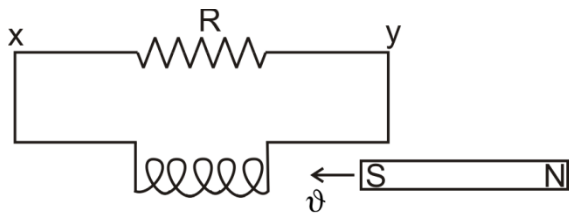
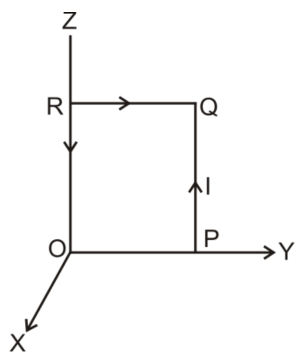
SAMPLE QUESTION PAPER
PHYSICS (042)
CLASS-XII – (2012-13)

Q1. A magnet is moving towards a coil with a uniform speed ϑ as shown in the figure. State the direction of the induced current in the resistor R. 1



Q2. A square coil, OPQR, of side a, carrying a current I, is placed in the Y-Z plane as shown here. Find the magnetic moment associated with this coil. 1



Q3. Give one example each of a 'system' that uses the

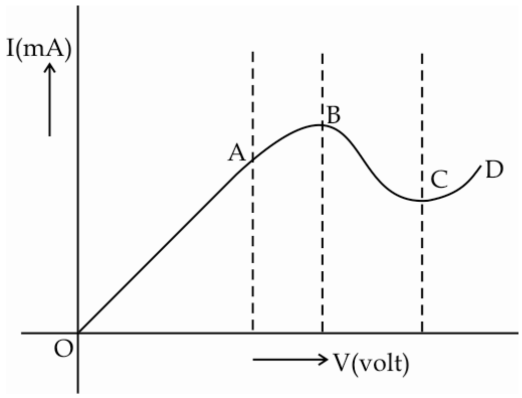
(i) Sky wave (ii) Space wave

mode of propagation 1

Q4. A concave mirror, of aperture 4cm, has a point object placed on its principal axis at a distance of 10cm from the mirror. The image, formed by the mirror, is not likely to be a sharp image. State the likely reason for the same. 1

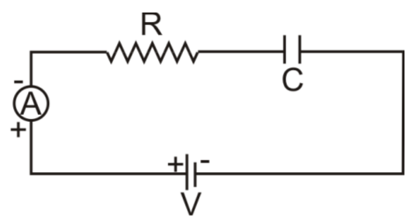
Q5. Two dipoles, made from charges $\pm$ q and $\pm$ Q, respectively, have equal dipole moments. Give the (i) ratio between the 'separations' of the these two pairs of charges (ii) angle between the dipole axis of these two dipoles. 1

Q6. The graph, shown here, represents the V-I characteristics of a device. Identify the region, if any, over which this device has a negative resistance. 1



Q7. Define the term 'Transducer' for a communication system. 1

Q8. State the steady value of the reading of the ammeter in the circuit shown below.



1

Q9. The following table gives data about the single slit diffraction experiment:

Wave length of Light	Half Angular width of the principal maxima
λ	θ
$p\,\lambda$	$q\,\theta$

Find the ratio of the widths of the slits used in the two cases. Would the ratio of the half angular widths of the first secondary maxima, in the two cases, be also equal to q? 2

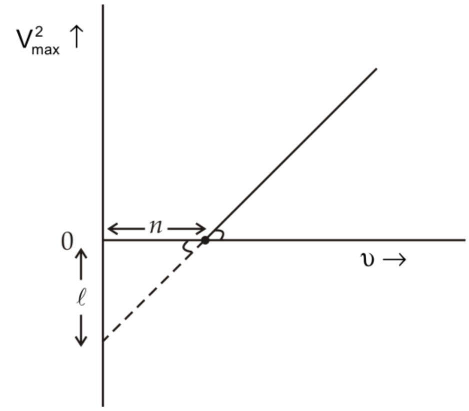
Q10. N spherical droplets, each of radius r, have been charged to have a potential V each. If all these droplets were to coalesce to form a single large drop, what would be the potential of this large drop?

(It is given that the capacitance of a sphere of radius x equals $4\,\pi\, \epsilon_0 k x$.)

OR

Two point charges, q_1 and q_2, are located at points (a, o, o) and (o, b, o) respectively. Find the electric field, due to both these charges, at the point, (o, o, c). 2

Q11. When a given photosensitive material is irradiated with light of frequency ν, the maximum speed of the emitted photoelectrons equals ν_{max}. The square of ν_{max}, i.e., ν_{max}^2, is observed to vary with ν, as per the graph shown here.



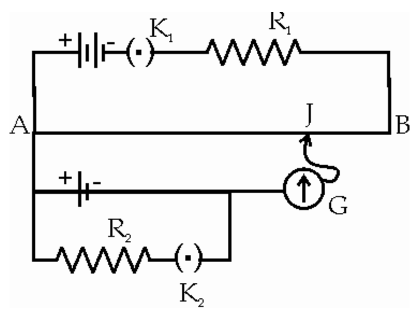
Obtain expres

(i) Planck's constant, and

(ii) The work function of the given photosensitive material,

in terms of the parameters, ℓ, n and the mass, m, of the electron.

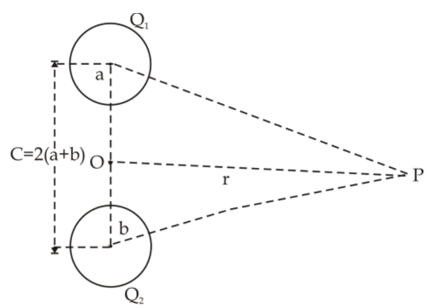
Q12. For the circuit shown here, would the balancing length increase, decrease or remain the same, if 2



(i) R_1 is decreased
(ii) R_2 is increased

without any other change, (in each case) in the rest of the circuit. Justify your answers in each case.

Q13. Find the P.E. associated with a charge 'q' if it were present at the point P with respect to the 'set-up' of two charged spheres, arranged as shown. Here O is the mid-point of the line O_1 O_2. 2



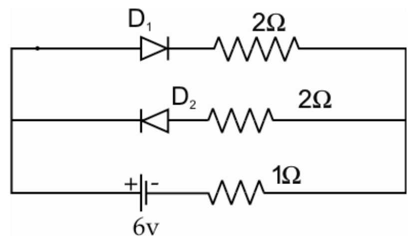
Q14. An athlete peddles a stationary tricycle whose pedals are attached to a coil having 100 turns each of area $0.1m^2$. The coil, lying in the X-Y plane, is rotated, in this plane, at the rate of 50 rpm, about the Y-axis, in a region where a uniform magnetic field, $\vec{B} = (0.01)\,\hat{k}$ tesla, is present. Find the

(i) maximum emf (ii) average e.m.f

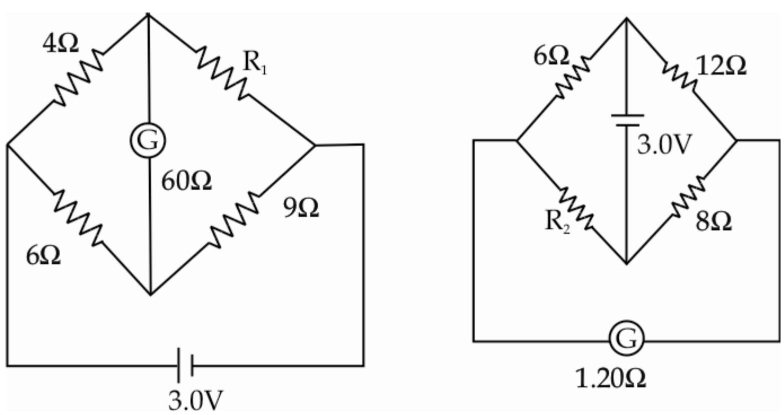
generated in the coil over one complete revolution. 2

Q15. A monochromatic source, emitting light of wave length, 600 nm, has a power output of 66W. Calculate the number of photons emitted by this source in 2 minutes. 2

Q16. For the circuit shown here, find the current flowing through the 1Ω resistor. Assume that the two diodes, D_1 and D_2, are ideal diodes. 2



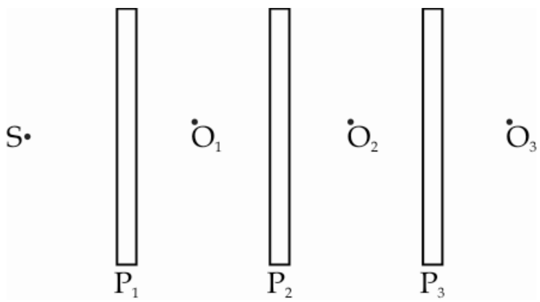
Q17. The galvanometer, in each of the two given circuits, does not show any deflection. Find the ratio of the resistors R_1 and R_2, used in these two circuits. 3



Q18. The electron, in a hydrogen atom, initially in a state of quantum number n_1 makes a transition to a state whose excitation energy, with respect to the ground state, is 10.2 eV. If the wavelength, associated with the photon emitted in this transition, is 487.5 mm, find the

(i) energy in ev, and (ii) value of the quantum number, n_1 of the electron in its initial state. 3

Q19. Three identical polaroid sheets P_1, P_2, and P_3 are oriented so that the (pass) axis of P_2 and P_3 are inclined at angles of 60^0 and 90^0, respectively, with respect to the (pass) axis of P_1. A monochromatic source, S, of intensity I_0, is kept in front of the polaroid sheet P_1. Find the intensity of this light, as observed by observers O_1, O_2, and O_3, positioned as shown below.



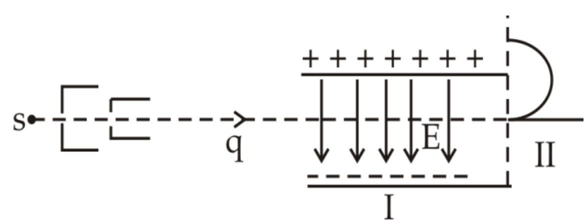
Q20. A fine pencil of β-particles, moving with a speed ϑ, enters a region (region I), where a uniform electric and a uniform magnetic field are both present. These β-particles then move into region II where only the magnetic field, (out of the two fields present in region I), exists. The path of the β-particles, in the two regions, is as shown in the figure.

(i) State the direction of the magnetic field.

(ii) State the relation between 'E' and 'B' in region I.

(iii) Drive the expression for the radius of the circular path of the β-particle in region II.

If the magnitude of magnetic field, in region II, is changed to n times its earlier value, (without changing the magnetic field in region I) find the factor by which the radius of this circular path would change. 3



Q21. Draw an appropriate ray diagram to show the passage of a 'white ray', incident on one of the two refracting faces of a prism. State the relation for the angle of deviation, for a prism of small refracting angle.

It is known that the refractive index, μ, of the material of a prism, depends on the wavelength , λ, of the incident radiation as per the relation

$$\mu = A + \frac{B}{\lambda^2}$$

where A and B are constants. Plot a graph showing the dependence of μ on λ and identify the pair of variables, that can be used here, to get a straight line graph. 3

Q22. Define the terms (i) mass defect (ii) binding energy for a nucleus and state the relation between the two.

For a given nuclear reaction the B.E./nucleon of the product nucleus/nuclei is more than that for the original nucleus/nuclei. Is this nuclear reaction exothermic or endothermic in nature? Justify your choice.

OR

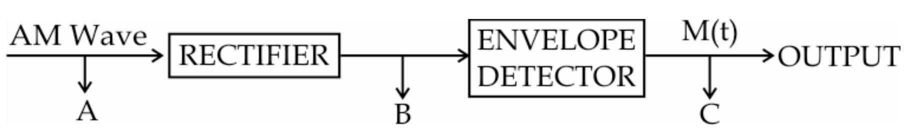
(a) The number of nuclei, of a given radioactive nucleus, at times t=0 and t=T, are N_0 and (N_0/n) respectively. Obtain an expression for the half life ($T_{1/2}$) of this nucleus in terms of n and T.

(b) Identify the nature of the 'radioactive radiations', emitted in each step of the 'decay chain' given below: 3

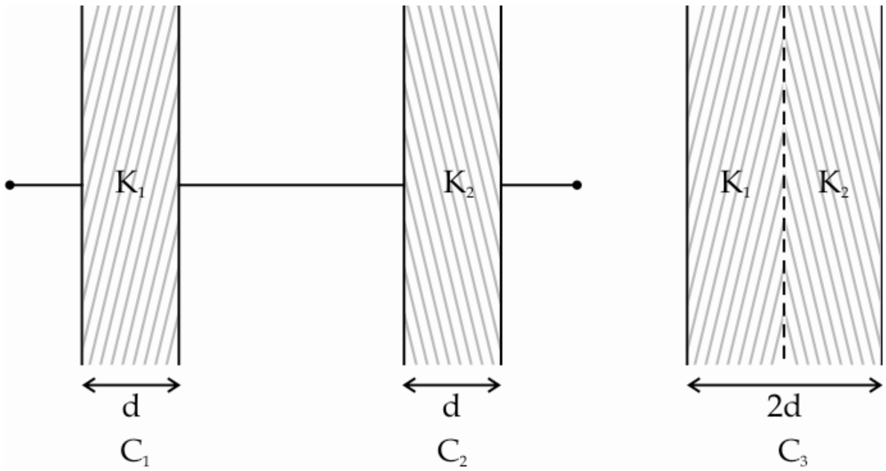
$${}^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}Y \longrightarrow {}^{A-4}_{Z-2}Y \longrightarrow {}^{A-4}_{Z-1}W$$

Q23. Draw the waveforms for

The (i) Input AM wave at A, (ii) output, B, of the rectifier and (iii) output signal, C, of the envelope detector. 3



Q24. The capacitors C_1, and C_2, having plates of area A each, are connected in series, as shown. Campare the capacitance of this combination with the capacitor C_3, again having plates of area A each, but 'made up' as shown in the figure. 3



3

Q25 (a) Write the formula for the velocity of light in a material medium of relative permittivity ϵ_r and relative magnetic permeability μ_r. 1

(b) The following table gives the wavelength range of some constituents of the electromagnetic spectrum.

S.No.	Wavelength Range
1.	1mm to 700nm
2.	0.1m to 1mm
3.	400 nm to 1nm
4.	$< 10^{-3}$ nm

Select the wavelength range, and name the (associated) electromagnetic waves, that are used in

(i) Radar systems for Aircraft navigation

(ii) Earth satellites to observe growth of crops. 2

Q26. Suhasini's uncle, was advised by his doctor to have an MRI scan of his chest. Her uncle did not know much about the details and significance of this test. He also felt that it was too expensive and thought of postponing it.

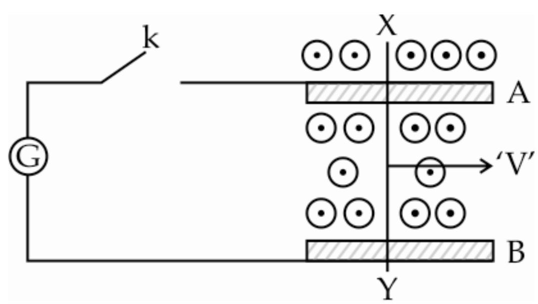
When Suhasini learnt about her uncle's problems, she immediately decided to do something about it. She took the help of her family, friends and neighbors and arranged for the cost of the test. She also told her uncle that an MRI (Magnetic Resonance Imaging) scan of his chest would enable the doctors to know of the condition of his heart and lungs without causing any (test related) harm to him. This test was expensive because of its set up that needed strong magnetic fields (0.5 T to 3T) and pulses of radio wave energy.

Her uncle was convinced and had the required MRI scan of his chest done. The resulting information greatly helped his doctors to treat him well.

(a) What according to you, are the values displayed by Suhasini and her family, friends and neighbours to help her uncle ? **(2)**

(b) Assuming that the MRI scan of her uncle's chest was done by using a magnetic field of 1.0 T, find the maximum and minimum values of force that this magnetic field could exert on a proton (charge = $1.6\text{x}10^{-19}$) that was moving with a speed of 10^4 m/s. State the condition under which the force has its minimum value. 2

Q27. A conducting rod XY slides freely on two parallel rails, A and B, with a uniform velocity 'V'. A galvanometer 'G' is connected, as shown in the figure and the closed circuit has a total resistance 'R'. A uniform magnetic field, perpendicular to the plane defined by the rails A and B and the rod XY (which are mutually perpendicular), is present over the region, as shown.



(a) With key k open:

(i) Find the nature of charges developed at the ends of the rod XY.

(ii) Why do the electrons, in the rod XY, (finally) experience no net force even through the magnetic force is acting on them due to the motion of the rod?

(b) How much power needs to be delivered, (by an external agency), to keep the rod moving at its uniform speed when key k is (i) closed (ii) open?

(c) With key k closed, how much power gets dissipated as heat in the circuit? State the source of this power.

OR

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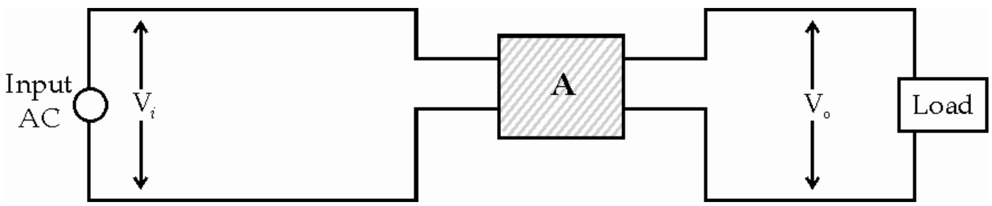
Box' A, in the set up shown below, represents an electric device often used/needed to supply, electric power from the (ac) mains, to a load.

It

is known that $V_o < V_i$.



(a) Identify the device A and draw its symbol.

(b) Draw a schematic diagram of this electric device. Explain its principle and working. Obtain an expression for the ratio between its output and input voltages.

(c) Find the relation between the input and output currents of this device assuming it to be ideal. 5

Q28. Define the terms 'depletion layer' and 'barrier potential' for a P-N junction diode. How does an increase in the doping concentration affect the width of the depletion region?

Draw the circuit of a full wave rectifier. Explain its working.

OR

Why is the base region of a transistor kept thin and lightly doped?

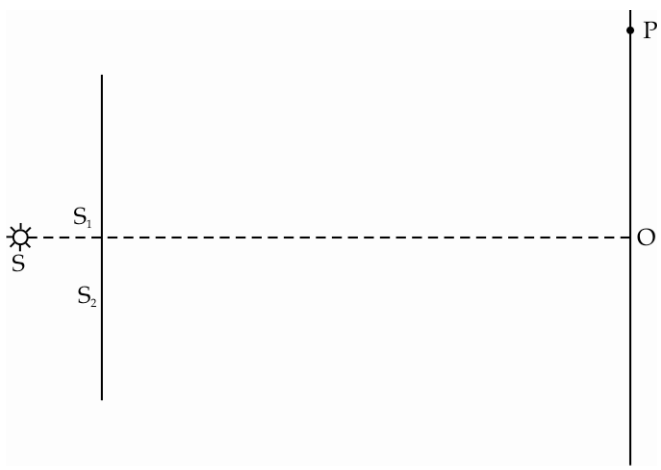
Draw the circuit diagram of the 'set-up' used to study the characteristics of a npn transistor in its common emitter configuration. Sketch the typical (i) Input characteristics and (ii) Output characteristics for this transistor configuration.

How can the out put characteristics be used to calculate the 'current gain' of the transistor?

Q29. (i) A thin lens, having two surfaces of radii of curvature r_1 and r_2, made from a material of refractive index μ_2, is kept in a medium of refractive index μ_1. Derive the Lens Maker's formula for this 'set-up'

(ii) A convex lens is placed over a plane mirror. A pin is now positioned so that there is no parallax between the pin and its image formed by this lens-mirror combination. How can this observation be used to find the focal length of the convex lens? Give appropriate reasons in support of your answer.

OR



The figure, drawn here, shows a modified Young's double slit experimental set up. If $SS_2 - SS_1, = \lambda/4$,

(i) state the condition for constructive and destructive interference

(ii) obtain an expression for the fringe width.

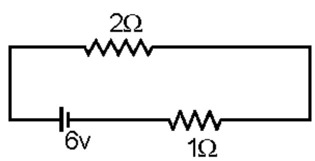
(iii) locate the position of the central fringe. 5

MARKING SCHEME

Q.No.	Value point/ expected points	Marks	Total
1.	From X to Y	1	1
2.	The magnetic moment, associated with the coil, is $\vec{\mu}_m = Ia^2\,\hat{\imath}$	1	1
3.	(i) Short wave broadcast services (ii) Television broadcast (or microwave links or Satellite communication)	½ ½	1
4.	The incident rays are not likely to be paraxial.	1	1
5.	As qa = Qa′, we have $\frac{a'}{a} = \frac{q}{Q}$ and $\theta = 0^o$	½ ½	1
6.	Region BC	1	1
7.	A ‘transducer’ is any device that converts one form of energy into another	1	1
8.	Zero	1	1
9.	Let d and d′ be the width of the slits in the two cases. $\therefore\ \theta = \frac{\lambda}{d}$ and $q\theta = \frac{p\lambda}{d'}$ $\therefore \frac{d}{d'} = \frac{q}{p}$ Yes, this ratio would also equal q	½+½ ½ ½	2
10.	Total (initial) charge on all the droplets		

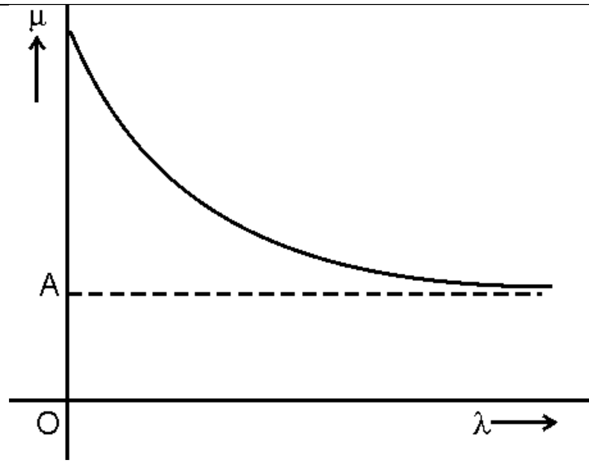
	$= N \times (4\pi \epsilon_0 k\, r\, V)$ Also $N \times \frac{4}{3}\Pi r^3 = \frac{4}{3}\Pi R^3$ $\therefore R = N^{1/3} r$ If V' is the potential of the large drop, we have $4\Pi \in_o R \times V' = N \times 4\Pi \in_o kr \times V$ $\therefore V' = \frac{Nr}{R} V = N^{2/3} V$ OR We have $\vec{E}_{net} = \vec{E}_1 + \vec{E}_2$ $= \frac{1}{4\Pi \in_o}\frac{q_1}{r_1^3}\vec{r}_1 + \frac{1}{4\Pi \in_o}\frac{q_2}{r_2^3}\vec{r}_2$ where $\vec{r}_1 = -a\,\hat{\imath} + c\,\hat{k}$ and $\vec{r}_2 = -b\,\hat{\jmath} + c\,\hat{k}$ $\vec{E}_{net} = \frac{1}{4\Pi\in_o}\left[\frac{q_1(-a\,\hat{\imath}+c\,\hat{k})}{(a^2+c^2)^{3/2}} + \frac{q_2(-b\,\hat{\jmath}+c\,\hat{k})}{(b^2+c^2)^{3/2}}\right]$	½ ½ ½ ½ ½ ½ 1	2 2
11.	According to Einestein's Equation: $K_{max} = \frac{1}{2} m\, \vartheta^2{}_{max} = h^2 - \phi_o$ $\therefore \vartheta^2_{max} = \left(\frac{2h}{m}\right)\nu - \frac{2\phi_o}{m}$ This is the equation of a straight line having a slope 2h/m and an intercept (on the $\vartheta^2{}_{max}$ axis) of $\left(-\frac{2\phi_o}{m}\right)$. Comparing these, with the given graph, we get $\frac{2h}{m} = \frac{\ell}{n}$ or $h = \frac{\ell m}{2n}$ and $\ell = \frac{2\phi_o}{m}$ or $\phi_o = \frac{m\ell}{2}$	½ ½ ½+½	2
12.	(i) decreases (The potential gradient would increase)	½+½	

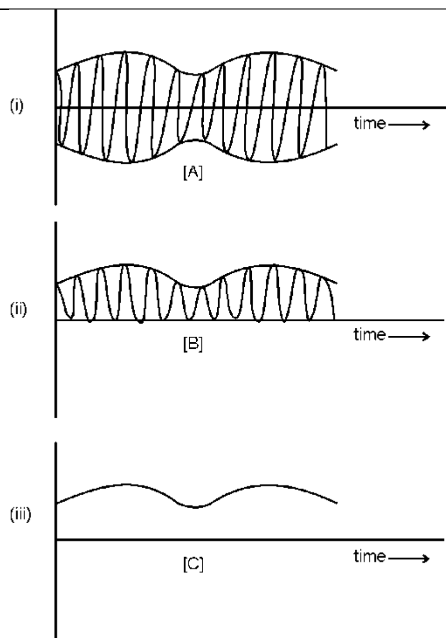
	(ii) increases (The terminal p.d across the cell would increase)	½+½	
13.	$r_1 = O_1P = \sqrt{r^2 + (2a+b)^2}$ $r_2 = O_2P = \sqrt{r^2 + (a+2b)^2}$ $\therefore V = \frac{1}{4\Pi\epsilon_0}\left[\frac{Q_1}{r_1} + \frac{Q_2}{r_2}\right]$ ∴ P.E of charge , q, at P = qV $= \frac{q}{4\Pi\epsilon_0}\left[\frac{Q_1}{[r^2+(2a+b)^2]^{1/2}} + \frac{Q_2}{[r^2+(a+2b)^2]^{1/2}}\right]$	½ ½ ½ ½	2
14.	(i) The maximum emf '∈' generated in the coil is, $\epsilon = N\,B\,A\,\omega$ $= N\,B\,A\,2\Pi f$ $= [100 \times 0.01 \times 0.1 \times 2\Pi \frac{(5)}{6}]$ V $= \frac{\Pi}{6}$ V $\simeq 0.52$ V (ii) The average emf generated in the coil over one complete revolution = 0	½ 1 ½	2
15.	Energy of one photon = $E = \frac{hc}{\lambda}$ $E = \frac{6.6\times10^{-34}\times3\times10^{8}}{6\times10^{-7}}$ $\simeq 3.3 \times 10^{-19}$ J E_1 = energy emitted by the source in one second = 66J ∴ number of photons emitted by the source in 1s = n = $\frac{66}{3.3\times10^{-19}} = 2 \times 10^{20}$ ∴ Total number of photons emitted by	 ½ ½ ½	

	source in 2 minutes = N = n x 2 x 60 = 2 x 10^{20} x 120 = 2.4 x 10^{22} photons	½	2
16.	Diode D_1 is forward biased while Diode D_2 is reverse biased Hence the resistances, of (ideal) diodes, D_1 and D_2, can be taken as zero and infinity, respectively. The given circuit can, therefore, be redrawn as shown in the figure.  ∴ Using ohm's law, $I = \frac{6}{(2+1)}$ A = 2A ∴ current flowing in the 1Ω resistor, is 2A.	½ ½ ½ ½	2
17.	For circuit 1, we have, (from the Wheatstone bridge balance condition), $$\frac{R_1}{9} = \frac{4}{6}$$ ∴ R_1 = 6Ω In circuit 2, the interchange of the positions of the battery and the galvanometer, does not change the (wheatstone Bridge) balance condition. ∴ $\frac{R_2}{8} = \frac{6}{12}$	½ ½ ½ ½	

	or $R_2 = 4\Omega$ $\therefore \frac{R_1}{R_2} = \frac{6}{4} = \frac{3}{2}$	½ ½	3
18.	In a hydrogen atom, the energy (E_n) of electron, in a state, having principal quantum number 'n', is given by $E_n = \frac{-13.6}{n^2}$ eV $\therefore E_1 = -13.6$eV and $E_2 = -3.4$ eV It follows that the state n=2 has an excitation energy of 10.2 eV. Hence the electron is making a transition from $n=n_1$ to n=2 where ($n_1>2$). Now $E_{n1} - E_2 = \frac{hc}{\lambda}$ But $\frac{hc}{\lambda} = \frac{6.63x10^{-24}x3x10^{8}}{487.3x10^{-9}x1.6x10^{-9}}$eV = 2.55eV $\therefore E_{n1}$= (-3.4 + 2.55) eV $\simeq$ - 0.85 eV But we also have $E_{n1} = \frac{-13.6}{n_1^2}$ eV $\therefore$ we get $n_1 = 4$	½ ½ ½ ½ ½ ½	3
19.	Intensity observed by (i) Observer $O_1 = \frac{I_o}{2}$ (ii) Observer $O_2 = \frac{I_o}{2} \cos^2 60^o$ $= \frac{I_o}{8}$ (iii) Observer $O_3 = \left(\frac{I_o}{8}\right) \cos^2 (90^o - 60^o)$	½ ½ ½ 1	3

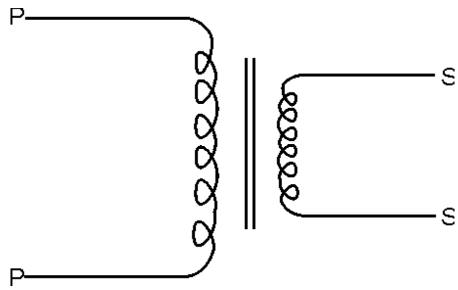
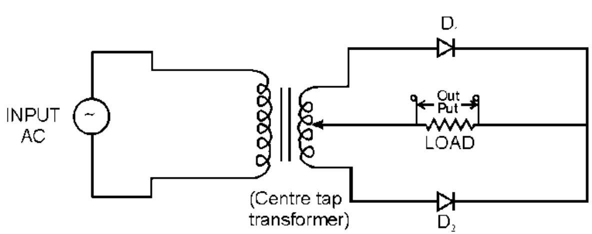
	$= \frac{I_o}{8} \times \frac{3}{4} = \frac{3I_o}{32}$	½	3
20.	(i) The magnetic field is perpendicular to the plane of page and is directed inwards (ii) In region I $\lvert\vec{F}_e\rvert = \lvert\vec{F}_m\rvert$ $qE = q\,\vartheta B$ $\therefore E = \vartheta B$ (iii) In region II $\frac{mv^2}{r} = q\vartheta B \Rightarrow r = \frac{m\vartheta}{qB}$ Substituting the value of ϑ, we get $r = \frac{mE}{qB^2}$ Let B′ (=nB) denote the new magnetic field in region II. If r′ is the radius of the circular path now, we have $\Rightarrow r^1 = \frac{m\vartheta}{qB'} = \frac{mE}{qnB^2}$ Hence radius of the circular path, would decrease by a factor n.	½ ½ ½ ½ ½ ½	3
21.	See (fig 9.25, Page 332 Part II NCERT) For a small angled prism, of refracting angle α : Angle of deviation $\propto = (\mu - 1) \propto$ where μ is the refractive index of the material of the prism.	1 ½	

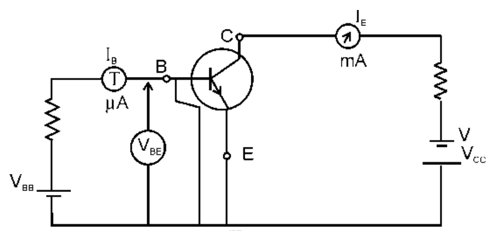
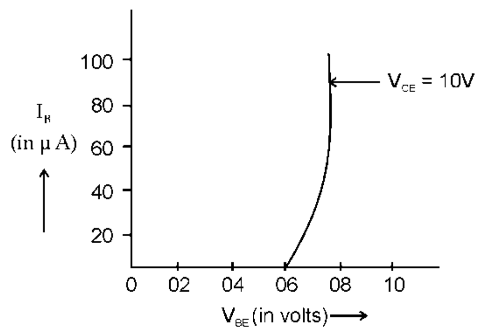
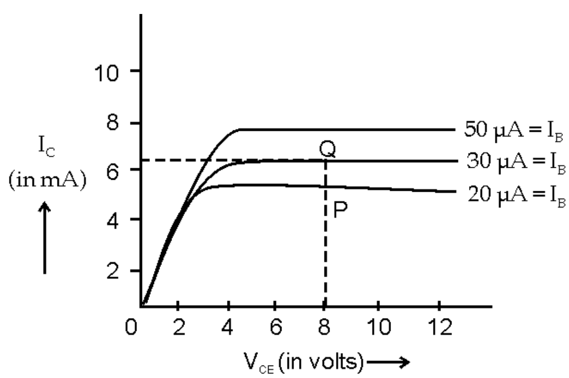
	 To get a straight line graph, we need to use μ and $^{1}/_{\lambda^2}$ as the pair of variables.	1 ½	3
22.	(i) Mass defect (ΔM), of any nucleus $^{A}_{Z}X$, is the difference in the mass of the nucleus (=M) and the sum of masses of its constituent nucleons (= M′). $\therefore \Delta M = M' - M$ $= [Z m_p + (A-Z) m_n] - M$ where m_p and m_n denote the mass of the proton and the neutron respectively. (ii) Binding energy is the energy required to separate a nucleus into its constituent nucleons. The relation between the two is: B.E. = (mass defect) c^2 (iii) There is a release of energy i.e., the reaction is exothermic. Reason: Increase in B.E/nucleon implies that more mass has been converted into energy. This would result in release of energy.	1 ½ ½ ½ ½	3

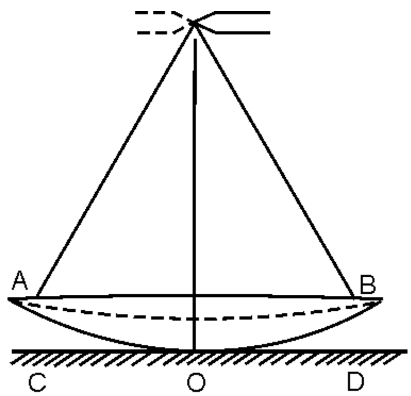
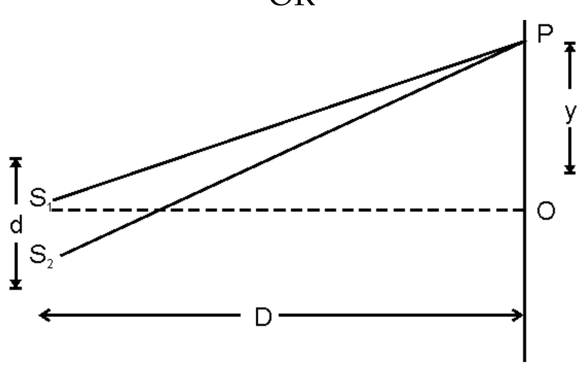
	OR (a) According to the (exponential) law of radioactive decay. $N = N_0 e^{-\lambda t}$ Given N=No/n and t = T $\therefore \left(\frac{N_0}{n}\right) = N_0 e^{-\lambda T}$ or $n = e^{\lambda T}$ $\therefore \lambda = \frac{\ell n(n)}{T}$ $\therefore$ half life $\tau_{1/2} = \frac{0.6931}{\lambda} = \frac{0.693T}{\ell n(n)}$ (b) (i) α – rays (ii) γ – rays (iii) β – rays	½ ½ ½ ½ ½ ½	3
23.		1 1 1	3

24.	We have $C_1 = \frac{A\epsilon_o K_1}{d}$ and $C_2 = \frac{A\epsilon_o K_2}{d}$ $\therefore C_{eq} = \frac{C_1 C_2}{C_1+C_2} = \frac{A\epsilon_o}{d}\left(\frac{K_1 K_2}{K_1+K_2}\right)$ Now, capacitor C_3 can be considered as made up of two capacitors C_1 and C_2, each of plate area A and separation d, connected in series. We have : $C_1' = \frac{A\epsilon_o K_1}{d}$ and $C_2' = \frac{A\epsilon_o K_2}{d}$ $\Rightarrow C_3 = \frac{C_1' C_2'}{C_1'+C_2'} = \frac{A\epsilon_o}{d}\left(\frac{K_1 K_2}{K_{1+} K_2}\right)$ $\therefore \frac{C_3}{C_{eq}} = 1$ Hence net capacitance of the combination is equal to that of C_3.	½ ½ ½ ½ ½ ½	3
25. (a) (b)	We have $\vartheta = \frac{1}{\sqrt{\mu\epsilon}} = \frac{1}{\sqrt{\mu_0 \mu_r \epsilon_o \epsilon_r}}$ (i) Wavelength range : [0.1m to 1mm] (Microwaves) (ii) Wavelength range: [1mm to 700 nm] (Infrared waves)	½+½ ½+½ ½+½	1 3
26.	(a) (i) Presence of mind High degree of general awareness Ability to take prompt decisions Concern for her uncle (Any two) (ii) Empathy; Helping and caring	(½+½)	

	nature (b) Maximum force = qVB $= 1.6 \times 10^{-19} \times 10^{4} \times 1$ N $= 1.6 \times 10^{-15}$N Minimum force = zero Condition: when $\vec{V}$ is parallel to $\vec{B}$	(½+½) ½ ½ ½ ½	4
27.	(a) (i) X : negative , Y: positive (ii) Magnetic force, F_m, experienced by the moving electrons, gets balanced by the electric force due to the electric field, caused by the charges developed at the ends of the rod. Hence net force on the electrons, inside the rod, (finally) become zero. (b) The power, that needs to be delivered by the external agency, when key k is closed, is $P=F_mV = (I\,l\,B)V = \frac{BlV}{R}.lBV$ $= B^2l^2V^2/R$ When k is open, there is an induced emf, but no induced current. Hence power that needs to be delivered is zero. (c) Power, dissipated as heat $= i^2 R = \frac{B^2\ell^2V^2}{R}$ The source of this power is the mechanical work done by the external agency. **OR**	 ½ 1+½ ½+½ ½ ½+½ ½	5

	(a) Step down transformer.  (b) Diagram Principle Working Obtaining the expression (c) Input power = output power $\therefore V_p i_P = V_s i_s$ $\Rightarrow \frac{i_p}{i_s} = \frac{V_s}{V_p} = \frac{N_s}{N_p}$	½ ½ ½ ½ ½ 2 ½	5
28.	The space charge region, on either side of the junction (taken together), is known as the depletion layer. The p.d across the depletion layer is known as the barrier potential The width of the depletion region decreases with an increase in the doping concentraction. The circuit of a full-wave rectifier is shown below. 	½ ½ ½ 1½	

	Working details	2	5
	OR		
	The base region of a transistor is thin and lightly doped so that the base current (I_B) is very small compared to emitter current (I_E).	1	
	 (Circuit for studying the characteristics of a npn transistor in its CE configuration)	1	
	 INPUT CHARACTERISTIC	1	
	 OUTPUT CHARACTERISTIC	1	
	The current gain (β) of a transistor in common emitter configuration is		

	$\beta = \frac{\Delta I_C}{\Delta I_B}$ Δ I_C and ΔI_B can be obtained, from the two curves, in the output characteristics.	1	5
29.	(i) Diagram	1	
	Derivation	2½	
	(ii) The rays must fall normally on the plane mirror so that the image of the pin coincides with itself	½	
		½	
	Hence rays, like CA and DB, form a parallel beam incident on the lens. ∴ P is the position of the focus of the lens ∴ Distance OP equals the focal length of the lens	½	5
	OR		
		1	
	Δ_o = initial path different between S_1 and S_2 = $SS_2 - SS_1 = \lambda/4$	½	
	Δ = $S_2P - S_1P$ = path difference between		

	disturbance from S_1 and S_2, at point P $= \frac{yd}{D}$ Δ_T = Total path difference between the two disturbances at P $= \Delta_o + \Delta = \frac{\lambda}{4} + \frac{yd}{D}$ ∴ For constructive interference: $\Delta_T = \left(\frac{\lambda}{4} + \frac{yd}{D}\right) = n\lambda$; n = 0, 1, 2,…. ∴ $\frac{y_n d}{D} = (n - \frac{1}{4})\lambda$ …(i) For destructive interference $\Delta_T = \left(\frac{\lambda}{4} + \frac{yd}{D}\right) = (2n-1)\frac{\lambda}{2}$ . . . (ii) ∴ $\frac{Y_n' d}{D} = \left(2n - 1 - \frac{1}{2}\right)\frac{\lambda}{2}$ ∴ $\frac{Y_n' d}{D} = \left(2n - \frac{3}{2}\right)\frac{\lambda}{2}$ β = fringe width = $y_{n+1} - y_n = \frac{\lambda D}{d}$ The position Y_o of central fringe is obtained by putting n=o in Eqn (i). Therefore, ∴ $y_o = -\frac{\lambda D}{4d}$ [Negative sign shows that the central fringe is obtained at a point below the (central) point O.]	½ 1 1 1	5