G.C.E A / L Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In collaboration with

Provincial Department of Education Northern Province

FWC

Grade:- 13 (2018)	*Physics*	*Marking Scheme*

	I	II	III	IV	V
①	4	3	2	1	4
②	5	4	4	3	2
③	2	5	3	4	5
④	3	2	3	3	3
⑤	2	2	2	2	2
⑥	5	2	1	2	5
⑦	4	3	5	3	1
⑧	4	3	2	1	1
⑨	5	3	2	1	5
⑩	5	2	1	1	2

Part 1 (M.C.Q)	100
Part II - A (St. Essay	40
Part II. B (Essay)	60
Total	200
Final	$\frac{200}{2} = 100$

Part II A

① (a) i) $d = \frac{\pi r}{N}$ 1

ii) 100 1

(b) i) 0.01 mm 1

ii) $\frac{0.41 + 0.41 + 0.42 + 0.40 + 0.42}{5}$

$= 0.412$ mm

$d_{average} = 0.41$ mm 1

iii) zero error $= -0.03$ mm

∴ corrected reading $= 0.41 + 0.03$

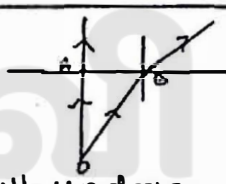
$= 0.44$ mm 1

iv) diameter of the spring (x) 1

Vernier calipper 1

v) $V = \frac{\pi d^2}{4} \cdot \pi \times N$ 2

② (a) i)



Drawing the paths 1

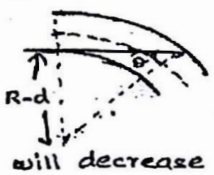
ii) will undergo TIR 1

iii) $e^{n_1} = \frac{n_1}{n_2}$ 1

iv) $\frac{n_1}{n_2} = \frac{1}{\sin\theta_c}$; $e^{n_1} = \frac{1}{\sin\theta_c}$ 1

(b) (i) 1.5

(ii)



$\sin\theta = \frac{R-d}{R+d}$ 1

(iii) will decrease continuously 1

(iv) No ray will escape when $\theta \geq \theta_c$ 1

$\sin\theta \geq \sin\theta_c$

$\frac{R-d}{R+d} \geq \frac{1.44}{1.5}$

$\frac{R-d}{R+d} \geq 0.96$ $\quad R \geq 490$ mm

R min $= 490$ mm 1

(v) For each application and the corresponding advantage 1+1

③ a) Instrument - Thermometer
apparatus - stirrer } 1

b) Heat the tube (using bunsen burner) and dip the open end in a vessel containing mercury and allow it to cool (for a short period) 1

c) water vapor will be present if water is used instead 1
(accept any other suitable answer)

d) In order to ensure the temperature of the dry air ... is same that of the ~~kalvi.lk~~ bath 1

e) (i) selection of two points that intersects the grid }

gradient = $0.1\ cm\ °C^{-1}$

(ii) $0.1 = \frac{27}{x} \Rightarrow x = 270°C$ (To find the inte

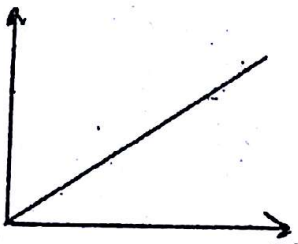
Absolute zero temperature = $-270°C$

(Accept $-265 \rightarrow -275°C$)

(iii) reason: Volume is assumed to be proportional to the le (of air column)

Property: uniform internal cross section / diameter

(iv)



f) To increase the sensitivity of the tube / To obtain a good distribution of experimental points

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(4) (a) E_1 – should provide constant current.

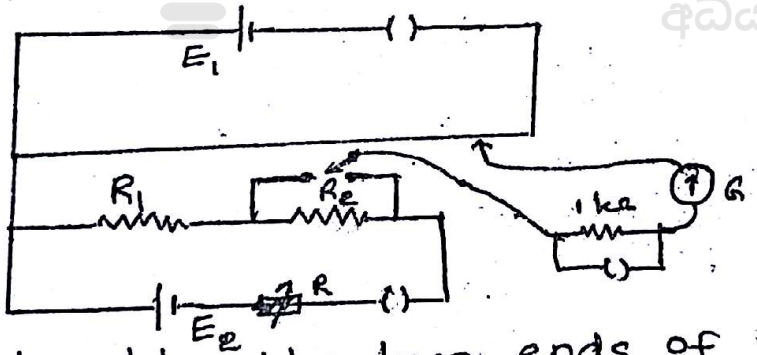
PQ - ... possesses uniform cross sectional area/ Thin wire with uniform diameter / uniform resisti wire

(b) (i) X – ——————

(ii) $\frac{V_1}{V_2} = \frac{R_1}{R_1+R_2}$

(c) (i) in order to protect the galvanometer

(ii)



(iii) by touching the two ends of the potentiometer wire and check whether the deflections of the centre zero galvanometer are in the opposite directions

d (i) $\frac{R_1}{R_1+R_2} = \frac{l_1}{l_2}$; $\frac{l_2}{l_1} = 1 + \frac{R_2}{R_1}$

(ii) by changing the resistance of the resistance box; R

(iii) gradient of the l_2 vs l_1 graph is $1 + \frac{R_2}{R_1}$

$1 + \frac{R_2}{R_1} = 1.5$

$\frac{R_1}{R_2} = 2$

Part II B Essay

(a) (i) $\tau = Fr$ ---------- 1

$\tau = I\alpha$ α - angular acceleration ---------- 1

$\alpha = \frac{Fr}{\frac{1}{2}Mr^2} = \frac{2F}{Mr}$ ---------- 1

(ii) Since the torque is same as before in a(i) $\alpha = \frac{2F}{Mr}$ 1

(b) (i) $\therefore \Sigma\tau = 0$, condition for equilibrium

If T is the tension in the rope then

$T \times 0.1 = 200 \times 0.8$ 1

$T = 1600$ N ---------- 1

(ii) less than that calculated ---------- 1

(c) (i) New tension in the rope = 3200 N (force doubled)

weight of the boat = 3200 N

mass of the boat = 320 kg ---------- 1

(ii) minimum work done = gain in P.E $= 320 \times 10 \times 2$

6400 J ---------- 1

(d) (i) If the tension in the rope is T',

$400 \times 0.8 = T' \times 0.1 + \tau_{frictional}$ ---------- 1

$\therefore = T' \times 0.1 + 4$

$T' = 3160$ N

Frictional force acting on the boat = 3160 N ---------- 1

(ii) angular speed of the cylinder, $\omega = \frac{V}{r} = \frac{0.2}{0.1} = 2$ rad s^{-1} 1

∴ Total power loss against friction and frictional torque $= \tau\omega$ ---------- 1

$= 400 \times 0.8 \times 2$

$= 640$ W ---------- 1

Can use $F.V + \tau_f \omega$ alternatively

(iii)

angular deceleration $\alpha = \frac{\tau}{I} = \frac{4}{\frac{1}{2} \times 100 \times 0.1^2} = 8$ rad s^{-2} --- 1

using $\omega = \omega_0 + \alpha t$

$0 = 2 - 8.t$

$t = 0.25$ s

comes to rest in 0.25 s ---------- 1

(i) Stating any 3 differences between P and S waves { All / Any two } 2 (1)

(ii) (a) ; Direction of propagation of wave and the direction of vibration are parallel to each other. 1+1

(iii) $D_1, D_2, P_3, D_4, D_5, D_6, D_7, D_8$ (or in the reverse order) 1

(iv) direct pulse – 0.4 s

reflected pulse – 0.6 s } 1

(v) Speed = $\therefore$ 3 km s^{-1}

$MX + X D_8 = 3 \times 0.6 = 1.8$ km ---------- 1

$MD_8 = 3 \times 0.4 = 1.2$ km ---------- 1

contd

If thickness of the rock is d, $d = \sqrt{Mx^2 - \left(\frac{MD_8}{2}\right)^2}$

$= \sqrt{0.9^2 - 0.6^2} = 0.3\sqrt{3^2-2^2} = 0.3\times\sqrt{5}$

$= 0.672$ km (0.62 – 0.72 km)

(vi) $A = V_p^2 \rho$

$= 3000^2 \times 2700 = 2.43 \times 10^{10}$ kg $s^{-2} m^{-1}$ = 2.43×10^{10} Pa

(Do not award this mark if unit is wrong)

(vii) rock sample may have irregular boundary / the rock boundary not horizontal / sample is not homogeneous

wave encountering intermediate different layer

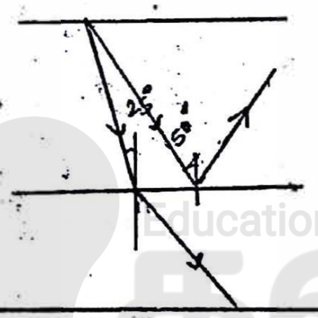
(accept any other possible answers)

(b) (i) refractive index of the second medium (vel. 5 km s^{-1}) w.r.to the rock medium $= 3/5 = 0.6000$

critical angle C is given by $\sin C = 0.6$

$C = 37^\circ$

(ii)



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(7) A – Proportional limit
B – Elastic limit
C – Breaking point
(All correct Only 2)

Distinguishing A and B

(a) (i) Young's modulus of steel, $Y_s = \frac{3\times10^8}{1.5\times10^{-3}} = 2\times10^{11}$ N m^{-2}

Young's modulus of copper, $Y_c = \frac{2\times10^8}{2\times10^{-3}} = 1\times10^{11}$ N m^{-2}

(ii) For steel wire,
max^m load (without exceeding proportional limit),

$F_1 = 3\times10^8 \times 0.8\times10^{-6} = 240$ N

For copper wire,
max^m load (without exceeding proportional limit)

$F_2 = 2\times10^8 \times 0.8\times10^{-6} = 160$ N

(iii) Maximum load on the composite wire = 160 N.

(b) Force on a wire, $F = \frac{AYe}{l}$

Each wire is extended by 1 mm (to identify)

$F = \frac{0.8\times10^{-6} \times 2\times10^{11} \times 1\times10^{-3}}{2} = 80$ N

Contd

Weight to be placed at the centre = 4×80 N = 320 N.

mass = 32 kg 1

12) (i) Let the forces acting on the steel and copper wires are F_s and F_c respectively.

$F \propto AY$ (e & l same for each)

$\frac{F_s}{F_c} = \frac{0.8 \times 2 \times 10^{11}}{2.4 \times 1 \times 10^{11}} = \frac{2}{3}$ 1

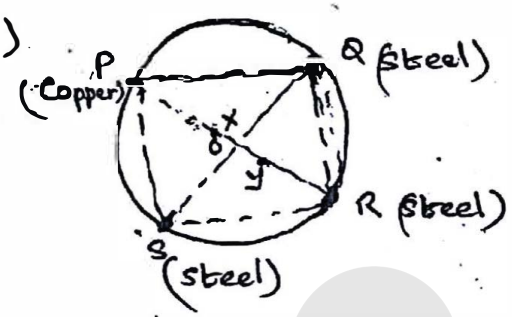
(ii) Force acting on the copper wire $F_c = \frac{2.4 \times 10^{-6} \times 1 \times 10^{11} \times 1 \times 10^{-3}}{2}$

$= 120$ N

Tension on one of the steel wires $= \frac{2}{3} \times 120 = 80$ N

$\therefore$ Total weight $= 120 + 3 \times 80 = 360$ N 1

(iii)



Resultant of the tensions due to 3 steel wires passes through Y, such that

$OY = \frac{1}{3} OR = 2.5$ cm

Resultant of all four wires acts at X. (Mark X on the diagram) 1

$\frac{PX}{XY} = \frac{240}{120} = 2$

$PX = \frac{2}{3} \times PY = \frac{2}{3} \times 10 = 6.67$ cm 1

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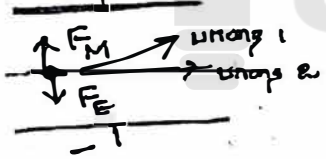
13) (a) (i)



For denoting F_E and F_M 1+1

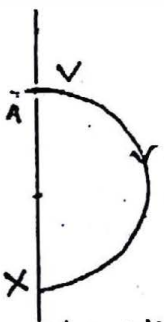
(ii) 1, 2 } For drawing paths 1 and 2 ..... 1+1

(iii) For undeviated particle, $F_E = F_M$

$qE = Bqv \Rightarrow v = \frac{E}{B}$ 1

(b) (i) Circle / Part of a circle. Magnetic force is always perpendicular to the path of the particle. 1

(ii)



..... 1

..... 1

(iii) V, No work is done by the magnetic field

(iv) Magnetic force $= B_0 qV$

centripetal acceleration $= \frac{V^2}{r}$ r - radius

Using $F = ma$, $B_0 qV = m\frac{V^2}{r}$ ..... for LHS and RHS 1+1

$r = \frac{mV}{B_0 q} = \frac{x}{2} \Rightarrow x = \frac{2mV}{B_0 q} = \frac{2mE}{B_0 q B}$

(c) (i) M_1 ——————————————————

(ii) For isotope with mass M_1, $AX = \frac{2 M_1 E}{B_0 q B}$

M_2, $AY = \frac{2 M_2 E}{B_0 q B}$ } ∴

Separation $XY = AX - AY$

$$d = \frac{2(M_1 - M_2)E}{B_0 q B}$$

(iii) $$d = \frac{2(M_1 - M_2)V}{B_0 q B}$$

$$= \frac{2 \times (6.17 \times 10^{-26} - 5.87 \times 10^{-26}) \times 500}{2 \times 10^{-3} \times 1.6 \times 10^{-19}}$$

$$= 9.375 \times 10^{-3} \text{ m}$$

(Q9) (A) (c) (i) $R = \frac{\rho l}{A}$

ρ – Resistivity
l – length
A – cross sectional area } Any 2

(ii) $V = Al = \text{constant}$

$$R = \frac{\rho l}{V/l} = \frac{\rho l^2}{V}$$

$\therefore R \propto l^2$.

(b) (i) length of the wire could be increased and hence the change in resistance will be significantly high

(ii) $8 \times 0.075 \text{ m} = 0.60 \text{ m}$

(iii) $$R = \frac{\rho l}{A} = \frac{5 \times 10^{-7} \times 0.6}{\pi \times (0.02 \times 10^{-3})^2} = \frac{75}{\pi} \times 10 = 239 \Omega$$

(iv) $239 \propto 0.600^2$

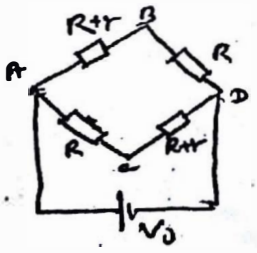
change in resistance $\Delta R \propto 2 \times 0.600 \times 0.001$

$$\frac{\Delta R}{239} = \frac{2 \times 0.001}{0.600} = \frac{1}{300}$$

$\therefore \Delta R = 0.800 \Omega$.

(c) i. 0 V

ii.



Potential drop across A and B $= \frac{V_0 \cdot (R+r)}{R+r+R}$

Potential drop across A and C $= \frac{V_0 \cdot R}{R+R+r}$

∴ p. drop across B and C $= \frac{V_0(R+r)}{2R+r} - \frac{V_0 R}{2R+r} = \frac{V_0 r}{2R+r}$

∴ Voltmeter reading $= \frac{V_0 r}{2R+r}$

"Least count of the voltmeter = 0.01 V

Minimum change in resistance corresponds to 0.01 V

$\frac{\% r_{min}}{2R + r_{min}} = 0.01$ · $V_0 = 10$ V, $R = 239\ \Omega$ 1

$\therefore r_{min} = 0.48\ \Omega$ 1

B (a) (i) I–V characteristics of a Zener diode 2

denoting V_z (Zener breakdown voltage) 1

P.d across the device = 10 V

$\therefore$ P.d across R = 12 − 10 = 2 V

Current through R, $I_R = I_{Load} + I_Z$

$= \frac{10}{100} + \frac{10}{1000}$ A $= 0.11$ A 1

$\therefore R = \frac{2}{0.11} = 18.18\ \Omega$ 1

(ii) If the voltmeter is assumed to function when voltage (supply) increases to 15 V the current through R would be $I_R = \frac{5}{18.18} = \frac{5}{200/11} = 275$ mA 1

The current through the load = 100 mA

current through zener = 175 mA 1

This is impossible (max. current = 65 mA) 1

(iii) Maximum allowed current through R is

$(I_R)_{max} = 100 + 65$ mA

$= 165$ mA. 1

maximum p.d across R is $(V_R)_{max} = \frac{165}{1000} \times \frac{200}{11}$

$= 3$ V 1

$\therefore$ Maximum of the source voltage = 10 + 3 = 13 V 1

(b) (i) $V_{R_1} = 6 - 0.6 = 5.4$ V. 1

(ii) Base current $I_B = \frac{5.4}{R_1} = \frac{5.4}{100 \times 10^2} = 5.4 \times 10^{-5}$ A.

$= 54\ \mu A$ 1

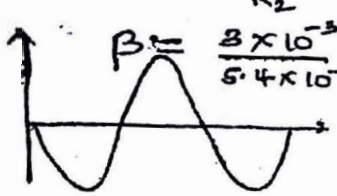
(iii) Current gain $\beta = \frac{I_c}{I_B}$

$V_{R_2} = 6 - 3 = 3$ V 1

$I_c = \frac{3}{R_2} = \frac{3}{1 \times 10^3}$ A $= 3 \times 10^{-3}$ A (3 mA)

$\beta = \frac{3 \times 10^{-3}}{5.4 \times 10^{-5}} = 55.6$ 1

(iv)



(Note the change in phase + increased amplitude) 1

(10) a (i) $P = P_0 + \frac{Mg}{A}$ ——— 1

(ii) Pressure at 27°C $= 1\times10^5 + \frac{12\times10}{25\times10^{-4}} = 1.48\times10^5$ Pa 1

(iii) Pressure remains constant $\therefore \frac{V}{T} = \text{const.}$

1. $\frac{Ah}{300} = \frac{Ah'}{330}$ h' - new height at 57°C 1

2. $h = 20$ cm ; $h' = 22$ cm

$\Delta W = P\,\Delta V$ 1

$= 1.48\times10^5 \times 2\times25\times10^{-6}$

$= 7.4$ J 1

3. $n = \frac{PV}{RT} = \frac{1.48\times10^5 \times 25\times20\times10^{-6}}{25/3 \times 300} = 0.0296$ mol 1

4. $\frac{P_{27}}{300} = \frac{P_{57}}{330}$

$\frac{1.48\times10^5}{300} = \frac{P_{57}}{330}$ 1

Pressure at 57°C is 1.628×10^5 Pa ——— 1

If the load that brings the piston to its original position is M', $\frac{M'g}{A} = 1.628\times10^5 - 1\times10^5$

$= 0.628\times10^5$ N m^{-2}

$M' = \frac{0.628\times10^5 \times 25\times10^{-4}}{10} = 157$ kg

$\therefore$ additional load $= 157 - 12 = 370$ kg

(b) (i) Pressure inside the vessel $= 1\times10^5 + \frac{25\times10}{25\times10^{-4}}$

$= 2\times10^5$ Pa 1

(ii) Temperature corresponds to this pressure = 130°C ——— 1

(iii) Yes. Since the pressure in the region surrounding water becomes equals to SVP of water. ——— 1

(c) (i) 8000 Pa.

(ii) R.H $= \frac{\text{S.V.P at dew point}}{\text{SVP at air temp}} \times 100\ \%$

$50 = \frac{\text{S.V.P at dew point}}{8000} \times 100$

S.V.P. at dew point = 4000 Pa

dew point temp = 26°C

Education கல்வி අධ්‍යාපන

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 கலவித்துறை 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 ஊடாக உங்களிற்கு தேவையான பரீட்சை வினாத்தாள்களை இலகுவான முறையில் தரவிறக்கம் செய்து கொள்ளமுடியும்.

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

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