

29.5 PHYSICS (232)

29.5.1 Physics Paper 1 (232/1)

SECTION A (25 marks)

Answer all the questions in this section in the spaces provided.

- 1 Figure 1 shows a vernier callipers being used to measure the internal diameter of a tube.

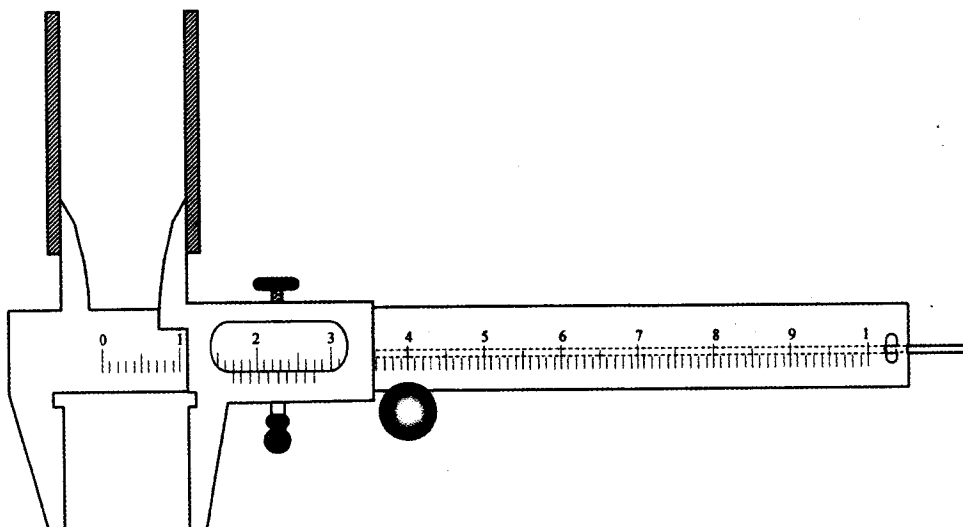
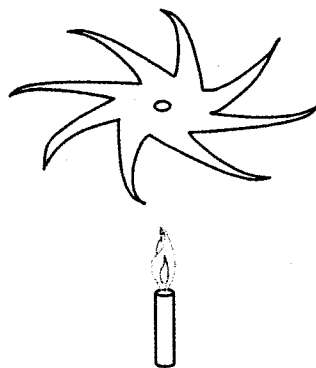


Figure 1

- Record the diameter of the tube. (1 mark)
- 2 A stopwatch started 0.50s after the start button was pressed. The time recorded using the stopwatch for a ball bearing falling through a liquid was 2.53s. Determine the time of fall. (1 mark)
- 3 Some water in a tin can was boiled for some time. The tin can was then sealed and cooled. After some time it collapsed. Explain this observation. (2 marks)
- 4 A paper windmill in a horizontal axis was placed above a candle as shown in figure 2.



Lit candle

Figure 2

When the candle was lit the paper windmill begun to rotate.

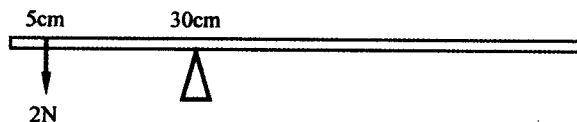
Explain this observation.

(2 marks)

- 5 When a liquid is heated in a glass flask, its level at first falls, then rises. Explain this observation.

(2 marks)

- 6 **Figure 3** shows a uniform metre rule pivoted at the 30cm mark. It is balanced by a weight of 2N suspended at the 5cm mark.

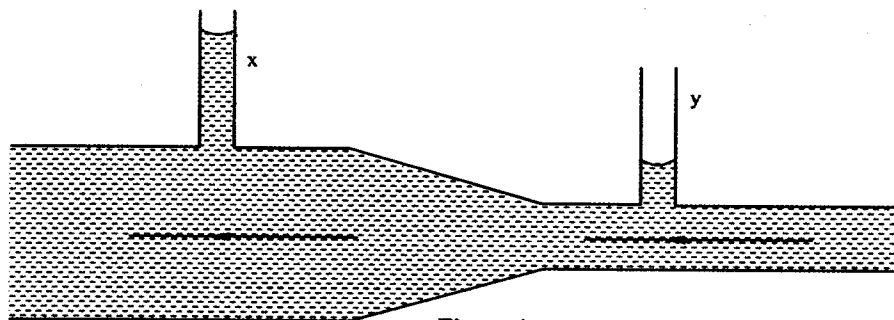


**Figure 3**

Determine the weight of the metre rule.

(2 marks)

- 7 **Figure 4** shows a horizontal tube with two vertical tubes x and y. Water flows through the horizontal tube from right to left. The water level in tube x is higher than water level in tube y.



**Figure 4**

Explain this observation.

(2 marks)

- 8 A cart of mass 30kg is pushed along a horizontal path by a horizontal force of 8N and moves with a constant velocity. The force is then increased to 14N.

Determine:

- (a) the resistance to the motion of the cart;

(1 mark)

- (b) the acceleration of the cart.

(2 marks)

- 9 When a drop of oleic acid of known volume is dropped on the surface of water in a large trough, it spreads out to form a large circular patch. State **one** assumption made when the size of the molecule of oleic acid is estimated by determining the area of the patch.

(1 mark)

- 10 The weight of a solid in air is 5.0N. When it is fully immersed in a liquid of density  $800\text{Kg m}^{-3}$ , its weight is 4.04N.

Determine:

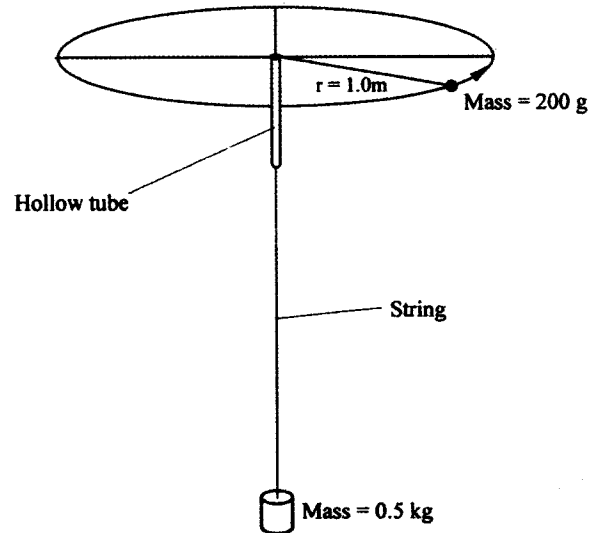
- (a) the upthrust in the liquid;

(1 mark)

(b) the volume of the solid. (2 marks)

11 When a bicycle pump was sealed at the nozzle and the handle slowly pushed towards the nozzle, the pressure of the air inside increased.  
Explain this observation. (1 mark)

12 **Figure 5** shows a mass of 200g connected by a string through a hollow tube to a mass of 0.5kg. The 0.5kg mass is kept stationary in the air by whirling the 200g mass round in a horizontal circle of radius 1.0metre.

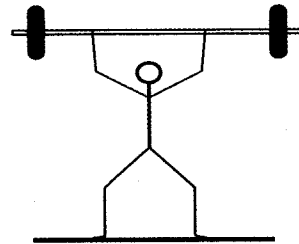


**Figure 5**

Determine the angular velocity of the 200g mass. (3 marks)

13 State the SI unit of a spring constant. (1 mark)

14 **Figure 6** shows an athlete lifting weights while standing with the feet apart.



**Figure 6**

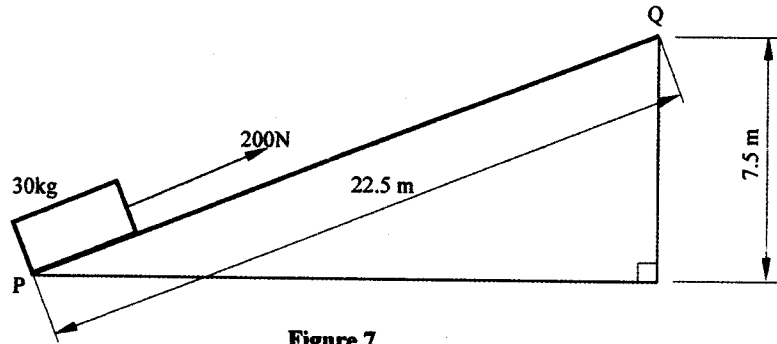
Explain why standing with the feet apart improves the athletes's stability. (1 mark)

### SECTION B (55 marks)

*Answer all the questions in this section in the spaces provided.*

15 (a) A cyclist initially at rest moved down a hill without pedalling. He applied brakes and eventually stopped. State the energy changes as the cyclist moved down the hill. (1 mark)

- (b) **Figure 7** shows a mass of 30kg being pulled from point P to point Q, with a force of 200N parallel to an inclined plane. The distance between P and Q is 22.5m. In being moved from P to Q the mass is raised through a vertical height of 7.5m.



**Figure 7**

- (i) Determine the work done:
- I by the force; (2 marks)
  - II on the mass; (2 marks)
  - III to overcome friction. (2 marks)
- (ii) Determine the efficiency of the inclined plane. (2 marks)
- (c) Suggest **one** method of improving the efficiency of an inclined plane. (1 mark)

- 16** In an experiment to determine the density of sand using a density bottle, the following measurements were recorded:

Mass of empty density bottle	=	43.2g
Mass of density bottle full of water	=	66.4g
Mass of density bottle with some sand	=	67.5g
Mass of density bottle with the sand filled up with water	=	82.3g

Use the above data to determine the:

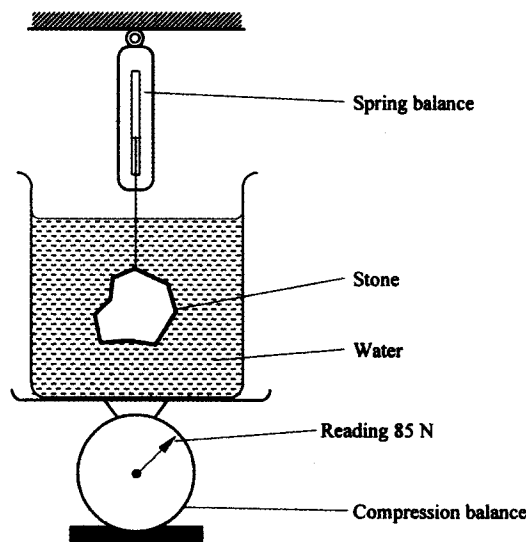
- (a) mass of water that completely filled the bottle; (2 marks)
  - (b) volume of water that completely filled the bottle; (1 mark)
  - (c) volume of the density bottle; (1 mark)
  - (d) mass of sand; (1 mark)
  - (e) mass of water that filled the space above the sand; (1 mark)
  - (f) volume of the sand; (3 marks)
  - (g) density of the sand. (2 marks)
- 17** (a) Explain why it is advisable to use a pressure cooker for cooking at high altitudes. (2 marks)

- (b) Water of mass 3.0kg initially at 20°C is heated in an electric kettle rated 3.0KW. The water is heated until it boils at 100°C. (Take specific heat capacity of water  $4200\text{Jkg}^{-1}\text{K}^{-1}$ , Heat capacity of the kettle =  $450\text{JK}^{-1}$ , Specific latent heat of vaporisation of water =  $2.3\text{mJkg}^{-1}$ )

Determine:

- (i) the heat absorbed by the water; (2 marks)  
 (ii) heat absorbed by the electric kettle; (2 marks)  
 (iii) the time taken for the water to boil; (3 marks)  
 (iv) how much longer it will take to boil away all the water. (3 marks)

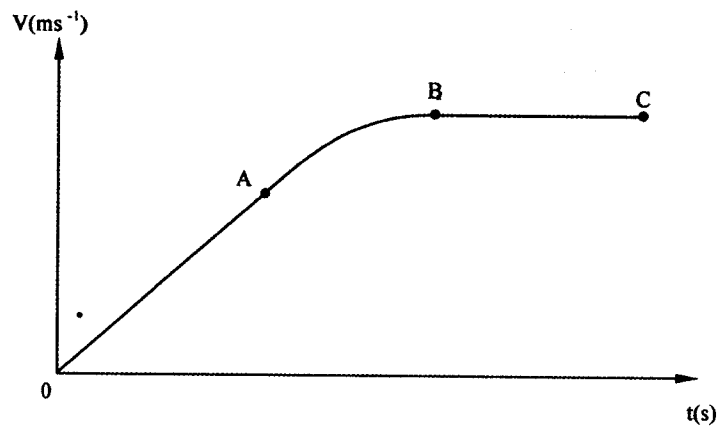
- 18 **Figure 8** shows a stone of mass 4.0kg immersed in water and suspended from a spring balance with a string. The beaker was placed on a compression balance whose reading was 85N. The density of the stone was  $3000\text{kgm}^{-3}$  while the density of the liquid was  $800\text{kgm}^{-3}$ .



**Figure 8**

Determine the:

- (a) volume of the liquid displaced; (2 marks)  
 (b) upthrust on the stone; (4 marks)  
 (c) reading of the spring balance; (2 marks)  
 (d) reading of the compression balance when the stone was removed from the water. (2 marks)
- 19 (a) **Figure 9** shows a velocity-time graph for the motion of a certain body.



**Figure 9**

Describe the motion of the body in the region:

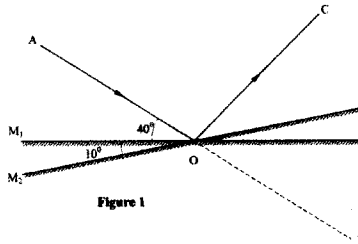
- (i) OA; (1 mark)
  - (ii) AB; (1 mark)
  - (iii) BC. (1 mark)
- (b) A car moving initially at  $10\text{ms}^{-1}$  decelerates at  $2.5\text{ms}^{-2}$ .
- (i) Determine:
    - (I) its velocity after 1.5s; (2 marks)
    - (II) the distance travelled in 1.5s; (2 marks)
    - (III) the time taken for the car to stop. (2 marks)
  - (ii) Sketch the velocity-time graph for the motion of the car up to the time the car stopped. (1 mark)
  - (iii) From the graph, determine the distance the car travelled before stopping. (2 marks)

29.5.2 Physics Paper 2 (232/2)

SECTION A (25 marks)

Answer ALL the questions in this section in the spaces provided.

- 1 **Figure 1**, shows a ray of light incident on a plane mirror at O. The mirror is then rotated anticlockwise about O from position  $M_1$  to position  $M_2$  through an angle of  $10^\circ$ . The final reflected ray is OC.



Determine the angle of deviation BOC.

(2 marks)

- 2 **Figure 2(a)**, shows a magnetic compass placed under a horizontal wire XY

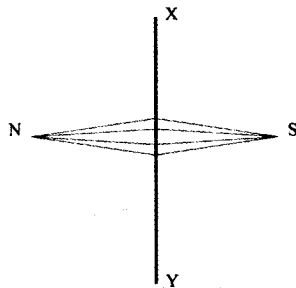


Figure 2(a)

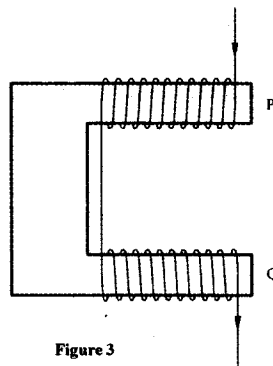


Figure 2(b)

A large current is passed from X to Y. Draw the final position of the magnetic compass needle in figure 2b.

(1 mark)

- 3 **Figure 3**, shows a diagram of a current-carrying wire wound on a U-shaped soft iron.



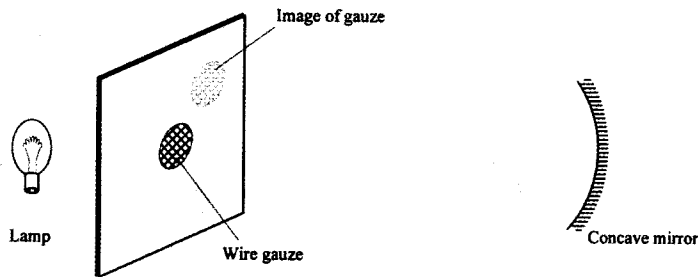
Draw the magnetic field pattern around P and Q.

(2 marks)

- 4 A positively charged sphere is suspended by an insulating thread. A negatively charged conductor is suspended near it. The conductor is first attracted, after touching the sphere it is repelled. Explain this observation.

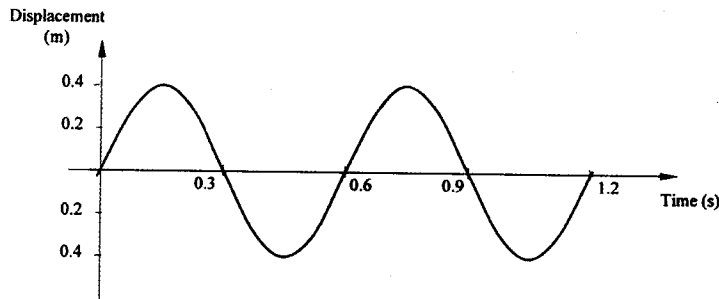
(2 marks)

- 5 **Figure 4**, shows a bright electric lamp placed behind a screen which has a hole covered with a wire gauze. A concave mirror of focal length 25cm is placed in front of the screen. The position of the mirror is adjusted until a sharp image of the gauze is formed on the screen.



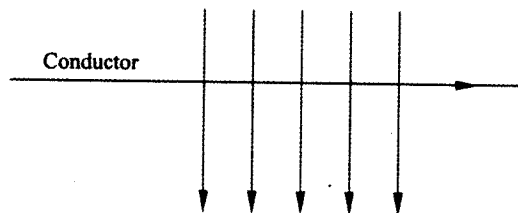
**Figure 4**

- Determine the distance between the mirror and the screen. (1 mark)
- 6 Explain why electric power is transmitted over long distances at high voltages. (2 marks)
- 7 **Figure 5**, shows how the displacement of a point varies with time as a wave passes it.



**Figure 5**

- On the same diagram, draw a wave which passes the point with half the amplitude and twice the frequency of the one shown. (2 marks)
- 8 A water wave of wavelength 18 mm is incident on a boundary of shallow water at right angles. If the wavelength in the shallow end is 14.4 mm, determine the refractive index of water for a wave moving from the deep to the shallow end. (3 marks)
- 9 The initial mass of a radioactive substance is 20g. The substance has a half-life of 5 years. Determine the mass remaining after 20 years. (2 marks)
- 10 A current  $I$  flowing through a wire of resistance  $R$  was increased seven times. Determine the factor by which the rate of heat production was increased. (3 marks)
- 11 **Figure 6**, shows a horizontal conductor in a magnetic field parallel to the plane of the paper.



**Figure 6**

- State the direction in which the wire may be moved so that the induced current is in the direction shown by the arrow. (1 mark)
- 12 An x-ray tube produces soft x-rays. State the adjustment that may be made so that the tube produces hard x-rays. (1 mark)



- 13 The wavelength of a radio wave is 1km. Determine its frequency. (2 marks)  
(Take the speed of light as  $3.0 \times 10^8 \text{ ms}^{-1}$ )

- 14 Figure 7, shows a block diagram of a p-n junction diode.

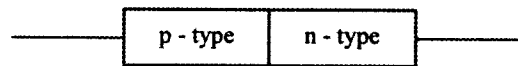


Figure 7

- On the same diagram, show how a battery may be connected so that the diode is reverse biased. (1 mark)

SECTION B (55 marks)

Answer ALL the questions in this section in the spaces provided.

- 15 (a) Figure 8, shows a circuit that may be used to charge a capacitor.

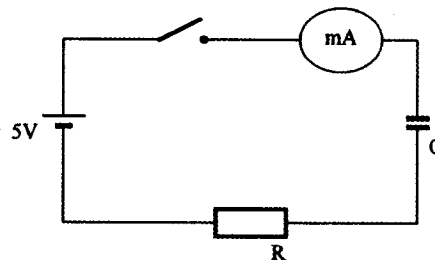


Figure 8

- (i) state the observation on the milliammeter when the circuit is switched on: (1 mark)
- (ii) explain the observation in (i) above. (2 marks)
- (b) The circuit in figure 8 is left on for some time. State the value of p.d. across:
- (i) the resistor R; (1 mark)
- (ii) the capacitor C; (1 mark)
- (c) sketch the graph of potential difference (V) across R against time. (1 mark)
- (d) Figure 9 shows three capacitors connected to a 10V battery.

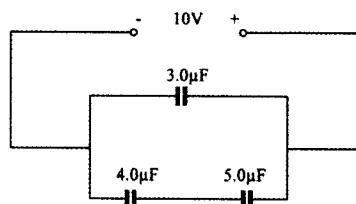


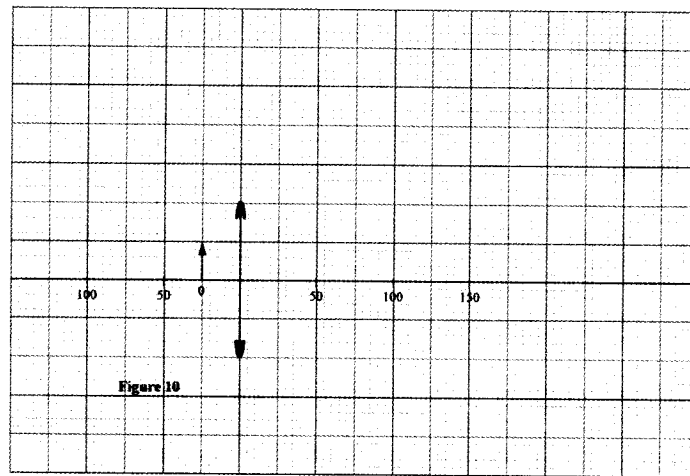
Figure 9

Calculate:

- (i) the combined capacitance of the three capacitors; (3 marks)

(ii) the charge on the  $5.0 \mu\text{F}$  capacitor. (3 marks)

16 (a) **Figure 10**, shows an object placed in front of a converging lens of focal length  $50\text{mm}$ .



(i) On the same figure, draw a ray diagram showing the location of the image. (3 marks)

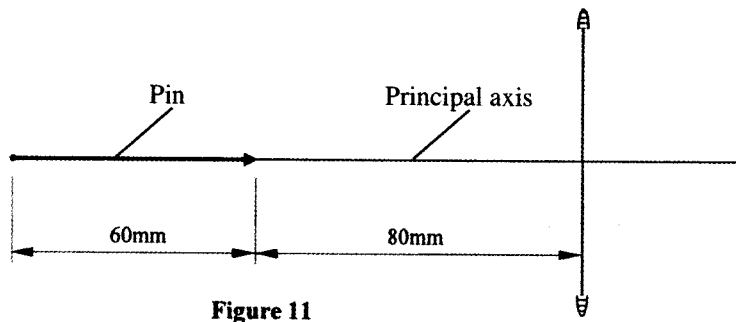
(ii) Use the ray diagram to determine the:  
(I) image distance; (1 mark)

(II) magnification. (2 marks)

(iii) State the adjustment that should be done to obtain a larger virtual image using the same lens. (1 mark)

(iv) State **one** application of the arrangement in **figure 10**. (1 mark)

(b) **Figure 11**, shows a pin  $60\text{mm}$  long placed along the principal axis of the lens used in part (a). The near end of the pin is  $80\text{mm}$  from the lens.



Determine the length of the image. (5 marks)

- 17 (a) **Figure 12**, shows an electrical circuit including three switches,  $S_1$ ,  $S_2$ ,  $S_3$ , and three identical lamps  $L_1$ ,  $L_2$ ,  $L_3$ . A constant potential difference is applied across X and Y.

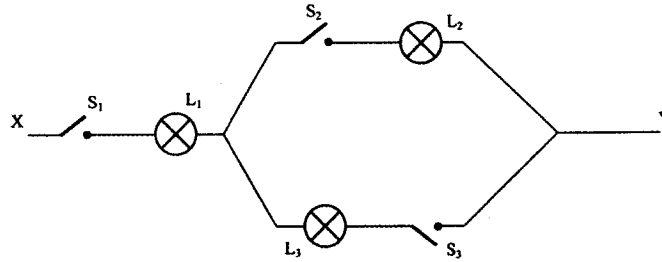


Figure 12

- (i) Other than  $L_1$ , state the lamp that will light when  $S_1$  and  $S_2$  are closed. (1 mark)
- (ii) How does the brightness of  $L_1$  in (i) above compare with its brightness when all the switches are closed? (1 mark)
- (iii) Explain the observation in part (ii) above. (1 mark)
- (b) **Figure 13**, shows a cell in series with a  $3\Omega$  resistor and a switch. A high resistance voltmeter is connected across the cell.

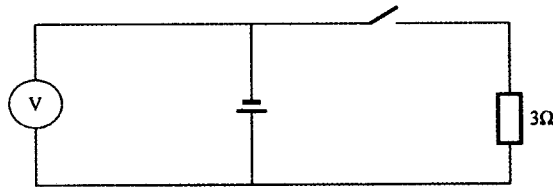


Figure 13

The voltmeter reads 1.5V with the switch open and 1.2V with the switch closed.

- (i) State the electromotive force of the cell. (1 mark)
- (ii) Determine the current through the  $3\Omega$  resistor when the switch is closed. (2 marks)
- (iii) Determine the internal resistance of the cell. (2 marks)
- (c) (i) Another resistor  $R$  is connected in series with the  $3\Omega$  resistor so that a current of 0.15A flows when the switch is closed. Determine the resistance of  $R$ . (3 marks)

18 **Figure 14a**, is a diagram of a cathode ray tube. M and N are parallel vertical plates.

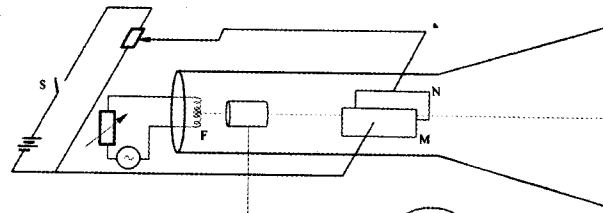


Figure 14(a)

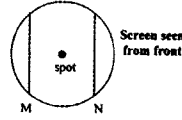
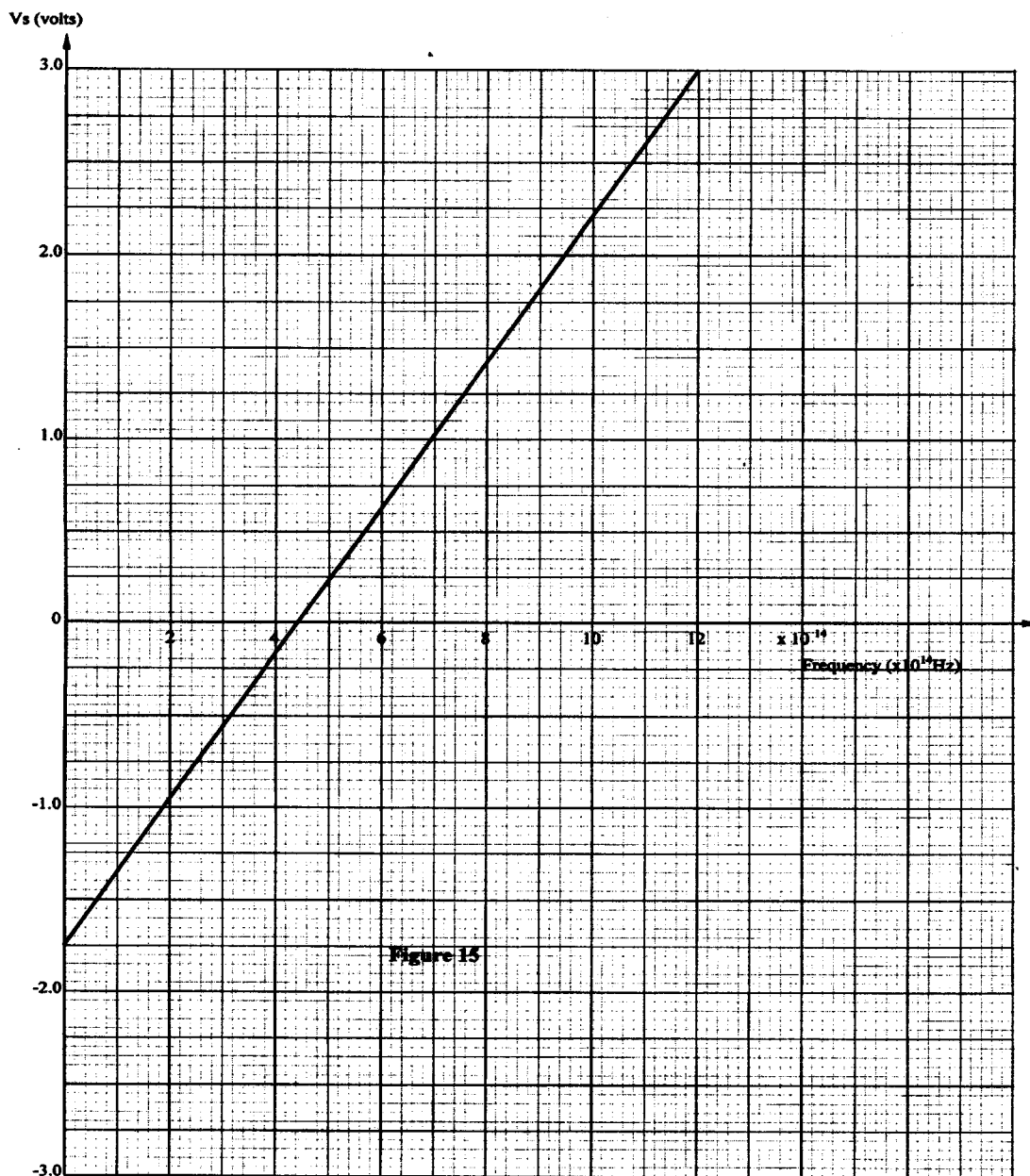


Figure 14(b)

- (a) When switch S is open, a spot is seen at the centre of the screen as shown in **figure 14(b)**.
- (i) State what happens to the spot when S is closed. (1 mark)
  - (ii) State what would happen to the spot if the potential difference across MN is increased. (1 mark)
  - (iii) State what would be seen on the screen if the battery is replaced with an alternating emf of:
    - (I) a low frequency of about 1 Hz; (1 mark)
    - (II) a high frequency of about 50Hz. (1 mark)
- (b) Explain the process by which electrons are produced at F. (2 marks)
- (c) State with a reason how the brightness of the spot can be increased. (2 marks)
- (d) The accelerating voltage of the tube is 1000V and the electron current in the beam is 1.5mA. Determine the energy conveyed to the screen per second. (2 marks)

- 19 (a) State the property of radiation that determines the number of electrons emitted when a radiation falls on a metal surface. (1 mark)
- (b) **Figure 15** is a graph of the stopping potential  $V_s$  against frequency in an experiment on photoelectric effect.



(i) What is meant by stopping potential? (1 mark)

(ii) Given that the stopping potential  $V_s$  is related to the frequency by the equation.

$$V_s = \frac{h}{e}f - \frac{\omega_0}{e}, \quad \text{Where } e \text{ is the charge of an electron, } (e = 1.6 \times 10^{-19}\text{C})$$

Determine from the graph:

(I) plank's constant,  $h$ ; (4 marks)

(II) the work function  $\omega_0$  for the metal in electron volts (eV). (3 marks)

### 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.

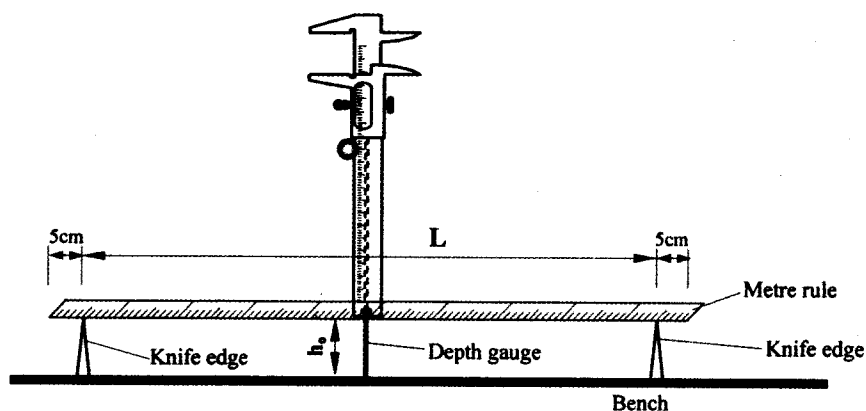
Proceed as follows:

- (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  $h_0$ , of the upper edge of the metre rule at the 50 cm mark. (see **figure 1**).

$h_0 = \dots\dots\dots$  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.

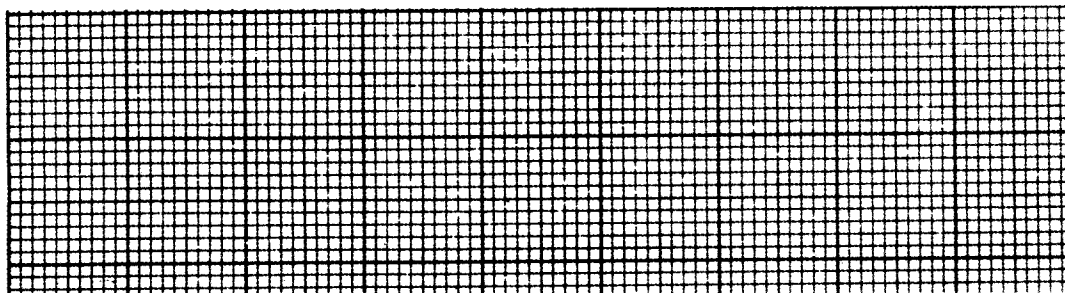
- (d) Repeat the procedure in (c) for other values of L shown in table 1. Complete the table.

Length L (mm)	900	800	700	600	500
Height h (mm)					
Depression d (h <sub>0</sub> - 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.

$$d_1 = \dots\dots\dots \text{cm}$$

$$d_2 = \dots\dots\dots \text{cm} \quad (1 \text{ mark})$$

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

$$X = \dots\dots\dots \text{cm} \quad (1 \text{ mark})$$

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

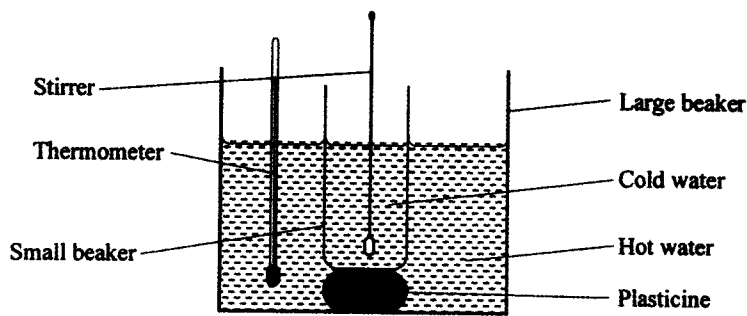
$$h = \dots\dots\dots \text{cm} \quad (1 \text{ mark})$$

Determine the area  $A$  of the glass walls in contact with water, given that

$$A = \pi d_1 h.$$

$$A = \dots\dots\dots \text{cm}^2 \quad (1 \text{ mark})$$

- (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 stopwatch 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.

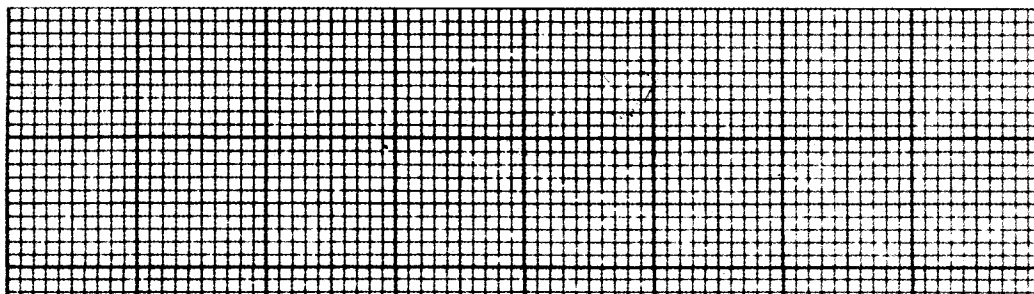
Time t (seconds)	0	20	40	60	80	100	120	140	160	180
Temperature $T_1$ °C										
Temperature $T_2$ °C										

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  $t = 60$ s,  
and  $X$  and  $A$  are in m and  $m^2$  respectively. (2 marks)