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Acceleration due to gravity, g, = 10 ms^2

1. Figure 1 shows a fencing post whose length is being measured using a strip of a measuring tape.

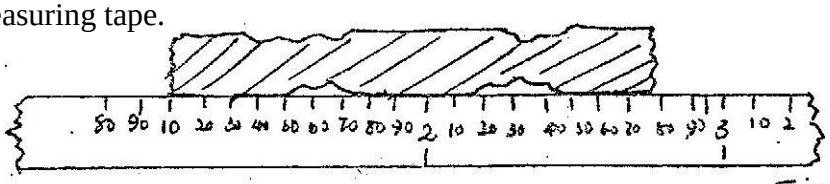


Fig. 1

Use this information to answer questions 1 and 2.

1. State the accuracy of the tape:
2. What is the length of the post?
3. A heating coil rated 1000 W takes 15 minutes to heat 20kg of a liquid from 26^{o}C of 42^{o}C. Determine the specific heat capacity of the liquid.
4. State one industrial use of X – rays
5. A metal pin was observed to float on the surface of pure water. However the pin sank when a few drops of soap solution were carefully added to the water. Explain his observation.
6. Figure 2 draw to scale shows a lens L1 placed 30cm fro an object O. The image is formed on the screen S 50cm from the lens.

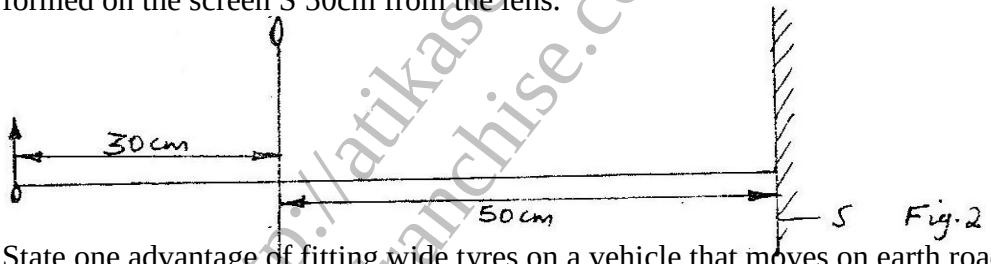


Fig. 2

7. State one advantage of fitting wide tyres on a vehicle that moves on earth roads.
8. The primary coils of a transformer has 2000 turns and carries a current of 3A. If the secondary coil is designed to carry a current of 30A, calculate the maximum number of turns in the secondary coil.
9. Water of mass 3kg at a temperature of 90^{o}C is allowed to cool for 10 minutes. State tow factors other than humidity, that determine the final temperature.
10. A car battery requires topping up with distilled water occasionally. Explain why this is necessary and why distilled water is used.
11. The internal resistance of the cell, E in figure 3 is 0.5 ohms.
    Determine the ammeter reading when the switch S is closed.

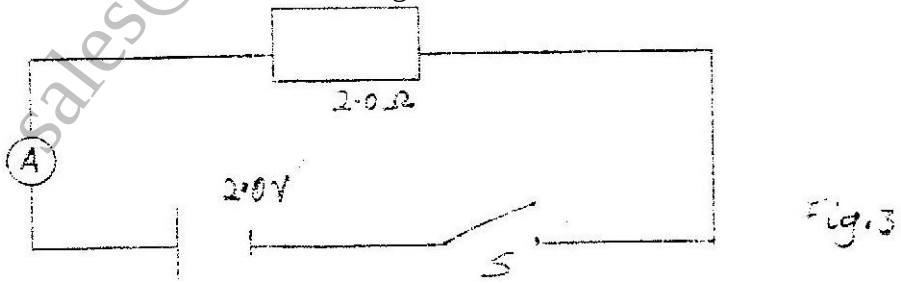


Fig. 3

12. The activity of a radioactive substance, initially at 400 counts per second reduces to 50 counts per second in 72 minutes. Determine the half – life of the substance.
13. State the reason why a voltmeter of high resistance is more accurate in measuring potential differences, that one of low resistance.
14. Explain how hammering demagnetizes a magnet
15. A highly negatively charged rod is gradually brought close to the cap of a positively charged electroscope. It is observed that the leaf collapses initially and then diverges. Explain the observation.
16. In figure 4 one end of a metal rod is placed in steam and the other end in melting ice. The length of the rod in between in lagged.

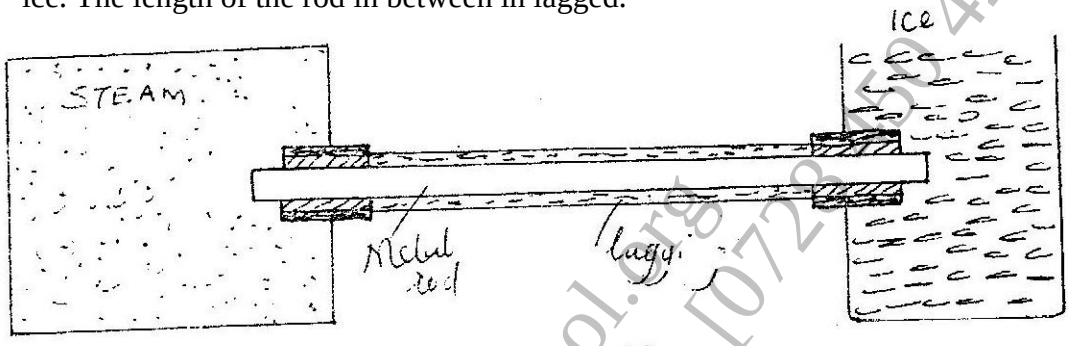
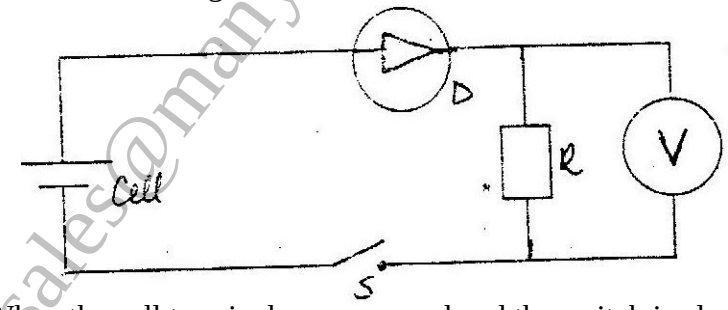


Fig. 4

State two factors that determine the rate at which ice melts.
17. Calculate the length of a wire required to make a resistor of 0.5 ohms, if the receptivity of the material is 4.9 x 10-7 Ω m and the cross sectional area is 2.0 x 10^{-6-2}
18. State the reason why the amplitude of a simple pendulum decreases with time.
19. State two differences between the cathode ray tube (CRT) of a TV and the cathode ray oscilloscope (CRO)
20. Table 1 carries information on the type of radiation, detector and use for some of the electromagnetic radiations. Fill in the blanks.

Type of radiation	Detector	Used
Microwave	Microwave receiver	
Visible light		Seeing / vision

21. In the circuit in fig 5 when the switch S is closed, the voltmeter shows a reading.



When the cell terminals are reversed and the switch is closed, the voltmeter reading is zero. Explain these observations.
22. A body of mass M is allowed to slide down an inclined plane. State two factors that affect its final velocity at the bottom of the incline.

23. Cleavage in crystals is possible in certain directions only. Explain this observation.
24. John carried a uniform post of mass 20kg horizontally on his shoulder as shown in fig 6. He placed the post on his shoulder such that the centre of gravity of the pole is 1.0m behind him. He balanced the post by applying a downward force F at a point 0.5m on the part of the post in front of him.

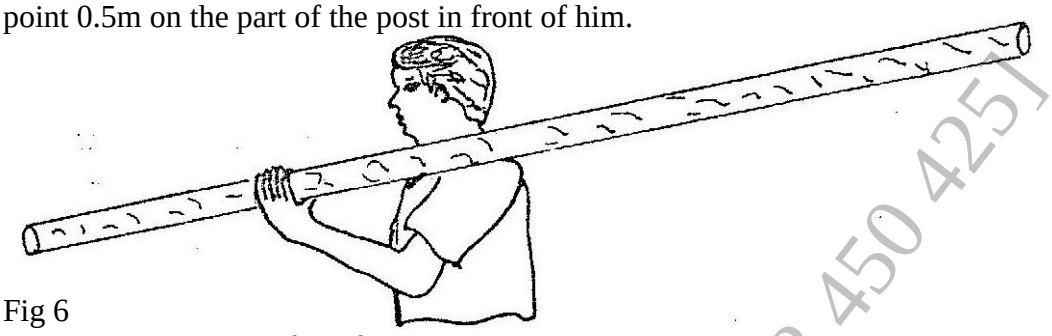


Fig 6

Determine the value of the force F.

25. Fig 7 shows a graph of pressure P, against volume, V, for a fixed mass of gas at constant temperature.

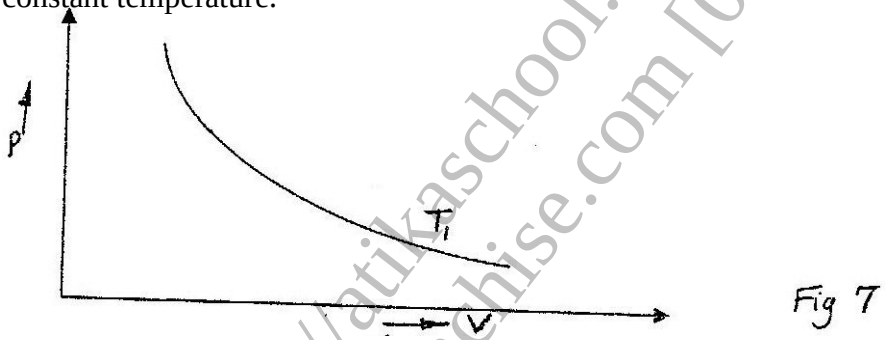


Fig 7

Sketch on the same axes a graph for the same mass of gas with a temperature T_2 lower than T_1

26. State two factors that would raise the boiling point of water to above 100oC
27. During total eclipse of the sun, both light and heat are observed to disappear simultaneously. Explain the observation.
28. What determines the quality of a musical note?
29. Fig. 8 shows a car of mass M moving along a curved part of the road with a constant speed.

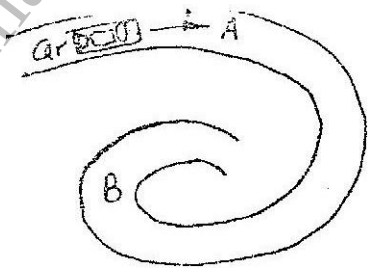


Fig 8

Explain the fact that the car is more likely to slide at B than at A if the speed is not changed.

30. Fig 9 shows a Bunsen burner.

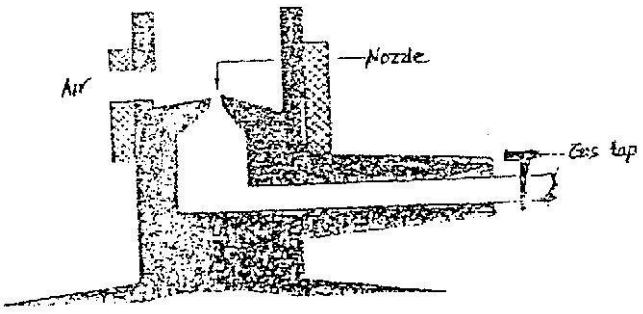


Fig. 9

Use Bernoulli's principle to explain how air is drawn into the burner, when, the gas tap is opened.

31. Fig 10 shows a fire alarm circuit.

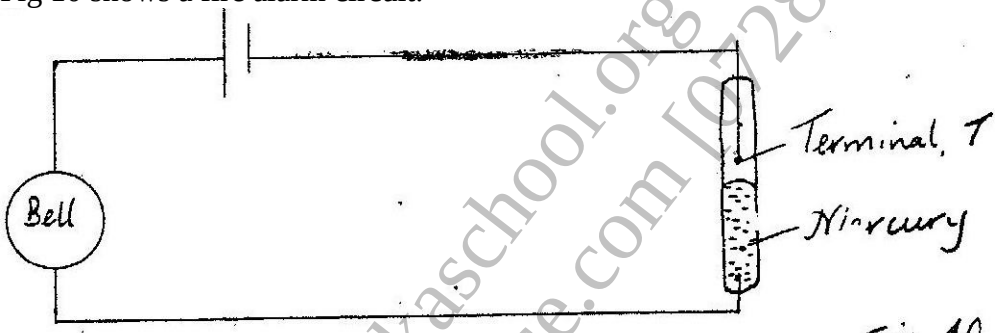


Fig. 10

Explain how the alarm functions.

32. Fig 11 shows a double slit placed in front of a source, s of waves, a director D is placed beyond the slits, such that its position can be adjusted along the line XY.

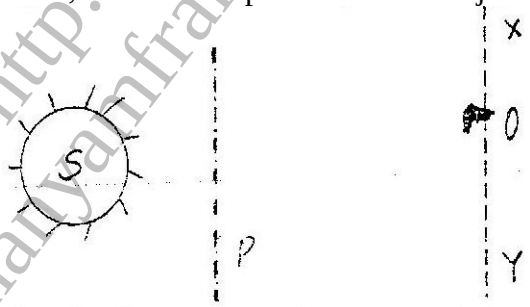


Fig. 11

State with a reason, what the detector records along XY.

33. What is meant by virtual image?

34. Fig 12 shows a body of weight 50N placed on a surface which is inclined at an angle of 30^0 to the horizontal . The body experiences a maximum frictional force of 29N with the surface.

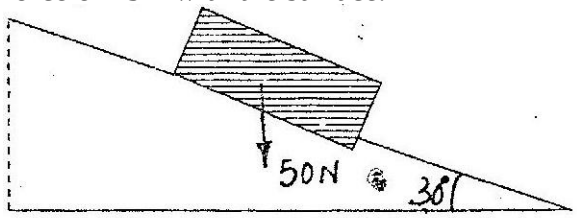


Fig. 12

Determine the force required to move the body, up the inclined with constant velocity.

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1.a) In an experiment to determine the strength of an electromagnet, the weight of pins that can be supported by the electromagnet, was recorded against the number of turns. The current was kept constant throughout the experiment. Table 1 shows the data obtained.

Number of turns, n,	0	4	8	12	16	20	24	28	32	36
Weight, of pins x 10-3(N)	0	4	14	30	58	108	198	264	296	300

Table 1

(i) Plot a graph of weigh, W (y-axis) against the number of turn's n

(ii) Use the domain theory to explain the nature of the curve.

(iii) Sketch on the same axes, the curve that would be obtained using a higher current.

b) Using a labeled diagram, explain the working of a simple relay.

2a) You are provided with two straight open tubes each about 1m long, a sound source, a sound detector and a reflecting surface. With the aid of a labeled diagram, describe an experiment to show that the angle of incidents is equal to reflection for sound waves.

b)Fig. 1 shows a block with a graduated side, and of dimension 4cm x-4cm x 4cm x 16cm, just about to be lowered into a liquid contained in an overflow can.

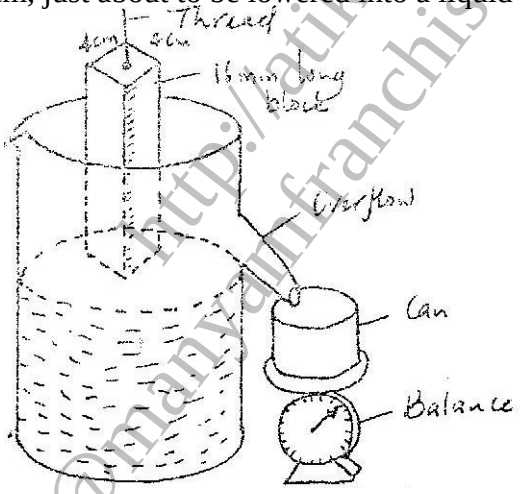

Fig. 1

During an experiment with this set-up, the following information was recorded;

-The block floated with three quarters of it submerged

-Initial reading of balance=0 grammes

-final reading of balance= 154 grammes.

Use the information to determine the density of the:

(i) Block (ii) Liquid

(Use g= 10ms2 . give your answers to 1 decimal place.)

3 a) A gun is fired vertically upwards from the top of 2 open truck moving horizontally at a uniform velocity of $50ms^{-1}$. The bullet achieves a maximum height of 45m. State with reason whether or not the bullet will land on the truck.

(i) Calculate the distance covered by the truck just before the bullet reaches the level from which it was fired. (Use g =10 ms^{-2})

b) Figure 2 shows a set-up that may be used to verify Boyle's law.

Fig 2

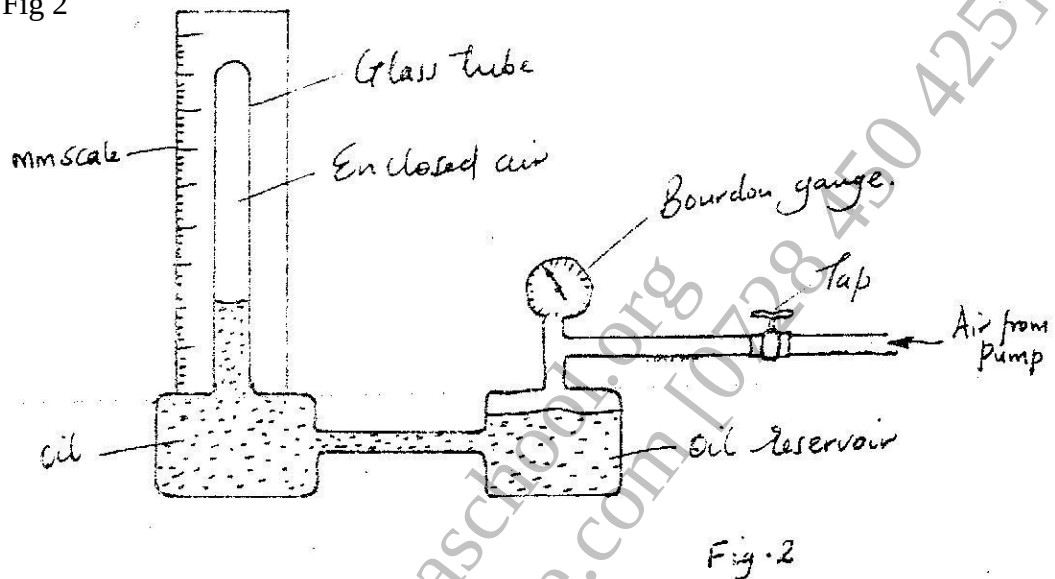

Fig. 2

i) Describe the measurements that should be taken in the experiment

ii) Explain how the measurements taken in (i) above may be used to verify Boyle's law.

4 a) In an experiment to determine the rate at which solar energy is absorbed by a surface, an aluminum block, coated black and fitted with a heater (Fig. 3) is exposed to the sun, for a period of time. The temperature rise in noted. After the temperature of the block is allowed to fall to the initial temperature, the block is electrically heated to the temperature.

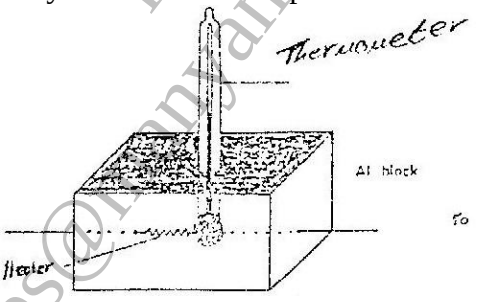

Fig. 3

(i) Draw and labeled a circuit diagram that would be used to determine the electrical energy.

(ii) State the measurements that would be taken in (a)(i) to determine the rate of heating of the block.

(iii) Explain how the measurements stated in (a) (ii) would be used to determine the rate of heating of the block by the sun.

b) Fig 4 shows a photocell

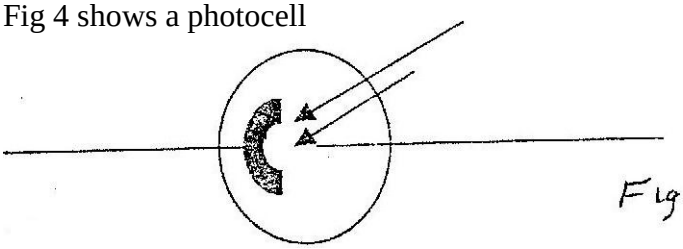

Fig. 4

(i) Label the cathode and anode.
(ii) How are electrons produced in the cell/
(iii) Draw a simple circuit including the photocell to show the direction of flow of current
(iv) Calculate the photon energy in ultraviolet radiation whose frequency is 8.60×10^{14} HZ. (Plank's constant $h=6.63 \times 10^{-34}$ Js)

5. a) A ray of white light is incident on one face of a rectangular glass prism.
i) Draw a ray diagram to illustrate the dispersion of white light by the prism, showing only the red ® and violet (V) rays.
ii) On the same diagram drawn in (i) mark and label the initial angle of incidence, 1, and the angles of reflection on the first face for red r_R and for violet r_V.
iii) Snell's law for the red and colours can be written as

$$nr = \frac{\text{Sin } I}{\text{Sin } r_R} \text{ and}$$

b) Calculate the critical angle for a material whose refractive index is 1.40.

SECTION II

6. Fig 5 shows a circuit for charging and discharging a capacitor; e, through a variable resistor R, X Y and T are points on a two-way switch.

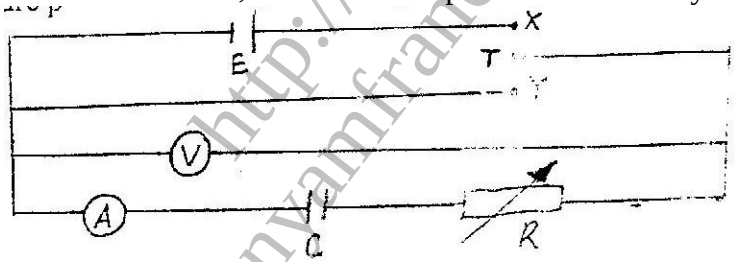

Fig. 5

a) Explain how the charging and discharging processes are achieved.
b) Table 2 show the variation of the charge q with time t when a 500u F capacitor was discharged though a resistor.

Time, t, (s)	0	20	40	60	80	100
Charge, 0 (μc)	300	150	75	38	19	10

Table 2

(i) Plot a graph of charge 0 (y axis) against time.
(ii) Determine the current flowing in the circuit at t =30s. (Give your answer to 1 decimal place)

7 a) Fig. 6 shows an object, 0.3cm high placed in front of a concave mirror. C is the centre of curvature of the mirror. The diagram is drawn to scale: (1cm: 2cm)

Draw a ray diagram, on figure 6, and determine the size of the image produced.

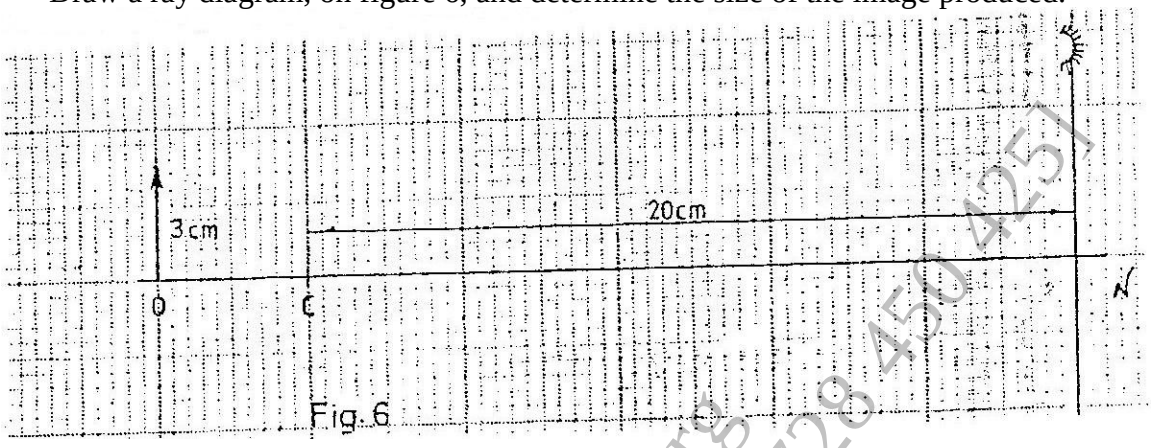

Fig. 6

b) Table 3 shows the object distance y and the corresponding image distance v, for an object placed in front of a concave mirror.

U(cm	20	25	30	40	50	70
V(cm	20	16.7	15	13.3	12.0	11.6
1/v(cm-1)						
V(cm-1)						

Table 3

i) Complete the table and plot a graph of 1/v (y-axis) against 1/u (give your answers to 3 decimal places).

ii) From the graph, determine the focal length of the mirror.