

PHYSICS PAPER 232/2 K.C.S.E 1998

- 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.

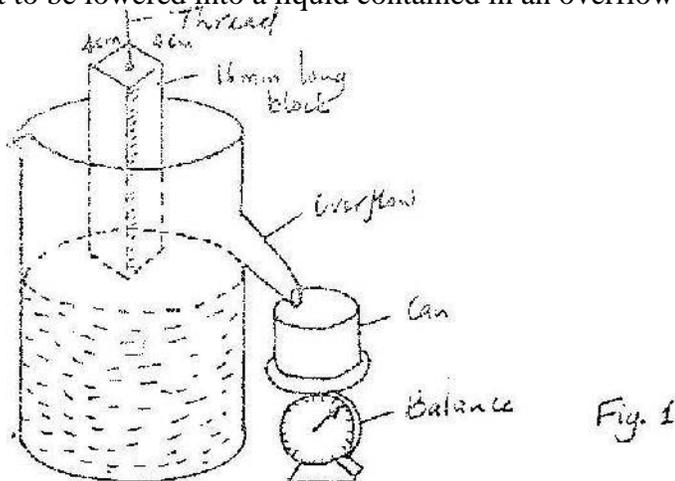
| | | | | | | | | | | |
|--------------------------------------|---|---|----|----|----|-----|-----|-----|-----|-----|
| Number of turns, n | 0 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| Weight, of pins $\times 10^{-3}$ (N) | 0 | 4 | 14 | 30 | 58 | 108 | 198 | 264 | 296 | 300 |

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.

- 2.a) 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.



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 $g = 10 \text{ms}^{-2}$. 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 $g = 10 \text{ ms}^{-2}$)
- b) Figure 2 shows a set-up that may be used to verify Boyle's law.

Fig 2

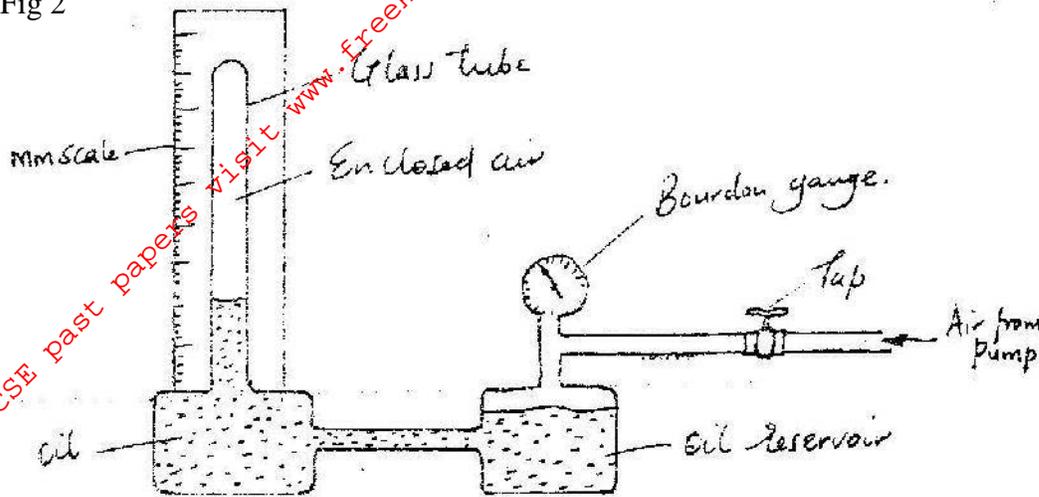


Fig. 2

- 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 is noted. After the temperature of the block is allowed to fall to the initial temperature, the block is electrically heated to the temperature.

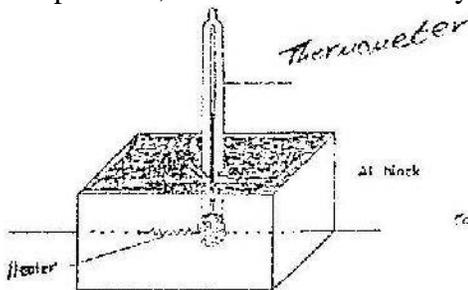
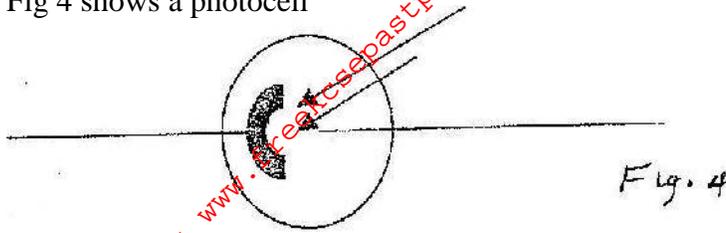


Fig. 3

- (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



- Label the cathode and anode.
- How are electrons produced in the cell/
- Draw a simple circuit including the photocell to show the direction of flow of current
- 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.

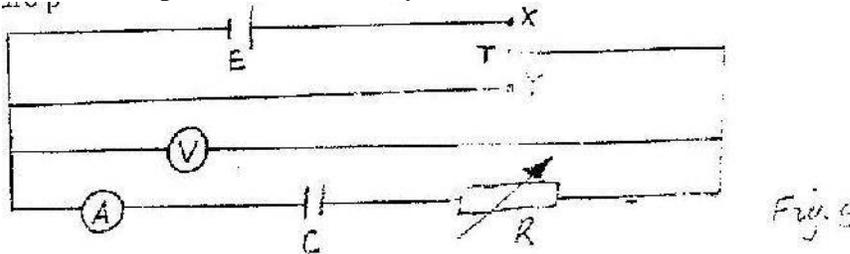
- Draw a ray diagram to illustrate the dispersion of white light by the prism, showing only the red (R) and violet (V) rays.
- On the same diagram drawn in (i) mark and label the initial angle of incidence, i , and the angles of refraction on the first face for red r_R and for violet r_V .
- Snell's law for the red and violet colours can be written as

$$n_r = \frac{\sin i}{\sin r_R} \text{ and}$$

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.



- Explain how the charging and discharging processes are achieved.
- Table 2 show the variation of the charge q with time t when a $500\mu\text{F}$ capacitor was discharged through a resistor.

| | | | | | | |
|-------------------------------|-----|-----|----|----|----|-----|
| Time, t , (s) | 0 | 20 | 40 | 60 | 80 | 100 |
| Charge, q (μC) | 300 | 150 | 75 | 38 | 19 | 10 |

Table 2

- Plot a graph of charge q (y axis) against time.
- Determine the current flowing in the circuit at $t=30\text{s}$. (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.

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- b) Table 3 shows the object distance u 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 |
| $1/v(\text{cm}^{-1})$ | | | | | | |
| $1/u(\text{cm}^{-1})$ | | | | | | |

Table 3

- Complete the table and plot a graph of $1/v$ (y-axis) against $1/u$ (give your answers to 3 decimal places).
- From the graph, determine the focal length of the mirror.