



HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 10
PAPER 1 - Physics



NOVEMBER 2022
TIME: 2 HRS

Total: 100

Instructions

1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (10)
SECTION B (90)

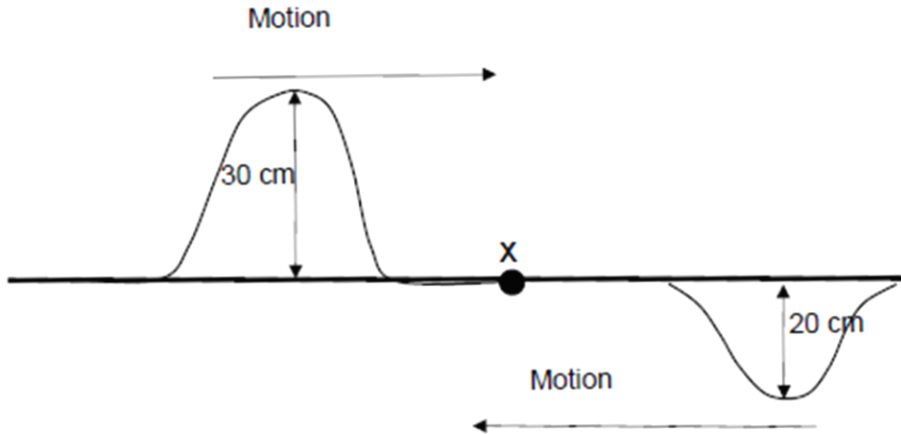
Answer SECTIONS A and B in the ANSWER BOOK.
4. Non-programmable calculators may be used.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Data sheets are attached for your use.
8. Give brief motivations, discussions, et cetera where required.
9. 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.

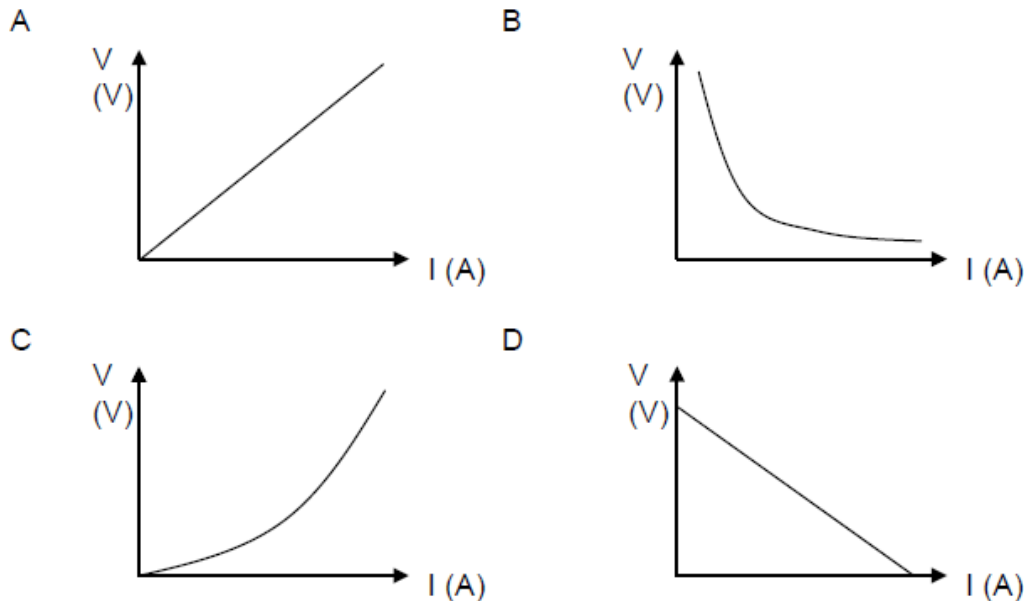
1.1 Consider the diagram of two pulses shown below.



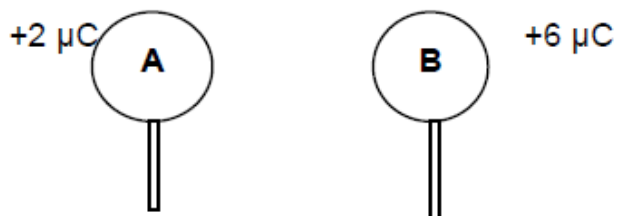
When the two pulses in the diagram meet at point X, the type of interference and the resultant amplitude of the disturbance will be ...

	TYPE OF INTERFERENCE	AMPLITUDE (cm)
A	Destructive	10
B	Destructive	50
C	Constructive	10
D	Constructive	50

1.2 Which ONE of the graphs below CORRECTLY represents the relationship between potential difference and current in a resistor?



- 1.3 Two identical spheres **A** and **B** placed on insulated stands, carry charges of $+2 \mu\text{C}$ and $+6 \mu\text{C}$, respectively as shown below.



When the spheres are brought into contact, in which direction do electrons move?

- A From **A** to **B**
- B From **B** to **A**
- C No movement as both spheres are positively charged
- D No movement, electrons remain in **A**

- 1.4 The table below shows the changes in the velocity of a car in intervals of 2 seconds.

Time (s)	0	2	4	6	8	10	12	14	16
Velocity ($\text{m}\cdot\text{s}^{-1}$)	0	5	10	15	20	20	20	20	20

Which ONE of the following is CORRECT about the acceleration of the car?

The acceleration of the car ...

- A increases initially for 8 s then remains constant.
- B is initially constant for 8 s then becomes zero.
- C is initially constant for 8 s and then decreases.
- D increases initially for 8 s and then becomes zero.

1.5 An object starts moving from a position of rest with a constant acceleration a . After covering a distance Δx , the velocity is v .

What will its velocity be after it has covered a distance of $2\Delta x$?

A $v/2$

B $\sqrt{2v}$


C $2v$

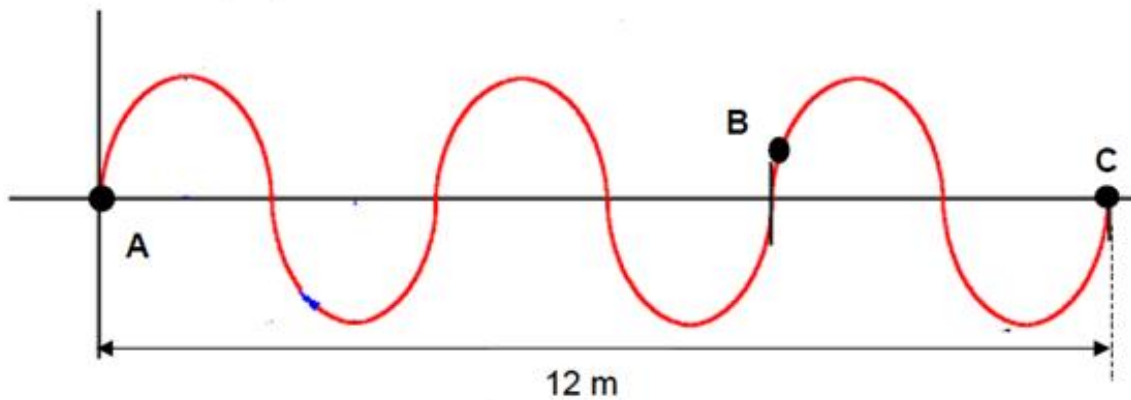
D $4v$

[2 X 5 = 10]

Question 2

The diagram below shows a wave pattern of a wave train with a frequency of 30 Hz.

This wave is moving
in this direction 



- 2.1 Define the term *pulse*. (2)
- 2.2 In which direction is the particle at point **B** about to move?
Write down UP or DOWN. (1)
- 2.3 Calculate the:
- 2.3.1 Time that lapsed while the wave moved from **A** to **C** (4)
- 2.3.2 Wavelength of the wave (2)
- 2.3.3 Speed of the wave (3)
- [12]

Question 3

Three types of electromagnetic radiations are given in the table below.

Radiation
X-rays
Ultraviolet
Infra-red

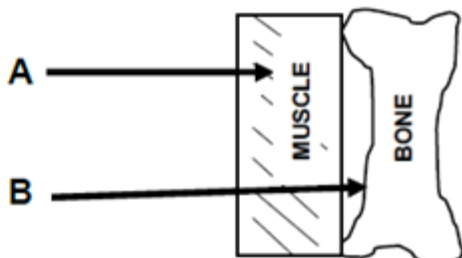
3.1 Write down the NAME of:

3.1.1 The radiation with the longest wavelength from the given list (1)

3.1.2 ONE source of ultraviolet light (1)

3.2 Calculate the energy of a photon of infra-red if its wavelength is $4 \times 10^{-5} \text{ m}$ (5)

3.3 Learners are investigating the penetrating ability of ultraviolet radiation and X-rays. They shine electromagnetic radiation (ultraviolet and X-rays) using identical bulbs onto a muscle tissue and a bone tissue as shown below.



Rays of radiation **B** penetrate through the muscle tissue but they are stopped by the bone tissue. Rays of radiation **A** do not reach the bone tissue.

3.3.1 Which radiation (**A** or **B**) represents X-rays?
Give a reason for your answer. (2)

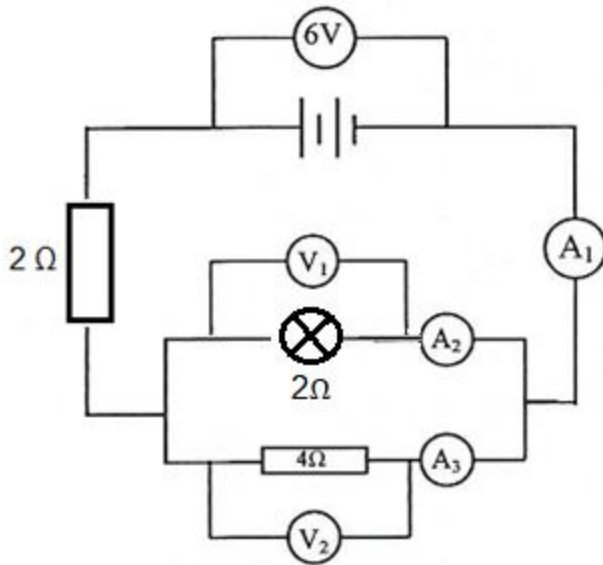
3.3.2 Write down the independent variable for the investigation. (1)

3.3.3 Give a reason why it is necessary to use identical bulbs for the investigation. (2)

[12]

Question 4

The questions given below relate to the following circuit diagram.

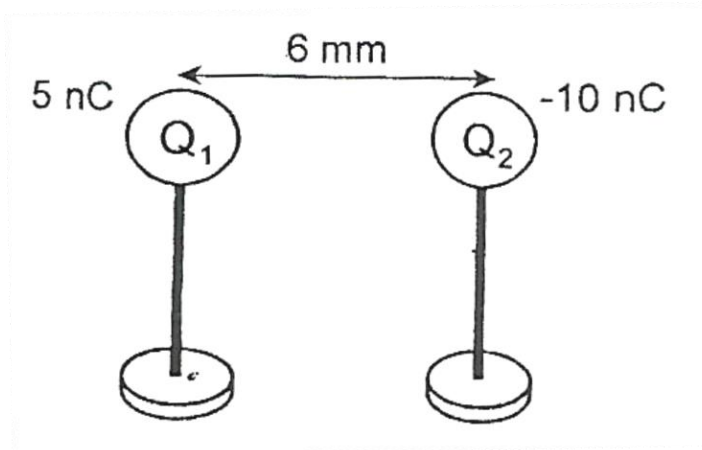


- 4.1 Calculate the reading on A_1 . (5)
- 4.2 Calculate the reading on V_1 . (3)
- 4.3 Calculate the current flowing through the 2Ω resistor in parallel. (3)
- 4.4 Determine the current flowing through A_3 . (3)
- 4.5 Calculate the charge that passes through the 4Ω resistor in 1 minute. (3)
- 4.6 The 2Ω bulb (in parallel) burns out. State (INCREASE, DECREASE or REMAIN THE SAME) how the following will be affected and explain why:
- 4.6.1 The total current in the current in the circuit. (3)
- 4.6.2 The p.d of the battery. (2)
- 4.7 State the reason that current does not travel through voltmeters. (1)

[23]

Question 5

The centres of two identical spheres are a distance of 6 mm apart. They carry charges of +5 nC and – 10 nC respectively as shown below.



- 5.1 State Coulombs Law in words. (2)
- 5.2 Calculate the magnitude of the electrostatic force between the two spheres. (4)

The spheres touch each other and are then moved back to their original positions.

- 5.3 Calculate the new charge on the spheres. (2)
- 5.4 Show by means of calculation that the number of electrons transferred during their contact is 4.7×10^{10} . (5)

[13]

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 10 s (3)

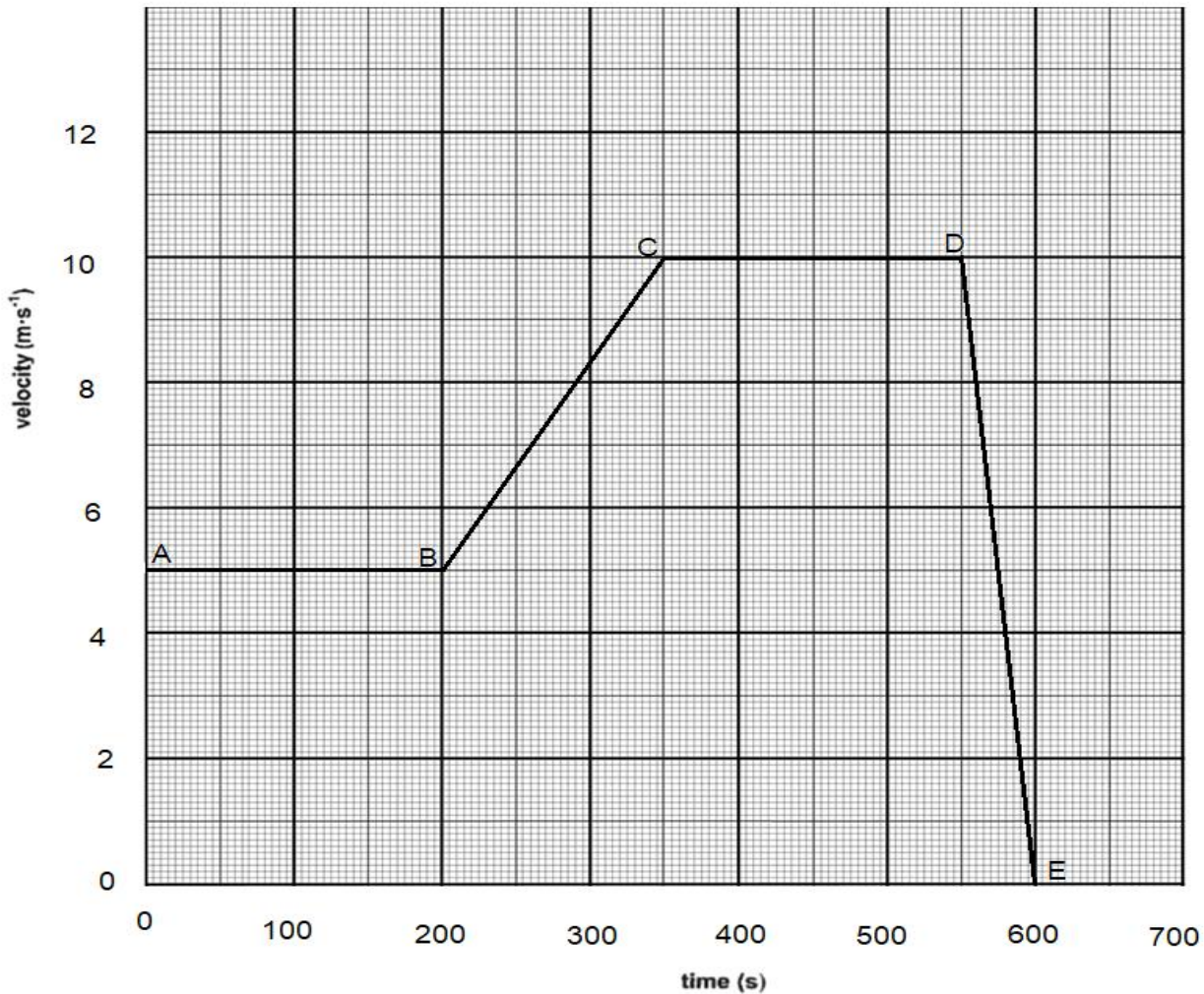
6.1.2 Distance covered during the first 10 s (3)

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 velocity time graph below represents the motion of a girl riding her bicycle in an easterly direction on a straight, level road.



7.1 Write down the:

7.1.1 Girl's initial velocity (2)

7.1.2 Magnitude of the girl's velocity at $t = 300$ s (2)

7.2 Use the information from the graph to describe the girl's motion:

7.2.1 From **B** to **C** (2)

7.2.2 From **C** to **D** (2)

7.3 Without using equations of motion, calculate EACH of the following:

7.3.1 Distance covered by the girl from **A** to **C** (4)

7.3.2 Acceleration of the girl from **D** to **E** (4)

7.4 Give a reason using information from the graph why it can be concluded that the acceleration of the girl is HIGHEST during the interval **D** to **E**. (2)

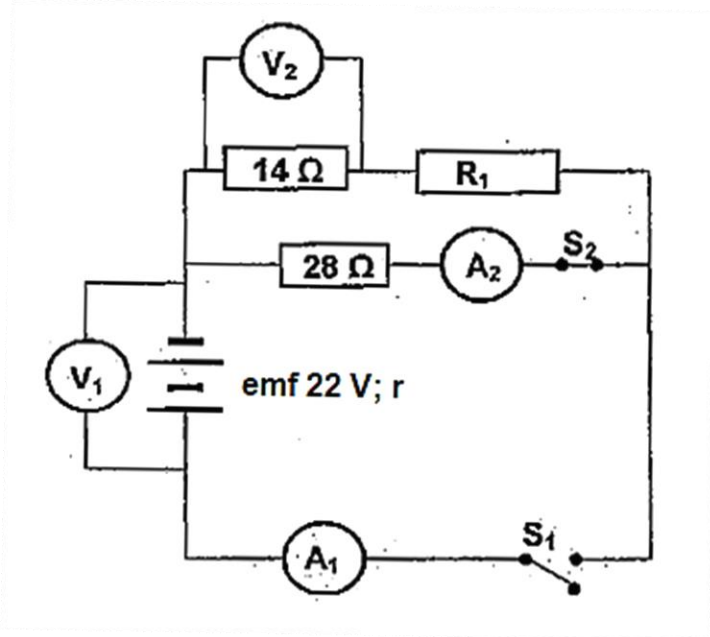
[18]

Total 100 marks

Extension question: Only complete this after you have finished the entire exam

Question 8

The circuit diagram below consists of a battery of emf 22 V, an internal resistance r and two resistors having a resistance of $14\ \Omega$ and $28\ \Omega$ as well as R_1 of unknown resistance.



8. With switch S_1 open and switch S_2 closed, what is the reading on:

8.1.1 Voltmeter V_1 (1)

8.1.2 Ammeter A_1 (1)

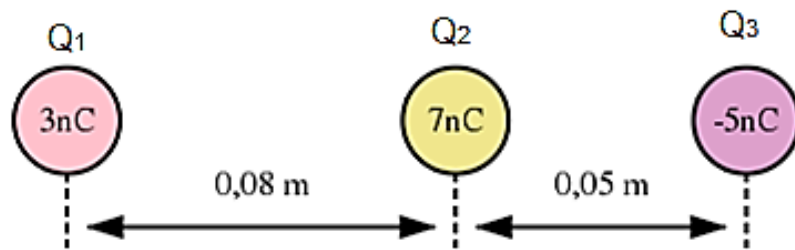
With both switch S_1 and switch S_2 closed, voltmeter V_1 has a reading of 21 V and V_2 has a reading of 7 V.

8.2 Calculate the internal resistance r of the battery. (7)

[9]

Extension: Question 9

Three point charges are in a straight line.



What is the net electrostatic force on Q_2 from the other two charges?

**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

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

FORMULAE ELECTRICITY AND MAGNETISM

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$	$R = \frac{V}{I}$	
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$R_s = R_1 + R_2 + \dots$		$F = \frac{k Q_1 Q_2}{r^2}$
$P = \frac{W}{t}$			$n = \frac{Q}{e}$