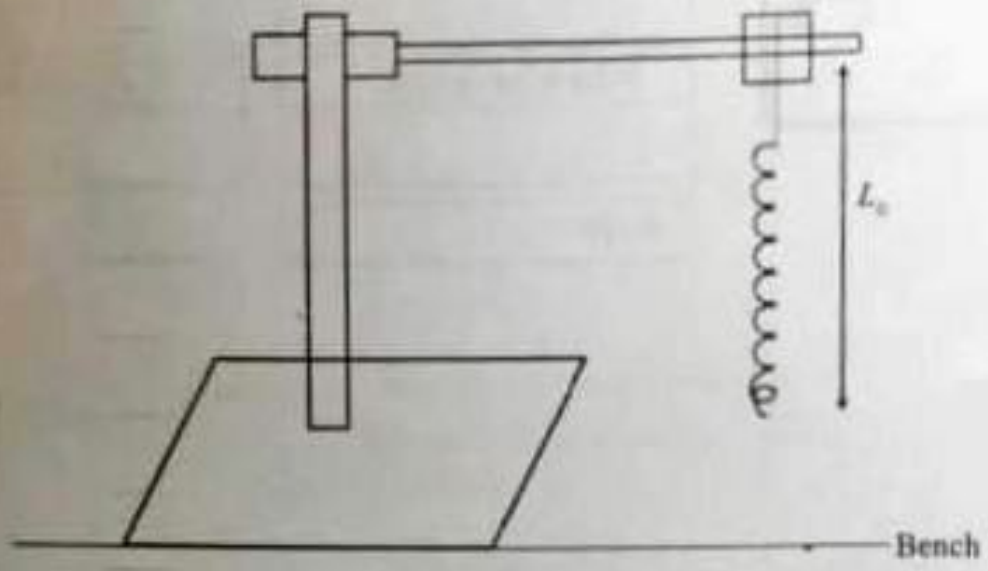
Answer **two** *questions* **only**.

1. (*a*)



You are provided with a retort stand, spiral spring, mass hanger, slotted masses, stop watch, meter rule and other necessary apparatuses.
Use the diagram above as a guide to perform the experiment.

(i) **Measure the length L_o of the spiral spring.**
(ii) **Attached the mass hanger. Add a mass m =20 g.**
(iii) **Measure and record the new length L of the spring.**
(iv) **Evaluate $e = L - L_o$**
(v) **Keep the mass hanger in its position, repeat the procedure for m = 40 g, 60 g, 80 g and 100 g respectively. In each case, measure and record the value of L, evaluate e.**
(vi) **Tabulate the results.**
(vii) **With the mass m = 40 g only, set the spring into a vertical oscillation, read and record the time t taken to complete 20 oscillations.**
(viii) **Evaluate period T and T^2.**
(ix) **Plot a graph of m on the vertical axis and e on the horizontal axis starting the axes from the origin (0,0).**
(x) **Determine the slope s, of the graph.**
(xi) **Using the expression**

$$T^2 = 4\pi^2\left(\frac{m_o + m}{s}\right)$$

, where m = 40 g and $\pi = 3.14$, calculate the mass m_o of the spring.

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

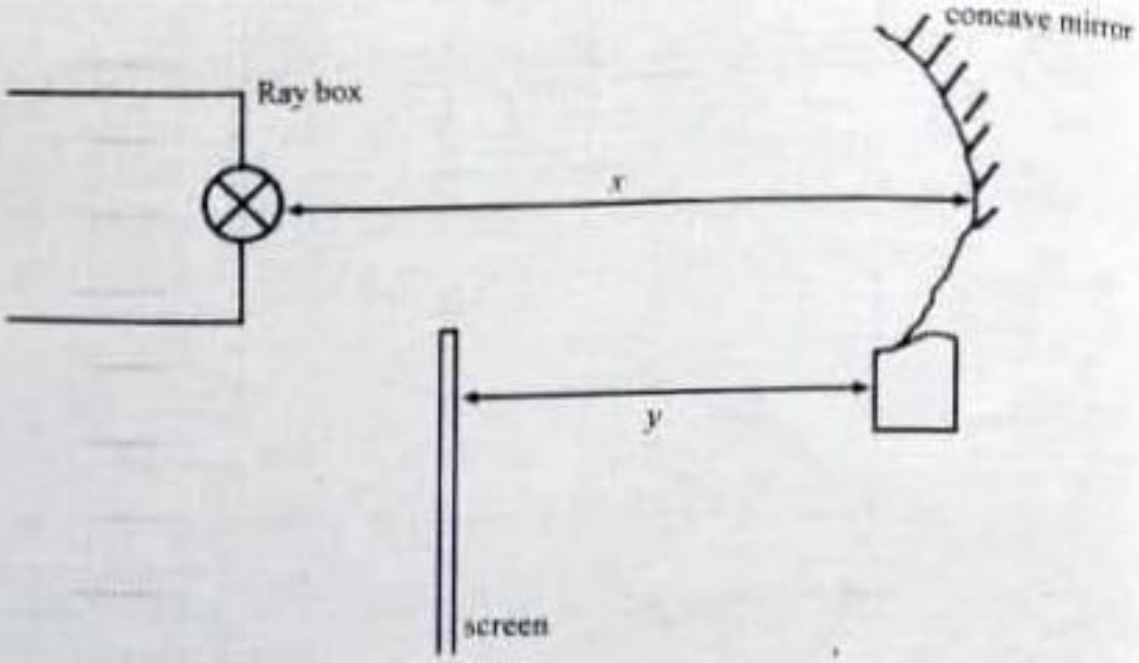
[21 marks]

(*b*) (i) **Define *simple harmonic motion*.** [2 marks]

(ii) **A spring is set into vertical oscillation by hanging a mass of 90 g on it. If the period of oscillation is 2.12 s, calculate the stiffness of the spring. ($\pi = 3.14$)**

[2 marks]

2. (*a*)



You are provided with a concave mirror, a ray box, screen, meter rule, and other necessary apparatuses.

Use the diagram above as a guide to perform the experiment.

(i) Set up the apparatuses as shown in the diagram above.

(ii) Place the ray box at a position $x = 25$ cm from the mirror. Adjust the screen until a sharp image of the cross wire is shown on the screen.

(iii) Measure and record the distance y.

(iv) Evaluate $p = \frac{x}{y}$.

(v) Repeat the procedure for $x = 30$ cm, 35 cm, 40 cm and 45 cm respectively. Measure and record the value of y and in **each** case evaluate p.

(vi) Tabulate the result.

(vii) Plot a graph of p on the vertical axis and y on the horizontal axis starting both axis from the origin.

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

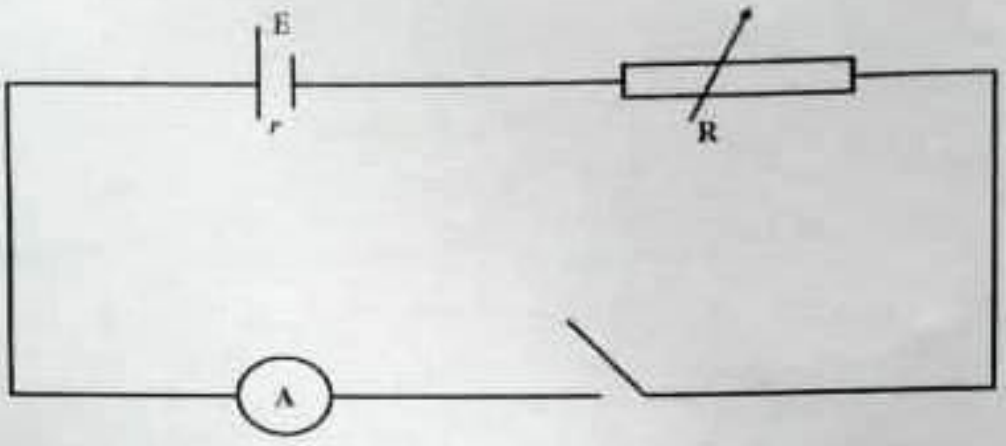
(ix) State **two** precautions taken to ensure **correct** result.

[21 marks]

(*b*) (i) Define *principal focus* of a concave mirror. [2 marks]

(ii) The Magnification of the image formed by a concave mirror of focal length f is 3. Calculate the image distance. [2 marks]

3. (*a*)



You are provided with a cell of emf E, voltmeter, ammeter, resistance box connecting wire and other necessary apparatuses.

Use the diagram above as a guide to perform the experiment.

(i) Set up the apparatus as shown in the diagram above.

(ii) Measure and record E.

(iii) With the resistance box set at $R = 2\ \Omega$, close the circuit, read and record the ammeter reading I.

(iv) Evaluate $Q = \frac{E}{I}$.

(v) Repeat the procedure for $R = 4\ \Omega$, $6\ \Omega$, $8\ \Omega$, and $10\ \Omega$. Read and record the ammeter reading I. In **each** case evaluate Q.

(vi) Tabulate the result.

(vii) Plot a graph of R on the vertical axis and Q on the horizontal starting both axes from the origin (0,0).

(viii) Determine the slope s of the graph.

(ix) Determine the intercept c on the horizontal axis.

(x) From the graph, determine the internal resistance r of the cell.

(xi) State **two** precaution taken to ensure correct result.

[21 marks]

(*b*) (i) Define *internal resistance* of a cell. [2 marks]

(ii) The *lost volt* in a circuit with 2 A flowing through it is 3 V. Calculate the internal resistance of the cell.

[2 marks]

END OF PAPER