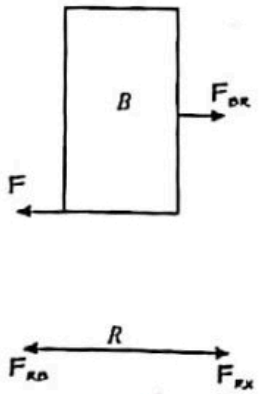
******

ANSWERS

Part A Structured Essay

1.(*a*)(i)



(ii) F_{BR} and F_{RB}

(*b*)100 N

(*c*)(i) 150 N (ii) 0.3

(*d*)(i) 198 N (ii) 98 N (iii) $\mu_1 = 0.196$

2. (a)(i) Tube *A* : Immerse the lower end of the tube in water.

(ii) Tube *B* : keep the lower end of the tube above the water level.

(b) In order to maintain a constant pressure inside the steam generator and to safety

(c)(i) because the condensed water in *B* can mix with water in the calorimeter.

(ii)

(d) (i)(1) Mass of the empty calorimeter.

(2) Mass of the calorimeter with water.

(3) Mass of the calorimeter and its contents after passing steam.

(ii) (1) specific heat capacity of the material of calorimeter or the heat capacity of calorimeter.

(2) Specific heat capacity of water.

(e) (1) place a screen between the burner and colorimeter (to avoid heating the calorimeter)

(2) Lower the initial temperature by few Celsius (5 °C) bellow the room temperature and then add steam until the final temperature is few Celsius (5 °C) above the room temperature.

(f) Use the correct boiling temperature at this pressure (other than 100 °C)

3. (a) On the sonometer box (around the middle of two pegs.) or on one peg.

(b) Firs bring two pegs close together and then increase the distance between them while the sounded tuning fork on the box until resonance occur for the first time.

(c) $f = \frac{1}{2l}\sqrt{\frac{Mg}{m}}$

(d)(i) The largest l value

(ii) It has the lowest percentage error.

(e)(i) *Two of the following points are acceptable.* (1, 100), (3,350), (5, 600), (7, 850)

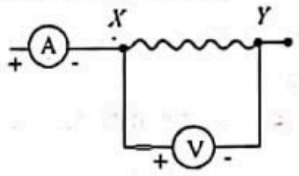
(ii) 125 $cm^2\ kg^{-1}$ (120-130 $cm^2\ kg^{-1}$)

(f) 500 Hz (490-510 Hz)

4. (a) $R = \rho\frac{l}{\pi r^2}$ (b) 100 kΩ,

(c) V_{XY} = 5 mV therefore suitable full scale deflection is 10mV

(d)



(e) Yes. temperature of the wire will not increase appreciably.

(f) 8.25 Ω m (8.2-8.3 Ω m)

(g) Replace R_0 by a resistance box

Part B Essay

1.(i) Kinetic energy per unit volume of moving air = $E = \frac{1}{2}\rho v^2$

(ii) Volume of air passing through an A area per unit time = Av

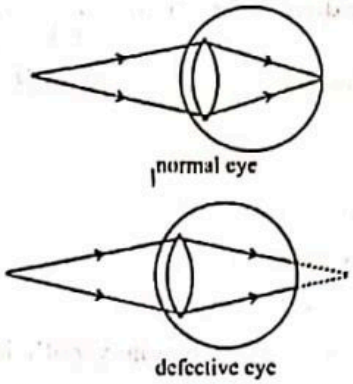
Then the rate of energy transferred to the wind mill = $Av \times \frac{1}{2}\rho v^2 = \frac{1}{2}\rho A v^3$.

(iii) Frictional torque = 2262 N m (261 – 263 N m)

(iv) 823 W (820-827 W)

(v) 4.2 %

2.(i)



(ii) Sign convention: all the distances are measured from the optical center of the lens. Distances measured in the direction of incident rays are negative while those measured in the direction opposite to the rays are positive.

Focal length = 33.3 cm convex glass.

(iii) Focal length of the eye lens. = 2.4 cm

(iv) Power of the eye lens = 40 D

3.(i) (a) the magnetic force is always perpendicular to the direction of motion of the proton. Therefore it can act as the centripetal force to bring the proton in a circle. Radius r = 0.5 m.

(b) Electron will move in the opposite sense (the other side) with a lower radius.

(ii) Since the mass of the α particle is as twice as that of proton and has a charge four times the proton, its radius is twice (1 m)

(iii) *A straight line*

(iv) Magnitude of the electric field is 1.36×10^4 V m^{-1}. The direction of the electric field must be perpendicular to both magnetic field and the direction of motion of the proton. (Downward according to the above figure.)

Velocity does not change because no force is acting along the direction of motion.

4. $\frac{Q}{t} = \frac{\pi a^4 (P_1 - P_2)}{8\eta l}$

Q – volume of fluid flow through the tube in a t time.

a – internal radius of the tube.

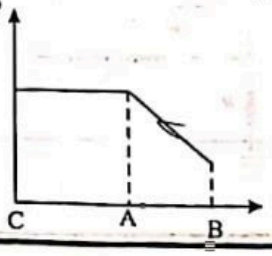
P_1 – pressure of the fluid at the inlet.

P_2 – pressure of the fluid at the outlet.

l – length of the tube.

η – coefficient of viscosity of the fluid.

(i)



(ii) Pressure difference across $AB = 3.2 \times 10^3$ Pa (3.1-3.3 $\times 10^3$ Pa)

(iii) Additional force to be applied on $D = 1.02$ N

5.

(a)(i) 5 A

(ii) $n = 8.6 \times 10^{28}$ m^{-3}

(iii) $V_d = 2.4 \times 10^{-4}$ $m\ s^{-1}$

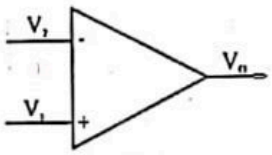
(iv) $V_{r.m.s.} = 1.2 \times 10^5$ $m\ s^{-1}$

Electrons suffer so many collisions with atoms while moving and directions of their velocity changes; $V_{r.m.s}$ measures the velocity of electrons between those collisions. Whereas V_d measures the net velocity of electrons along the electric field, therefore the net forward velocity is much smaller than the velocity between collisions.

(v) Time taken = 4.2×10^3 s (4.0 4.4 $\times 10^3$ s)

The electric field is set up in the wire taking no time (approximately with the velocity of light.) and all the electrons start moving. Therefore the current in the wire is set up as soon as the switch is on. The time taken by an individual electron to move across the wire is not relevant tor the current.

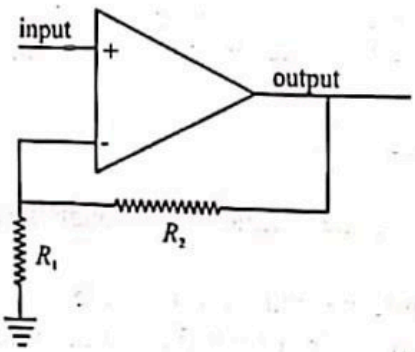
(b)



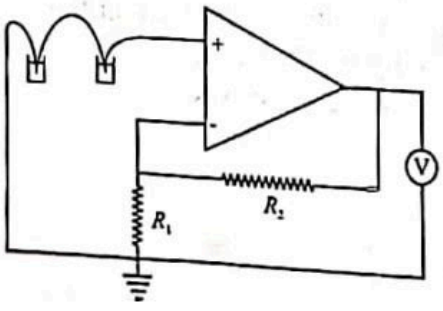
$V_O = A(V_1 - V_2)$

(i) $V_O = 2 \times 10^5$ mV; the polarity is positive.
Even though the calculated output is very high it will remain 15 V as the supply voltage is 15 V

(ii) (a)

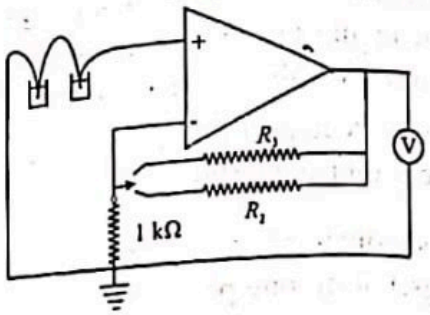


(b)



(c) $R_1 = 1$ kΩ, and R_2

(iii)



$R_3 = 9$ kΩ

6.

(a)(i) Considering the first possibility, fin temperature must be 110° C which is grea than the suggested possibility. Therefore t suggestion is impossible.

(ii) Considering the second possibility, mass steam produced is 0.006 kg which is le than 0.1 kg. Therefore this is what reall happens.

(iii) 0.018 kg (0.017-0.02 kg)

(b)(i) A – target\ anode B – Filament\ cathode

(ii) To avoid loss of electrons or energy fro electrons due to collision.

(iii) To produce thermal electrons by heating th filament.

(iv) Positive.

(v) Number of electrons hitting the target per un time. (voltage of P_2)

(vi) Energy of the electrons hitting the targ (voltage of P_1)

(vii) 35 kV

(viii) 0.35 Å

(ix) To obtain X-ray images of various body par in the field of medicine.
Use in cancer therapy.
For security checks at airports and customs
To detect defects in materials.
To obtain crustal structures of materials.

(x) Photo electric effect.

******

පිළිතුරු

1.	(2)	2.	(4)	3.	(3)	4.	(5)	5.	(3)
6.	(4)	(5) 7.	(3)	8.	(3)	9.	(4)	10.	(4)
11.	(2)	12.	(2)	13.	(3)	14.	(4)	15.	(3)
16.	(3)	17.	(4)	18.	(1)	19.	(5)	20.	(5)
21.	(1)	22.	(2)	23.	(1)	24.	(1)	25.	(5)
26.	(2)	27.	(2)	28.	(2)	29.	(3)	30.	(1)
31.	(5)	32.	(2)	33.	(1)	34.	(all)	35.	(4)
36.	(5)	37.	(4)	38.	(2)	39.	(4)	40.	(4)
41.	(5)	42.	(1)	43.	(3)	44.	(3)	45.	(5)
46.	(4)	47.	(3)	48.	(4)	49.	(5)	50.	(5)
51.	(5)	52.	(1)	53.	(2)	54.	(1)	55.	(1)
56.	(3)	57.	(2)	58.	(1)	59.	(2)	60.	(4)