BLUE PRINT FOR MODEL QUESTION PAPER – 2

SUBJECT : PHYSICS (33) CLASS : II PUC

UNIT	Chapter Number	TOPICS (CHAPTERS)	Number of teaching Hours	Weightage of marks	1Mark	2 Marks	3 Marks	5 Marks (Theory)	5 Marks (Numerica 1 Problem)
I	1	Electric Charges And Fields	9	8	✓	✓		✓	
II	2	Electrostatic Potential And Capacitance	9	8			✓		✓
III	3	Current Electricity	15	13	✓	✓		✓	✓
IV	4	Moving Charges And Magnetism	10	9	✓		✓	✓	
V	5	Magnetism And Matter	8	6	✓	✓	✓		
	6	Electromagnetic Induction	7	6	✓	✓	✓		
VI	7	Alternating Current	8	8			✓		✓
	8	Electromagnetic Waves	2	2		✓			
VII	9	Ray Optics and Optical instruments	9	8	✓	✓			✓
VIII	10	Wave Optics	9	8			✓	✓	
IX	11	Dual Nature Of Radiation And Matter	6	6	✓			✓	
	12	Atoms	5	4	✓		✓		
X	13	Nuclei	7	6	✓				✓
	14	Semiconductor Electronics	12	10		✓	✓	✓	
	15	Communication System	4	3	✓	✓			
		Total Number of Questions	--	--	10	8	8	6	5
		TOTAL MARKS	120	105	20	16	24	30	25

MODEL QUESTION PAPER – 2

II P.U.C. PHYSICS (33)

Time: 3 hours 15 min. **Max. Marks: 70**

General instructions:

a) All parts are compulsory.

b) Answers without relevant diagram/ figure/circuit wherever necessary will not carry any marks.

c) Direct answers to the Numerical problems without detailed solutions will not carry any marks.

PART – A

I. Answer ALL the following questions: 10 × 1 = 10

1. Two point charges are separated by some distance, repel each other with a force F. What will be the force if distance between them is halved?
2. In a Wheat stone's network four resistors with resistances P, Q, R and S are connected in a cyclic order. Write the balancing condition of the network.
3. A current flows in a conductor from west to east. What is the direction of the magnetic field at a point below the conductor?
4. State Gauss law in magnetism.
5. Name the phenomenon in which an emf is induced in a coil due to the change of current in the same coil.
6. What do you mean by dispersion of light?
7. How does the de-Broglie wavelength of a charged particle changes when accelerating potential increases?
8. What is the significance of the negative total energy of an electron orbiting round the nucleus?
9. A radioactive element ${}_{92}X^{238}$ emits one α-particle and one β^+ particle in succession. What is the mass number of new element formed?
10. What is sky wave propagation?

PART – B

II. Answer any FIVE of the following questions. 5 × 2 = 10

11. Write any two properties of electric field lines.
12. What are the limitations of ohm's law?
13. Mention the expression for time period of oscillation of small compass needle in a uniform magnetic field. Explain the terms.
14. Give two applications of eddy currents.
15. What is displacement current? Mention its need.
16. Write the two conditions for total internal reflection.
17. Give the circuit symbol and truth table for OR gate.
18. Draw the block diagram of AM receiver.

PART – C

III. Answer any <u>FIVE</u> of the following questions. 5 × 3 = 15

19. Obtain an expression for electric potential energy of a system of two point charges in the absence of external electric field.
20. Derive the expression for the magnetic force experienced by a current carrying conductor.
21. Write three properties of paramagnetic substances.
22. Obtain the expression for the magnetic energy stored in a coil (solenoid).
23. What is resonance in series LCR circuit? Derive the expression for resonant angular frequency.
24. Derive the expression for resultant displacement and amplitude when two waves having same amplitude and a phase difference ϕ superpose.
25. Give the de-Broglie's explanation of Bohr's second postulate.
26. Distinguish between extrinsic and intrinsic semiconductors.

PART – D

IV. Answer any <u>TWO</u> of the following questions. 2 × 5 = 10

27. Obtain the expression for the electric field at any point on the equatorial plane of an electric dipole.
28. Assuming the expression for drift velocity, derive the expression for conductivity of a material $\sigma = ne^2\tau/m$.
29. Using Biot Savart's law, derive the expression for magnetic field at a point on the axis of a circular current loop.

V. Answer any <u>TWO</u> of the following questions. 2 × 5 = 10

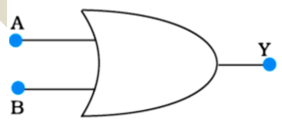
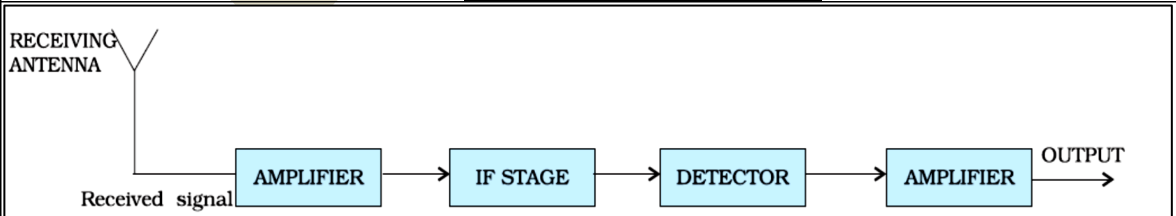
30. Using Huygen's wave theory of light, derive Snell's law of refraction.
31. Write the five experimental observations of photoelectric effect.
32. Explain the working of semiconductor diode when it is forward biased.

    Draw the I-V characteristics for both forward bias and reverse bias of semiconductor diode.

VI. Answer any <u>THREE</u> of the following questions. 3 × 5 = 15

33. A 600 pF capacitor is charged by a 200 V supply. Calculate the electrostatic energy stored in it.
    It is then disconnected from the supply and is connected in parallel to another uncharged 600 pF capacitor. What is the energy stored in the combination?
34. Two cells of emf 3 V and 2V and internal resistances 1.5 Ω and 1 Ω respectively are connected in parallel across 3Ω resistor such that they tend to send current through resistor in the same direction. Calculate potential difference across 3 Ω resistor.
35. A 60V, 10W lamp is to be run on 100V, 60 Hz ac mains. Calculate the inductance of a choke coil required to be connected in series with it to work the bulb.
36. A convex lens of focal length 0.24m and of refractive index 1.5 is completely immersed in water of refractive index 1.33. Find the change in the focal length of the lens.
37. A given coin has a mass 3.0 gram, Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. Assume that the coin is entirely made of ${}_{29}Cu^{63}$ atoms of mass = 62.92960u. Given Avogadro number = 6.023×10^{23}
    mass of proton m_p = 1.00727 u and mass of neutron m_n = 1.00866 u.

SCHEME OF EVALUATION FOR PHYSICS MODEL QUESTION PAPER – 2

Q. No	ANSWERS	Marks
I.	**PART – A**	
1.	New force = 4F. (Since force $\propto 1/d^2$ and new distance = d/2)	1
2.	P/Q = S/R	1
3.	Towards North	1
4.	"The net magnetic flux through any closed surface is zero"	1
5.	Self-induction.	1
6.	The phenomenon of splitting of light into its component colours is known as dispersion.	1
7.	The de Broglie wavelength decreases when accelerating potential increases. (Since $\lambda \propto \frac{1}{\sqrt{V}}$)	1
8.	The electron is bound to the nucleus.	1
9.	Mass number of the new element = 234. (Since the mass number decreases by 4 units in alpha decay but it does not change in beta decay)	1
10.	The radio waves emitted from the transmitter antenna reach the receiving antenna after reflection by the ionosphere of earth atmosphere. This mode of propagation is known as sky wave propagation.	1
II.	**PART–B**	
11.	(i) Field lines are continuous curves without any breaks. (ii) Two field lines cannot cross each other. (iii) Electrostatic field lines start at positive charges and end at negative charges. (iv) They do not form closed loops. **(any two)**	1 1
12.	Ohms law fails if (i) V depends on I non-linearly. (ii) The relation between V and I depends on the sign of V for the same absolute value of V. (iii) The relation between V and I is non-unique. **(any two)**	1 1
13.	Time period: $T = 2\pi\sqrt{\frac{I}{m\,B}}$ Where I - moment of inertia, B - magnetic field and m - magnetic moment of compass needle.	1 1
14.	Magnetic braking in trains, Induction furnace, electromagnetic damping, electric power meters. (any 2)	1+1
15.	The current due to changing electric field (time-varying electric field) is called displacement current. To remove the inconsistency of Ampere's circuital law.	1 1
16.	**(i)** The ray must travel from a denser medium to a rarer medium. **(ii)** The angle of incidence in the denser medium must be greater than the critical angle, for the pair of media and for the given colour of light.	1 1
17.		1+1
18.		2
III	**PART – C**	
19.	Consider two charges q_1 and q_2 with position vector $\vec{r}_1$ and $\vec{r}_2$ relative to some origin. There is no external field, so work done in bringing q_1 from infinity to $\vec{r}_1$ is zero. This charge produces a potential in space given by $V_1 = \frac{1}{4\pi\varepsilon_o}\frac{q_1}{r_{1P}}$	1

Truth table for Q17:

Input		Output
A	**B**	**Y = A + B**
0	0	0
1	0	1
0	1	1
1	1	1

	Work done in bringing charge q_2 from infinity to the point $\vec{r_2}$ is q_2 times the potential at $\vec{r_2}$ due to q_1 i.e., $W = q_2 V_1 = q_2\left(\frac{1}{4\pi\varepsilon_o}\frac{q_1}{r_{12}}\right)$, Where r_{12} is the distance between q_1 and q_2. This work gets stored in the form of potential energy of the system. Thus, the potential energy of a system of two charges q_1 and q_2 is $U = \frac{1}{4\pi\varepsilon_o}\left(\frac{q_1 q_2}{r_{12}}\right)$	1 1
20.	Consider a rod of uniform cross-sectional area A and length l. Let the number density of mobile charge carriers (of each charge q) in it be n. Then the total number of mobile charge carriers in it is nAl. For a steady current I in this conducting rod, each mobile carrier has an average drift velocity $\vec{v_d}$ In the presence of an external magnetic field $\vec{B}$, the force on these carriers is $\vec{F} = (nAl)q\,[\vec{v_d} \times \vec{B}]$ But $nq\vec{v_d} = \vec{j}$, is the current density and $\lvert(nq\vec{v_d})\rvert A = I$ is the current. Thus, force on the conductor $\vec{F} = [(n\,q\,\vec{v_d})\,A\,l] \times \vec{B} = [\vec{j}\,A\,l] \times \vec{B} = I(\vec{l} \times \vec{B})$ Where $\vec{l}$ is a vector of magnitude l, the length of the rod, and with a direction identical to the current I.	1 1 1
21.	i) When placed in a non-uniform magnetic field, a piece of paramagnetic substance will tend to move from weak field to strong field. i.e., they get weakly attracted to a magnet. ii) They get weakly magnetised when placed in an external magnetic field. iii) The individual atoms (or ions or molecules) of a paramagnetic material possess a permanent magnetic dipole moment of their own. iv) Paramagnetic substances do not possess net magnetisation. v) The magnetisation of a paramagnetic material is inversely proportional to the absolute temperature T. vi) χ is small and positive for paramagnetic materials. (**any three, one mark each**)	1 1 1
22.	When a current is established in a solenoid (coil), work has to be done against the back emf. This work done is stored in the form of magnetic energy in the coil. For a current I in the coil, the rate of work done (power) is: $P = \frac{dW}{dt} = \lvert\varepsilon\rvert\, I$ (since power P=V I) But we know that, $\varepsilon = L\frac{dI}{dt}$ Therefore, $\frac{dW}{dt} = L\,I\,\frac{dI}{dt} \Rightarrow dW = L\,I\,dI$ Therefore, the total work done in establishing a current I is given by $W = \int dW = \int_0^I L\,I\,dI = ½\,LI^2$ This work is stored in the coil in the form of magnetic potential energy, $U = \frac{1}{2}LI^2$	1 1 1
23.	In a series LCR circuit for a particular frequency of the applied ac the current in the circuit becomes maximum. This is known as electrical resonance. At resonance, inductive reactance (X_L) = capacitive reactance (X_C) $\Rightarrow \omega_o L = \frac{1}{\omega_o C}$ Thus, resonant angular frequency $\omega_o = \frac{1}{\sqrt{LC}}$	1 1 1
24.	Let the displacement produced by source S_1 is given by $y_1 = a\cos(\omega t)$ that by S_2 be $y_2 = a\cos(\omega t + \phi)$ where ϕ is the phase difference between the waves. The resultant displacement: $y = y_1 + y_2 = [\,a\cos(\omega t) + a\cos(\omega t + \phi)] = a\,[\cos(\omega t + \phi) + \cos(\omega t)]$ $= 2a\cos\left(\frac{2\omega t + \phi}{2}\right)\cos\left(\frac{\phi}{2}\right)$ [Using $\cos C + \cos D = 2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$] $= 2a\cos\left(\frac{\phi}{2}\right)\cos\left(\omega t + \frac{\phi}{2}\right)$ The **amplitude** of the resultant displacement is $= 2a\cos\left(\frac{\phi}{2}\right)$	1 1 1

25. For an electron moving in n^{th} circular orbit of radius r_n ,the total distance is = $2\pi r_n$

Circumference of a stationary Bohr orbit of radius r_n is equal to integral multiple of wavelength of matter waves $2\pi r_n = n\lambda$ ....(1) 1

The de Broglie wavelength of the electron moving in the n^{th} orbit: $\lambda = \dfrac{h}{mv}$ ....(2) 1

From equn(1) and (2), $2\pi r_n = \dfrac{nh}{mv}$ i.e., $mvr_n = \dfrac{n\,h}{2\pi}$

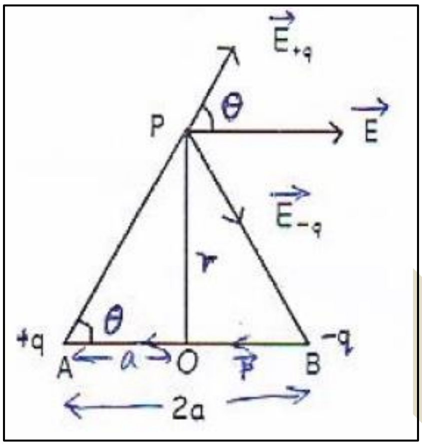
But, angular momentum of the electron is $L = mvr_n$. Hence $L = \dfrac{n\,h}{2\pi}$ 1

26.

INTRINSIC SEMICONDUCTOR	**EXTRINSIC SEMICONDUCTOR**	
Semiconductor without doping (pure form)	Semiconductor doped with impurity atoms (impure form)	1
Number of free electrons (n_e) is equal to the number of holes (n_h)	Number of free electrons (n_e) and number of holes (n_h) are unequal.	1
Conductivity is low	Conductivity is high	1
Conductivity is due to both electrons and holes	Conductivity is mainly due to majority charge carriers	
Conductivity depends only on temperature.	Conductivity depends on both temperature and impurity added (doping). **(any three)**	

IV. PART – D

27. **LABELLED DIAGRAM** 1



Let a point P be at a distance r from the centre of the dipole (O). Dipole length AB = 2a,

Using Pythagoras theorem, the distance of the point P from the charges is , AP=BP =d= $\sqrt{r^2+a^2}$

Using, the expression for electric field due to a charge *q* at a distance d from it, $E = \dfrac{1}{4\pi\varepsilon_0}\dfrac{q}{d^2}$,

The **magnitude** of the electric field at P due to the charge +*q* is $E_{+q} = \dfrac{1}{4\pi\varepsilon_0}\dfrac{q}{r^2+a^2}$

The **magnitude** of the electric field at P due to the charge '–*q*' *is* $E_{-q} = \dfrac{1}{4\pi\varepsilon_0}\dfrac{q}{r^2+a^2}$ 1

The total field at P, $\vec{E}_{+q}$ and $\vec{E}_{-q}$ are resolved in to components parallel to $\vec{p}$ and perpendicular to $\vec{p}$.

The direction of $\vec{p}$ $\left(\text{or } p\right)$ is from –q to +q.

The components normal to the dipole axis ($E_{+q}\sin\theta$) and ($E_{-q}\sin\theta$) **cancel out** as they are **equal in magnitude** and **opposite in direction**.

The components along the dipole axis ($E_{+q}\cos\theta$) and ($E_{-q}\cos\theta$) add up. 1

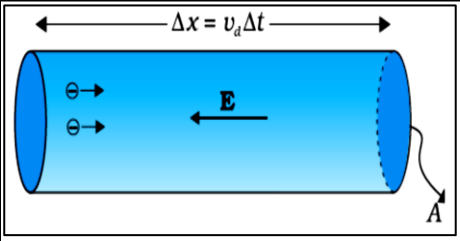
The total electric field is $\vec{E} = -(E_{+q} + E_{-q})\cos\theta\ \hat{p}$

$$= -\left(\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2+a^2} + \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2+a^2}\right)\cos\theta\ \hat{p} \quad ; \qquad \cos\theta = \frac{a}{\sqrt{r^2+a^2}}$$ 1

$$= -2\left(\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2+a^2}\right)\frac{a}{\sqrt{r^2+a^2}}\hat{p}$$

$$\vec{E} = \frac{-\,2qa}{4\pi\varepsilon_0\left(r^2+a^2\right)^{3/2}}\hat{p} = \frac{1}{4\pi\varepsilon_0}\frac{-\vec{p}}{\left(r^2+a^2\right)^{3/2}} \quad ; \qquad \text{since } \vec{p} = 2a\,q\,p$$ 1

28.



Drift velocity: $\vec{v}_d = \left(-\frac{e\vec{E}}{m}\right)\tau$ and $\left|\vec{v}_d\right| = \frac{e\left|\vec{E}\right|\tau}{m}$ …………..(1) 1

The amount of charge crossing the area A of a conductor in time Δt is $\Delta q = +\,n\,e\,A\left|\vec{v}_d\right|(\Delta t)$ ………………(2) 1

Also $\Delta q = I(\Delta t)$; where I is current.

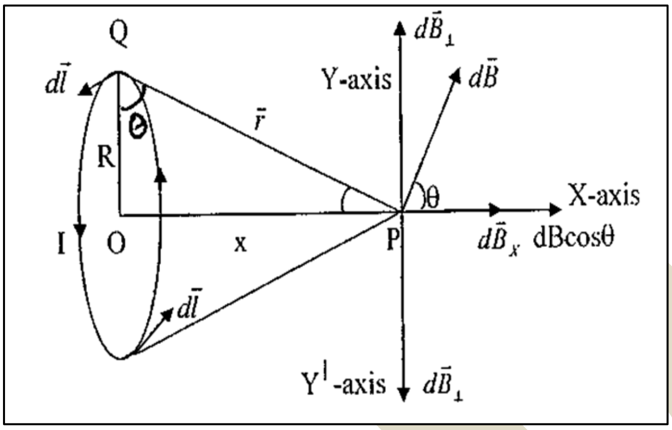
Thus , $I(\Delta t) = +\,n\,e\,A\left|\vec{v}_d\right|(\Delta t)$; Using(1) in (2) , $I = \left(\frac{e^2 A\,\tau\,n}{m}\right)\left|\vec{E}\right|$ 1

Magnitude of current density: $\left|\vec{j}\right| = \frac{I}{A} = \left(\frac{n\,e^2\,\tau}{m}\right)\left|\vec{E}\right|$ ………… (3) 1

In the vector form, $\vec{j} = \left(\frac{n\,e^2\,\tau}{m}\right)\vec{E}$, but $\vec{j} = \sigma\vec{E}$

Thus, conductivity: $\sigma = \frac{n\,e^2\,\tau}{m}$ 1

29.



LABELLED DIAGRAM, 1

(θ is angle between r and R)

Let a circular loop with its centre at the origin O, radius R carrying a steady current I and having axis as X-axis. Let *x* be the distance of P from the centre O of the loop.

Consider a conducting element $d\vec{l}$ of the loop.

The magnitude of the magnetic field dB due to $\vec{dl}$ is given by Biot-Savart's law,

$$\left|\vec{dB}\right| = \left(\frac{\mu_0}{4\pi}\right)\left(\frac{I\left|\vec{dl}\times\vec{r}\right|}{r^3}\right) \text{ and we have } r^2 = x^2 + R^2.$$ 1

Any element of the loop will be perpendicular to the displacement vector from the element to the axial point. i.e., $d\vec{l}\perp\vec{r}$. Hence $\left|d\vec{l}\times\vec{r}\right| = r\,dl$.

Thus, $dB = \frac{\mu_0}{4\pi}\frac{I\,r\,dl}{r^3} = \frac{\mu_0}{4\pi}\frac{I\,dl}{r^2} = \frac{\mu_0}{4\pi}\frac{I\,dl}{\left(x^2+R^2\right)}$ ………….. (1)

The direction of magnetic field $\left(d\vec{B}\right)$ is perpendicular to the plane containing $d\vec{l}$ and $\vec{r}$.

$d\vec{B}$ has a X-component dB_x and a component perpendicular to *x*-axis $dB_\perp$ (in XZ plane).
When the components perpendicular to the X-axis are summed over a complete loop, they cancel out.
Thus, only the X-component dBcosθ remains.
The net magnetic field along X-direction can be obtained by integrating (summing) $dB_x = dB\cos\theta$ …….(2) 1

From equations (1) and (2), $dB_x = \frac{\mu_0}{4\pi}\frac{I\,dl}{\left(x^2+R^2\right)}\cos\theta$; But $\mathbf{\cos\theta = \frac{R}{r} = \frac{R}{\left(x^2+R^2\right)^{1/2}}}$

$$\therefore\quad \mathbf{dB_x = \frac{\mu_0 I\,dl}{4\,\pi}\frac{R}{\left(x^2+R^2\right)^{3/2}}}$$ 1

The summation of elements d*l* over the loop gives 2πR, the circumference of the loop. i.e., $\sum dl = 2\,\pi\,R$

Thus, the magnetic field at P due to the entire circular loop is $\mathbf{\vec{B} = B_x\hat{i} = \frac{\mu_0}{4\pi}\frac{2\pi\,I\,R^2}{\left(x^2+R^2\right)^{3/2}}\hat{i} = \frac{\mu_0\,I\,R^2}{2\left(x^2+R^2\right)^{3/2}}\hat{i}}$ 1

IV.

30.

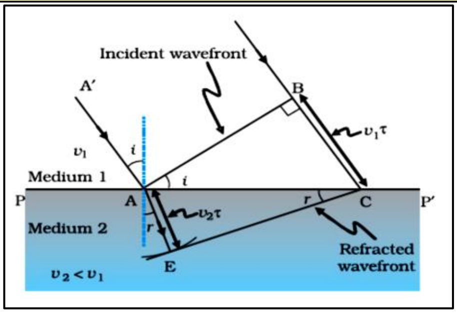


DIAGRAM 1

Let PP' represent the surface separating medium-1 and medium-2.

Let v_1 and v_2 be the speed of light in medium-1 and medium-2 respectively. Consider a plane wave front AB incident in medium-1 at angle 'i' on the surface PP'.

According to Huygens principle, every point on the wave front AB is a source of secondary wavelets.

Let the secondary wavelet from B strike the surface PP' at C in a time τ. Then BC = $v_1\tau$.

The secondary wavelet from A will travel a distance $v_2\tau$ as radius; draw an arc in medium 2.

The tangent from C touches the arc at E. Then AE = $v_2\tau$ and CE is the tangential surface touching all the spheres of refracted secondary wavelets. Hence, CE is the refracted wave front. Let r be the angle of refraction. 1

In the above figure, $\angle$BAC = i = angle of incidence and $\angle$ECA = r = angle of refraction

BC = $v_1\tau$ and AE = $v_2\tau$

From triangle BAC, $\sin i = \dfrac{BC}{AC}$ and from triangle ECA, $\sin r = \dfrac{AE}{AC}$ 1

$$\therefore \quad \frac{\sin i}{\sin r} = \frac{BC/AC}{AE/AC} = \frac{BC}{AE} = \frac{v_1\tau}{v_2\tau} = \frac{v_1}{v_2}$$

Since v_1 is a constant in medium-1 and v_2 is a constant in medium-2, $\dfrac{\sin i}{\sin r} = \dfrac{v_1}{v_2} = \text{constant}$.........(*) 1

Now, refractive index (n) of a medium: $n = \dfrac{c}{v}$ or $v = \dfrac{c}{n}$, where c – speed of light in vacuum.

For the first medium: $v_1 = \dfrac{c}{n_1}$ and for the second medium: $v_2 = \dfrac{c}{n_2}$ $\Rightarrow$ $\dfrac{v_1}{v_2} = \dfrac{n_2}{n_1}$

(*) becomes $\dfrac{\sin i}{\sin r} = \dfrac{n_2}{n_1}$ or $n_1 \sin i = n_2 \sin r$. This is the Snell's law of refraction. 1

31.

(i) For a given photosensitive material and frequency of incident radiation (above the threshold frequency), the photoelectric current is directly proportional to the intensity of incident light. 1

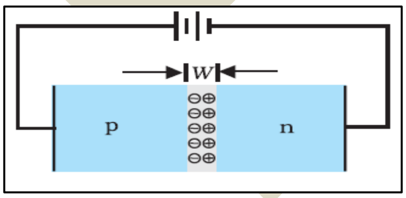
(ii) For a given photosensitive material and frequency of incident radiation, saturation current is proportional to the intensity of incident radiation but stopping potential is independent of its intensity. 1

(iii) For a given photosensitive material, there exists a certain minimum cut-off frequency of the incident radiation called the threshold frequency, below which no photoelectrons emission 1

(iv) Above the threshold frequency, the stopping potential or the maximum kinetic energy of the emitted photoelectrons increases linearly with the frequency of the incident radiation, but is independent of its intensity. 1

(v) The photoelectric emission is an instantaneous process. 1

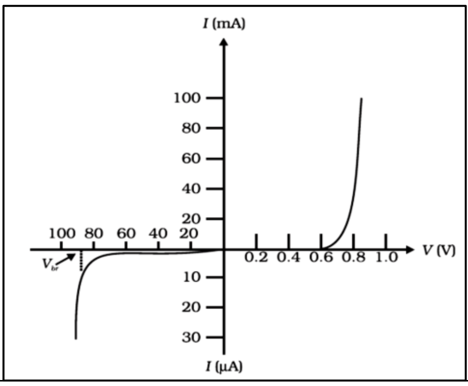
32.



CIRCUIT DIAGRAM 1

I – V CHARACTERISTIC CURVE 1

When an external voltage V is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased. 1



The direction of the applied voltage (V) is opposite to the built-in potential V_0 in the semiconductor diode. As a result, the width of depletion layer decreases and the barrier height is reduced. 1

If the applied voltage is small, the barrier potential will be reduced only slightly below the equilibrium value, the current will be small. If the applied voltage increase to large value, the barrier height will be reduced, the current increases. 1

VI.		
33.	Energy stored initially in the capacitor: $U = \frac{1}{2}CV^2 = \frac{1}{2}\left(600\times10^{-12}\right)(200)^2 = 12\times10^{-6}$ J	1+1
	Initial charge on the single capacitor is $Q = CV = 12\times10^{-8}$ coulomb.	1
	When other (second) uncharged capacitor connected parallel to the first, charge is distributed among them.	
	Capacitors are having equal capacitances, hence charges on each capacitor are equal = $Q_1 = Q/2 = 6\times10^{-8}$ C	1
	Now, energy stored in each capacitor: $U_1 = \frac{1}{2}\frac{Q_1^2}{C} = \frac{1}{2}\frac{\left(6\times10^{-8}\right)^2}{\left(600\times10^{-12}\right)} = 3\times10^{-6}$ J	
	Therefore, the total energy of the combination = 6×10^{-6} J **(with unit)**	1
34.	Equivalent internal resistance of the combination: $r_{eq} = \frac{r_1 r_2}{r_1 + r_2} = \frac{1.5\times1}{1.5+1} = 0.6\ \Omega$	1
	Equivalent emf of the combination: $\frac{\varepsilon_{eq}}{r_{eq}} = \frac{\varepsilon_1}{r_1} + \frac{\varepsilon_2}{r_2} \Rightarrow \frac{\varepsilon_{eq}}{0.6} = \frac{3}{1.5} + \frac{2}{1} \Rightarrow \varepsilon_{eq} = 2.4$ V	1
	Current through the 3Ω resistor (external resistor), $I = \frac{\varepsilon_{eq}}{R + r_{eq}} = \frac{2.4}{3+0.6} = \frac{2}{3}$ A	1+1
	Potential difference across 3 Ω resistor, V= IR = (2/3)(3) = 2 V **(with unit)**	1
	ALTERNATE METHOD: Applying Kirchhoff's rules also this problem can be solved.	
35.	Resistance of Lamp = R = V^2/P = (60×60)/10 = 360 Ω	1
	Current, $I_{rms} = P/V$ = 10/60 = 1/6 A	1
	Impedance: $Z = \frac{V_{rms}}{I_{rms}} = \frac{100}{(1/6)} = 600\ \Omega$	1
	$Z = \sqrt{R^2 + X_L^2} \Rightarrow L = \frac{\sqrt{Z^2 - R^2}}{2\pi f}$	1
	$L = \frac{\sqrt{600^2 - 360^2}}{2\,(3.142)\,(60)} = 1.273\,\text{H}$ **(with unit)**	1
36.	Lens in air, $\frac{1}{f_g} = (n_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$; (f_g – focal length in air)	1
	$\frac{1}{0.24} = (1.5 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ……………...(1)	1
	Lens in water, $\frac{1}{f_{gw}} = \left(\frac{n_g}{n_w} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$; (f_{gw} – focal length of lens in water)	1
	$\frac{1}{f_{gw}} = \left(\frac{1.5}{1.33} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ……………....(2)	1
	Dividing equation (1) by (2), f_{gw} = 0.939 m ∴ Change in focal length = 0.699 m **(with unit)**	1
37.	Mass defect in each copper nucleus = $29\ m_p + 34\ m_n - M_{Cu}$	
	= (29 × 1.00727) + (34 ×1.00866) – 62.92960	1
	Δm = 0.57567 u	
	Energy required to separate all neutrons and protons in one nucleus (is binding energy)	
	= $\Delta m \times 931.5$ MeV	1
	E_b = 0.57567 × 931.5 = 536.2 MeV	
	Number of atoms in the copper coin: $N = \frac{6.023\times10^{23}\times 3}{63} = 2.868\times10^{22}$	1
	∴ Total energy required to separate all neutrons and protons in the coin	
	= $E_b \times N$	1
	= 536.2 × 2.868 × 10^{22} = 1.538 × 10^{25} MeV **(with unit)**	1

NOTE: Any other alternate correct method should be considered.