29.5.3 Physics Paper 3 (232/3)

1 You are provided with the following:

- a metre rule;
- vernier callipers;
- a 300 g mass;
- two knife edges;
- some thread.

Proceed as follows:

(a) Place the metre rule on the knife edges such that each knife edge is 45 cm from the 50 cm mark (centre of the rule). See **figure** 1. Ensure that the millimetre scale of the metre rule is facing upwards. The distance **L** between the knife edges is now 900 mm.

Place the vernier callipers vertically against the metre rule at the 50 cm mark with the depth gauge lowered to touch the bench as shown in figure 1.

Record the height $\mathbf{h_o}$, of the upper edge of the metre rule at the 50 cm mark. (see **figure 1**).

$\mathbf{h_o}$ = ... mm (1 mark)

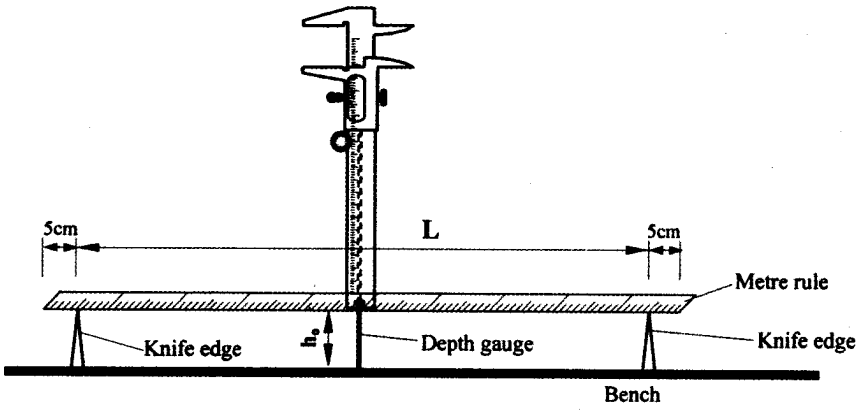


Figure 1

(b) Using the thread provided, hang the 300g mass at the 50 cm mark of the metre rule. Ensure that the mass does not touch the bench. Measure and record in table 1, the height **h** of the edge of the metre rule at the 50 cm mark.

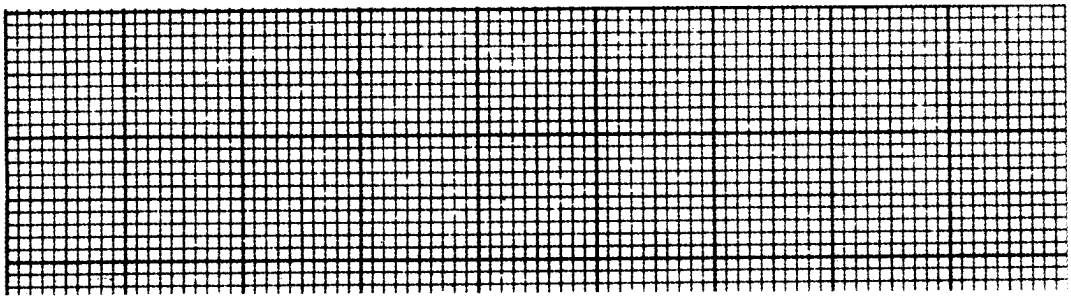
(c) With the 300g mass still at the 50 cm mark, adjust the position of the knife edges so that **L** is now 800 mm. (The knife edges should be equidistant from the centre of the metre rule). Measure and record in table 1 the height **h** of the edge of the metre rule at the 50 cm mark.

(d) Repeat the procedure in (c) for other values of **L** shown in table 1. Complete the table.

Length **L** (mm)	900	800	700	600	500
Height **h** (mm)					
Depression d (h_o-h) mm					
Log **L**					
Log d					

Table 1 (7 marks)

(e) Plot a graph of log **L** (y-axis) against log d. (5 marks)



(f) (i) Determine the slope s of the graph. (3 marks)

(ii) Evaluate $y = \frac{1}{s}$

y=..... (1 mark)

(iii) Determine G, the value of log **L**, when log d = 0.

G = ... (2 marks)

(iv) Given that $G = \frac{\log k}{y}$, determine the value of k.

k ..... (1 mark)

2 You are provided with the following:

- a 100 ml beaker;
- a 600 ml beaker;
- 2 thermometers range -10°C to 110°C;
- a measuring cylinder; (to be shared)
- some plasticine;
- vernier callipers; (to be shared)
- a meter-rule or half metre rule;
- some boiling water;
- some cold water; (at room temperature).
- stopwatch;
- a stirrer.

Proceed as follows:

(a) Using the vernier callipers, measure the internal diameter d_1 and the external diameter d_2 of the 100 ml beaker.

d_1 = ...cm

d_2 = ... cm (1 mark)

Determine the thickness X of the glass wall of the beaker, given that $X = \frac{d_2 - d_1}{2}$

X = ... cm (1 mark)

(b) Using the measuring cylinder provided, pour 75 ml of cold water into the small beake Measure the height h, of the water in the small beaker.

h = ... cm (1 mark)

Determine the area A of the glass walls in contact with water, given that $A = \pi d_1 h$.

A = ... cm^2 (1 mark)

(c) Use the plasticine provided to make a circular disc of about the same area as the bottom surface of the smaller beaker and about 1 cm thick. Place this disc at the bottom of the large beaker and place the small beaker on it.
Now pour boiling water into the large beaker until the levels of the water in the two beakers are same. See **figure** 2.

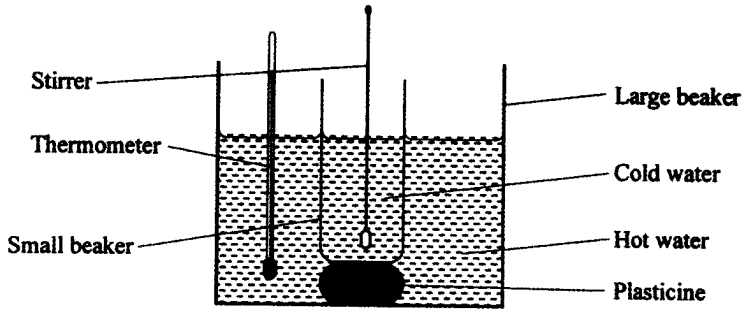


Figure 2

(d) Place a thermometer in the hot water and stir gently until the temperature drops to 75°C. Now start the stopwatch and measure the temperature T_1 of the hot water at intervals of 20 seconds. Record the values in Table 2.
(Stir the water in the two beakers before taking the readings).
Pour out the contents of the two beakers.

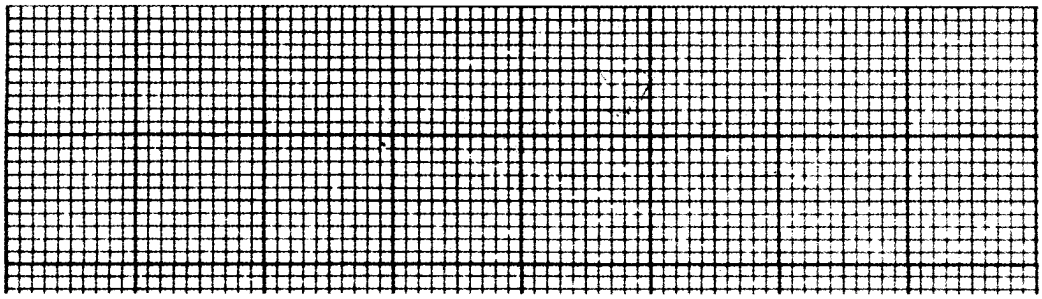
(e) Measure another 75 ml of cold water and put it into the small beaker. Place the small beaker inside the large beaker on the plasticine disc as before.
Again pour boiling water into the large beaker until the levels of the water in the two beakers are the same. Place one thermometer in the cold water and the other in the hot water. Stir gently until the temperature of the hot water drops to 75°C. Start the stop watch and immediately read and record in Table 2 the temperature T_2 of the cold water.
(You may now remove the thermometer in the hot water).

Read other values of T_2 at intervals of 20s and record in table 2.

Time t (seconds)	0	20	40	60	80	100	120	140	160	180
Temperature T_1 °C										
Temperature T_2 °C										

Table 2 (6 marks)

(f) Plot a graph of temperature T_2 (y-axis) against time. (5 marks)



(g) (i) Determine the slope S of the graph at time t = 60 seconds. (3 marks)

(ii) Determine the constant k, given that $k = \frac{315\,SX}{A(T_1 - T_2)}$
where T_1 and T_2 are the temperatures of the hot and the cold water at t = 60s, and X and A are in m and m^2 respectively. (2 marks)