 (Start on a new page.)

A worker accidentally drops a hammer of a mass of 1 kg from point X, which is at the edge of a flat roof of a building that is 35 m tall. Y is a point on the ground where the hammer lands, as shown in the diagram below.

Ignore the effects of air resistance.

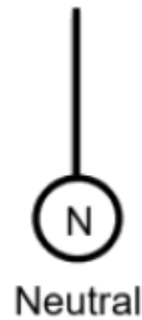
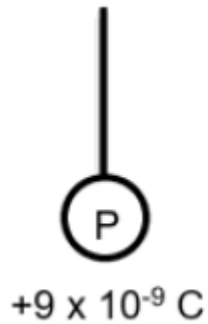


- 5.1 Define the term *gravitational potential energy* of an object in words. (2)
- 5.2 Calculate the *gravitational potential energy* of the hammer at point X. (3)
- 5.3 State, in words, the *principle of conservation of mechanical energy*. (2)
- 5.4 Use the principle of conservation of mechanical energy to calculate the speed of the hammer at the instant it strikes the ground at point Y. (4)

[11]

QUESTION 6 (Start on a new page.)

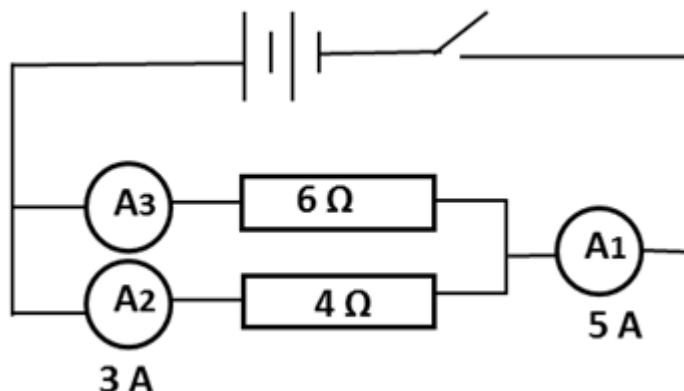
A NEUTRAL plastic ball, N, is suspended from an insulating string. An identical ball, P, is attached to a similar string and ball P has a charge of $+9 \times 10^{-9} \text{C}$.



- 6.1 Have electrons been ADDED or REMOVED from ball P? Give a reason for your answer. (3)
- 6.2 Ball N, is allowed to come into contact with ball P and they are then separated from each other.
- 6.2.1 State the principle of quantization of charge, in words. (2)
- 6.2.2 Calculate the new charge on ball N, after separation. (3)
- 6.2.3 Calculate the number of electrons transferred between the two balls, N and P. (4)
- [12]**

QUESTION 7 (Start on a new page.)

Consider the circuit below. When the switch is open and a voltmeter is connected across the battery, it reads the *emf* of the battery. When the switch is closed, ammeter A_1 reads 5 A and ammeter A_2 reads 3 A.



- 7.1 Define a current of 5 A.
The switch is now closed. (2)
- 7.2 Calculate the total resistance of the circuit. (3)
- 7.3 What will be the reading on ammeter A_3 when the switch is closed? (3)
- 7.4 If the potential difference across the $6\ \Omega$ resistor is 12 V, determine the energy transferred per coulomb of charge. (3)
- [11]

TOTAL SECTION B: 70

TOTAL: 80

END

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

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

TABLE 2: FORMULAE
WAVES, SOUND AND LIGHT

$v = f\lambda$	$f = \frac{1}{T} \text{ or } T = \frac{1}{f}$
$E = hf = \frac{hc}{\lambda}$	

ELECTRIC CIRCUITS

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