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Answer all the questions in this paper mathematical tables to be used

Take: *Density of mercury = 1.36 x 10^4*
Speed sound = 340ms^1
Speed of light = 3.0 x 10^8 ms^{-1}
g = 10ms^{-2}

1. Figure 1 shows a measuring cylinder, which contains water initially at level A. A solid of mass 11 g is immersed in the water, the level rises to

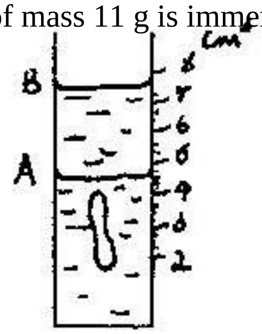

Fig.1

Determine the density of the solid. (Give your answer to 1 decimal place)

1. Figure 2 shows a rigid body acted upon by a set of forces. The magnitudes of the forces are as follow
F_1 = 3N_1, F_2 = 6N, F_3 = 3N, F_4 = 4 N_1, F_5 = 3N and F_6 = 3 N

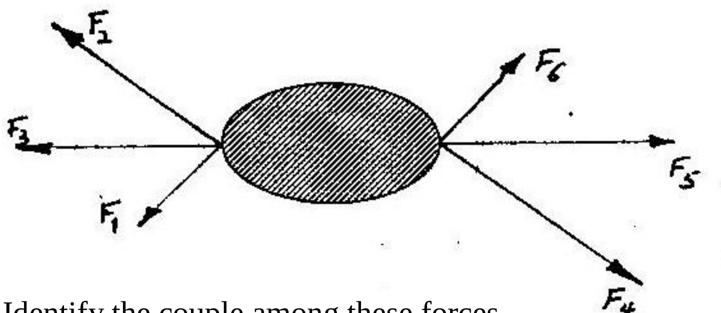

Fig. 2

Identify the couple among these forces

2. Give a reason why the weight of the body varies from place to place

3. A butcher has a beam balance and masses 0.5 kg and 2kg. How would he measure 1.5 kg of meat on the balance at once?

4. The height of the mercury column in a barometer at a place is 64cm. What would be the height of a column of paraffin in barometer at the same place? (Density of paraffin = 8.0 x 10^2 kgm^{-3})

5. The number of molecules in 18cm^3 of a liquid is 6 x 10^{23}. Assuming that the diameter of the molecules is equivalent to the side of a cube having the same volume as the molecule. Determine the diameter of the molecule.

6. Explain why a glass container with thick walls is more likely to crack than one with a thin wall when a very hot liquid is poured into them.

7. State the reason why water spilled on a glass surface wets the surface

8. Figure 3 shows two aluminium containers, A and B placed on a wooded table. A and B have equal volumes of hot water initially at the same temperature.

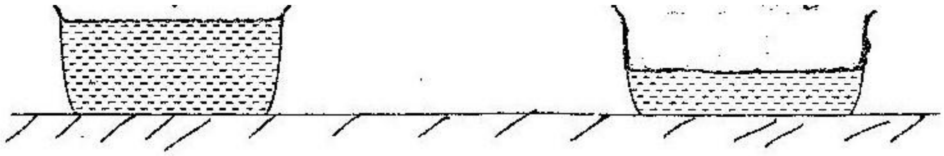

Fig. 3

9. Figure 4 shows two point objects A, and B, placed in front of a mirror M

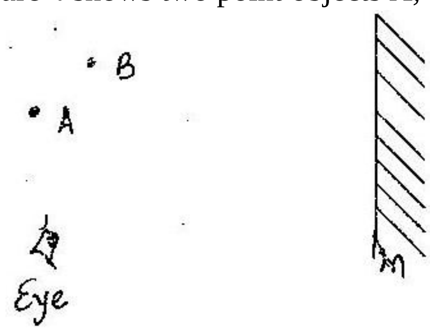

Fig. 4

Sketch a ray diagram to show the positions of their images as seen by the eye.

10. Figure 5 shows two charged identical conduction spheres on insulting stands. Each cross represents a charge. The spheres are briefly brought into contact and then separated.

Fig. 5

Sketch in the space provided the diagrams of the spheres showing charge distribution after separation

11. Name a device used to convert light energy directly into electrical energy

12. Figure 6 shows a beam AB supported at points A and B. A large F is applied on the beam as shown. Mark on the diagram, the position X, where a notch is likely to appear.

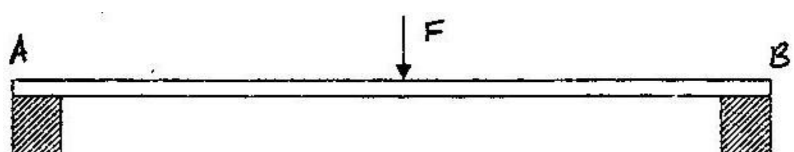

Fig. 6

13. Distinguish between soft and hard magnetic materials

14. A current of 0.5A flows in a circuit. Determine the quantity of charge that crosses a point in 4 minutes.

15. Figure 7 shows an incomplete circuit of an electromagnet. Complete the circuit between X and Y drawing the windings on the two arms of the core such that A and B are both North poles when switch S is closed. Indicate the direction of the current on the windings drawn.

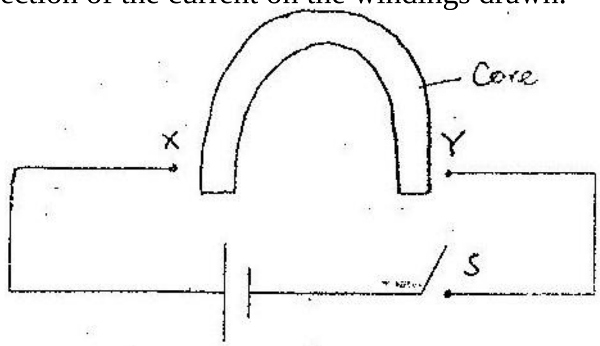

Fig. 7

16. An observer watching a fireworks displays sees the light from an explosion and hears the sound 2 seconds later. How far was the explosion from the observer?

17. Water flows in a horizontal smooth pipe. State the changes that would be observed in the nature of the flow if the speed of the water is steadily increased from low to a high value

18. A transformer in a welding machine supplies 6 volts from a 240V main supply. If the current used in the welding is 30A. Determine the current in at the mains.

19. An object dropped from a height h attains a velocity of 6 ms^{-1} just before hitting the ground. Find the value of h.

20. Calculate the wavelength of the KBC FM radio wave transmitted at a frequency of 95.6 Mega Hertz.

Using the information in figure 8 answer questions 22 and 23.

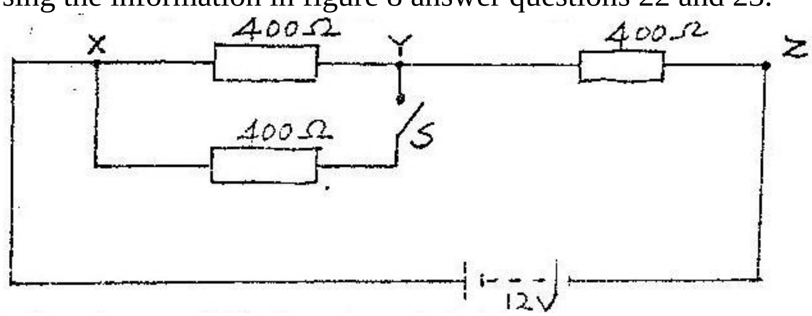

Fig. 8

21. What is the p.d across YZ when the switch S is open?

22. Determine the p.d across YZ when the switch S is closed

23. How many 1000W electric irons could be safely connected to a 240V main circuit fitted with 13A fuse?

24. Ice changes to water at 0^0C. Equal masses of the ice and water at 0^0C are each heated to 1^0C. Give a reason why more heat energy is required to heat ice.

25. Figure 9 shows two parallel rays incident on a concave mirror. F is the focal point of the mirror.

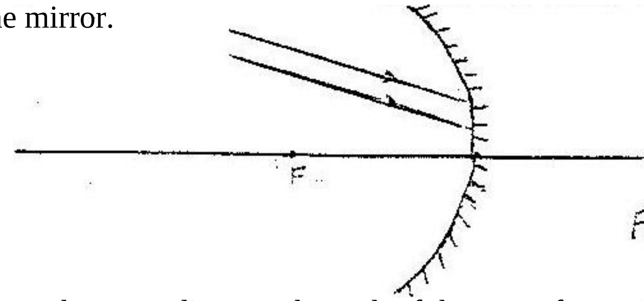

Fig. 9

Sketch on the same diagram the path of the rays after striking the mirror

26. Figure 10 shows the apparent position of a fly in air as seen by a fish in water

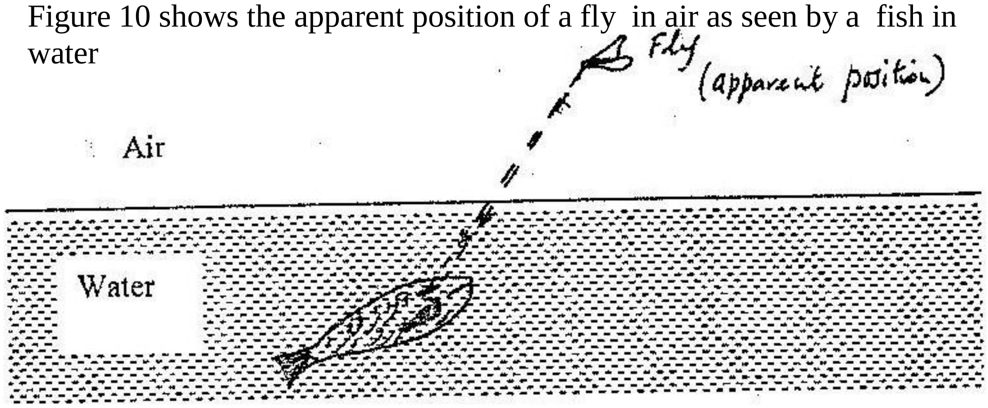

Fig. 10

Sketch on the same diagram rays to show the actual position of the fly

27. A trolley is moving at constant speed in a friction compensated track. Some plasticine is dropped on the trolley and sticks on it. State with a reason what is observed about the motion of the trolley.

28. Figure 11 shows part of a circuit containing three capacitors

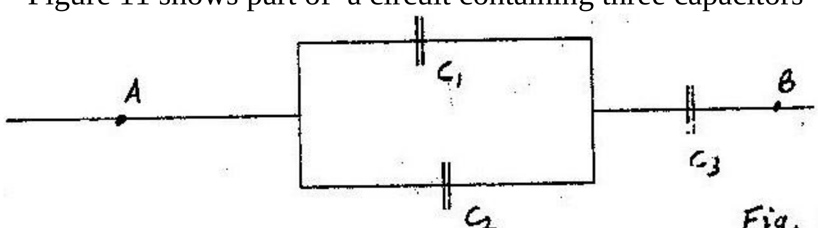

Fig. 11

Write an expression for C_T the effective capacitance between A and B.

29. What is the value of -20^0C on the absolute temperature scale?

30. Figure 12 shows an experiment arrangement. S_1 S_2 and S are narrow slit

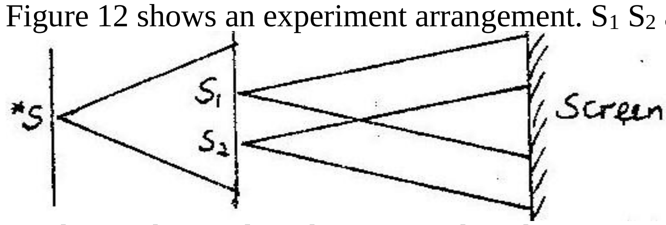

Fig. 12

State what is observed on the screen when the source is?

(a) Monochromatic (b) White light

31. Two turning forks are sounded together. What is the condition for the beats to be heard?

32. Using the components symbols shown in figure 14, sketch a series circuit diagram for a forward biased diode.

Fig. 13

33. State how eddy currents are reduced in a transformer

34. A lithium atom has 3 protons in its nucleus. Complete the diagram in figure 14 by marking X in the appropriate shells show the electron distribution when the atom is not excited

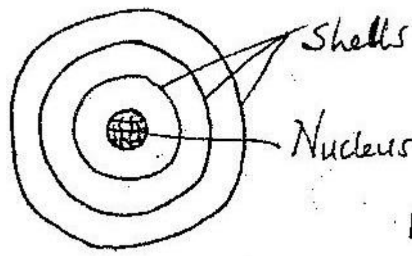

Fig. 14

In a sample there are 5.12 x 1020 atoms of krypton – 92 initially. If the half of krypton; 92 is 3.0s determine the number of atoms that will have decayed after 6s.

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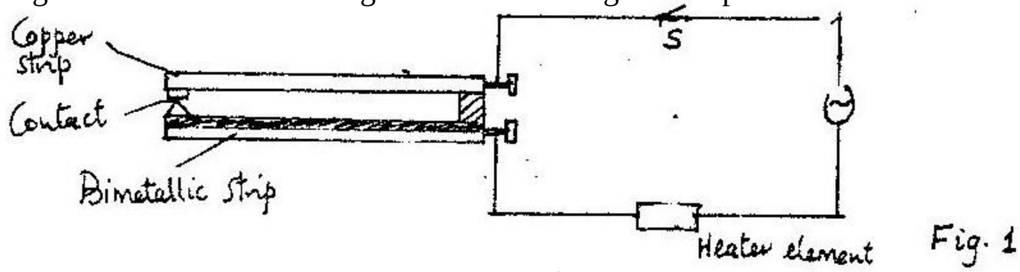
Answer all the questions in section I and any one in section II

Take: *specific heat capacity of water = 4200$Jkg^{-1}K^{-1}$*
Latent heat of melting ice = 334,000$Jkg^{-1}K^{1}$
Planck's constant h = 3.34 x 10^{-34} JS
Speed of light, c = 3.0 x $10^{8}ms^{-1}$

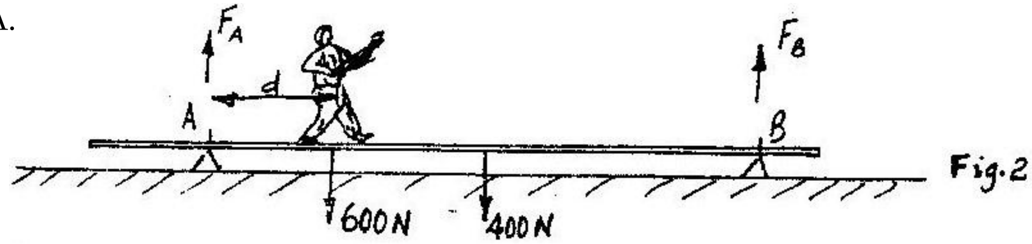
1. Figure 1 shows a circuit diagram for controlling the temperature of a room.



(i) State and explain the purpose of the Bimetallic strip
(ii) Describe how the circuit controls the temperature when the switch is closed

(b) A drinking glass 0.02 kg contains 200gms of water at 20^{0}C. A mass of 0.04 kg of ice at 0^{0} C is dropped into the glass. Determine the final temperature of the mixture. Specific heat capacity of glass = 670$kg^{-1}K^{-1}$. (Give your answer to correct one decimal place)

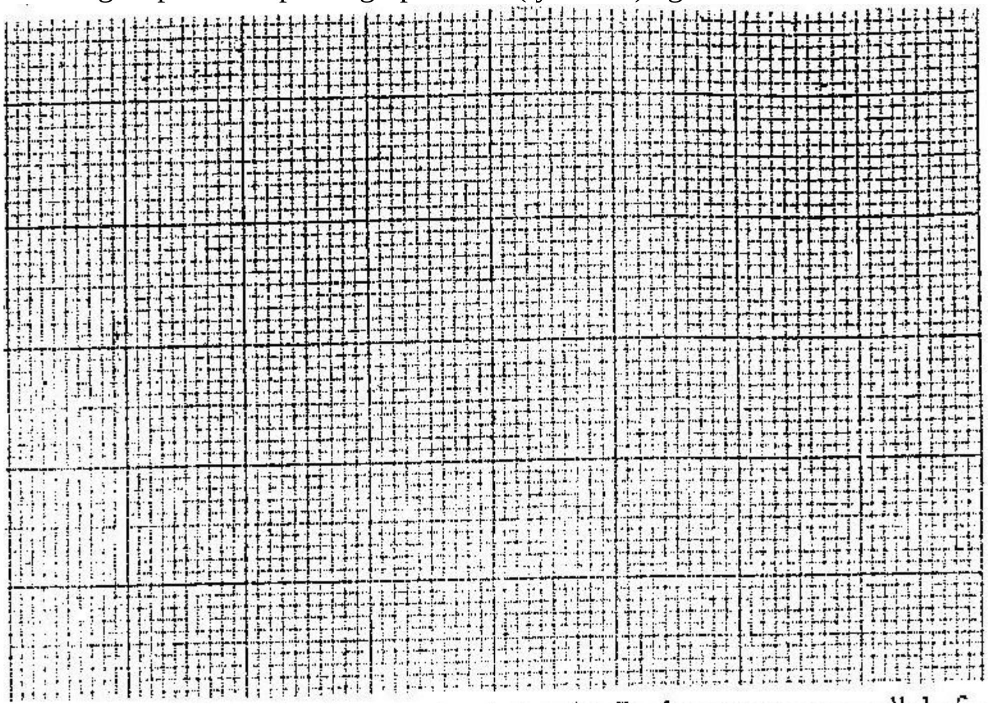
2. (a) Figure 2 shows a uniform plank 20 m long, weighing 400N resting on two supports A and B 9cm apart. A person weighing 600N walks towards B starting at A.



The data in the table below represents the upward force F_A exerted at A as a function of distance, d. The distance d is measured from A.

D (m)	0	2	4	6	8	10
F_A(N)	800	650	500	350	200	50

(i) On the grid provided plot a graph of F_A (y – axis) against the distance d.



(ii) From the graph determine how far beyond point B, the person can walk before the plank tips

(b) In the set up in the figure 3, the metre rule is in equilibrium

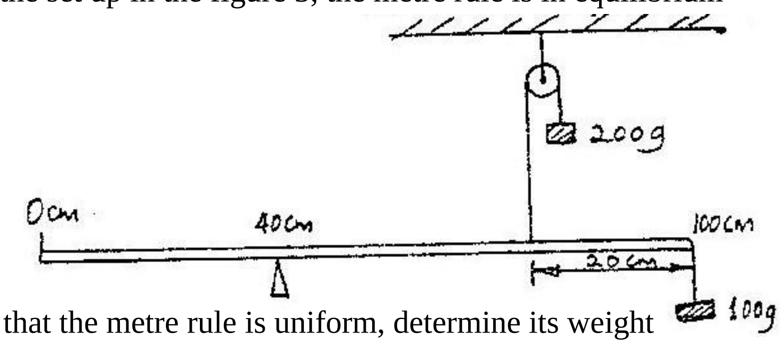
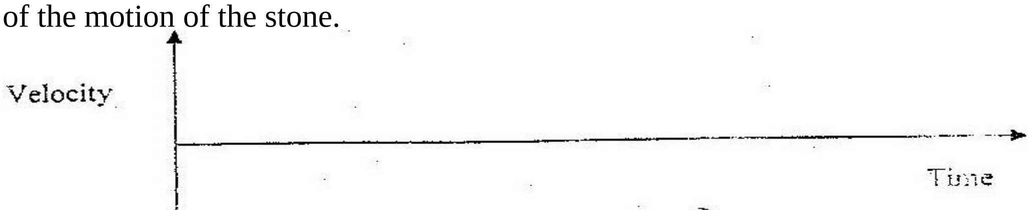


Fig. 3

Given that the metre rule is uniform, determine its weight

3. (a) A stone is thrown vertically upwards from the edges of a platform. Eventually the stone lands without bouncing on the ground below the platform. Taking the upward velocity to be positive sketch on the axis provided the velocity time graph of the motion of the stone.

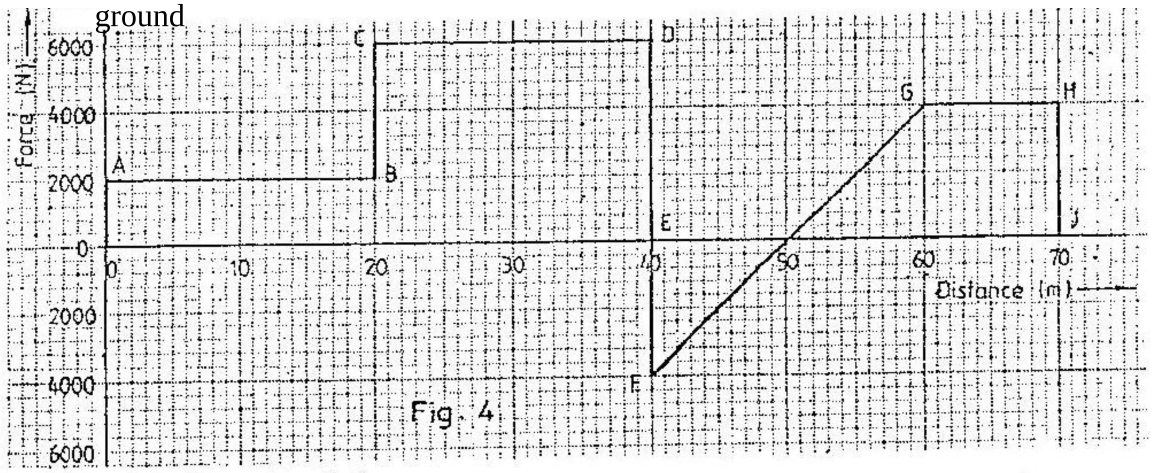


(b) A car can be brought to rest from a speed of 20 ms^{-1} in a time of 2s

(i) Calculate the average deceleration

(ii) If the driver's reaction time is 0.2s, determine the shortest stopping distance

4. Figure 4 shows a force- distance graph for a car being towed on a horizontal ground



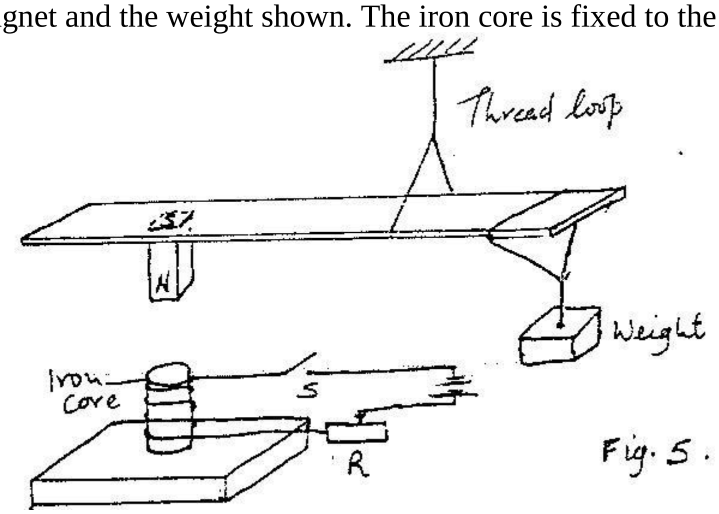
(a) Calculate the total work done

(b) If the velocity just before reaching point D is $0.6ms^{-1}$, calculate the power developed by the agent providing the force at this point.

(c) An electric pump can raise water from a low level reservoir to the higher – level reservoir at the rate of 3.0×10^5 kg per hour. The vertical height of the water raised 360m. If the rate of energy loss in form of heat is 200KW, determine the efficiency of the pump

5. (a) State two factors that affect the strength of an electromagnet.

(b) In the set up in figure 5, the suspended metre rule is in equilibrium balanced by the magnet and the weight shown. The iron core is fixed to the bench.



(i) State and explain the effect on metre rule when the switch S is closed

(ii) What would be the effect of reversing the battery terminals

(iii) Suggest how the set up in figure 5 can be adapted to measure the current flowing in the current circuit.

(c) Electrons emitted from a metal when light of a certain frequency is shone on the metal are found to have a maximum energy of 8.0×10^{-19}J. If the work function of the metal is 3.2×10^{-19}J, determine the wavelength of the light used.

SECTION II

6. (a) (i) Distinguish between semiconductor and conductors

Semiconductors	Conductors

(ii) Give one example of a semiconductor and one for a conductor

Semiconductors	Conductors

(b) An **npn** transistor is operating in the common emitter mode

(i) Draw the circuit diagram and indicate the direction of the currents

(ii) Given that the emitter current is 2.0 m A and that 0.5% of the electrons diffusing into the base combine there with holes, determine the values of the base current and the collector current

(ii) By increasing the p.d across the emitter – base junction in (ii), the emitter current increase to 4mA. Determine the transistor current amplification

7. a) i. Distinguish between transverse and longitudinal waves

ii. Give one example of a transverse and one example of longitudinal.

b) Figure 6 shows the displacement of a particle in a progressive wave incident on a boundary between deep and shallow regions.

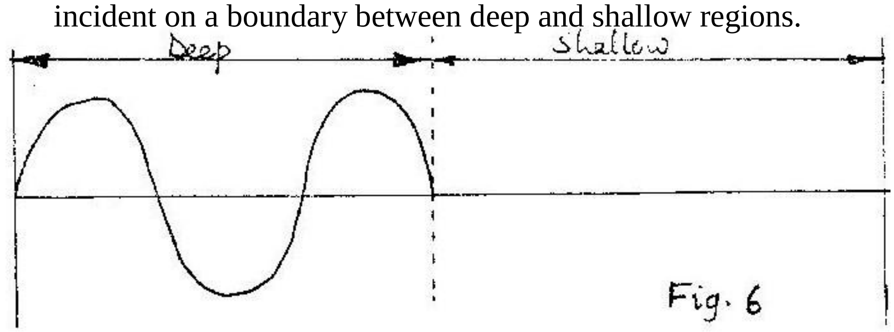


Fig. 6

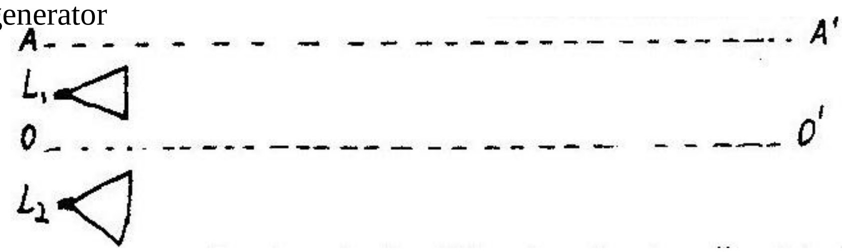
i. Complete the diagram to show what is observed after boundary. (assume no loss of energy)

ii. Explain the observation in (i) above.

(c) Water waves are observed as they pass a fixed point at a rate of 30 crests per minute. A particular wave crest takes 2s to travel between two fixed points 6m apart. Determine for the wave:

(a) The frequency (1mk) (b) Wavelength (3mks)

(d) Figure 7 shows two loud speakers L_1 and L_2 connected to a signal generator



One observer walks along line 00' and another line AA' for some distance. Describe the observations made by each observer and give reasons for your answer.