

Hillcrest High School

PHYSICAL SCIENCE P1

Nov 2025

Grade 10

MARKS: 110

EXAMINER: Ms N. Badenhorst

TIME: 2 Hours

MODERATORS: Mrs J. Knox-Whitehead
Miss T. Thrash

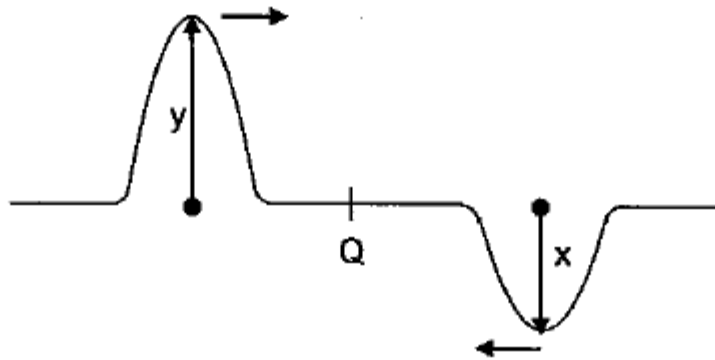
Instructions:

1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (12)
SECTION B (98)
4. Answer SECTIONS A and B in the ANSWER BOOK.
5. Non-programmable calculators may be used.
6. Appropriate mathematical instruments may be used.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Data sheets are attached for your use.
9. Give brief motivations, discussions, et cetera where required.
10. Numbers must be rounded off to two decimal places

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 (1.1-1.10) in the answer book.

1.1 Two pulses are travelling towards each other along a string, as shown in the diagram below.



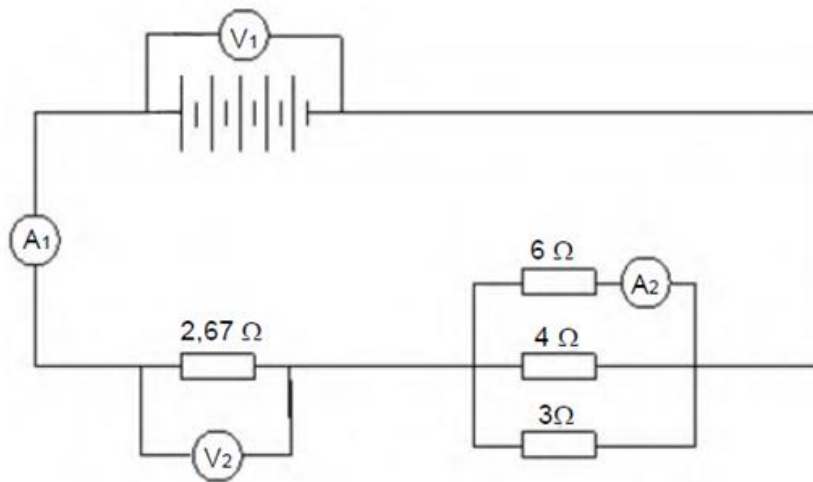
When the centres of the pulses meet at **Q**, the amplitude of the resultant pulse will be ...

- A. $x + y$
 - B. $2(x + y)$
 - C. $2(y - x)$
 - D. $y - x$
- 1.2 A tuning fork is made to vibrate by striking it gently on a rubber stopper.
The sound waves produced are ...
- A. Transverse waves and require a medium for propagation.
 - B. Transverse waves and require no medium for propagation.
 - C. Longitudinal waves and require a medium for propagation.
 - D. Longitudinal waves and require no medium for propagation.

1.3 A negatively charged plastic ruler is brought close to small pieces of paper but does not touch them. If the ruler and papers are now attracted to each other, the original charge(s) on the papers is/are...

- A positive only.
- B negative only.
- C neutral only.
- D both positive and neutral.

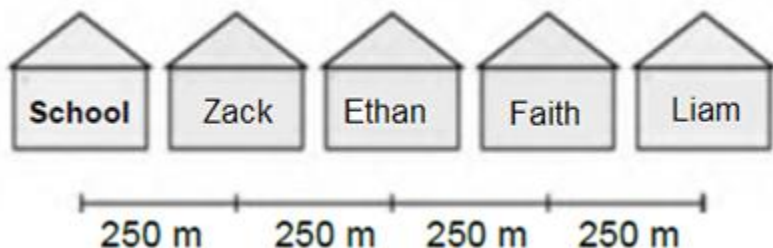
1.4 In the circuit diagram below, each cell has a voltage of 1,5 V. Use the diagram to answer the questions that follow.



If the branch with the 4 Ω resistor is removed, what effect this will have on the reading on A₁ and V₁?

	Reading on A ₁	Reading on V ₁
A	Increases	Remains the same
B	Remains the same	Decreases
C	Decreases	Remains the same
D	Decreases	Increases

Consider the scenario below to answer questions 1.5 and 1.6:



Liam decides to walk from his house to Zack's house to play PlayStation, but he then remembers he needs to study for his science exam. He then walks to Faith's house to study.

1.5 What is Liam's displacement?

- A 1250 m
- B 250 m left
- C 1250 m left
- D 250 m right

1.6 What is Liam's average velocity, if the whole trip took 15 minutes.

- A $1,38 \text{ m}\cdot\text{s}^{-1}$ left
- B $16,67 \text{ m}\cdot\text{s}^{-1}$ right
- C $0,28 \text{ m}\cdot\text{s}^{-1}$ left
- D $83,33 \text{ m}\cdot\text{s}^{-1}$ left

[2 X 6 = 12]

SECTION B**Question 2**

2.1 Learners are observing waves moving in a ripple tank, they observe that 3 wave crests are passing through a length of 120 mm after every 10 seconds.

2.1.1 Define the term, **wavelength** of a wave in words (2)

Calculate the:

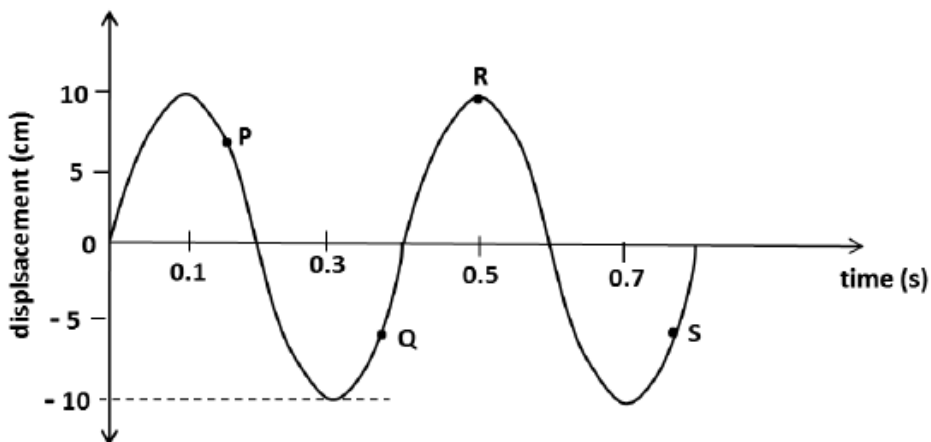
2.1.2 wavelength of the wave, in metres. (3)

2.1.3 the speed of this wave. (4)

2.1.4 the period of the wave. (3)

2.2 The graph below shows the displacement of particles in the water. Points P, R, Q and S are indicated on the wave.

The speed of the wave produced is $12 \text{ m}\cdot\text{s}^{-1}$.



Calculate:

2.2.1 The frequency of wave produced. (2)

[14]

Question 3

3.1 Electromagnetic waves can be used to transmit signals such as those for mobile phone calls, cooking and satellite transmission.

3.1.1 Identify the electromagnetic radiation described above. (1)

3.2 A satellite transmission transmits photons with a wavelength of $2 \times 10^{-2} \text{ m}$

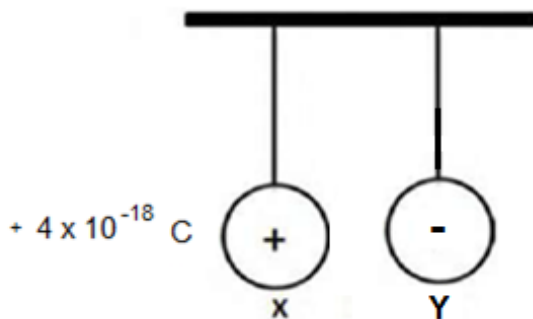
3.2.1 Define a **photon** (1)

3.2.2 Calculate the frequency of this photon. (3)

3.2.3 Calculate the energy of this photon. (3)

[8]**Question 4**

Two insulated spheres **X** and **Y** are suspended by threads from a ceiling, and are held a small distance apart, as shown in the diagram below.



4.1 Sphere **X** carries a charge of $+4 \times 10^{-18} \text{ C}$, while sphere **Y** has excess of 30 electrons.

4.1.1 Calculate the charge on sphere **Y**. (3)

4.1.2 **Identify** and **define** the principle used to answer question 4.1.1 (2)

4.2 The two spheres are now released and they move towards each other.

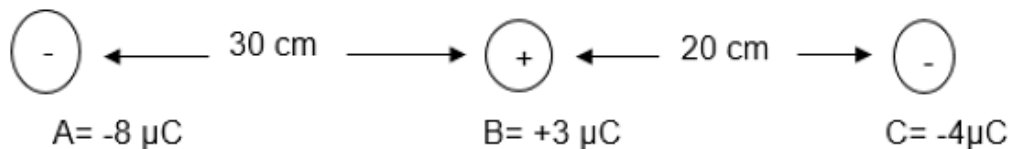
4.2.1 Give a reason why spheres **X** and **Y** move towards each other. (1)

4.3 After touching the two sphere X and Y are observed to move away from each other.

4.3.1 Explain why the two sphere move away from each other after touching. (2)

4.3.2 Calculate the charge that transferred between the charges when they touched. (5)

4.4 Three charged particles A, B and C are arranged in a line as shown in the diagram.

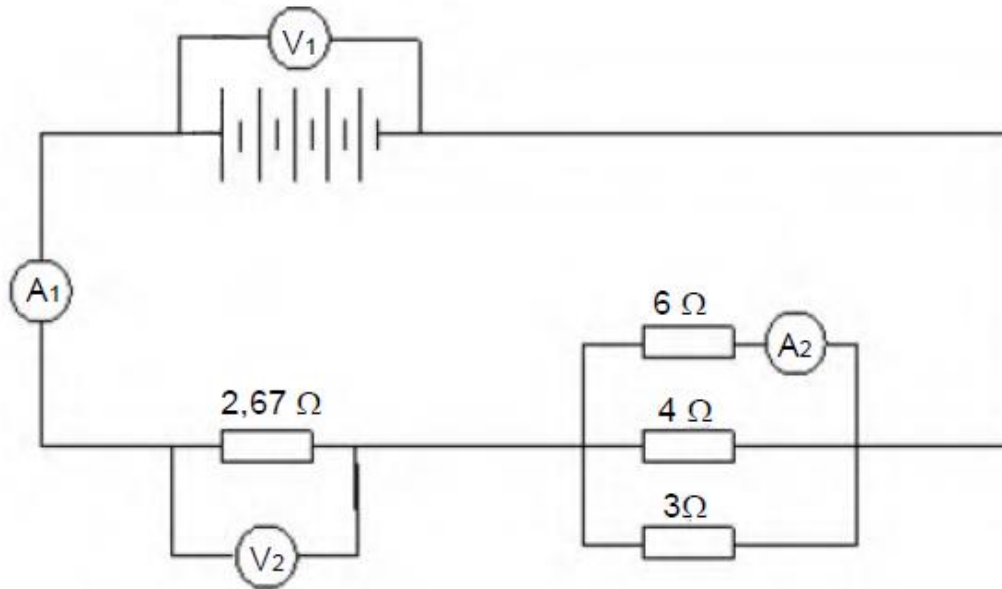


Calculate the magnitude and direction of net electrostatic force on particle C due to the other two charges. (5)

[18]

Question 5

In the circuit diagram below, each cell has a voltage of 1,5 V. Use the diagram to answer the questions that follow.



- 5.1 What is the reading on V_1 ? (1)
- 5.2 Calculate the following:
- 5.2.1 Total resistance of the circuit. (3)
- 5.2.2 Reading on A_1 (2)
- 5.2.3 The potential difference across the $6\ \Omega$ resistor. (3)
- 5.3 Determine the potential difference across the $3\ \Omega$ resistor. (1)
- 5.4 Determine the energy transferred in the $4\ \Omega$ resistor in 3 mins. (3)
- 5.5 Determine the magnitude of the charge that flows through A_1 in 6 mins. (3)

[16]

Question 6

6.1 A car initially at rest moves with a constant acceleration of $2 \text{ m}\cdot\text{s}^{-2}$ east.

Calculate the:

6.1.1 Magnitude of the velocity after 10s.

(3)

6.1.2 Distance covered during the first 10 s

(3)

6.2 An airplane has an unknown initial velocity. After travelling a distance of 3 500 m while accelerating at a constant acceleration of $5 \text{ m}\cdot\text{s}^{-2}$ it doubles its velocity.

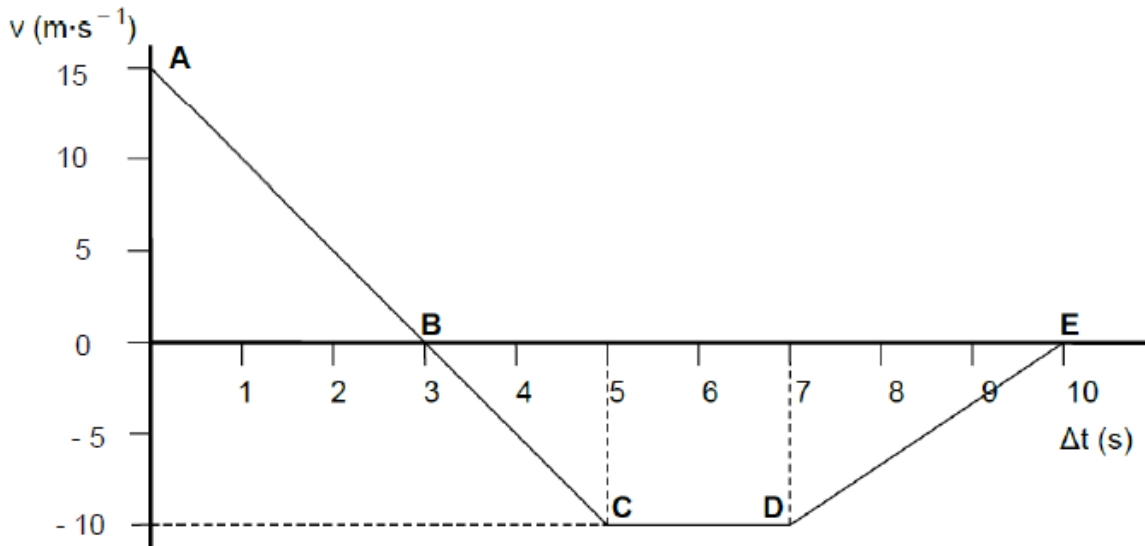
Calculate the time it took to double the velocity.

(6)

[12]

Question 7

The graph below shows the changing velocity of an object over a 10 s period. The object was initially moving in a Northerly direction.

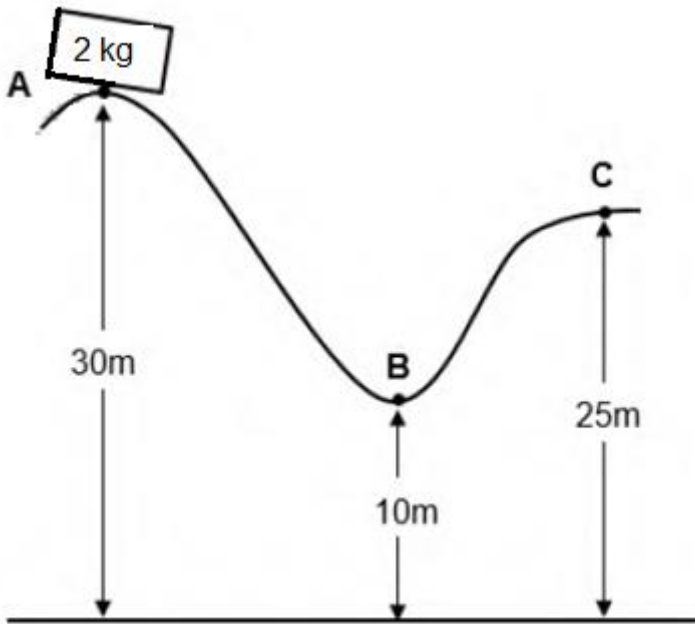


- 7.1 Describe the motion of the object from A to B. Include any relevant values in your description. (3)
- 7.2 In which time period is the object moving at a constant velocity? (1)
- 7.3 In which section of the graph is the object moving South? (1)
- 7.4 Using the graph, calculate the distance the object had travelled in the first five seconds. (4)
- 7.5 Find the total displacement of the object in the first 5 seconds. (2)
- 7.6 Use the graph to calculate the acceleration of the object over the first five seconds. (3)
- 7.7 Draw a corresponding acceleration time graph for the above motion for the entire 10s of the motion. (3)

[17]

Question 8

A rollercoaster cart of mass 2 kg is released from rest at point **A**, 30 metres above the ground. The cart moves along a frictionless surface **ABC** as shown below.



- 8.1 Define gravitational potential energy. (2)
- 8.2 Prove with calculations that the mechanical energy of the cart at point A is 588 J. (3)
- 8.3 State the *law of conservation of mechanical energy* in words. (2)
- 8.4 Calculate the velocity of the cart when it is at point **B**. (4)
- 8.5 How will the mechanical energy of the cart at point C compare with the mechanical energy of the cart at point B? Write only GREATER THAN, LESS THAN or EQUAL TO. Give a reason for your answer. (2)

[13]**Total 110**

DATA FOR PHYSICAL SCIENCES GRADE 10**PAPER 1 (PHYSICS)****TABLE 1: PHYSICAL CONSTANTS**

NAME	SYMBOL	VALUE
Speed of light in a vacuum	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Speed of sound in air	$v_{(\text{air})}$	$340 \text{ m}\cdot\text{s}^{-1}$
Speed of sound in water	$v_{(\text{water})}$	$1500 \text{ m}\cdot\text{s}^{-1}$
Planck's constant	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Charge on electron	e^-	$-1,6 \times 10^{-19} \text{ C}$
Coulomb's constant	k	$9 \times 10^9 \text{ N}\cdot\text{m}^2 \text{ C}^{-2}$
Gravitational acceleration	g	$9,8 \text{ m}\cdot\text{s}^{-2}$

FORMULAE MOTION

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

$v = f \lambda$	$T = \frac{1}{f}$	$E = hf \quad E = h \frac{c}{\lambda}$
$\Delta x = v \Delta t$		$c = f \lambda$

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

$R = \frac{V}{I}$	$\text{emf } (\varepsilon) = I(R + r)$ $\text{emk } (\varepsilon) = I(R + r)$
$R_s = R_1 + R_2 + \dots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$q = I \Delta t$
$W = Vq$ $W = VI \Delta t$ $W = I^2 R \Delta t$ $W = \frac{V^2 \Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2 R$ $P = \frac{V^2}{R}$

ELECTROSTATICS/ELEKTROSTATIKA

$F = \frac{kQ_1 Q_2}{r^2}$
$n = \frac{Q}{e} \text{ or/of } n = \frac{Q}{q_e}$

WORK, ENERGY AND POWER

$$E_k = \frac{1}{2} mv^2$$

$$E_p = mgh$$