G.C.E. (Advanced Level) Examination - August 2013
PHYSICS - I
Provisional Scheme of Marking

2013 Answers

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

G.C.E. (Advanced Level) Examination - August 2013

PHYSICS - II

Provisional Scheme of Marking

A - PART

(01) (a) $(V + Al_1)dg$ 01

(b) $W = Mg + (V + Al_1)dg$ 01

(c) $U = (V + Al_2)d_w g$ 01

(d) (i) $W = U$

(ii) $Mg + (V + Al_1)dg = (V + Al_2)d_w g$

$M + Vd + Al_1 d = Vd_w + Al_2 d_w$

$$l_2 = \frac{d}{d_w} l_1 + \frac{M + Vd - Vd_w}{Ad_w}$$ 01

(iii) $d = (\text{gradient}) \times d_w$

Mulitplying the gradient of graph by d_w/ density of water 01

(e) (i) Travelling mieroscope 01

(ii) Focus the horizontal cross wire of the travelling microscope to the ring / point p and take the reading.

Then focus the horizontal cross wire of the travelling microscope to the oil and water surface / levels and take corresponding readings. 02

(f) (i) internal diameter of the tube

Exteranl diameter of the tube 01

(ii) Using the inner Jaws of the vernier Calliper

Using the outer Jaws of the vernier Calliper 01

(02) (a) $\alpha = \frac{l_1 = l_0}{l_0 \theta}$ 01

(b) $\frac{1mm}{(l_0)\min} \times 100\% = 0.2\%$ OR $\frac{0.5mm}{(l_0)\min} \times 100 = 0.2$ 01

$(l_0)\min = 500$ mm | $(l_0)\min = 250$ mm

50 cm | = 25 cm

0.5 m | = 2.5 m 01

(c) Tube reaches the thermal equilibrium state OR equilibrium / stable temperature quickly/ with small amount of heat or it will have a small heat capacity.

Tube will heat up uniformly/ tube will achieve the same interanl and external temperatures or beter thermal contact to the inside and outside of the tube. 01

(d) (i) $(x - x_0) = \frac{10}{2}(l_1 - l_0)$

$1\ mm = 5(l_1 - l_0)$

minimum value of $(l_1 - l_0)$ that can be measured using the setup = 0.2 mm = 0.02 cm = 2×10^{-4}m 01

OR $(x - x_0) = 5(l_1 - l_0)$

$0.5\ mm = 5(l_1 - l_0)$

$l_1 - l_0 = 0.1$ mm / 0.01 cm/ 1×10^{-4} m 01

$\alpha = \frac{(X - X_0)}{5l_0 \theta}$ $X - X_0 = 5(l_1 - l_0)$

$X - X_0 = 5[\alpha l_0 \theta]$ 01

OR $X = 5 \times l_0 \theta + X_0$

$X = \frac{ql_0}{P} \times \theta + X_0$

(e) (i) Gradient of the graph = 0.1 mm °C⁻¹ = 10^{-4}m °C⁻¹ 01

(ii) $5\alpha l_0 = 10^{-4}$ OR $5\alpha l_0 = 0.1$mm °C^{-1} 01

$$\alpha = \frac{10^{-4}}{5 \times 80 \times 10^{-2}} \ {}^\circ C^{-1}$$

$\alpha = 2.5 \times 10^{-5}\ {}^\circ C^{-1}$ 01

(f) yes.

low thermal conductivity for the arm ABC is disired because;

Heat absorbed by the ABC arm will be small, OR

Expansion of the ABC Arm will be small negligible.

OR

Temperature rise of the arm ABC will be small,

OR

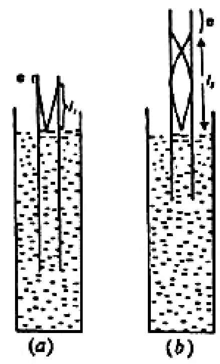
The ratio (p/q) will not be different from the given value.

OR

No additional contribution to the expansion will come from the heated arm 01

(g) looking from above and move until the indicator pears right in top of its own mirror image and take the reading. 01

03.



(a) (i) Correct diagram with the end correction 01

(ii) Correct diagram with the end correction as shown Length above the water level should be approximately three times compared fo the first case.

(iii) Correctly marked the height from the water level to the open end of the tube 01

(b) (i) $\frac{\lambda}{4} = l_1 + e$

$V = 4(l_1 + e)$ 01.

$V = f\lambda$

$V = f4(l_1 + e)$

$V = 4f(l_1 + e)$ —— Ⓐ 01

(ii) $\lambda = \frac{4}{3}(l_2 + e)$

$V = \frac{4f}{3}(l_2 + e)$ —— Ⓑ 01

(iii) Ⓐ $\Rightarrow \frac{V}{4f} = l_1 + e$

Ⓑ $\Rightarrow \frac{3V}{4f} = l_2 + e$

$\Rightarrow \frac{2V}{4f} = l_2 - l_1$

$V = 2f(l_2 - l_1)$ 01

(iv) $V = 2f(l_2 - l_1)$

$= 2 \times 512 (0.509 - 0.169)$

$V = 348.16\ ms^{-1} = 348.2\ ms^{-1}$

Ⓐ $\Rightarrow e = V/4f - l_1$

$e = \frac{348.2}{4 \times 512} - 0.169$

$e = 0.001$ m 01

(c) The length of the tube or the height of the measuring cylinder equired would be too long OR

length of the tube or the measuring cylinder may not be sufficient.

The intensity of sound / loudness would be too low to hear sufficient number of overtones. OR (if would be difficult to hear sufficient number of overtones) 01

04. (a) $l_1 R_1 = l_2 R_3$ } 01

$l_1 R_2 = l_2 R_4$

$\therefore \frac{R_1}{R_2} = \frac{R_3}{R_4}$ 01

(b) To reduce the resistance between the interconnection of items OR

To reduce the contrrbution of connecting wires to be the resistances OR

To reduce errors associated with resistances due to conecting wires 01

(c) Centre - Zero Galvonometer with a Safety resistor 01

(d) Resistance box

Reasons

To obtain read the value of the resistance (R_1) to plot the graph OR

The resistance box will provide the value of resistance

OR

Numerical value of the resistance is needed to plot the graph

OR

Rheostatdoes not provide the value of the resistance (R_1) 01

(e) (i) $\frac{R_1}{R_2} = \frac{l}{1-l}$ or $\frac{R_1}{R_2} = \frac{l}{100-l}$ 01

(ii) $\frac{R_2}{R_1} = \frac{1-l}{l}$ or $\frac{R_2}{R_1} = \frac{100-l}{l}$

$\frac{R_2}{R_1} = \frac{1}{l} - 1$ $\frac{R_2}{R_1} = \frac{100}{l} - 1$

$\frac{1}{l} = (R_2)\frac{1}{R_1} + 1$ or $\frac{1}{l} = \left(\frac{R_2}{100}\right)\frac{1}{R_1} + \frac{1}{100}$ 01

(iii) Form the gradient OR gradient x 100

(f) If small l value are selected.

1. Fractional / percentage error due to end correction will be large.
2. Fractional / percentage error due to l measurment will be large.
3. Galvonometer is more sensitive when the readings are taken at the middle (or 30 cm - 70 cm) 02

PART - B

05. (a) (i) Change in momentum of the air molecule perpendicular fo the wing = 2 mv sin θ 01

(ii) Vertical force generated by the collisions

$= 2mv \sin\theta \times \cos\theta \times N$ 01

(b) (i) Mass of molecules hitting the wing in one second

$= Avd$ 01

(ii) Number of molecules hitting the wing in one second,

$N = \frac{Avd}{m}$ $[Nm = Avd]$ 01

(iii) Total vertical force on both wings due to collisions of air molecules on the wings,

$F_C = 2mv\sin\theta\cos\theta \times \frac{Avd}{m} \times 2$

$F_C = 4Adv^2\sin\theta\cos\theta$ 01

(iv) If $A = 25m^2$, $d = 1.2\ kgm^{-3}$, $\cos\theta = 1$ $\sin\theta = 0.2$

$F_C = 4 \times 25 \times 1.2 \times V^2 \times 0.2 \times 1$

$F_C = 24V^2$

(c) (i) Bernullis eq; $P + \frac{1}{2}\rho v^2 + \rho gh =$ Constant 01

OR $P + \frac{1}{2}\rho v^2 =$ Constant 01

$P_1 + \frac{1}{2}d\left(\frac{7v}{6}\right)^2 = P_2 + \frac{1}{2}d\left(\frac{5v}{6}\right)^2$ 01

$P_2 - P_1 = \frac{1}{2}d\left(\frac{49v^2}{36} - \frac{25v^2}{36}\right)$

$= \frac{1}{2} \times d \times \frac{24V^2}{36}$

$= \frac{1}{2} \times d \times \frac{2V^2}{3}$

$P_2 - P_1 = \frac{dv^2}{3} = \frac{1.2V^2}{3}$

$P_2 - P_1 = \frac{2}{5}V^2$ 01

(ii) Total vertical force on both wings due to Bernulli's effect;

$\frac{F}{A} = P_2 - P_1$

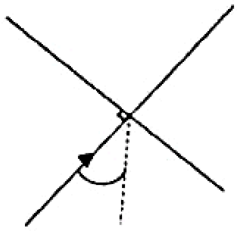
$F = A\left(P_2 - P_1\right)$

$= A\ \frac{2V^2}{5}$

$F = 2 \times \frac{120}{5} \times 2 \times V^2$

$F_b = 2 \times \frac{120}{5} \times 2 \times V^2 \times \cos 10^0$

$F_b = 96V^2$ 01



(d) Total vertical force on the airplane;

$F_b + F_c = 96V^2 + 24V^2$

$= 120\ V^2$ 01

$F_b + F_c = mg$

$120\ V^2 = 4.32 \times 10^5$

$V^2 = \frac{4.32 \times 10^5}{120}$

$V^2 = 3600$

$V = 60\ ms^{-1}$ 01

(e) Initial velasity, U = O Final velocity = 60 ms^{-1}

$a = 0.9\ ms^{-2}$

$V^2 = U^2 + 2as$

$60^2 = 0 + 2 \times 0.9 \times S$ 01

$S = \frac{3600}{1.8}$ m S = 2000m

Required minimum length of the runway = 2 km

(f) Pilots take off airplanes by accelerating in the direction against the wing in order to have a higher value of v OR to achive a higher lift

OR

Airplane can take off at a lower speed relative to the earth.
01

06. (a) (i) $n_1 \sin i = n_2 \sin r$

$1.5 \sin C = 1.44$ 01

$\sin C = \frac{1.44}{1.5} = 0.96$

$C = 74^0$ 01

(ii) Angle of refraction of the first surface (r)

$r = 90^0 - C$ 01

$r = 90 - 74$

$r = 16^0$

$\sin \theta = 1.5 \times \sin r\ (\sin 16^0)$ 01

$\sin \theta = 1.5 \times 0.28 = 0.42$

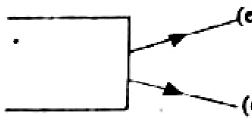
$\theta = 25^0$ 01

(iii) Range of θ : 0 to 25° or $0 < \theta \leq 25^0$

$-25^0 \leq \theta \leq 25^0$ 01

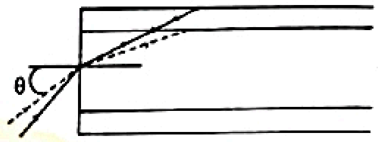
(iv) Advantages : - No interfences from external electromagnetic waves/ imterferences from external noises could be avoided OR Bandwidth is large OR low transmission loss OR Less heat dissipation OR No cross-talk 01

(v)



01
01

(vi)



01

(b) Speed of the blue light in the fibre $= \frac{3 \times 10^8}{1.53}$

OR

Speed of the Red light in the fibre $= \frac{3 \times 10^8}{1.48}$ 01

Time taken by the blue light $= \frac{3 \times 10^3}{\frac{3 \times 10^8}{1.53}}$

$t_b = \frac{3 \times 10^3}{3 \times 10^8} \times 1.53$

OR

Time taken by the red light $(t_R) = \frac{3 \times 10^3 \times 1.48}{3 \times 10^8}$

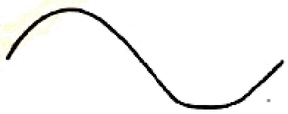
Time difference $t = t_b - t_R$

$t = \frac{3 \times 10^3}{3 \times 10^8}\ (1.53 - 1.48)$

$t = 10^{-5} \times 0.05$ S

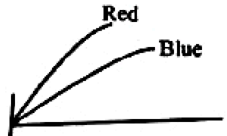
$t = 5 \times 10^{-7} S\ (0.5\mu s)$ 01

(c) - (i)



01

(ii)



01

Speeds / refractive indices / Wavelengths of blue and red rays are diffrent inside the fibre

07. (a) (i) Presure differece $= \Delta P = \frac{8\eta l}{\pi r^4} Q$ 01

(ii) Give that $r = 2 \times 10^{-4}$m, $l = 3 \times 10^{-2}$m

$Q = 1.5 \times 10^{-7}\ m^3s^{-1}$

$\Delta P = \frac{8 \times 2 \times 10^{-3} \times 3 \times 10^{-2}}{3x\left(2 \times 10^{-4}\right)^4} \times 1.5 \times 10^{-7}$ 01

$\Delta P = 1.5 \times 10^4$ Pa

∴ Value of h required to maintain this pressure diffrence is given by

$hdg = \Delta p$ (For equaling Δp to $h\rho g$)

$h \times 1.2 \times 10^3 \times 10 = 1.5 \times 10^4$

$h = 1.25$ m 01

(iii) If the pressure at the free end of the needle is increased by an amount 3×10^3 Nm^{-2} over and above the atmospheric pressure, the height of the saline coloumn must be increased by an amount h' Where

$$h'dg = 3 \times 10^3$$ 01

$$h' = \frac{3 \times 10^3}{1.2 \times 10^3 \times 10}$$

$$h' = 0.25 \text{ m}$$ 01

(iv) If the corresponding change in flow rate is ΔQ for a change in height of Δh, then.

$$(\Delta h)\, dg = \frac{8\eta l}{\pi r^4} \times \Delta Q$$

$$(\Delta h)\, dg = \frac{8 \times 2 \times 10^{-3} \times 10^{-2} \times \Delta Q}{3 \times \left(2 \times 10^{-4}\right)^4}$$

$$(\Delta h)dg = 10^{11}\, \Delta Q$$

$$\Delta Q = \frac{(\Delta h)dg}{10^{11}}$$

$$\Delta Q = \frac{20 \times 10^{-2} \times 1.2 \times 10^3 \times 10}{10^{11}}$$ 01

$$\Delta Q = 2.4 \times 10^{-8}\ m^3 s^{-1}$$ 01

OR Minimum volume flow rate Qmin which occurs when the bottle is almost empty

$$h = (1.5E - 0.2)m = 1.3\text{m}$$

$$1.3 \times 1.2 \times 10^3 \times 10 - 3 \times 10^3 = \frac{8 \times 2 \times 10^{-3} \times 3 \times 10^{-3}}{3 \times (2 \times 10^{-4})^4} \times Q_{min}$$ 01

$$Q_{min} = 1.26 \times 10^{-7}\ m^3\ s^{-1}$$

∴ Change in flowrate = $1.5 \times 10^{-7} - 1.26 \times 10^{-7}$

$= 2.4 \times 10^{-8}\, m^3 s^{-1}$ 01

(v) maximum flow rate (when the bottle is full) = 1.5×10^{-7} m^{3}S^{-1}

minimum flow rate (when the bottle is emty)

$= (1.5 \times 10^{-7} - 2.4 \times 10^{-8})$ m^{3}S^{-1}

$= 1.26 \times 10^{-7}$ m^{3}S^{-1}

Average flow rate $= \frac{(1.5 + 1.26)}{2} \times 10^{-7}$

$= 1.38 \times 10^{-7} m^3 s^{-1}$ 01

(vi) Time required to infuse 1104cm^3 of saline

$$t = \frac{1104 \times 10^{-6}}{1.38 \times 10^{-7}}\ S$$

$t = 8000$ S 01

(b) (i) If V is the speed of the piston with which it must be moved in order to maintain a volume flow rate of 1.5×10^{-7} m^{3}S^{-1}, then [Q = AV]

$V_x$cross sectional area of the syringe = 1.5×10^{-7}

$$V = \frac{1.5 \times 10^{-7}}{12 \times 10^{-4}}$$

$$V = 1.25 \times 10^{-4}\, ms^{-1}$$ 01

(ii) Required Pressure to maintain the given flow rate

[P = hρg]

$= 1.5 \times 1.2 \times 10^3 \times 10 = 1.8 \times 10^4$ Nm^{-2}

∴ Force exerted by the piston on the saline solution,

F = PA

F = $1.8 \times 10^4 \times 12 \times 10^{-4}$ 01

F = 21.6 N 01

(iii) Power = F x v

$= 21.6 \times 1.25 \times 10^{-4}$

$= 2.7 \times 10^{-3}$W = 2.7mW 01

OR

Power = P V

$= 1.8 \times 10^4 \times 1.5 \times 10^{-7}$

power $= 2.7 \times 10^{-3}$ W

= 2.7 W

08. (a) Nucleus, Coma and Tails (All three)

(b)

Ion tail	Dust tail
(i) Straight	Slightly curved
(ii) Bule Colour	White colour
(iii) Mostly ione	Mostly dust
(iv) Always directed away from the sun	Behind the comet 01

(c) $F = \frac{GMm}{r^2}$

$$F = \frac{6.7 \times 10^{-11} \times 2 \times 10^{30} \times 2 \times 10^{14}}{\left(5 \times 10^{12}\right)^2}$$ 01

$$F = 1.07 \times 10^9\ W$$ 01

(d) Apply $I_1\ \omega_1 = I_2\ \omega_2$ (Consevation of angular momontum)

$$mr_1^2\ \frac{V_1}{r_1} = mr_2^2\ \frac{V_2}{r_2} \qquad [mr_1v_1 = mr_2\ v_2]$$

$8.0 \times 10^{10} \times V = 5 \times 10^{12} \times 12.0 \times 10^3$

$V = 7.5 \times 10^5$ ms^{-1} OR $V = 7.5 \times 10^2$ kms^{-1} 01

(e) The debris left along the path of a comet enters the earth's atmosphere and burn out due to heat being genarated through friction, emitting light. 01

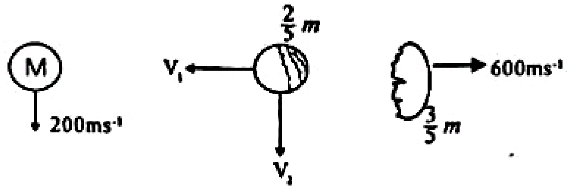
(f) Meteorites - Metorids which burn out partially and the remains fall into the earth surface.

Meteors - Meterids which burnt out completely in the atmosphere emitting light. 01

(g) linear (translational) and rotational kinetic energies.

(h) Fireballs are produced when the atoms surrounding the meteoroid ionize and rapidly recombine with the electrons, emitting light. 01

(i)



Applying consevation of linear momentum,

$\rightarrow \odot = \frac{3M}{5} \times 600 - \frac{2M}{5} \times V_1$

$V_1 = 900 \text{ ms}^{-1}$

$\downarrow V_2 \times \frac{2M}{5} = 200 \text{ M}$

$V_2 = 500 \text{ ms}^{-1}$

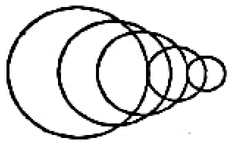
$V = \sqrt{V_1^2 + V_2^2}$

$V = \sqrt{900^2 + 500^2}$

$V = \sqrt{106} \times 10^2 \text{ ms}^{-1} = 1030 \text{ ms}^{-1}$ (1020 - 1040) 01

(j) Speed of the piece > the speed of saund. 01
[Mac Number > 1]

(k)



- Correct diagram with the envelope (two lines) 01

The cone procluced by the envelope of spherical wave fronts is the shock wave OR labeling the envelope of the wave front as the shockwave. 01

09. (A) (a) $I = \frac{E}{R_0 + R_L}$ 01

(b) $E = V_0$ 01

$I_s = E/R_0$ 01

$\therefore R_0 = \frac{V_0}{I_s}$ 01

Ohms (e) and Kirchhoff's lows are apply to the circuit, $I = \frac{V_L}{R_L}$ $\therefore E = IR_0 + IR_L$ 01

(c) Applying $V = IR$

$V_L = IR_L$

$V_L = \left(\frac{E}{R_0 + R_L}\right)R_L$ 01

$R_L = 1 \times 10^3$ and $V_L = 75$ mV

$75 = \times 10^{-3} = \frac{1 \times 10^3 E}{R_0 + 1 \times 10^3}$ 01

$75 \times 10^{-3} R_0 + 75 = 1 \times 10^3 E$

$E = 75 \times 10^{-6} R_0 + 75 \times 10^{-3}$ (A)

$R_L = 100 \times 10^3 \Omega$ and $V_L = 5V$

$5 = \frac{100 \times 10^3 E}{R_0 + 100 \times 10^3}$ 01

$5R_0 + 5 \times 10^5 = 100 \times 10^3 E$

$E = 5 \times 10^5 R_0 + 5$ (B)

(A) = (B) $75 \times 10^{-6} R_0 + 75 \times 10^{-3} = 75 \times 10^{-5} R_0 + 5$

$25 \times 10^{-6} R_0 = 4.925$

$R_0 = 0.197 \times 10^6 \ \Omega$

$R_0 = 197 \text{ k}\Omega$ 02 (02 or 00)

(B) $\Rightarrow$ $E = 5 \times 10^{-5} x \ 197 \times 10^3 + 5$

$= 985 \times 10^{-2} + 5$

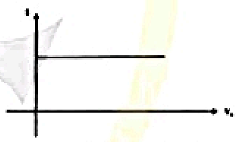
$E = 14.85$ V 02 (02 or 00)

(d) (i) Considering the eq $I = \frac{E}{R_0 + R_L}$ when $R_0 >>> R_c$

$\therefore I \approx E/R_0$ OR $I = E/R_0$ 01

OR Answer in words followed by a correct argument.

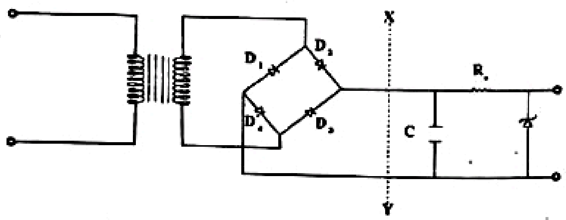
(ii)



01

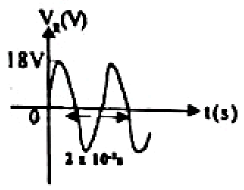
(e) The nearly horizontal flat region of the output characteristic is similar to the above curve. 01
(the one corresponding to the active region)
The above curre is produecd by a circuit baving a large internal resistance (R_0), there fore the internal resistance of the transistor is also large. OR
The qradient of the above curve is very small implying that the associated resistance $\left(\frac{\Delta V_L}{\Delta I}\right)$ is vey large.
Therefore the resistance, of the transistor is very large.
any one 01

(B)

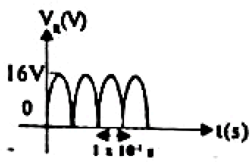


For correctdiagram up to the line xy from left 01

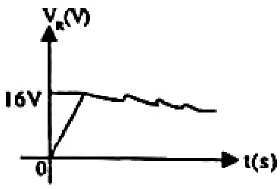
(b) (i)



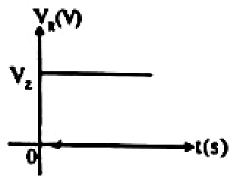
(ii)



(iii)



(iv)



01 mark each for the shapes and labeling of axes of above graphs 04

18V and 16V mark at least one graphs 01

Respective periods of the wave forms 2×10^{-2} S and 1×10^{-2} S 01

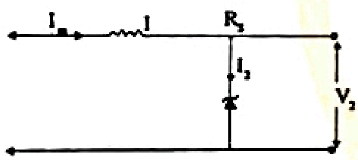
(ii) Smoothing capacitor connection shown in the diagram 01

(iii) Zenor diode connection shown in the diagram 01

(c) (i) The dc component bigger OR the voltage smoother OR A large capacitance will make ripple voltage smaller OR ripple factor smaller OR make the output more dc 01

(ii) Maximum reverse - bias voltage across a diode is 17 V 01

(d)

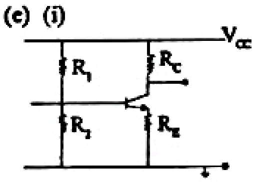


$\frac{16-10}{R_S} = 200 \times 10^{-3}$ OR $\frac{16-10}{R_S} \leq 200 \times 10^{-3}$

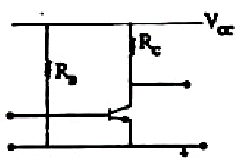
$R_S = \frac{6}{200 \times 10^{-3}}$ $R_S \geq 30\,\Omega$ 01

$R_S = 30\Omega$ 01

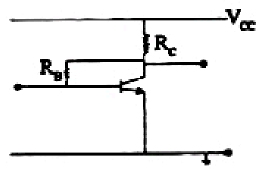
(e) (i)



OR



OR



Correct circuits 01

(ii) Base voltage would vary according to the ripple voltage. This will appear as a signal variation at the base and produce an amplified (inverted) signal at the collector. 01

10. (A) $PV = nRT$ OR $PV = \left(\frac{m}{M}\right)RT$ 01

$\rho = \left(\frac{m}{v}\right)\frac{RT}{M}$

$\rho = \frac{\rho RT}{M}$

$\rho = \frac{PM}{RT}$ 01

(a) (i) $\rho_A = \frac{10^5 \times 30\ 10^{-3}}{8.31 \times 300} = \frac{0.12 \times 10^5 \times 30 \times 10^{-3}}{300}$

$\rho_A = 1.2\ \text{kgm}^{-3}$ 01

(ii) $\rho_B = \frac{1.5 \times 10^5 \times 30 \times 10^{-3}}{8.31 \times 337.5} = \frac{0.12 \times 1.5 \times 10^5 \times 30 \times 10^{-3}}{337.5}$

$\rho_B = 1.6\ \text{Kgm}^{-3}$ 01

(iii) $\rho_C = \frac{1.5 \times 10^5 \times 30 \times 10^{-3}}{8.31 \times 300} = \frac{0.12 \times 1.5 \times 10^5 \times 30 \times 10^{-3}}{300}$

$= 1.8\ \text{kgm}^{-3}$ 01

(b) (i) $V_1 = \frac{1.2}{1.6}$ OR $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$;

$\frac{1.0 \times 10^5 \times 1}{300} = \frac{1.5 \times 10^5 \times V_1}{337.5}$

$V_1 = 0.75\ \text{m}^3$ 01

(ii) $V_2 = \frac{1.2}{1.8}$ OR $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{1.0 \times 10^5 \times 1}{300} = \frac{1.5 \times 10^5 \times V_2}{300}$

$V_2 = 0.67\text{m}^3$ 01

(c) (i) Work done from A to B $= \frac{-1}{2} \times 0.25 \times (1 + 1.5) \times 10^5$

$= -31250J\ (3.125 \times 10^4 J)$

(ii) For an adiabatic process $\Delta Q = 0$ 01

$\Delta Q = \Delta U + \Delta w$

$0 = \Delta U + \Delta w$

$\therefore \Delta u = -\Delta w$ 01

Change in internal energy from A to B = 31250J 01

(d) (i) Workdone form B to C $= -1.5 \times 10^5 \times 0.08$

$= -12000J\ (1.2 \times 10^4 J)$

(ii) Since temperature at C is equal to the temperature at A, the internal energy of the air of C is same as that at A. Therfore the internal energy gained during the process from A to B has to be lost during the process from B to C

$\therefore$ Applying $\Delta Q = \Delta U + \Delta w$

$\Delta U = \Delta Q - \Delta w$

$-31250 = \Delta Q - (-12000)$ 01

$\Delta Q = -43250J\ (4.325 \times 10^4 J)$ 01

(e) Increase in efficienct $= \frac{(1.8 - 1.2)}{1.2} \times 100\%$

$= 50\ \%$

10. (B) (a) (i) $\frac{hc}{\lambda} - \phi = K_{max}$ 01

(ii) When $\lambda = \lambda 0$, $K_{max} = 0$ 01

$\phi = \frac{hc}{\lambda_0}$ 01

(b) (i) $\lambda_1 = 430$ nm $(430 \times 10^{-9} m)$ 01

$\lambda_2 = 660$ nm $(660 \times 10^{-9} m)$ 01

(ii) 430 nm OR λ_1 OR shorter wavelength 01

(c) (i) $\phi_1 = \frac{1290}{430}$ OR $\phi_1 = \frac{1290 \times 1.6 \times 10^{-19} J\ nm}{430 nm}$

$\phi_1 = 3eV$ $\phi_1 = 4.8 \times 10^{-19}$ J 01

$\phi_2 = \frac{1290}{660}$ OR $\phi_2 = \frac{1290 \times 1.6 \times 10^{-19}}{660}$

$\phi_2 = 1.96$ ev $\phi_2 = 3.13 \times 10^{-19} J$ 01

(1.95 − 1.96) (3.12 − 3.12)

(d) (i) Rate of energy incident on unit surface area due to λ_1

$= \frac{1200}{100} \times 0.1$

$= 1.2\ Wm^{-2}$ 01

(ii)(1) Rate of energy incident on chlorophgll molecules $= 1.2 \times 4 \times 10^{-4}$

$= 4.8 \times 10^{-4}\ W$ 01

(2) Number of photons incident per second

$= \frac{4.8 \times 10^{-4}}{3 \times 1.6 \times 10^{-19}}$ 01

$= 10^{15}$ Photons S^{-1} 01

(iii) Number of chlorophyll molecules excited Per Second $= \frac{10^{15}}{10^{14}}$

$= 10$ molecules S^{-1}

01

(iv) time taken to make on glucase molecule $= 6/10$

$= 0.6$ S

01