



தொண்டைமாளாறு வெளிக்கள நிலையம் நடாத்தும்  
ஐந்தாம் தவணைப் பரீட்சை - 2022  
Conducted by Field Work Centre, Thondaimanaru.  
5<sup>th</sup> Term Term Examination - 2022

தரம் :- 13 (2022)

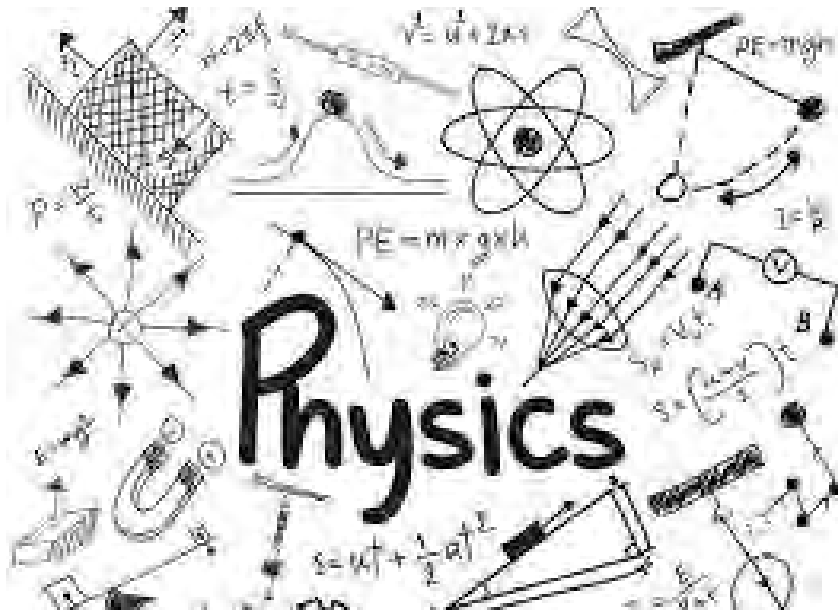
பௌதிகவியல்

புள்ளித்திட்டம்

பகுதி - I

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 01) 1 | 11) 4 | 21) 3 | 31) 3 | 41) 2 |
| 02) 2 | 12) 5 | 22) 4 | 32) 5 | 42) 5 |
| 03) 2 | 13) 3 | 23) 2 | 33) 3 | 43) 1 |
| 04) 3 | 14) 4 | 24) 1 | 34) 5 | 44) 2 |
| 05) 4 | 15) 3 | 25) 5 | 35) 1 | 45) 2 |
| 06) 5 | 16) 5 | 26) 2 | 36) 3 | 46) 3 |
| 07) 2 | 17) 1 | 27) 3 | 37) 3 | 47) 5 |
| 08) 2 | 18) 3 | 28) 3 | 38) 5 | 48) 4 |
| 09) 2 | 19) 2 | 29) 1 | 39) 1 | 49) 1 |
| 10) 5 | 20) 2 | 30) 4 | 40) 2 | 50) 1 |

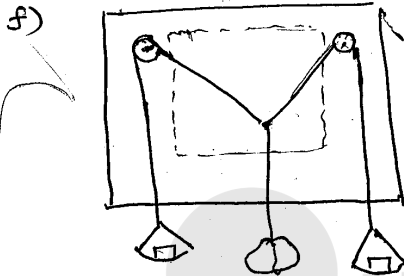
(50 x 1 = 50 புள்ளிகள்)



## Structured Essay

### Part II A

- 01) a) Set square / compass, metre ruler / half metre ruler (01) (01)
- b) Electronic balance / Triple beam balance (01)
- c) Pull down the middle mass a little and release and test whether it returns to the original position (02)
- d) By applying lubricant to (the axle of) the pulleys (01)
- e) Weights act in the vertical plane / If not the tension would not be equal to the weight hung / In addition to the weights frictional forces too will contribute to the tension forces. (02)



- (g) Place the mirror strip below the string. Mark two dots when the string covers its own image. (02)
- (h) Presence of friction in the pulleys / strings may have weight (01)
- (i) To identify the length of OA as 10 units (5 cm) (01)  
 scale: 5 g/unit (10 g/cm) OR 1 unit to represent 5g (01)
- (ii) Completing the parallelogram (01)
- (iii) Mass of the stone =  $12 \times 5 = 60 \text{ g}$  (01)
- (j)  $\text{upthrust} = \text{apparent weight loss}$  (01)  
 $= 4(\text{units}) \times 5 = 20 \text{ g}$  (01)
- Relative density =  $\frac{\text{weight (in air)}}{\text{upthrust (in water)}} = \frac{60}{20} = 3$  (01)

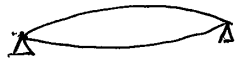
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- 02) a. Paper rider (01)
- b. i) To determine the mass per unit length of the sonometer wire (01)
- ii) 1. Mass of the wire      triple beam balance (01)  
 2. Length of the wire      metre ruler (01)
- c. On the sonometre box (stem normal to the surface) (01)  
 Energy transfer is efficient OR Air column inside the sonometer box will vibrate with maximum amplitude / will resonate OR surface of the sonometer will vibrate with maximum amplitude (01)

- d) (Place the paper rider on (the middle) the wire)  
(Place the stem of the vibrated tuning fork on top of the sonometer surface)

Adjust the bridges / one of the bridges until the paper rider jumps off (very) quickly / instantly / to a maximum height

e) (i)



(ii) Transverse, standing ... (01)

(iii) By the spe superposition of two identical waves / incident and reflected waves traveling in opposite direction (01)

f)  $a_{max} = g$ ,  $\omega^2 A = g$  } (01)

( $\omega = 2\pi f$ )  $A = \frac{g}{4\pi^2 f^2}$  (01)

g) (i)  $V = \sqrt{\frac{Mg}{m}}$  (iii)  $\frac{g}{4f^2} = l \Rightarrow \lambda = 2l$  (01)

(ii)  $f^2 = \frac{1}{4l^2} \cdot \frac{Mg}{m}$  (01)

$l^2 = \left(\frac{g}{4f^2 m}\right) M$  (01)

(iii)  $\frac{g}{4f^2 m} = \text{gradient}$

$f^2 = \frac{g}{4m \times \text{gradient}} = \frac{10}{4 \times 1 \times 10^{-3} \times 0.01} = \frac{10^6}{4}$  (01)

$f = 500 \text{ Hz}$  (01)

13) a) A - Steam generator, B - Steam trap, C - Heat insulating sheet (03)

b) A - To supply continuous stream of steam (01)

B - To send dry steam to the calorimeter (01)

C - To minimize transfer of heat to the calorimeter by radiation OR Prevent the transfer of heat directly from the burner and steam generator (01)

c) Electronic balance / Four beam balance (01)

d) D - mercury in glass thermometer - can read temp. close to 100°C (01)

E - alcohol in glass thermometer - smaller L.C. more accurate / Precise (01)

e) To send dry steam (without water) to the water (01)

f) selecting the initial temp. 5°C below the R.T. and mixing of steam is commenced with stirring (01)

Mixing of steam is stopped when the temp. is increased by about 10°C (the maximum temp reached will be noted) (01)

- 3) Initial temp. should not below the dew point (0.2)
- (A) Mass of empty calorimeter (with stirrer) (X<sub>1</sub>)
- mass of calorimeter with water (X<sub>2</sub>)
- Initial temperature of water (X<sub>3</sub>)
- Maximum temp. of water after mixing with steam (X<sub>4</sub>)
- mass of the calorimeter with the mixture (contents) (X<sub>5</sub>)

(ii) Heat lost by steam = Heat gained by Calorimeter and water

$$(X_5 - X_2) L + (X_5 - X_2) C_w (100 - X_4) = [X_1 C + (X_2 - X_1) C_w] (X_4 - X_3)$$

L.H.S (0.1)

R.H.S (0.1)

4) a) i) Item (4) (10 Item (1)) (0.1 + 0.1)

- b) Non uniformity / uniformity of the potentiometer wire (0.1)
- Temp. dependence of the resistance of the pot. wire
- OR Temp. coefficient of the resistance of the pot. wire (0.1)

c) Resistance box (0.1)

d) Yes (0.1)

Range can be adjusted by varying the value of R, OR

By increasing / varying the length of the pot. wire (0.1)

e) Yes, zero error of the galvanometer does not affect the results of the experiment OR

It is the deflection, not the zero reading of the galvanometer that matters in the experiment OR

Expt. can be continued by observing the deflection from the initial position (any one) (0.1)

f)  $E = k l_0$  } OR  $\frac{V}{E} = \frac{l}{l_0}$  (0.1)

$V = k l$  }

$V = E \left( \frac{R}{R+r} \right)$  OR  $\frac{V}{E} = \frac{R}{R+r}$  (0.1)

$\frac{R}{R+r} = \frac{l}{l_0}$  (0.1)

$r = R \left( \frac{l_0}{l} - 1 \right)$  (0.1)

g)  $l_0 = 72.2 + 0.2$  ;  $l = 50.2 - 0.2$  (0.1 + 0.1)

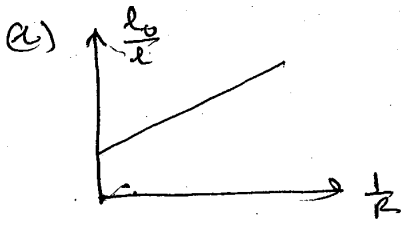
$r = 10 \left( \frac{72.2 + 0.2}{50.2 - 0.2} - 1 \right)$

$r = 10 \times \left( \frac{72.4}{50} - 1 \right) = 4.48 \Omega$  (0.1)

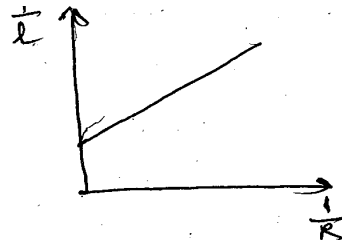
h)  $\frac{l_0}{l} = r \cdot \frac{1}{R} + 1$  OR  $\frac{1}{l} = \frac{r}{l_0} \cdot \frac{1}{R} + \frac{1}{l_0}$  (0.1)

$\frac{l_0}{l} = \frac{r}{l_0} \cdot \frac{1}{R} + \frac{1}{l_0}$

$x = \frac{1}{R}$  ;  $\frac{l_0}{l}$  OR  $\frac{1}{l}$  (0.1)



OR



Shape of the graph

----- (01)

Labelling the axes

----- (01)

$m = r$

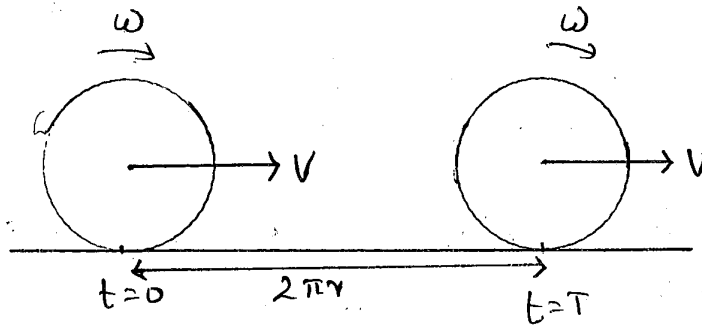
OR

$\frac{m}{c} = r$

----- (01)



1) a) (i)



$$V = \frac{S}{t} = \frac{2\pi r}{T} ; T = \frac{2\pi}{\omega}$$

$$V = \frac{2\pi r}{2\pi} \omega$$

$$V = r\omega \quad \text{--- ①}$$

(ii)  $V_{A,O} = \vec{r}\vec{\omega}$ ,  $V_{B,O} = \vec{r}\vec{\omega}$ ,  $V_{O,E} = \vec{r}\vec{\omega}$  --- ①

$$\begin{aligned} V_{A,E} &= V_{A,O} + V_{O,E} \\ &= \vec{r}\vec{\omega} + \vec{r}\vec{\omega} \\ &= 2r\omega \quad \text{--- ①} \end{aligned}$$

$$\begin{aligned} V_{B,E} &= V_{B,O} + V_{O,E} \\ &= \vec{r}\vec{\omega} + \vec{r}\vec{\omega} \\ &= 0 \quad \text{--- ①} \end{aligned}$$

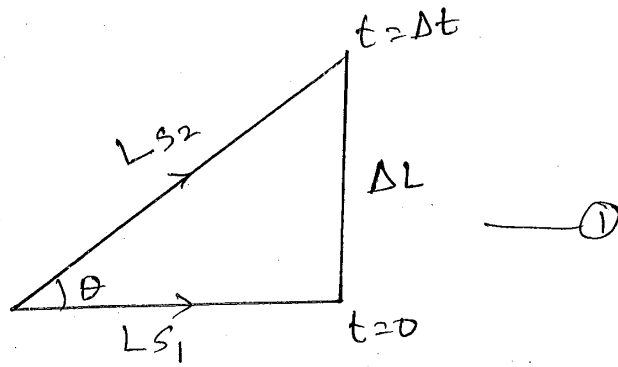
$$\begin{aligned} \text{(iii) K.E} &= \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 \\ &= \frac{1}{2} \times 12 \times \left(\frac{3}{10}\right)^2 + \frac{1}{2} \times 12 \times \left(\frac{2}{10}\right)^2 \left(\frac{3}{2}\right)^2 \quad \text{--- ①} \end{aligned}$$

$$= 0.81 \text{ J} \quad \text{--- ①}$$

(iv) The wheel can only perform rotational motion about the axis O --- ①

b) (i)  $L_s = I\omega_s$  direction  $\rightarrow$  --- ①

(10)



$$\omega_{pr} = \frac{\Delta\theta}{\Delta t} \quad \text{--- ①} \quad \Delta\theta = \frac{\Delta L}{L_s} \quad \text{--- ①}$$

$$= \frac{\Delta L / L_s}{\Delta t}$$

$$= \frac{1}{L_s} \times \frac{\Delta L}{\Delta t} \quad \tau_p = \frac{\Delta L}{\Delta t}$$

$$\omega_{pr} = \frac{\tau_p}{L_s} \quad \text{--- ①}$$

(11)

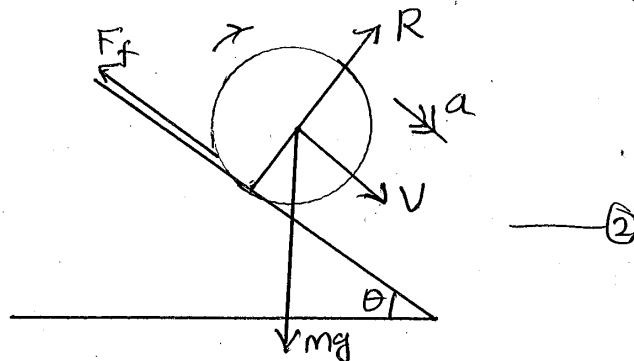
$$T_{pr} = \frac{2\pi}{\omega_{pr}} = \frac{2\pi}{m g R} \times \frac{m r^2}{2} \omega_s \quad \omega_s = 2\pi f_s = 10\pi$$

$$T_{pr} = \frac{\pi r^2}{g R} \omega_s$$

$$= \frac{10\pi^2 (0.3)^2}{10 \times 0.18} \quad \text{--- ①}$$

10) The wheel falls vertically and oscillates --- ①

c) d



$F_f$  - frictional force acting on the solid cylinder  
 $R$  - Normal reaction acts on the solid cylinder.  
 $Mg$  - weight of the cylinder.

(ii) Torque about O is  $\tau = F_f r$  — ①

(iii)

$$I\alpha = F_f r \quad ; \quad a = r\alpha$$

$$I \frac{a}{r} = F_f r$$

$$F_f = \frac{Ia}{r^2} \quad \text{--- ①}$$

From Newton's 2nd law,

$$Ma = Mg \sin\theta - F_f \quad \text{--- ①}$$

$$Ma = Mg \sin\theta - \frac{Ia}{r^2}$$

$$a [Mr^2 + I] = Mg r^2 \sin\theta \quad \text{--- ①}$$

$$a = Mr^2 \sin\theta / (Mr^2 + Mr^2/2) \quad I = Mr^2/2$$

$$a = \frac{2}{3} g \sin\theta \quad \text{--- ①}$$

(iv) For a solid cylinder to roll down a slope without slipping,

$$F_f \leq \mu R \quad \text{--- ①}$$

$$\frac{Ia}{r^2} \leq \mu mg \cos\theta \quad R = mg \cos\theta$$

(v)  $\mu \geq \frac{1}{3} \tan\theta \quad \text{--- ①}$

$$\frac{1}{3} \tan\theta = \frac{1}{3} \tan 60^\circ$$

$$= \frac{\sqrt{3}}{3} = 0.58 ; \mu = 0.6$$

$$\text{--- ①}$$

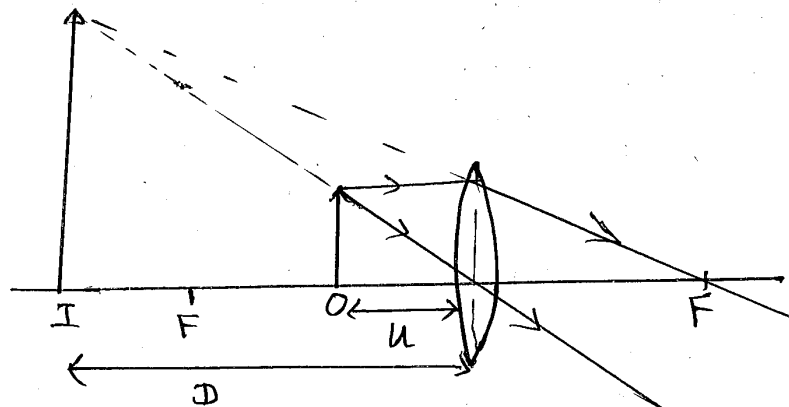
$$\mu \geq \frac{1}{3} \tan\theta$$

∴ The solid cylinder to roll down a slope without slipping — ①

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2) a) (i)



focal length — (2)  
ray diagram — (2)

(ii)  $u = +u, v = +D, f = -f$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{D} - \frac{1}{u} = -\frac{1}{f} \quad \text{--- (1)}$$

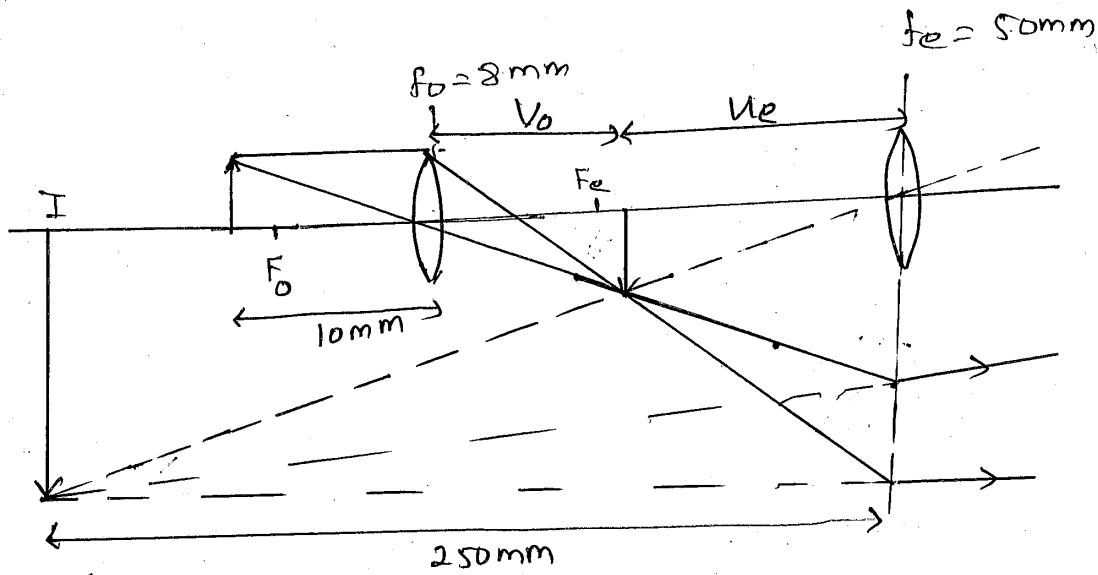
$$1 - \frac{D}{u} = -\frac{D}{f} \quad \text{--- (1)}$$

$$1 - M = -\frac{D}{f} \quad M = 1 + \frac{D}{f} \quad \text{--- (1)}$$

b) (i)  $\alpha$  - angle subtended at the unaided eye by the object at the near point (least distance of distinct vision) — (2)

$\beta$  - angle subtended at the eye by the image — (2)

(ii)



Ray diagram for objective — ①

Ray diagram for eyepiece — ②

1)  $u_o = +10 \text{ mm}$ ,  $f = -8 \text{ mm}$ ,  $v_o = ?$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v_o} - \frac{1}{10} = -\frac{1}{8} \quad \text{--- ①}$$

$$\frac{1}{v_o} = -\frac{1}{8} + \frac{1}{10}$$

$$= \frac{-5+4}{40}$$

$$v_o = -40 \text{ mm} \quad \text{--- ①}$$

2)  $f = -50 \text{ mm}$ ,  $v_e = 250 \text{ mm}$ ,  $u_e = ?$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{250} - \frac{1}{u_e} = -\frac{1}{50} \quad \text{--- ①}$$

$$\frac{1}{u_e} = \frac{1}{250} + \frac{1}{50}, \quad \frac{1}{u_e} = \frac{1+5}{250}, \quad u_e = 41.67 \text{ mm} \quad \text{--- ①}$$

$$\therefore \text{Separation} = 40 + 41.67 \text{ mm} \quad \text{--- ①}$$
$$= 81.67 \text{ mm} \quad \text{--- ①}$$

$$3) M = m_o \times m_e$$

$$= \frac{V_o}{u_o} \times \frac{V_e}{u_e} \text{ --- ①}$$

$$= \left(\frac{40}{10}\right) \left(\frac{200}{250} \times 6\right) \text{ --- ①}$$

$$= 24 \text{ --- ①}$$

(iii) (1)  $u_e = 40 \text{ mm}$  --- ①

$$f_e = -50 \text{ mm}$$

$$v_e = f$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v_e} - \frac{1}{40} = -\frac{1}{50} \text{ --- ①}$$

$$\frac{1}{v_e} = \frac{1}{40} - \frac{1}{50} = \frac{5-4}{200}$$

$$v_e = 200 \text{ mm} \text{ --- ①}$$

(2)  $M = \frac{V_o}{u_o} \times \frac{V_e}{u_e} \text{ --- ①}$

$$= \left(\frac{40}{10}\right) \left(\frac{200}{250} \times 6\right) \text{ --- ①}$$

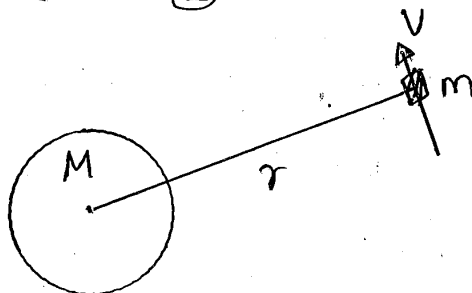
$$= 19.2 \text{ --- ①}$$

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03) a) (i) Newton's law of gravitation --- ③

ii)  $\text{m}^3 \text{s}^{-2}$  --- ②

iii)



Force acting on the satellite = Centripetal force

$$\frac{GMm}{r^2} = \frac{mv^2}{r} \quad \text{--- (1)}$$

$$v^2 = \frac{GM}{r} \quad \text{--- (1)}$$

$$\therefore M = \frac{GM}{v^2}$$

$$v = \sqrt{\frac{\mu}{r}} \quad \text{--- (1)}$$

(iv) Speed of the satellite =  $\frac{\text{distance}}{\text{time}}$

$$v = \frac{2\pi r}{T} \quad \text{--- (1)}$$

$$\sqrt{\frac{\mu}{r}} = \frac{2\pi r}{T} \quad \text{--- (1)}$$

$$\frac{\mu}{r} = \frac{4\pi^2 r^2}{T^2}$$

$$T^2 = \frac{4\pi^2 r^3}{\mu}$$

$$T = \sqrt{\frac{4\pi^2 r^3}{\mu}} \quad \text{--- (1)}$$

b) Angular speed of the geostationary satellite is equal to the angular speed of earth.

Period of geostationary satellite is equal to the period of earth. --- (2)

i) Angular velocity =  $\frac{\text{Angle}}{\text{time}}$

$$\omega = \frac{\theta}{t} \quad \text{--- (1)}$$

$$\text{If } t = 24 \text{ h, } \theta = 2\pi$$

$$\omega = \frac{2\pi}{24} = \frac{2 \times 3}{24} \quad \text{--- (1)}$$

$$\omega = 0.25 \text{ rad h}^{-1} \quad \text{--- (1)}$$

$$(ii) T^2 = 4\pi^2 r^3 / \mu \quad \text{--- ①}$$

$$r^3 = T^2 \mu / 4\pi^2$$

$$r^3 = \frac{(24 \times 3600)^2 \mu}{4\pi^2} \quad \text{--- ①}$$

$$r = \left[ \frac{(24 \times 3600)^2 \mu}{4\pi^2} \right]^{1/3} \quad \text{--- ①}$$

$$r = (592 \mu)^{1/3} \quad \text{--- ①}$$

$$(iii) v = r\omega$$

$$v = 42000 \times 10^3 \times \frac{6}{24 \times 3600} \quad \text{--- ①}$$

$$= 2916.67 \text{ ms}^{-1} \quad (2916 - 2917 \text{ ms}^{-1})$$

C) (i) Total Energy of meteorite at infinity = Total energy of meteorite at Earth surface

$$0 = -\frac{GmM}{R} + \frac{1}{2} mu^2 \quad \text{--- ①}$$

$$\frac{1}{2} mu^2 = \frac{GmM}{R}$$

$$u^2 = 2\mu/R$$

$$u = \sqrt{2\mu/R} \quad \text{--- ①}$$

$$(ii) u = \sqrt{\frac{2 \times 4 \times 10^{14}}{6400 \times 10^3}} \quad \text{--- ①}$$

$$= \frac{2\sqrt{20}}{8} \times 10^4$$

$$= 11175 \text{ ms}^{-1} \quad \text{--- ①}$$

(iii) Satellite moves towards Earth when it stops circular motion — (2)

Deceleration using a parachute — (2)

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Q4) a)

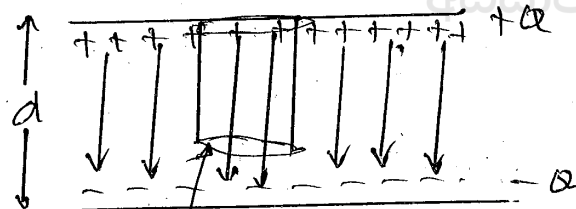
(i) When a neuron is non conducting a signal is called resting potential — (2)

(ii) It refers to the potential of the interior with respect to the exterior of the membrane. — (2)

(iii) An action potential occurs due to a change in membrane potential above a threshold value (resting potential) due to stimulus — (2)

(iv) Indepolarization phases — (1)

b) (i)



Gaussian surface with area  $\Delta A$

Charge to be covered by the surface  
 $= \sigma \cdot \Delta A$

Total flux  $\phi = E \cdot \Delta A$  — (1)

From Gauss's law

$$\phi = \frac{\sigma \cdot \Delta A}{\epsilon} \quad (\text{OR } \phi = Q/\epsilon)$$

— (1)

$$E \cdot \Delta A = \frac{\sigma \Delta A}{\epsilon}$$

$$E = \frac{\sigma}{\epsilon}$$

$$E = \frac{Q}{A\epsilon} \quad \text{--- (1)}$$

$$(ii) F = \frac{E}{2} \times Q \quad \text{--- (2)}$$

$$F = \frac{Q^2}{2A\epsilon} \quad \text{--- (1)}$$

$$(iii) kx = \frac{Q^2}{2A\epsilon} \quad \text{--- (2)}$$

$$; x = d_0 - d$$

$$d = d_0 - \frac{Q^2}{2A\epsilon k} \quad \text{--- (2)}$$

$$(iv) V = E \cdot d \quad \text{--- (1)}$$

$$V = \frac{Q}{A\epsilon} (d_0 - x) \quad \text{--- (1)}$$

$$V = \frac{Q}{A\epsilon} \left[ d_0 - \frac{Q^2}{2A\epsilon k} \right] \quad \text{--- (1)}$$

$$(v) C = \frac{Q}{V} \quad \text{--- (1)}$$

$$C = \frac{Q A \epsilon}{Q \left[ d_0 - \frac{Q^2}{2A\epsilon k} \right]} \quad \text{--- (1)}$$

(vi)  $\Rightarrow$  When charged

work done by the ion pumps = Energy stored in membrane  
+  
Elastic potential energy  
of membrane.

--- (1)

$$W = \frac{1}{2} k x^2 + \frac{Q^2}{2C} \quad \text{--- ①}$$

$$W = \frac{1}{2} \frac{k Q^4}{(2 \epsilon A k)^2} + \frac{Q}{2} \times \frac{Q}{\epsilon A} \left( d_0 - \frac{Q^2}{2 \epsilon A k} \right) \quad \text{①}$$

(For the correct substitution)

$$= \frac{Q^4}{8 \epsilon^2 A^2 k} - \frac{Q^4}{4 A^2 \epsilon^2 k} + \frac{Q^2 d_0}{2 \epsilon A}$$

$$W = \frac{Q^2 d_0}{2 \epsilon A} - \frac{Q^4}{8 A^2 \epsilon^2 k} \quad \text{--- ①}$$

⇒ When  $k$  is small, ion pumps work until the distance  $d$  reaches zero. That is ion pumps work until the capacitance of membrane reaches infinity. Thus the membrane has no electric energy.

$$\therefore x = d_0 \quad \text{--- ②}$$

$$W = \frac{1}{2} k d_0^2$$

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05) a)

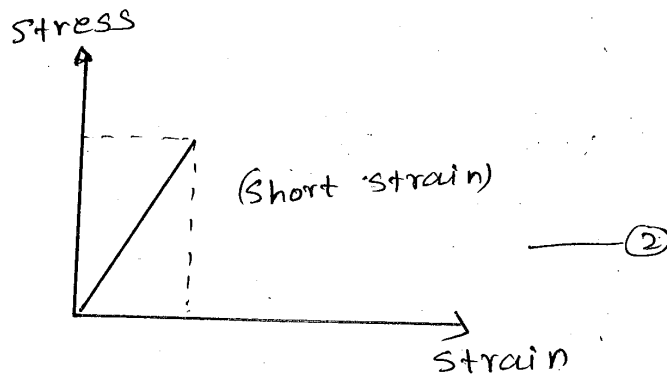
(i) Tensile stress } definition --- ②  
Tensile strain } definition --- ②

(ii) A - Proportional limit  
B - Elastic limit  
C - Yield point  
D - Fracture point } ④

iii) The ratio of tensile stress, tensile strain is constant, up to point A. --- ②



(iv)



b) (i) 
$$y_{\text{state of tension}} = \frac{3 \times 10^7}{0.015} \quad \text{--- (1)}$$
$$= 2 \times 10^9 \text{ Nm}^{-2} \quad \text{--- (1)}$$

$$y_{\text{state of compression}} = \frac{2 \times 10^7}{0.02} \quad \text{--- (1)}$$
$$= 1 \times 10^9 \text{ Nm}^{-2} \quad \text{--- (1)}$$

(ii) 1)  $F' = \frac{2}{3} F_0 \quad \text{--- (2)}$

2)  $W = \frac{1}{2} Fe \quad \text{--- (1)}$

$$F = \frac{YAE}{L} \quad \text{--- (1)}$$

$$W = \frac{1}{2} \frac{YAE}{L} \cdot e \quad \text{--- (1)}$$

$$= \frac{1}{2} Y \cdot \pi \frac{(a^2 - b^2)}{L} \Delta L^2 \quad \text{--- (2)}$$

c) For fracture state,

$$\frac{F}{A} = 2 \times 10^7 \text{ Nm}^{-2} \quad \text{--- (1)}$$

$$A = \pi (a^2 - b^2)$$

$$= 3 (2^2 - 1.5^2)$$

$$= 5.25 \text{ cm}^2 \quad \text{--- (1)}$$

$$\text{Force} = A \times 2 \times 10^7$$
$$= 5.25 \times 10^{-4} \times 2 \times 10^7 \quad \text{--- (1)}$$
$$= 1.05 \times 10^4 \text{ N} \quad \text{--- (1)}$$

$$d) (F - mg) \Delta t = m \sqrt{2gh} \quad \text{--- ①}$$

$$(20 \times 10^6 \times 3 \times 10^{-4} - 700) 0.14 = 70 \sqrt{2gh}$$

$$\sqrt{2gh} = 10.6$$

$$h = 10.6^2 / 20$$

$$h = 5.618 \text{ m.} \quad \text{--- ①}$$

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06) (A)

a) (i) First law:

The algebraic sum of currents in a network of conductors meeting at a point is zero --- ②

second law:

The directed sum of the potential differences (voltages) around any closed loop is zero --- ②

$$(i) \quad \dot{i}_1 = \dot{i}_2 + \dot{i}_3 \quad \text{--- ①}$$

$$(ii) \quad E = \dot{i}_1 R_1 + \dot{i}_2 R_2 \quad \text{--- ①}$$

$$(iv) \quad 0 = \dot{i}_3 R_3 - \dot{i}_2 R_2 \quad \text{--- ①}$$

(v) a) From (iii) above,

$$30 = 10 \dot{i}_1 + 10 \dot{i}_2 \Rightarrow \dot{i}_1 + \dot{i}_2 = 3$$

From (iv) above,

$$0 = 10 \dot{i}_3 - 10 \dot{i}_2 \Rightarrow \dot{i}_2 = \dot{i}_3$$

From (i) above,

$$\dot{i}_1 = \dot{i}_2 + \dot{i}_3$$

$$\dot{i}_1 = 2 \dot{i}_2 = 2 \dot{i}_3$$

$$\text{But } \dot{i}_1 = 2 \text{ A}$$

$$\therefore \dot{i}_2 = 1 \text{ A} \quad \text{--- ①}$$

$$\dot{i}_3 = 1 \text{ A} \quad \text{--- ①}$$

$$b) V_{BC} = I_1 R_1 = 2 \times 10 = 20V \quad \text{--- ①}$$

$$V_{CD} = I_2 R_2 = 2 \times 10 = 20V \quad \text{--- ①}$$

$$b) i) \text{ Resistance of } L_1, L_2 (R) = \frac{V^2}{P}$$

$$= \frac{12 \times 12}{12}$$

$$= 12 \Omega \quad \text{--- ①}$$

When switch  $S_1$  is operated,

$$V = IR \quad (\text{for the circuit})$$

$$16 = I \times 8$$

$$I = 2A \quad \text{--- ①}$$

$$\text{Potential difference across } L_1 = 1 \times 12$$

$$= 12V$$

or

$$V = E - Ir$$

$$= 16 - 2 \times 2 = 12V$$

$$ii) \text{ Resistance of } H_1, H_2 (R) = \frac{V^2}{P}$$

$$= \frac{12 \times 12}{24}$$

$$= 6 \Omega \quad \text{--- ①}$$

$S_1, S_2$  should turn on when the head lamps are on,

$$\text{for the circuit, } V = IR$$

$$16 = I \times 4$$

$$I = 4A \quad \text{--- ①}$$

Potential difference across  $H_1$ ,

$$= E - Ir$$
$$= 16 - 4 \times 2$$

$$= 8V \quad \text{--- (1)}$$

(ii) Power generated by the battery,

$$P = EI$$

$$= 16 \times 4$$

$$= 64W \quad \text{--- (1)}$$

(v) The brightness will decrease --- (1)

Because the potential difference will decrease --- (1)

(vi) The brightness will increase --- (1)

Because the potential difference will decrease --- (1)

c) (i) A, B --- (1)

(ii) 5A --- (1)

(iii) A, B, C --- (1)

(iv) 7A --- (1)

(v) 3A --- (1)

(vi) 230V --- (1)

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06)  
(B)

a) (i)  $P \Rightarrow Q_1 = \overline{A \cdot A} = \overline{A}$  --- (1)

$\therefore$  NOT --- (1)

$Q \Rightarrow Q_2 = \overline{(\overline{A \cdot B}) \cdot (\overline{A \cdot B})} = \overline{\overline{A \cdot B}} = A \cdot B$  --- (1)

$\therefore$  AND --- (1)

$$R \Rightarrow Q_3 = \overline{A \cdot B} = \overline{A} + \overline{B} = A + B \quad \text{--- (1)}$$

$\therefore$  OR --- (1)

$$S \Rightarrow Q_4 = \overline{\overline{A+B} \cdot \overline{A+B}} = \overline{\overline{A+B}} + \overline{\overline{A+B}} = \overline{\overline{A \cdot B}} = \overline{\overline{A \cdot B}} = A \cdot B \quad \text{--- (1)}$$

$\therefore$  NAND --- (1)

(ii)

| A | B | Q |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

(2)

for any three entries are correct  
1 marks

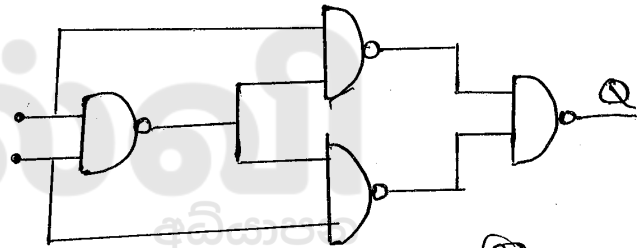
$\therefore$  XNOR --- (1)

(iii)  $Q = A \cdot \overline{B} + \overline{A} \cdot B$

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(2)

for any three entries  
are correct 01 marks



(2)

$\therefore$  XOR --- (1)

b) i)

| A  | B  | Q  |
|----|----|----|
| 0V | 0V | 0V |
| 0V | 5V | 0V |
| 5V | 0V | 0V |
| 5V | 5V | 5V |

(2)

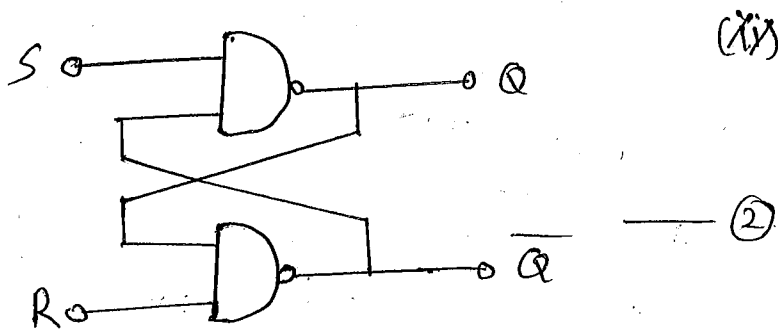
(ii)

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

(2)

$\therefore$  AND --- (1)

c) (i)

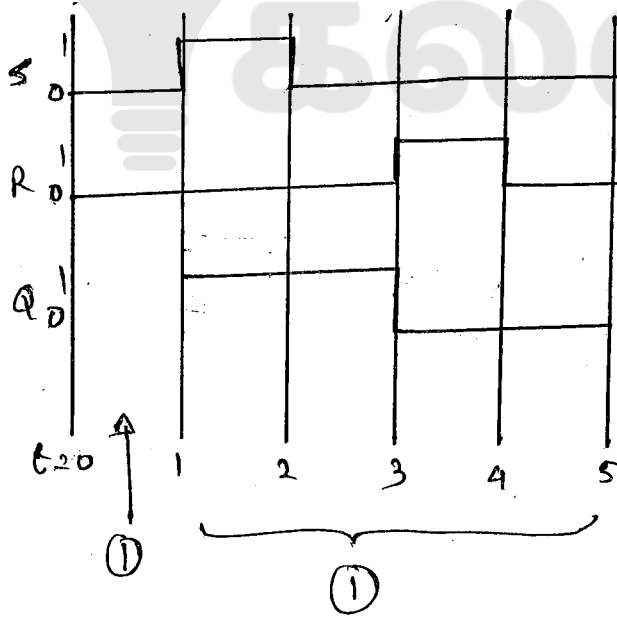


(ii)

| S | R | Q                     | $\bar{Q}$                   |
|---|---|-----------------------|-----------------------------|
| 0 | 0 | No Change / $Q_{old}$ | No Change / $\bar{Q}_{old}$ |
| 0 | 1 | 0                     | 1                           |
| 1 | 0 | 1                     | 0                           |
| 1 | 1 | Invalid / - / ?       | Invalid / - / ?             |

— (3)

(iii)



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07)

(a) (i) Definition — (2)

(ii)  $\Delta Q = \Delta U + \Delta W$  ;  $\Delta Q$  - Heat given to the system  
 — (1)  $\Delta U$  - Change in internal energy of the system  
 $\Delta W$  - work done by the system

(iii) Definition — (2) — (3)

| b) (i) | process               | Parts                 |
|--------|-----------------------|-----------------------|
| A → B  | Adiabatic compression | Compressor — (1)      |
| B → C  | Constant volume       | Condenser — (1)       |
| C → D  | Adiabatic expansion   | Expansion valve — (1) |
| D → A  | Constant volume       | Evaporator — (1)      |

(ii)  $\Delta Q = 0$  — (1)

$$\Delta Q = \Delta U + \Delta W \Rightarrow 0 = \Delta U + (-500), \Delta U = 500 \text{ J}$$

— (1) — (1)

(iii)  $\Delta W = 0$  — (1)

$$\Delta Q = \Delta U + \Delta W \Rightarrow \Delta Q = 3950 + 0, \Delta Q = 3950 \text{ J}$$

— (1) — (1)

(iv) obtain from brine — (2)

c) (i)  $Q/t = \frac{m s_1 \theta_1 + mL + m s_2 \theta_2}{3600}$

$$= \frac{600}{3600} [30 \times 4200 + 3.36 \times 10^5 + 2100 \times 6]$$

— (1) — (1) — (1)

$$= 79.1 \text{ kJ} \text{ — (1)}$$

(ii) By evaporation, heat is absorbed from the brine  
 During a cycle = 3950 J

$$\therefore \text{Number of cycle} = \frac{79100}{3950} \text{ — (1)}$$

(iii)  $Q/t = \frac{m s \theta}{t}$

$$79.1 \times 10^3 = \frac{m}{t} \times 4000 \times 10 \text{ — (1)}$$

$$\frac{m}{t} = 1.97 \text{ kg s}^{-1} \text{ — (1)}$$

(iv) The freezing point of brine is below  $-20^\circ\text{C}$ ,  
 If water is used, the water will freeze — (2)

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## எங்கள் குறிக்கோள்

எண்ணிம உலகத்தில் மாணவர்களிற்கென சிறந்ததொரு கற்றல் கட்டமைப்பை உருவாக்குதல்.

அனைத்தும் டிஜிட்டல் மயப்படுத்தப்பட்ட இந்த காலத்தில் பல்வேறு துறைகளும் கால ஓட்டத்துடன் இணைந்து டிஜிட்டல் தளத்தில் பல்கிப்பெருகி வருகின்றன. அந்த வகையில் கல்வித்துறையும் இதற்கு விதிவிலக்கல்ல. இணையவழி கல்வியின் மூலம் கல்வித்துறை புதியதொரு பரிமாணத்தை எட்டியுள்ளது. குறிப்பாக கொரோனா பேரிடர் காலத்தில் நாடே முடக்கப்பட்டிருந்தது. இதனால் மாணவர்களிற்கும் பாடசாலை, கல்வி நிறுவனங்களிற்கு இடையிலான தொடர்பு துண்டிக்கப்பட்டது. அந்த இக்கட்டான சூழ்நிலையில் இணையவழி வகுப்புகள் மாணவர்களிற்கு வரப்பிரசாதமாக அமைந்தது என்பதே உண்மை.

இன்று தொழில்நுட்பம் மாணவர்களை தவறான பாதைக்கு இட்டு செல்வதாக ஓர் எண்ண ஓட்டம் மக்கள் மத்தியில் உள்ளது. தொழில்நுட்பம் என்பது ஒரு கருவி மட்டுமே அதை எவ்வாறு பயன்படுத்துகிறோம் என்பதில் அதன் ஆக்க மற்றும் அழிவு விளைவுகள் தீர்மானிக்கப்படுகிறது. உளியை கொண்டு சிலையை செதுக்க நினைத்தால் அவன் நிச்சயம் சிற்பி ஆகலாம். இங்கு பிரச்சினையாக காணப்படுவது மாணவர்களை வழிப்படுத்த தொழில்நுட்ப உலகில் ஓர் முறையான கட்டமைப்பு இல்லாமையே. அதை உருவாக்குவதே எங்கள் நோக்கம். அதை நோக்கியே எங்கள் பயணம் அமையும்.

**எமது இணையத்தினூடக ஊடக உங்களிற்கு தேவையான பரீட்சை வினாத்தாள்களை இலகுவான முறையில் தரவிறக்கம் செய்து கொள்ளமுடியும்.**

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**கல்வி சார் செய்திகளை உடனுக்குடன் அறிந்து கொள்ள எமது சமூக ஊடக தளங்களின் ஊடக உடனுக்குடன் அறிந்து கொள்ள முடியும்.**

