HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE EXAM

GRADE 10 P1 **NOV 2020**
TIME: 2 HRS **TOTAL : 140**

INSTRUCTIONS

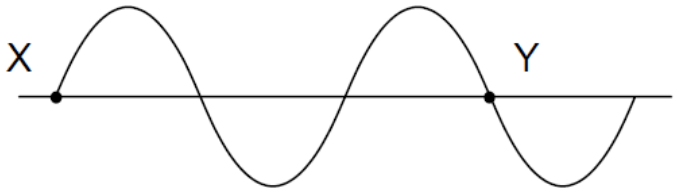
1. Write your name, surname and class teacher's name on your booklet.
2. This question paper consists of 13 pages and 2 SECTIONS:
   SECTION A (20) SECTION B (120)
3. Answer all the questions from SECTIONS A and B in the ANSWER BOOK provided.
4. Non-programmable calculators may be used.
5. Number the answers correctly according to the numbering system used in this question paper
6. Show all working and substitutions.
7. Leave a line between each answer to each question.
8. Give brief motivations, discussions, et cetera where required.
9. Calculations must be rounded off to two decimal places where appropriate.
10. Rule off after each question 1 – 9.
11. A data sheet is attached for your use.

SECTION A : MULTIPLE CHOICE (2 X 10 = 20)

QUESTION 1

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 Direction of energy transfer →



A transverse wave is shown in the diagram. X and Y are points on the wave. Which statement regarding points X and Y is incorrect?

A X and Y are in phase

B Y has the same amplitude as X

C X and Y are 1,5 λ apart

D Y is about to move up

1.2 In a wave motion, two complete wave cycles are made in 2x seconds. The period and the frequency of this wave are

	Period(s)	Frequency (Hz)
A	x	$2x$
B	x	$\frac{1}{x}$
C	x	$\frac{1}{2x}$
D	$2x$	$\frac{1}{2x}$

1.3 A charged sphere has an excess of 25 electrons. The charge on the sphere is

A 25 C

B - 1,6 x 10 -19 C

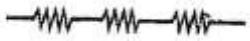
C 2,25 x 10^{-7} C

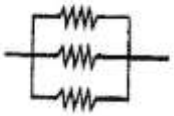
D - 4 x 10^{-18} C

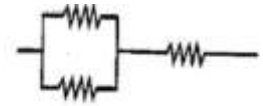
1.4 The dimensions of four Ohmic conductors are given below.
Which conductor will have the greatest resistance?

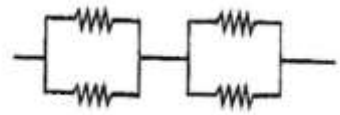
A	length : 2m	diameter : 0,5 mm
B	length : 1m	diameter : 0,5 mm
C	length : 1m	diameter : 0,3 mm
D	length : 2m	diameter : 0,3 mm

1.5 Which ONE of the following connections of identical resistors will give the LEAST resistance?

A 

B 

C 

D 

1.6 The unit of measurement of ***the rate at which energy is converted*** in an appliance is…

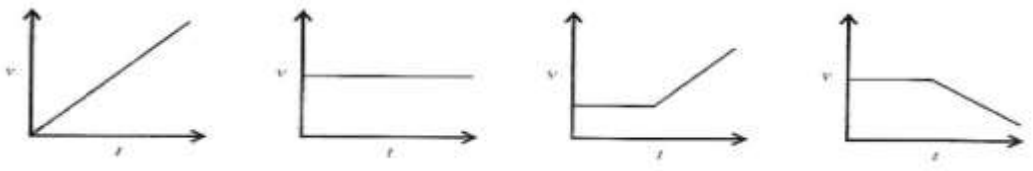
A Joule

B Volt

C Watt

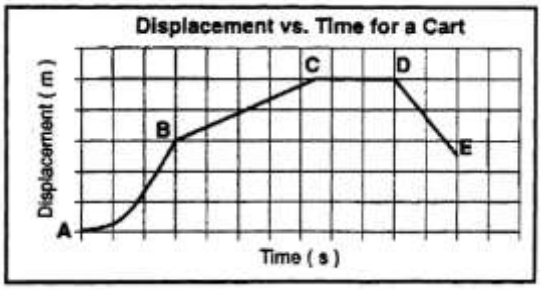
D Coulomb

1.7 A car is travelling at a constant velocity along a straight road. It then ascends a steep hill, slowing down uniformly. Which ONE of the following velocity vs time graphs best represents the motion of the car.



A B C D

1.8 The graph below shows the Δx vs Δt motion for a cart.



The cart is accelerating between points

A AB

B BC

C CD

D DE

1.9 In the equation $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$, the part $\frac{1}{2} a \Delta t^2$ represents the

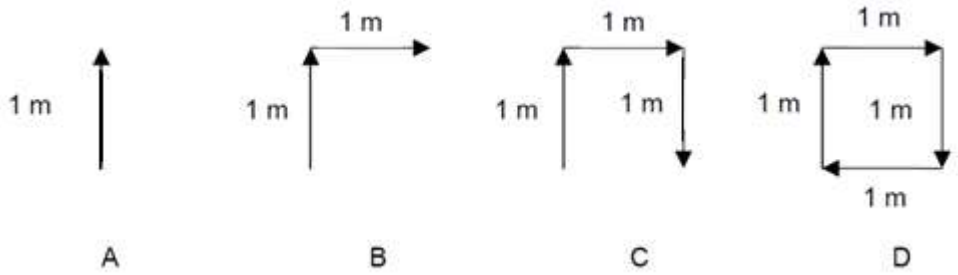
A time

B velocity

C displacement

D acceleration

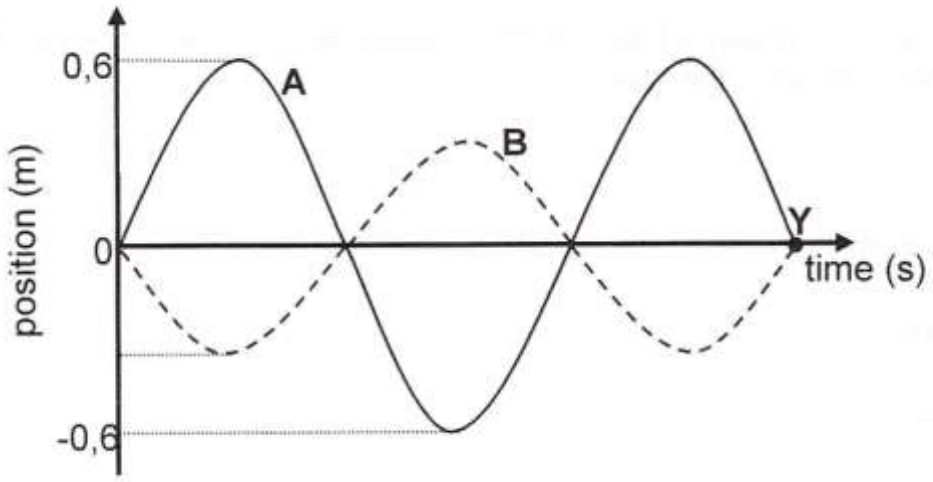
1.10 Which diagram shows the greatest resultant displacement?



SECTION B

QUESTION 2 (19)

The graph below (not drawn to scale) shows **TWO** waves A and B crossing each other but moving in the same direction.



Note : A and B have the same wavelength but different amplitudes.

2.1 Define the term 'wavelength'. (2)

2.2 Are wave A and wave B examples of t**ransverse** or **longitudinal** waves? Explain your answer. (3)

2.3 The amplitude of wave B is half the amplitude of wave A. Calculate the amplitude of wave B. (2)

2.4 Wave A travels a distance of 0,5 m from point 0 to point Y in 0,025 s. Calculate

2.4.1 the speed of wave A. (3)

2.4.2 the frequency of wave B. (2)

2.5 The two waves A and B meet and 'superposition ' occurs.

2.5.1 State the 'Principle of Superposition' of waves. (2)

2.5.2 Draw a diagram of the resultant wave that forms when wave A and wave B meet.
(N.B Label the axes clearly and show the resultant amplitude on the diagram.) (4)

2.5.3 What type of interference has occurred in 2.5.2? (1)

QUESTION 3 (16)

3.1 The following table shows some properties and uses of certain parts of the electromagnetic waves (EM) from the spectrum.

Complete the table by providing only the missing information for **3.1.1 – 3.1.6.** (Do **NOT** copy out the table.) (5)

EM SOURCE/ APPLICATION	TYPE OF EM	PROPERTY	USE
	3.1.1.	can be observed by the human eye	to enable us to see the world around us.
	3.1.2	have the longest wavelength	3.1.3
	x-rays	3.1.4	3.1.5

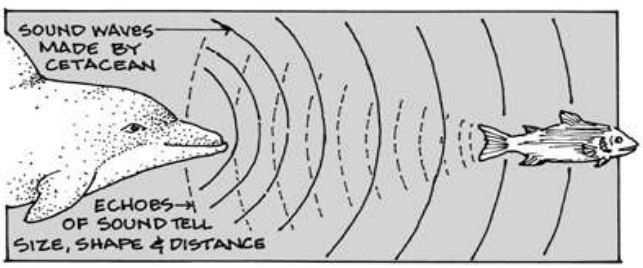
3.2 A beam of ultra-violet light from the sun has a wavelength of $4{,}6 \times 10^{-7}$ m.

Calculate

3.2.1 the frequency of ultra-violet light. (3)

3.2.2 the energy of a single photon of this ultra-violet light. (3)

3.3 Many animals make use of reflecting sound waves to hunt.



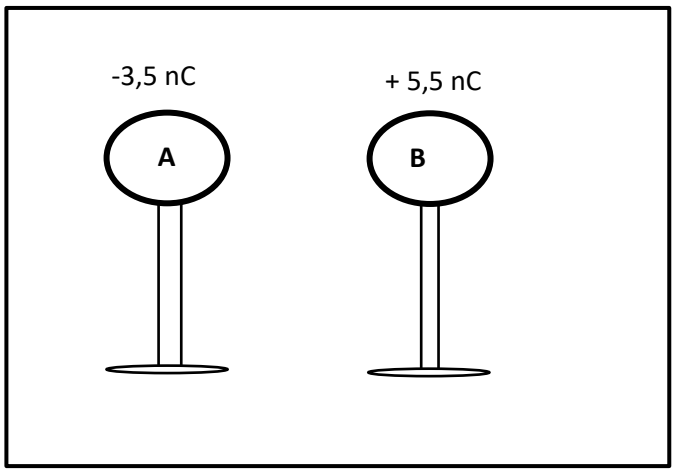
Cetaceans (dolphins) are one such example.

3.3.1 Name one other animal that makes use of ultrasound to communicate? (1)

3.3.2 If the dolphin emits a signal that returns from the fish 0,05 s later, calculate the distance between the dolphin and the fish. (speed of sound in water is 1500 $m.s^{-1}$) (4)

QUESTION 4 (15)

Two identical metal spheres **A** and **B** are placed on insulated stands. Spheres **A** and **B** carry charges of -3,5 nC and +5,5 nC respectively.

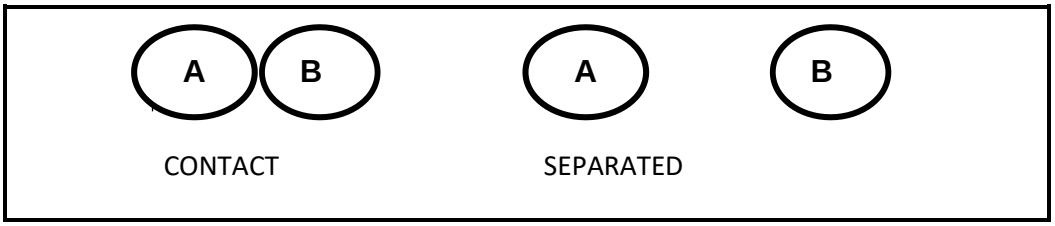


4.1 Which sphere (**A** or **B**) has FEWER electrons? (1)

4.2 Calculate the distance between the spheres if the force of attraction between them is $1,7 \times 10^{-5}$ N (4)

4.3 Name the Law that you used to calculate your answer in 4.2 above. (1)

The spheres are brought into contact and then separated as shown below.



4.4 Which sphere loses electrons when the two spheres come into contact? (1)

4.5 Calculate

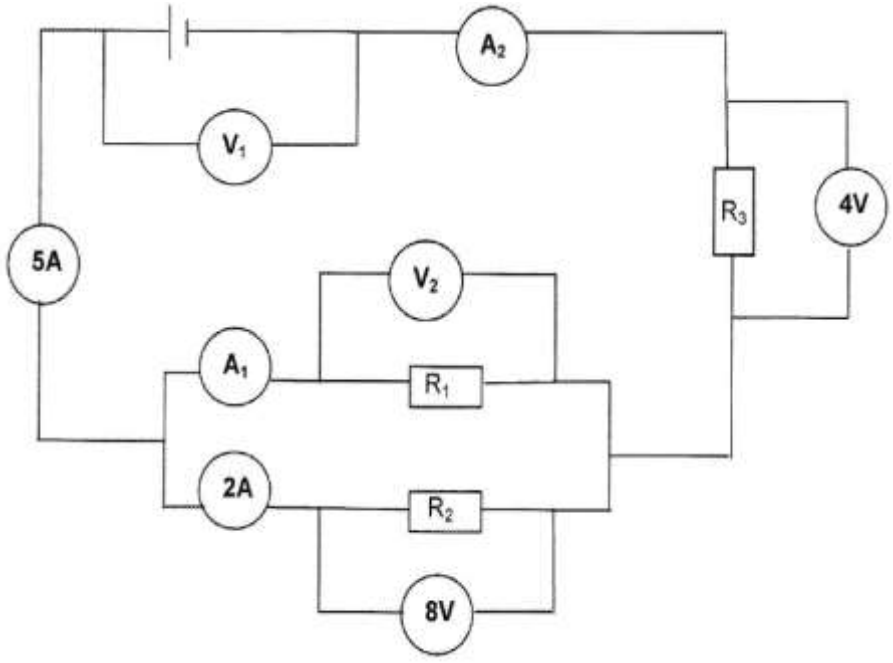
4.5.1 The new charge on each sphere (3)

4.5.2 The number of electrons transferred from one sphere to the other when they come into contact. (5)

QUESTION 5 (18)

A circuit is set up as shown in the diagram below.
(Note : the internal resistance of the battery and other components is negligible.)

Consider the values shown on the voltmeters and ammeters.



5.1 Determine the readings on the following meters:

5.1.1 V_1 (1)

5.1.2 V_2 (1)

5.1.3 A_1 (1)

5.1.4 A_2 (1)

5.2 Which resistor, R_1 or R_2 has the highest resistance?
Give a reason for your answer. (2)

5.3 Calculate :

5.3.1 the amount of charge that passes through R_3 in a time of three minutes (3)

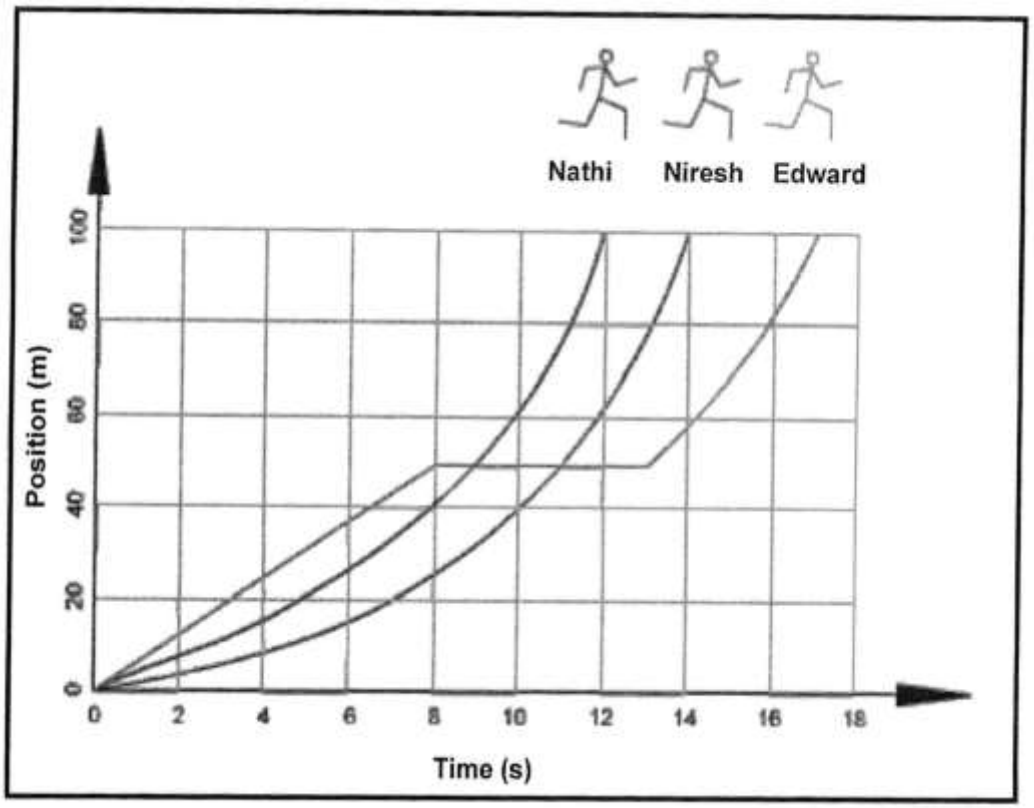
5.3.2 the work done by the quantity of charge that passes through R_3 in three minutes (3)

5.3.3 the resistance of R_2 (3)

5.3.4 the resistance of R_1 (3)

QUESTION 6 (11)

The graph shows three boys, Nathi, Niresh and Edward running the 100m sprint on Sport's Day .



6.1 Which runner won the race? Explain your answer. (3)

6.2 Which runner stopped to rest? Explain your answer. (2)

6.3 Describe Edward's velocity for the first 8 seconds. (1)

6.4 Calculate

6.4.1 Niresh's average speed for the race. (3)

6.4.2 Edward's instantaneous speed at the 6 second mark. (2)

QUESTION 7 (7)

A cyclist taking part in a cycling competition slows uniformly as he reaches the end of the race. He eventually comes to rest from a speed of 40 $m.s^{-1}$ in 10 seconds.

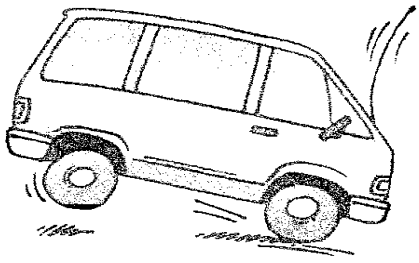
Calculate:

7.1 The acceleration of the cyclist. (3)

7.2 How far the cyclist moved from when he started applying the brakes. (4)

QUESTION 8 (12)

A taxi was traveling along at a constant velocity of 72 $km{\cdot}h^{-1}$.
Suddenly, a child crosses the road 100m in front of the taxi. The taxi driver slams on the brakes and comes to a stop in 8,0 s.



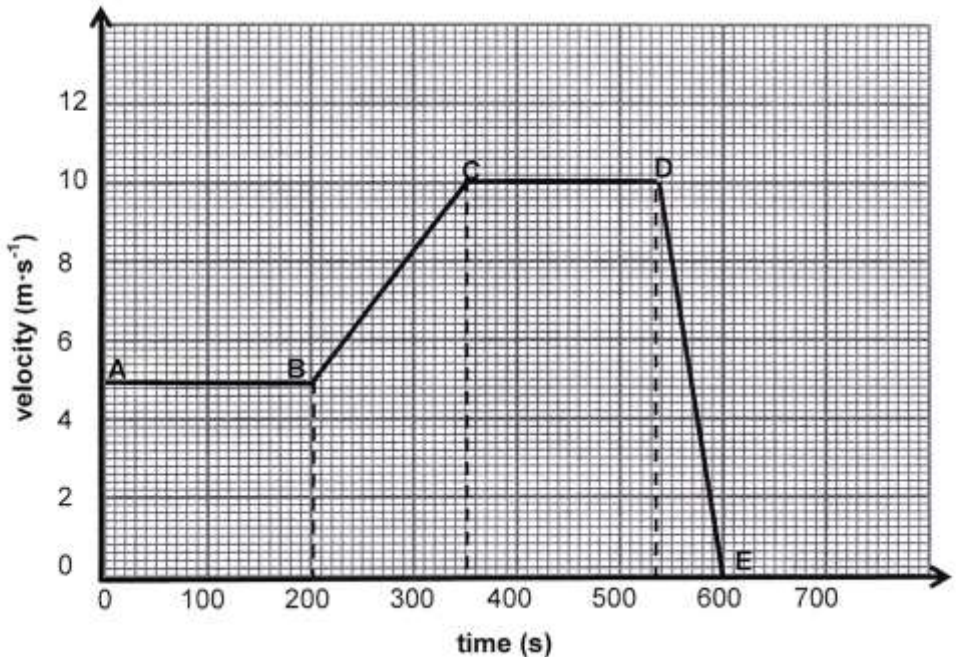
8.1. Convert 72 $km{\cdot}h^{-1}$ to $m{\cdot}s^{-1}$. (2)

8.2. Calculate the acceleration of the taxi while the driver brakes. (4)

8.3. Determine, using relevant calculations, whether the taxi stops before hitting the child. (6)

QUESTION 9 (21)

The following velocity-time graph represents the motion of a man riding his bicycle initially in a northerly direction**.**



9.1 Is velocity a vector or a scalar quantity?
Explain your answer. (3)

9.2 Write down

9.2.1 the man's initial velocity (2)

9.2.2 magnitude of the instantaneous velocity at 300 s. (1)

9.3 Use the information on the graph to describe in detail, the motion of the man

9.3.1 from B to C (3)

9.3.2 from C to D (3)

9.4 Using only the graph and not the equations of motion, calculate the following:

9.4.1 the distance covered by the man from A to C (3)

9.4.2 the acceleration of the man from D to E (4)

9.5 During which stage of the journey is the man's change in speed the greatest?
Explain your answer. (2)

TOTAL (140)

DATA FOR PHYSICAL SCIENCES GRADE 10

PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Speed of light in a vacuum	c	$3,0 \times 10^{8}$ m·s^{-1}
Speed of sound in air	$v_{(air)}$	340 m.s^{-1}
Speed of sound in water	$v_{(water)}$	1500 m.s^{-1}
Planck's constant	h	$6,63 \times 10^{-34}$ J.s
Charge on electron	e^-	-1.6×10^{-19} C
Coulomb's constant	k	9×10^{-9} N. m^2 C^{-2}

FORMULAE MOTION

$v_f = v_i + a\Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$	$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

FORMULAE WAVES, LIGHT AND SOUND

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

FORMULAE ELECTRICITY AND MAGNETISM

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$	$R = \frac{V}{I}$	$Q = \frac{Q_1 + Q_2}{2}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$R_s = R_1 + R_2 + \ldots$	$n = \frac{Q}{e}$	$F = \frac{k\,Q1\,Q2}{r^2}$
$P = \frac{W}{t}$			