Answer two questions only

1.

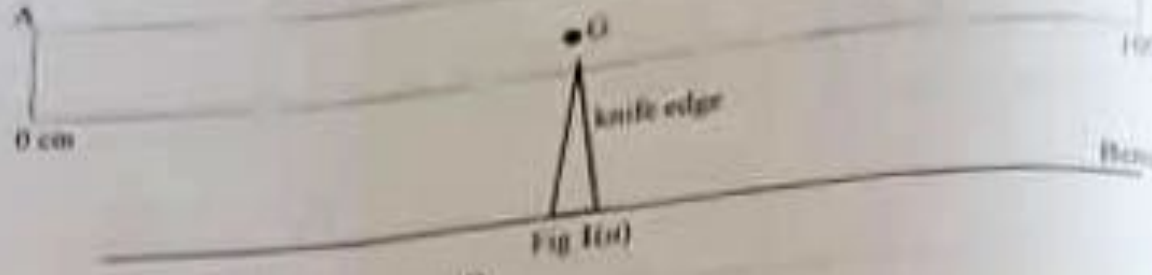


Fig 1(a)

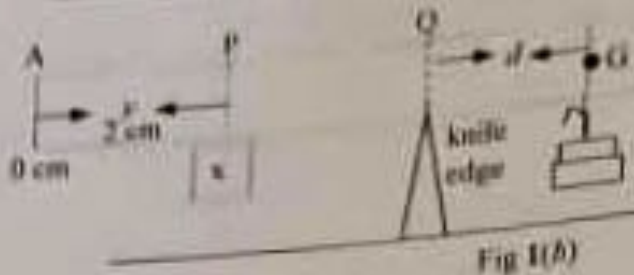


Fig 1(b)

You are provided with a hanger of mass 20 g, a fixed mass labelled X, slotted masses, a meter rule and two loops of string as shown in the diagram above.

(i) Place the meter rule on the knife edge with its scale facing upward. Adjust the position of the knife edge until the meter rule balances horizontally as shown in Fig 1(a). Record the point of balance G.

(ii) Use one of the loops of string to attach the 20 g mass hanger securely at G. Do not change this position of the hanger throughout the experiment.

(iii) Attach the mass X securely at a distance AP = 2 cm on the rule. This position of X should also be kept constant throughout the experiment.

(iv) Add a 20 g slotted mass to the hanger and record the total mass of the hanger and the added mass as $m = 40$ g.

(v) Adjust the position of the knife edge until the rule balances horizontally at Q as shown in Fig. 1(b).

(vi) Read and record the distance GQ = d.

(vii) Evaluate d^{-1}.

(viii) Repeat the experiment for **four** other total mass $m = 60$ g, 80 g, 100 g, and 120 g. In **each** case read and record d and evaluate d^{-1}.

(ix) Tabulate the results.

(x) Plot a graph with m on the vertical axis and d^{-1} on the horizontal axis, starting both axes at the origin, (0,0).

(xi) Determine the slope, s of the graph and the intercept c on the vertical axis.

(xii) If in the experiment $m = 70$ g, use the graph to determine the balance length d.

(xiii) Calculate Z using the equation $Z = \frac{100 + s}{50}$

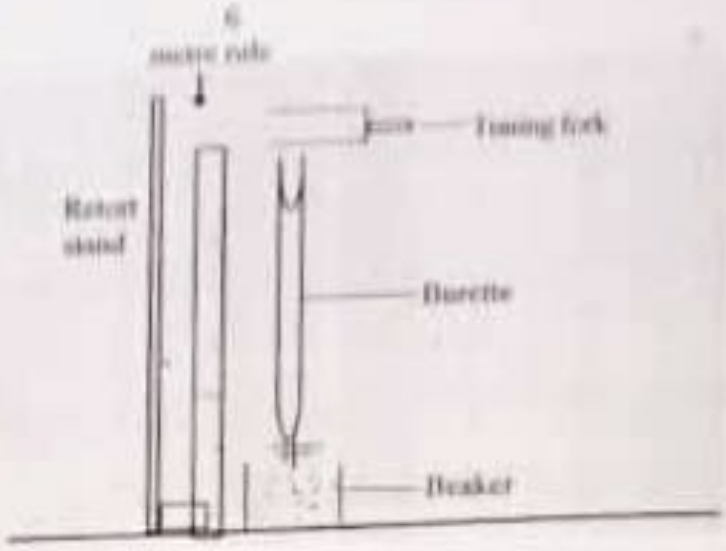
(xiv) State **two** precautions taken to ensure accurate results.

[21 marks]

(b) (i) State the conditions necessary for a body to be in equilibrium under parallel forces. [2 marks]

(ii) Define *moment of a force*. [2 marks]

2. (a)



You are provided with a meter rule, a retort stand with a clamp, a beaker of water, an empty beaker, a set of tuning forks, a soft pad (or rubber bung) and a 50 ml burette

(i) Arrange the apparatus as shown in the diagram above

(ii) Fill the burette with water

(iii) Strike the tuning fork of frequency, $f = 512Hz$ against the rubber bung gently and hold it close to the open end of the burette.

(iv) Open the burette tap and gradually let out some water until resonance occurs. Close the tap.

(v) Measure and record the length L of the air column.

(vi) Evaluate $P = 4L$ and f^{-1}.

(vii) Repeat the experiment for other values of $f = 480$, 426,320 and 256 Hz. In **each** case, measure and record L and evaluate P and f^{-1}.

(viii) Tabulate the results.

(ix) Plot a graph of P on the vertical axis and f^{-1} on the horizontal axis starting both axes from the origin, (0,0).

(x) Determine the slope, s of the graph and intercept, c on the vertical axis.

(xi) If a fork of frequency $f = 341.3$ Hz is used, determine from the graph the resonating length L of the air column.

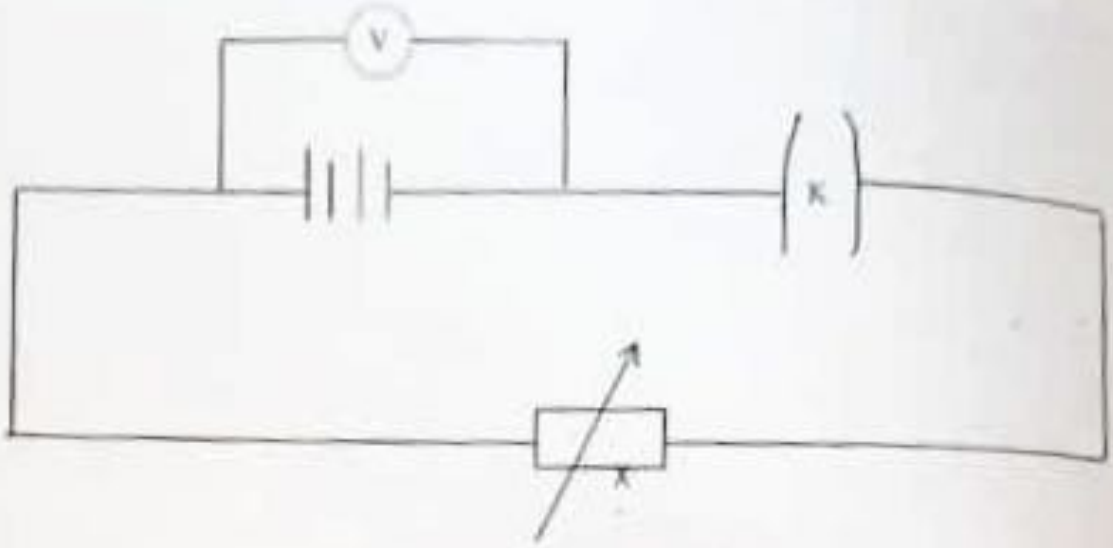
(x) State **two** precautions taken to ensure correct results.

[21marks]

(b) (i) Draw a diagram to show the mode of vibration of air in a tube, open at both ends, for the **first** harmonic mode. [2 marks]

(ii) In a resonance tube experiment, a tuning fork's first resonance occurs when the column of air is 16 cm. Calculate the speed of sound in air of frequency 512 Hz. [2 marks]

3. (a)



You are provided with a resistance box, a voltmeter, a key, a battery and connecting wires.

(i) Connect the circuit as shown above, and with the key open and $R = 0$ read and record the voltmeter reading E.

(ii) With R set to 1.0 Ω, close the key and record the voltmeter reading, V.

(iii) Evaluate $Z = \frac{V}{E - V}$.

(iv) Repeat the procedure for five other values of $R = 2\ \Omega$, 3 Ω, 4 Ω, 5 Ω and 6 Ω, respectively. In **each** case, record V and evaluate Z.

(v) Tabulate the results.

(vi) Plot the graph with Z on the vertical axis and R on the horizontal axis both axes starting from the origin, (0,0).

(vii) Determine the slope, s of the graph.

(viii) Given that $Z = \frac{R}{K}$, determine K.

(ix) State **two** precautions taken to obtain correct results.

[21 marks]

(b) (i) What is *fuse rating*? [2 marks]

(ii) A battery of e.m.f. 12 V and internal resistance of 4 Ω is connected to a resistance of 5 Ω. Calculate the terminal p.d. [2 marks]

END OF PAPER