



**GCE(A/L) Examination, November - 2017**  
**Conducted by Field Work Centre, Thondaimanaru**  
**In Collaboration with**  
**Provincial Department of Education Northern Province**

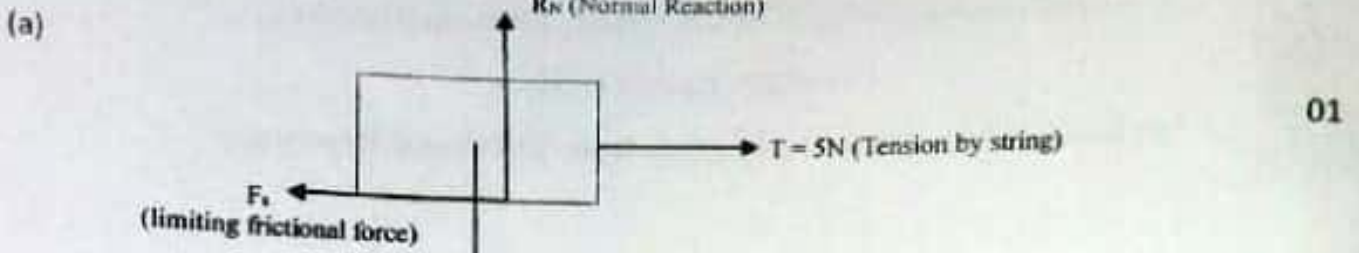
<b>Grade :- 13 (2018)</b>	<b>Physics</b>	<b>Marking Scheme</b>
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**PART I (MCQ)**

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

**PART II A (STRUCTURED ESSAY)**

1.



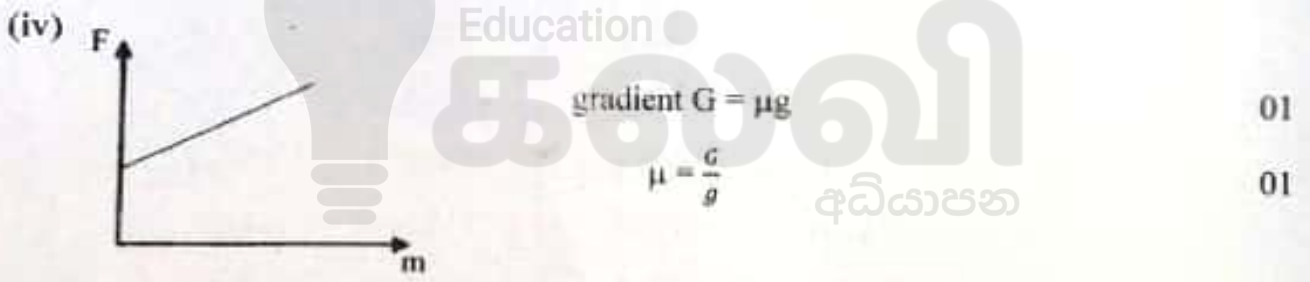
(b)  $\mu_s = \frac{F_s}{R_N} = \frac{5}{20} = 0.25$  01

(c) 5N 01

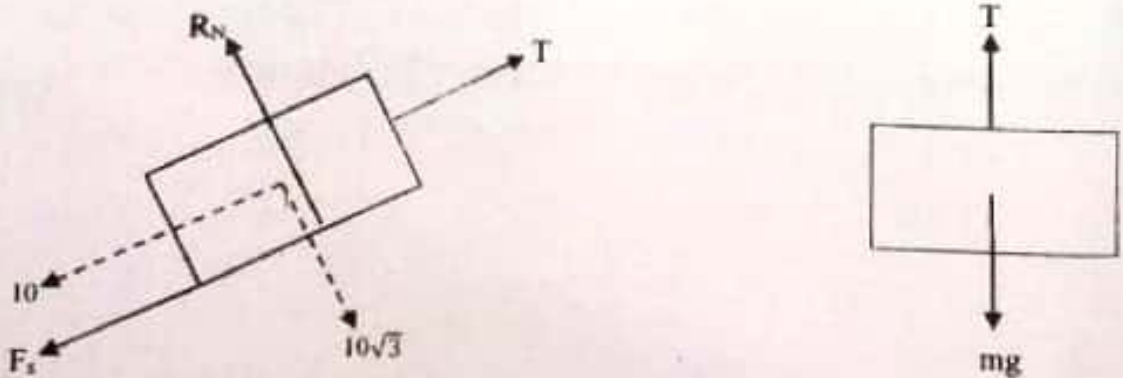
(d) (i) Without additional mass take the reading of spring balance when the block is in verge of moving. Next add 100g mass on the block, pull the spring balance and take the reading when the block is in verge of moving. Take at least six set of readings. 01

(ii)  $\mu = \frac{F}{W + mg}$  01

(iii)  $\mu W + \mu mg = F$   
 $F = (\mu g)m + \mu W$  01



(e)



$F_s = 0.25 \times 10\sqrt{3} = 4.3N$  4R.  
 $T = 10 + 4.3 = 14.3N$   $T = F_s + 10$  01  
 $14.3 = m \times 10$   $T = mg$   
 $m = 1.43 \text{ kg}$  01

2.

(a) Thermometer (0-100°C), Thermometer (0-50°C), Beaker with water, wire gauze,  
Triple beam balance, Tripod and stirrer 01

(b) Place the calorimeter on an insulating support

Close the calorimeter with lid

Polish the outer surface

Start the experiment 5°C below from room temperature and at 5°C above it. 01

(c) All lead shots attain same temperature

It's a fixed temperature and high temperature 01

(d) Small - Water may not cover the metal balls completely 01

Large - water may spill and increase in temperature may be too small 01

(e) Mass of empty calorimeter with stirrer =  $X_0$

Mass of calorimeter + stirrer + water =  $X_1$

Initial temperature of water =  $Y_1$

Maximum temperature of water =  $Y_2$

Mass of calorimeter + stirrer + water + lead shots =  $X_2$  02

(f)  $[X_0 C_0 + (X_1 - X_0) C_w](Y_2 - Y_1) = (X_2 - X_1) C(100 - Y_2)$  01

(g) Water should not splash } 01

Reduce the heat loss to the surrounding අධිසාපන

(h)  $S = \frac{1200}{0.15 \times 60} = 133.3 \text{ Jkg}^{-1}\text{K}^{-1}$  01

3.

(a) (i) longitudinal mechanical wave 01

(ii) only transverse waves can be polarized but sound waves are longitudinal 01

(b) Due to interference standing wave is formed 01

Maxima - Constructive interference (antinode) } 01

Minima - destructive interference (node) }

At constructive interference waves are in phase } 01

At minima waves are in antiphase }

(c) (i)  $\frac{\lambda}{2} = 0.05$  ,  $\lambda = 0.1 \text{ m}$  01



(ii)  $v = 3300 \times 0.1 = 330 \text{ m s}^{-1}$

02 (01 for unit)

(d) (i) There is no complete cancellation/ no total destructive interference

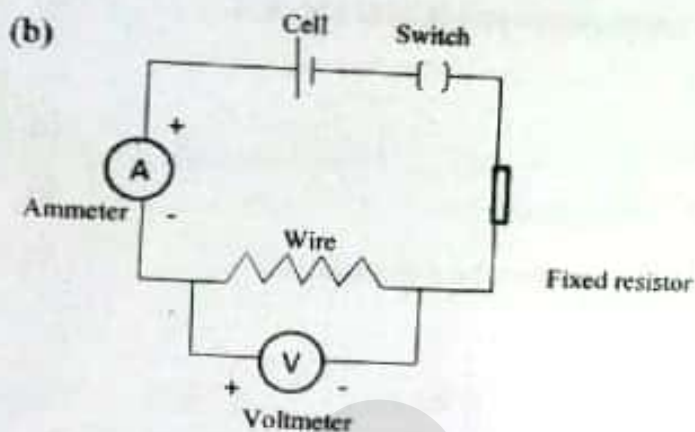
01

(ii) waves have different amplitudes. Amplitudes decrease with distance. Energy loss due to reflection.

01

4. (a) micrometer screw gauge

01



01

01

(c) (i) Fraction error =  $\frac{1}{100} \times 100 = 1\%$

Fractional error  $\leq 1\%$ . It is better measurement.

(ii)  $\alpha$  : voltmeter reading

$\beta$  : Ammeter reading

(iii)  $R = \alpha / \beta$

01

01

01

(d) (i)  $R = \frac{\rho}{lA}$

$$R = \frac{\left(\frac{\rho}{A}\right)l}{y = m \quad x}$$

01

It is in the form of  $y=mx$

At constant temperature  $\left(\frac{\rho}{A}\right)$  constant

(ii)  $41.9 = \frac{\rho}{3 \times (0.06 \times 10^{-3})^2}$

01

$\rho = 41.9 \times 3 \times 10^{-10} \times 36 = 4.5 \times 10^{-7} \Omega\text{m}$

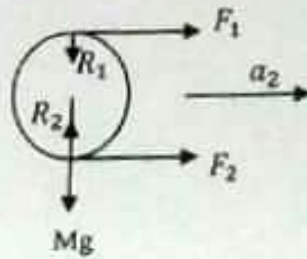
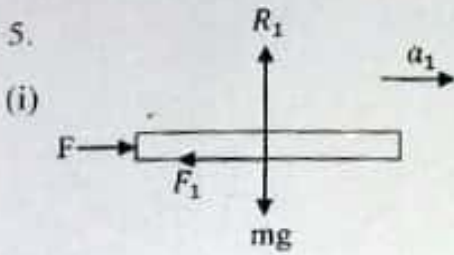
(e) Diameter is measured only once

Voltmeter takes current to show reading

01

01

**PART II B (ESSAY)**



01

(ii)  $a_1 = 2a_2$

01

(iii) plank  $F - F_1 = ma_1 \Rightarrow a_1 = \frac{F - F_1}{m}$

Cylinder  $F_1 + F_2 = Ma_2 \Rightarrow a_2 = \frac{F_1 + F_2}{M}$

} 01

$F_1$  - friction between plane and cylinder

$F_2$  - friction between cylinder and floor

(iv)  $r = I\alpha$

$(F_1 - F_2)R = \left(\frac{1}{2}MR^2\right)\alpha$

$\alpha = \frac{2(F_1 - F_2)}{MR}$

01

(v) no slipping  $a_2 = R\alpha = \frac{2(F_1 - F_2)}{M}$

01

Solving the above equations

$a_1 = \frac{8F}{3M + 8m}$

01

$a_2 = \frac{4F}{3M + 8m}$

01

(vi)  $f_1 = F - ma_1 = \frac{3MF}{3M + 8m}$

} 01

$f_2 = \frac{MF}{3M + 8m}$

(b)  $F - 2F_1 - 500 = 100 \times 1$

$F - 2F_1 = 600$

$F_1 - F_2 - 100 = 20a$

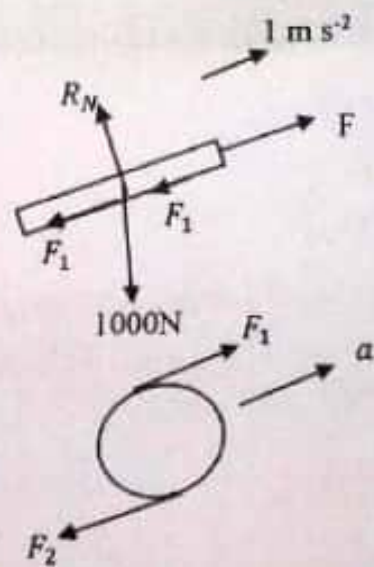
$F_1 - F_2 = 100 + 20a$

$(F_1 + F_2)0.1 = \left(\frac{1}{2} \times 20 \times 0.1^2\right)\alpha$

$\alpha = F_1 + F_2$

$a = 0.1\alpha$

$F_1 - F_2 = 100 + 20 \times 0.1$



01

01

01

$$3F_2 + F_1 = -100$$

01

$$a + R\alpha = 1$$

$$a + 0.1 \times \frac{a}{0.1} = 1 \Rightarrow a = 0.5 \text{ ms}^{-2}$$

01

$$\alpha = \frac{0.5}{0.1} = 5 \text{ rads}^{-2}$$

$$F_1 + F_2 = 5$$

$$F_1 - F_2 = 110$$

01

$$F_1 = 57.5 \text{ N} \quad F_2 = -52.5 \text{ N}$$

01

$$F = 2 \times 57.5 + 600 = 715 \text{ N}$$

6.

$$(a) (i) \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-(d+40)} - \frac{1}{20} = \frac{1}{-16}$$

01

$$d = 40 \text{ cm}$$

01

(ii)



01

$$(iii) \frac{50}{r} = \frac{80}{40}$$

$$r = 25 \text{ cm}$$

01

$$(iv) \pi \times 0.5^2 \times l_1 \times \frac{95}{100} = \pi \times 0.25^2 \times l_2$$

01

$$\frac{l_2}{l_1} = \frac{19}{5} = 3.8$$

01

$$(b) (i) \frac{1}{v} - \frac{1}{-50} = \frac{1}{+40}$$

01

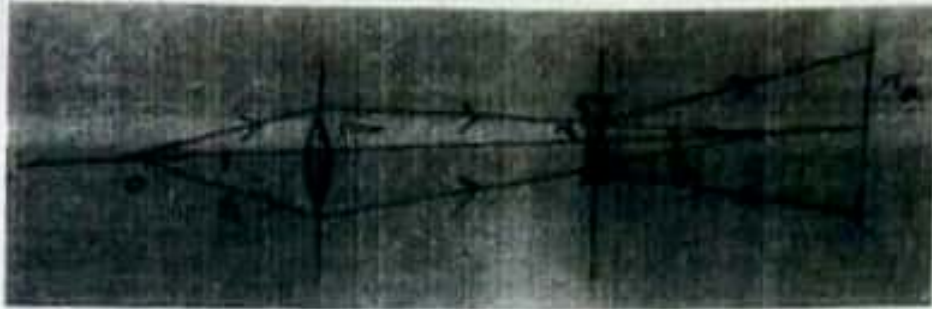
$$v = 200 \text{ cm}$$

01

from  $L_2$  2m



(ii)



01

(iii)  $\frac{50}{r_1} = \frac{80}{50}$

$r_1 = 31.25 \text{ cm}$

01

(iv)  $\frac{r_2}{r_1} = \frac{570}{200}$

$r_2 = 89.1 \text{ cm}$

01

(c) (i) reflection, refraction, interference and diffraction

01

(ii) Coherent, monochromatic, highly directional, high intensity

01

(iii) Population inversion

01

(iv)  $2^n - 1$

01

7.

Education

(a) (i) When one end of a solid is heated, the molecules vibrate more strongly. Whenever these molecules collide with the neighbouring molecules, the vibrational kinetic energy is transferred to the neighbouring molecules. This process is continued and heat is conducted through the solid.

02

(ii) Both involve a transfer of vibrational energy of the molecules in a medium

01

(b) (i) K - Thermal Conductivity

A - Cross sectional area perpendicular to the flow of heat.

$\frac{d\theta}{dx}$  - temperature gradient

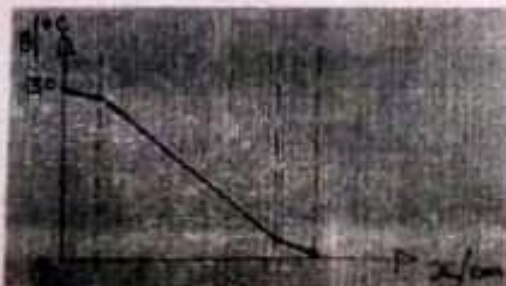
01

(ii) The rod must be well lagged

Steady state must be attained

01

(c) (i)



01

No heat loss from the sides

01

$$(ii) \frac{Q}{t} = KA \frac{(\theta_1 - \theta_2)}{l} \Rightarrow \frac{1}{A t} Q = K \frac{(\theta_1 - \theta_2)}{l} \Rightarrow \theta_1 - \theta_2 = \frac{l}{KA} \frac{Q}{t}$$

$$30 - \theta_1 = \frac{1}{A t} Q \left( \frac{2.00 \times 10^{-3}}{210} \right)$$

$$\theta_1 - \theta_2 = \frac{1}{A t} Q \left( \frac{1.60 \times 10^{-2}}{0.024} \right)$$

$$\theta_2 - 0 = \frac{1}{A t} Q \left( \frac{2.00 \times 10^{-3}}{210} \right)$$

$$30 = \frac{1}{A t} Q \left( \frac{4.00 \times 10^{-3}}{210} + \frac{1.60 \times 10^{-2}}{0.024} \right)$$

$$\frac{Q}{A t} = 45.0 \text{ W m}^{-2}$$

01

(iii) Thickness of air layer is reduced, temperature gradient increases. Hence the rate of heat flow increases. 01

(iv) 'K' of metals are of the same order and are very high compared to air. Rate of heat flow almost same. 01

(v) Trapped air cannot move. Hence loss of heat by convection cannot take place. 01

(vi) heat is lost by convection 01

8.

$$(a) \omega = 2\pi f = 2 \times \pi \times \frac{5000}{60}$$

$$= 524 \text{ rad s}^{-1}$$

01

$$(b) (i) \omega = \frac{2\pi}{24 \times 60 \times 60} = 7.3 \times 10^{-5} \text{ rad s}^{-1}$$

01

$$(ii) a = r\omega^2$$

$$= 6.4 \times 10^6 \times (7.3 \times 10^{-5})^2$$

01

$$= 3.4 \times 10^{-2} \text{ m s}^{-2}$$

01

(c) (i)



at equator

$$mg - F = m r \omega^2$$

$$F = m(g - r\omega^2) = mg'$$

$$g' = g - r\omega^2$$

01

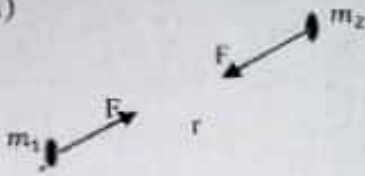
at equator part of this 'g' has to provide the centripetal acceleration, the acceleration of free fall lower. But poles are not in circular motion 01

(ii) Earth's angular velocity is low. 01

$$\text{At equator } g - g' = R\omega^2 = 0.03$$



(d) (i)



Gravitational force of attraction  $F$  between two point masses  $m_1, m_2$  is directly proportional to the product of masses. And inversely proportional to the square of their separation  $r$  01

$$F \propto \frac{m_1 m_2}{r^2}$$

(ii)



$$F = \frac{GMm}{r^2}$$

$$g = \frac{F}{m}$$

$$g = \frac{GM}{R^2}$$

01

(e) (i)



$$\frac{GMm}{r^2} = m r \omega^2$$

01

$$r^3 = \frac{GM}{\omega^2} = \frac{gR^2}{\omega^2}$$

$$r^3 = \frac{10 \times (6.4 \times 10^6)^2}{(7.3 \times 10^{-5})^2}$$

$$r = 4.2 \times 10^7 \text{ m}$$

01

(ii) 1. Satellite lies on a plane containing the earth's equator and is always directly above a point on the equator

2. The satellite rotates from west to east, the earth's direction of rotation.

01

(f) Polar - satellites in low orbits are closer to earth, signals are received more strongly. 01

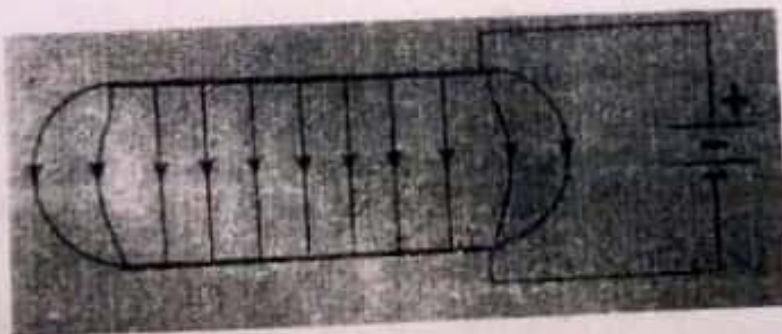
Geostationary - Continuous transmission between the ground station and the satellite, since they are always at the same spot above the equator 01

9.

(a) (i) Electrostatic force per unit positive charge placed at that point in the field. 01

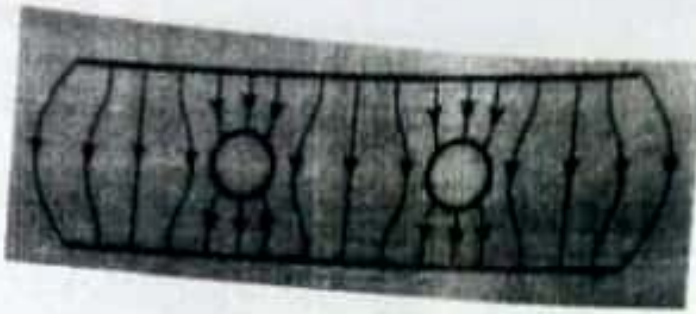
(ii) Magnitude of 'E' is equal at all points and direction at every point is same. 01

(iii) Connect a battery across a pair of parallel conducting plates.



01

(b) (i)



01

(ii)



01

(iii) The conductor must either be charged or close to another charged object so that a large electric field would exist near the conductor. This would occur near the pointed end where a high potential difference would exist between the pointed end and some nearby object.

01

(c) (i)  $F = qE$

$$W = qE \times d$$

$$= +qEd$$

$$(ii) V = \frac{W}{q} = \frac{qEd}{q} = Ed$$

Education

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01

01

$$(d) (i) n = \frac{8.6 \times 10^{-3} \text{ Cs}^{-1}}{1.6 \times 10^{-19} \text{ C}}$$

$$n = 5.4 \times 10^{16} \text{ s}^{-1}$$

01

01

(ii) Gain in Kinetic energy = loss in electrical potential energy

$$\frac{1}{2}mv^2 = eV$$

01

$$v = \sqrt{\frac{2eV}{m}} = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 60 \times 10^3}{9.11 \times 10^{-31}}}$$

$$v = 1.45 \times 10^8 \text{ m s}^{-1}$$

01

(iii) energy = 60 keV

$$\text{Power} = 5.4 \times 10^{16} \times 60 \text{ keV s}^{-1} = 5.4 \times 10^{16} \times 60 \times 10^3 \times 1.6 \times 10^{-19} = 517 \text{ W}$$

01

$$(e) (i) E = 9 \times 10^9 \times \frac{0.060 \times 10^{-6}}{(0.10)^2} = 5.4 \times 10^4 \text{ NC}^{-1}$$

01

$$(ii) V_B - V_C = V_A - V_B$$



$$\frac{q}{4\pi\epsilon_0} \left[ \frac{1}{r_B} - \frac{1}{r_C} \right] = \frac{q}{4\pi\epsilon_0} \left[ \frac{1}{r_A} - \frac{1}{r_B} \right]$$

$$\frac{1}{0.50} - \frac{1}{r_C} = \frac{1}{0.40} - \frac{1}{0.50}$$

$$r_C = 0.67m$$

01

10.

(a) (i) One volt is the potential difference between two points in a circuit if one joule of energy is converted from electrical to non-electrical form per Coulomb of positive charge flowing between two points. 01

(ii) Work done to take one Coulomb positive charge from negative terminal to positive terminal through the cell is e.m.f.

Work done to take unit positive charge from positive terminal to negative terminal through external circuit is potential difference 01

(b) (i)  $Q = 0.24 \times 5 \times 60 = 72 \text{ C}$  01

(ii)  $EQ = 1.5 \times 72 = 108 \text{ J}$  01

(iii) Energy loss in 'r' =  $I^2rt = 0.2rt = 0.24^2 \times 0.25 \times 5 \times 60 = 4.32 \text{ J}$  01

Energy transferred in 'R' =  $108 - 4.3 = 103.7 \text{ J}$  01

(iv)  $R = \frac{103.7}{4.32} \times 0.25 = 6.0 \Omega$  01

(c) (i)  $R = \frac{1.5+1.5}{0.41} = 7.32 \Omega$  01

New R =  $7.32 - (0.25+0.25) = 6.82 \Omega$  01

(ii) Current causes more heating an increase in amplitude of vibrations. More collisions. This increases resistivity. 01

(d) (i) The external loads will have a minimum total resistance of  $3800 \Omega$  ( $20^\circ\text{C}$ )

Internal resistance  $0.5 \Omega \ll 3800 \Omega$  01

(ii)  $0^\circ\text{C}$ ,  $V_1 = \frac{4000}{6000} \times 3 = 2.0V$  01

$0^\circ\text{C}$ ,  $V_2 = \frac{1800}{3800} \times 3 = 1.4V$  01

(iii)  $\frac{R}{4000+R} \times 3 = 1.2$

$R = 2670\Omega$

$\frac{R}{1800+R} \times 3 = 2.4$

$R = 7200 \Omega$

01

There is no single value for R that satisfies both conditions. 01





## 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.**

# kalvi.lk

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

