30.5 PHYSICS (232)

30.5.1 Physics Paper 1 (232/1)

1. 5.0×10^{-6} kg. ***(1 mark)***

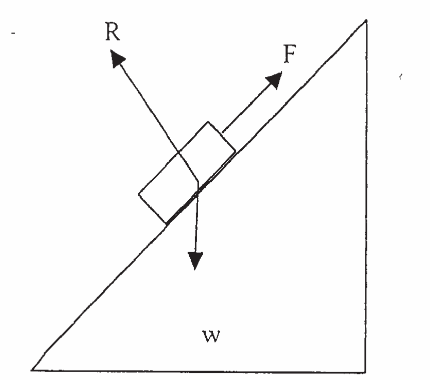
2. Since $\rho = \frac{m}{v}$ $\qquad V = \frac{m}{\rho}$

For water $\qquad v = \frac{mw}{1}$

For liquid $\qquad v = \frac{ml}{p}$

$$\frac{mw}{1} = \frac{ml}{p} \therefore p = \frac{ml}{mw}$$ ***(2 marks)***

3. (a) R = Reaction force Iar to surface
F = Friction parallel to surface



(b) When θ reduces, R increases (approaches w) while F reduces. ***(2 marks)***

4.
- Atmospheric pressure is higher than normal.
- Presence of impurities in water/Addition of impurities. ***(2 marks)***

5. When flask is cooled it contracts / (volume reduces), but due to poor conductivity the material of glass; subsequently as both cool the contraction of water is greater than that of glass.
(3 marks)

6.
- Heat conductivity/rates of conduction. ***(1 mark)***
- Thermal conductivity.

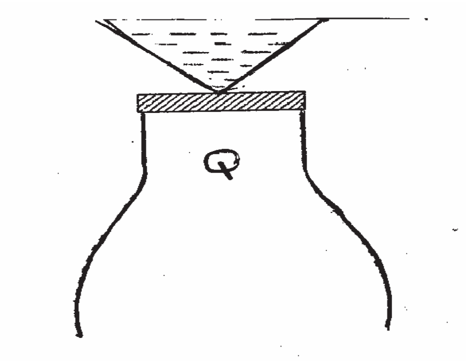
7. Cross-sectional area of the metal rods. ***(1 mark)***

8. Pressure in liquids $= \rho gh$
$= 1200 \times 10 \times 15 \times 10^{-2}$
$= 1800$ Pa

Total pressure = $(8.4 + 0.18) \times 10^4$ Pa = 8.58×10^4 Pa ***(3 marks)***

9. Intermolecular distances are greater/ larger in gas than in liquids. Forces of attraction in liquids are higher/stronger/larger/greater than in gases. ***(2 marks)***

10.



(1 mark)

11. ***Stable equilibrium***: When it is slightly tilted. C.O.G rises/is raised. When released it recovers. /comes to its original position ***(2 marks)***

12. Fast stream of air reduces pressure inside the tube. Pressure from outside is greater than inside, hence collapse. ***(2 marks)***

13.

- Diameter of the coils different.
- Wires have different thicknesses. no. of turns per unit length.
- Length of spring differs. ***(1 mark)***

14. Heated water has lower density, hence lower upthrust. ***(2 marks)***

15. (a) The rate of change of momentum of a body is (directly) proportional to the(resultant external)force producing the change, and takes place in the direction of the force. ***(1 mark)***

or $F \propto m\dfrac{(v-u)}{t}$

(b) (i) $S = ut + \frac{1}{2}at^2$

$49 = 0 + \frac{1}{2}ax7$ ***(3 marks)***

$a = 2ms^{-2}$

(ii) $V = u + at$

$= 0 + 2 \text{ x } 7 = 14 \text{ ms}^{-1}$. ***(2 marks)***

(c) (i) Vertical motion

$S = ut + \frac{1}{2}gt^2$

$1.2 = 0 + \frac{1}{2}x10xt^2$

$t = \sqrt{\frac{1.2}{5}} = 0.49\text{seconds}$

(2 marks)

(ii) Horizontal velocity

$$V = \frac{s}{t} = \frac{2.5}{0.49}$$ ***(2 marks)***

$= 5.1ms^{-1}$

16. (a) Heat capacity of a body is the energy required to raise the temperature of the body by 1 degree centigrade or 1 Kelvin. ***(1 mark)***

(b) Measurements:

Initial mass of water +calorimeter =M_i
Final mass of water + calorimeter = M_f

Time taken to evaporate (M_i– M_f) mass of steam = t
----------t.
Mass of calorimeter ----------M_c
Heat given out by heater = heat of vaporization

Pt = (M_i- M_f) L

$$l = \frac{Pt}{m_i - m_f}$$ ***(6 marks)***

(c) (i) ***Heat gained by the calorimeter***
Heat capacity × ΔT ***(2 marks)***
= 40 (34 – 25) = 40 × 9 = 360J

(ii) ***Heat gained by water***
$M_w x C_w \times \Delta T$
$= 100 \text{ x } 10^{-3} \times 4.2 \times 10^3 (34 - 25)$
= 3780 J ***(1 mark)***

(iii) ***Heat lost by metal block***
Mm C_m (100-34) ***(1 mark)***

(iv) $150 \times 10^{-3} \times C_m$ (100-34)
= 360 + 3780
= 4140

$$Cm = \frac{4140}{150 \times 10^{-3} \times 66}$$

$= 418 \quad JKg^{-1}K^{-1}$ ***(3 marks)***

17. (a) Absolute zero temperature is the lowest temperature theoretically possible.
(1 mark)

(b)
- Mass of the gas
- Pressure of the gas ***(2 marks)***

(c) (i) 4.0×10^{-5} m^3 ***(1 mark)***

(ii) -277°C ***(1 mark)***

(iii) A real gas liquefies and finally solidifies since molecules lose Kinetic energy with more cooling. ***(2 marks)***

(d)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}; \text{but} V_1 = V_2$$

$$P_2 = \frac{P_1}{T_1} \times T_2 = 95\text{x}10^3 \times \frac{283}{298}$$

$$= 90.2 \times 10^3 \text{Pa}$$

(4 marks)

18. (a)

$$\text{Velocity ratio} = \frac{\text{distance effort moves}}{\text{distance load moves}}$$ ***(1 mark)***

(b) (i) Pressure in liquid is transmitted equally through out the liquid. ***(1 mark)***

(ii) When plunger is moved through d' volume of oil = d x a
When ram piston is displaced by dist D
Volume of oil displaced = D × A
Since no compression occurs

$$\text{dxa} = \text{DxA} \Rightarrow \frac{d}{D} = \frac{A}{a}$$

$$\text{V.R} = \frac{d}{D} = \frac{A}{a}$$ ***(4 marks)***

(c) (i) M.A $= \frac{\text{Load}}{\text{Effort}}$

$$= \frac{4.5 \times 10^3}{135} = 33.3$$ ***(2 marks)***

(ii) Efficiency $= \frac{M.A}{V.R} \times 100 = \frac{33.3}{45} \times 100\%$

= 74% ***(2 marks)***

(iii) Work to overcome friction
= 100% - 74% = 26% ***(1 mark)***

19. (a) When an object is in equilibrium, the sum of the anti clockwise moments about any point is equal to the sum of the clockwise moments about that point. ***(1 mark)***

(b) (i) Volume = 100 × 3.0 × 0.6
= 180 cm^3

Mass = volume x density
= 180 × 2.7 = 486g

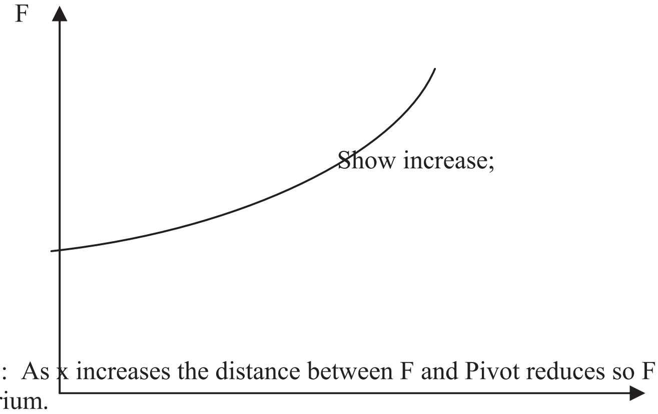
Weight = mg = $\frac{486}{1000} \times 10 = 4.86\text{N}$ ***(3 marks)***

(ii) 20F = 15 × 4.86

F = $\frac{15 \times 4.86}{20}$ = 3.645N

F = 3.65N
R = F + W = 8.51N *(3 marks)*

(iii)



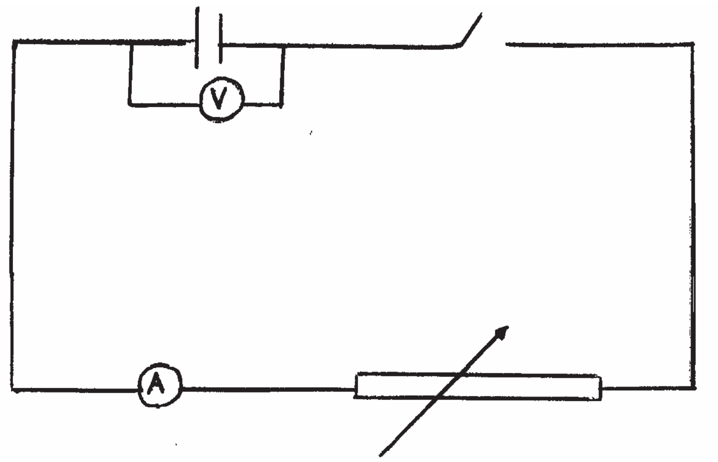
(iv) ***Reason***: As x increases the distance between F and Pivot reduces so F has to increase to maintain equilibrium. ***(2 marks)***

30.5.2 Physics Paper 2 (232/2)

1. BC is total absence of light; or umbra.
   Rays of light are completely blocked from this region by the object. **(2 marks)**

2. The leaf in A falls some distance while the lead in B rises some distance; the two leaf electroscopes share the charge. **(2 marks)**

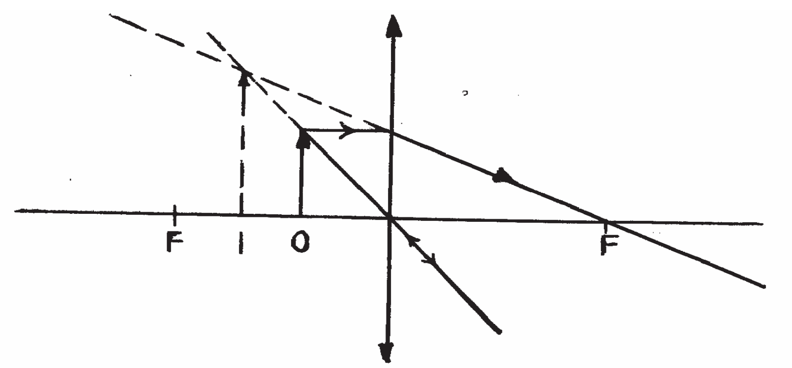
3.



(1 mark)

4. Hammering causes the domains in the rod to vibrate; when settling, some of the domains align themselves in the North-south direction due to the earths field; causing magnetization.
   (2 marks)

5.



(1 mark)

6. When the switch is closed so that current flows, the iron core in the solenoid is magnetized attracting the flat spring; this causes a break in contact at the contact point disconnecting the current; so the magnetism is lost releasing the spring and repeating the process.

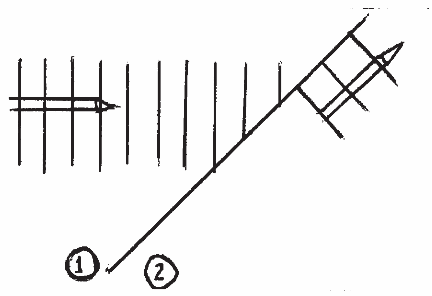
(3 marks)

7. Movement equals 1.75 D

So period $T = \frac{0.7}{1.75}$ S = 045S

$f = \frac{1}{T} = \frac{1}{0.4} = 2.5\ H_Z$. **(2 marks)**

8.



(2 marks)

9. (i) V = 0v (since no current).
Reason: no current.

(ii) Reason: Current flows in the resistor V = 3V. **(2 marks)**

10. $P = \frac{V^2}{R}$; $R = \frac{240^2}{100}$ $P = \frac{220^2}{240^2/100} = 84\ JS^{-2}$ **(3 marks)**

11. Defect: Short sightness.
Cause: Extended eyeball. **(1 mark)**

12. The spot moves up and down. **(1 mark)**

13. The frequency of the X-rays increases;
(accept become hard, wavelength decreases). **(1 mark)**

14. Radiation: Beta particle;
Gain of an electron. **(2 marks)**

15. (a) Temperature, density (any one). **(1 mark)**

(b) i) 46.5m; (accept 46m to 47m) **(1 mark)**

ii) $\frac{4x}{v}$, $\mu = \frac{4x}{t}$

$\frac{x}{t} = (\text{slope})^{-1} = \left[\frac{0.51}{43}\right]^{-1}$

$v = \frac{43}{0.51} \times 4\ ms^{-1} = 337\ ms^{-1}$ **(3 marks)**

iii) For maximum internal, observer is at one end and so distance = 2L

$337 \times 4.7 = 2L$

$L = 792$ m. **(3 marks)**

(c) i) Distance moved by echo from sea bed = 98×2m.

$v = \frac{98 \times 2m}{0.14s} = 1400\,ms^{-1}$ **(3 marks)**

ii) Distance = v × t

$= 1400 \times \frac{0.10m}{2} = 70m$ **(2 marks)**

16. (a) Light must travel from denser to less dense medium. Angle of incidence in the denser medium must exceed the critical. Angle of incidence in the denser medium must exceed the critical angle. (mark the two independently).
(2 marks)

(b)

$_1\eta_2 = \frac{\sin i}{\sin r}$;

Since I = 90°, r = θ

$_1\eta_2 = \frac{\sin 90^0}{\sin \theta}$;

$_1\eta_2 = \frac{1}{\sin \theta}$

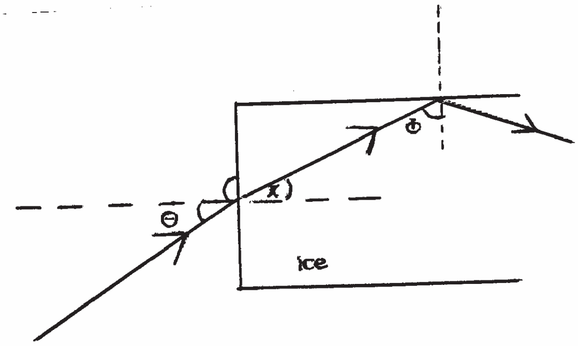
Alternative method

$_1\eta_2 = \frac{\sin i}{\sin r} = \frac{\sin \theta}{\sin 90^0}$

$= \sin \theta = {}_1\eta_2 = \frac{1}{_1\eta_2} = \frac{1}{\sin \theta}$

(2 marks)

(c)



At the greatest angle θ, the angle ϕ must equal the critical angle of the medium.

i) $\text{Sin } \theta = \text{sinc} = \dfrac{1}{n} = \dfrac{1}{1.31} = 0.763$

$\phi = 49.8^\circ$. **(2 marks)**

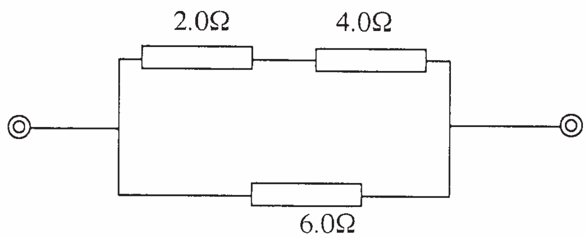
ii) $X = 90 - \phi = 40.2^\circ$. **(1 mark)**

iii) $\dfrac{\sin \theta}{\sin x} = n = 1.31$

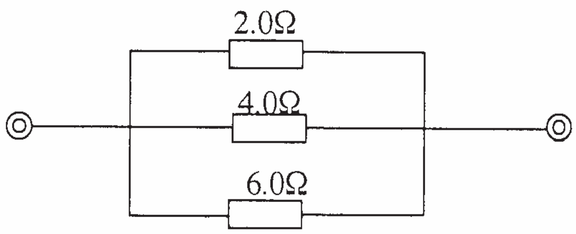
$\text{Sin } \theta = 1.31 \sin 40.2 = 0.846^\circ$

$\theta = 57.8^\circ$ **(2 marks)**

17. (a) i)



ii)



(b) i) emf = open circuit pd = 2.1V. **(1 mark)**

ii) The difference in pd is the pd across the internal resistance r.

2.1v – 1.8v = 1r = 0.1r

0.1r = 0.3v

$r = \dfrac{0.3}{0.1} = 3\Omega$ **(3 marks)**

ii) When current is being drawn from the cell, the pd across the external circuit is the one measured.

$$0.1 \times R = 1.8v$$

$$R = \frac{1.8v}{0.1} = 18\Omega$$ **(2 marks)**

18. (a) When the switch is closed, flux in the coil on L.H.S. grows and links the other coil inducing an emf; when the current is steady no flux change and hence no induced emf; when the switch is opened, the flux collapses even in the coil on R.H.S. inducing current in opposite direction.

(b) (i) Soft-iron reduces losses due to hysteresis (or magnetic losses); this is because the domains in soft iron respond quickly to changes in magnetic field (or have low reluctance). **(2 marks)**

(ii) Laminated core reduces losses due to eddy currents; this is because laminating cuts off the loops of the eddy currents reducing them considerably. **(2 marks)**

(c) (i) $$\frac{V_p}{V_s} = \frac{N_p}{N_S}$$

$$\frac{V_p}{N_p} = 400\text{ V}, \quad V_s = ?$$

$N_p = 2000$ $N_s = 200$

$V_s = 40v$

Power = V_sI_s = 800 w.

$$I_s = \frac{800w}{40v} = 20A$$ **(4 marks)**

(ii) $P_p = P_s = 800w = 400 \times 1_p$

$1_p = 2A$ **(2 marks)**

19. (a) (i) Hard – X-rays.

(ii) They are more penetrating (or energetic).

(b) (i) A – Electronic beam/cathode rays/electrons.
B – anode (copper anode).

(ii) Change in Pd across PQ changes filament current. This changes the number of electrons released by the Cathode hence intensity of X-rays.

(iii) Most of the kinetic energy of the electrons hitting target is converted to heat.

(iv) High density.

(c) Energy of electrons E = QV
= $1.6 \times 10^{-19}C \times 12000v$

Energy of X-rays = hf

Equating $6.62 \times 10^{-34} JS \times f = 1.6 \times 10^{-19} C \times 12000v$

$f = 2.9 \times 10^{18}\ H_z$ **(4 marks)**

30.5.3 Physics Paper 3 (232/3)

Question 1

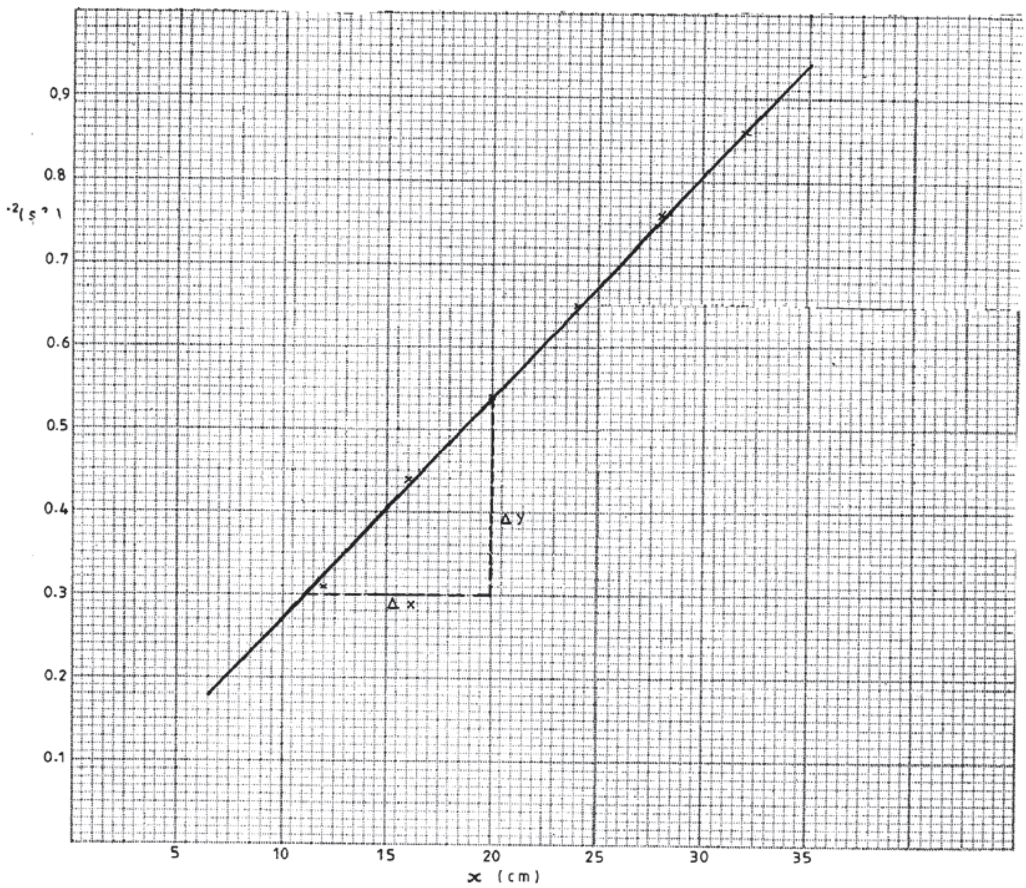
PART A

(c)

Length X (cm)	***32***	***28***	***24***	***20***	***16***	***12***
Time t for 20 oscillations	18.50	17.40	16.15	14.75	13.30	11.20
Period $T = \frac{t}{20}(s)$	0.925	0.870	0.808	0.738	0.665	0.560
$T^2(s^2)$	0.856	0.757	0.652	0.544	0.442	0.314

(5 marks)

(d) ***(5 marks)***



(e) (i) slope S = $\dfrac{0.54-0.30}{20-11}$

$= \dfrac{0.24}{9} = 0.0267\dfrac{s^2}{cm}$ ***(3 marks)***

(iii) S $= \dfrac{8\pi}{3k}$

$0.0267 = \dfrac{8\pi}{3k}$

$\therefore$ k $= \dfrac{8\pi}{3\times 0.0267}$

= 313.767 cm/s^2. ***(2 marks)***

PART B

(g)

t(s)	$t_{1\,(s)}$	t_2 *(s)*	t_3 *(s)*	*Average t(s)*	$T=\dfrac{t}{5}(s)$
	3.46	3.25	3.44	3.34	0.67

(3 marks)

(h) P - $\dfrac{40L}{T^2}$ $=$ $\dfrac{40\times 12}{0.67^2}$

= 1069 cm/s^2

= 10.7 m/s^2 (accept values between 9 and 11 m/s^2). ***(2 marks)***

Question 2

PART A

(a) $\mathrm{A}=60^{\circ}$

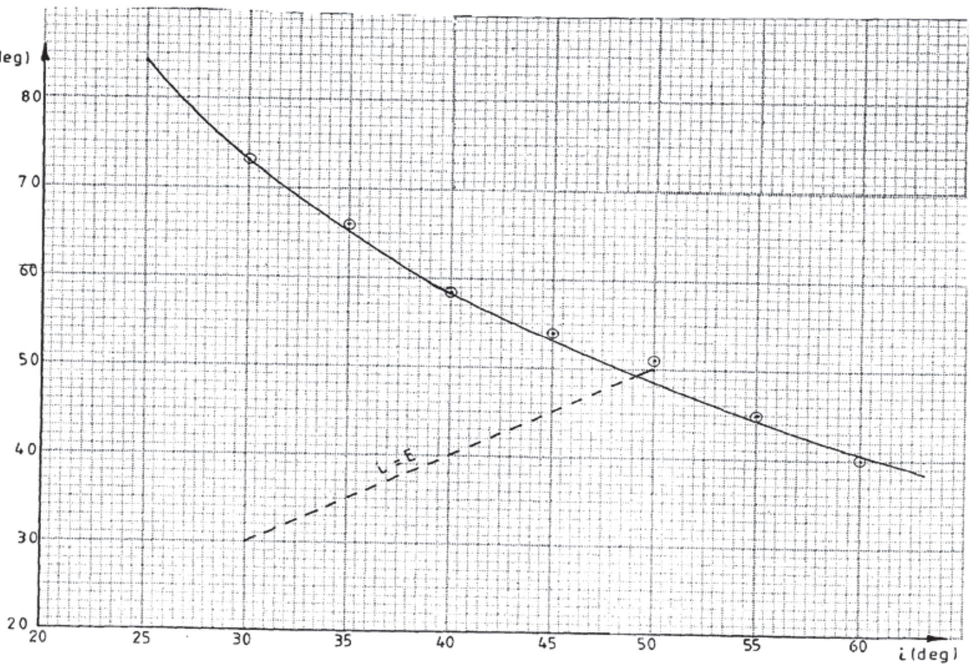
(1 mark)

(e)

Angle of incidence i (deg)	***30***	***35***	***40***	***45***	***50***	***55***	***60***
Angle Q (deg)	16.5	24.0	31.5	36.0	38.9	45.0	50.0
Angle of emergence E=90-Θ	73.5	66.0	58.5	54.0	51.1	45.0	40.0

(6 marks)

(f) (i)



(5 marks)

(ii) $i_o = 49°$ ***(1 mark)***

(iii) (I) $y = 2i_0 - R$

$= 2(49) - 60 = 38°$ ***(1 mark)***

(II) $k = 2 \sin 49° = 1.51$ ***(1 mark)***

PART B

(g) (i) $V = 60$ cm

(ii) $f = \dfrac{uv}{u+v} = \dfrac{(30)(60)}{90} = 20cm$ ***(2 marks)***

(h) (i) $d = 10$ cm ***(1 mark)***

(ii) I $= \dfrac{df}{f-d} = \dfrac{10 \times 20}{10} = 20$ ***(1 mark)***

II $x = \dfrac{L}{2f} + 1 = \dfrac{20}{40} + 1 = \dfrac{20}{40} + 1$

$= 1.5$ ***(1 mark)***