II PUC PHYSICS PASSING PACKAGE

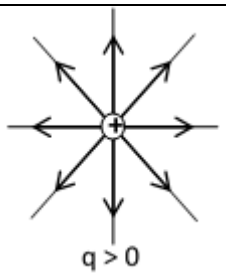
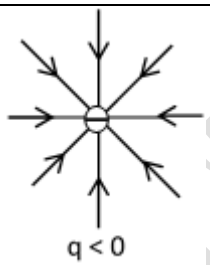
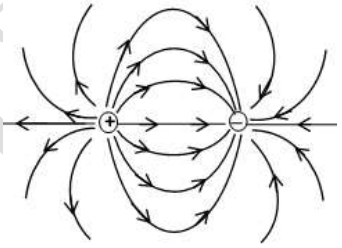
Electric Charge and Fields

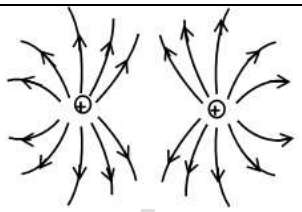
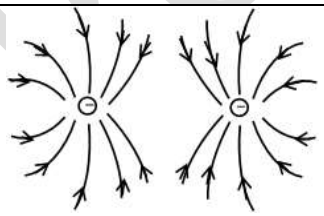
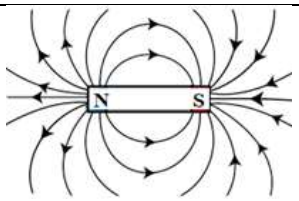
1. **Write any three properties of an electric charge**.
   (a) Charge is a scalar quantity.
   (b) Like charges repel and unlike charges attract.
   (c) Charges are quantized.

2. **Write any three properties of electric field lines.**
   (a) They never cross each other.
   (b) Tangent to the field lines gives direction of field.
   (c) If the lines are crowded, then field is strong.

3. **Write any three properties of magnetic field lines.**
   (a) They never cross each other.
   (b) Tangent to the field lines gives direction of field.
   (c) If the lines are crowded, then field is strong.

4.

Electric field lines around positive Point charge	Electric field lines around negative point charge	Electric field lines around dipole
		

Electric field lines around two Positive charges	Electric field lines around two negative charges	Magnetic field lines around a bar magnet
		

5. **State and explain Gauss's Law of electric field.**

   Statement: The flux of electric field through any closed surface is $\frac{1}{\in_o}$ times the total charge enclosed by the surface.

   Explanation: $\phi = \frac{1}{\in_o} q$. $\varepsilon_o \rightarrow$ permittivity of free space. q→charge, ϕ→electric flux

- **Some important 5 Marks questions (At least study formulas and terms)**

6. State and explain Coulomb's law.
7. Obtain an expression for electric field due to a dipole at a point on axial line and equatorial line.
8. State Gauss' theorem. Obtain an expression electric field at a point due to charged infinitely long wire.
9. State Gauss' theorem. Obtain an expression electric field at a point due to charged infinitely large sheet.
10. State Gauss' theorem. Obtain an expression electric field at a point due to a charged spherical shell.

Electric Potential and Capacitors

1. **Write any three properties of equipotential surfaces.**
   (a) They never intersect each other.
   (b) Electric field is always normal to the equipotential surface.
   (c) All points on equipotential surface have same potential.

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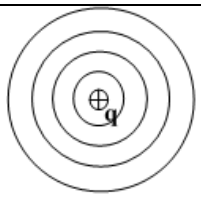
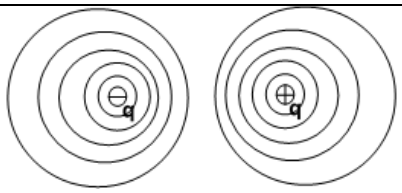
2. How can you increase the capacitance of a parallel plate capacitor?

(a) Increase the area of plates (b) decrease the distance between the plates

3. Equipotential surfaces

Point charge	dipole
	

Current Electricity

1. State and explain Ohm's Law.

Statement: Current through the conductor is directly proportional to the potential difference between its ends.

Explanation, $V \alpha I \Rightarrow V = R I$

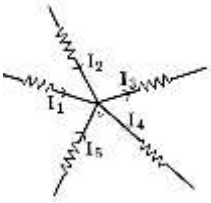
R→Resistance V→potential difference I→current

2. Mention three limitations of Ohm's law.

Ohm's law fails if (a) V is not proportional to I. (b) Relation between V and I depend on the sign of V. (c)Relation between V and I is not unique.

KCL, Node Rule	KVL, Loop Rule	Lenz's Law	Lenz's Law	Einstein's Photoelectric equation
Law of conservation of charge	Law of conservation of Energy	Law of conservation of Energy	Gives polarity of induced emf	Law of conservation of Energy

3. State and explain Junction rule or Kirchhoff's Current Law-KCL.



Statement: At any junction, the sum of the currents entering the junction is equal to the sum of currents leaving the junction.

Explanation: $I_1 + I_2 - I_3 - I_4 + I_5 = 0$ i.e. $\Sigma I = 0$

4. State and explain Loop rule or Kirchhoff's Voltage Law-KVL.

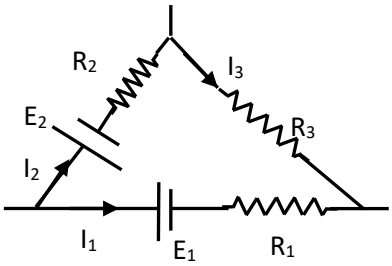
Ans: **Statement:** The algebraic sum of changes in potential around any closed loop containing resistors and cells is zero.

Explanation:

Applying the II law to the mesh

$+I_2R_2 + I_3R_3 - I_1R_1 - E_1 + E_2 = 0$

i.e. $\Sigma E + \Sigma IR = 0$



5. Obtain an expression for drift velocity and current density.
6. Derive an expression for equivalent emf and internal resistance of two cells in series and parallel.
7. Obtain the balancing condition of a Wheatstone's network.

Moving charges and Magnetism

1. Obtain an expression for magnetic field at a point due to a current carrying coil.
2. Derive an expression for force between two infinitely long straight parallel conductors carrying current in the same direction.

Magnetism and Matter

3. State and explain Gauss's law for magnetism.

Net magnetic flux through any closed surface is zero. $\phi_B = \sum_{ALL} \vec{B}.\vec{\Delta S} = 0$

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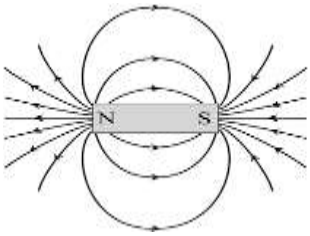
4. **Write any three properties of magnetic field lines (Answer is in second question of first chapter)**
5. **Draw the field lines around a bar magnet. Ans:**



6. **Distinguish Dia, Para and ferromagnetic materials**

	Diamagnetic	Paramagnetic	Ferromagnetic
1	They are repelled weakly by a magnet	They are attracted weakly by a magnet	They are attracted strongly by a magnet
2	Susceptibility very low and negative	Susceptibility very low and positive	Susceptibility very high and positive
3	Permeability is less than one	Permeability slightly greater than one	Permeability if much greater than one

Electromagnetic induction

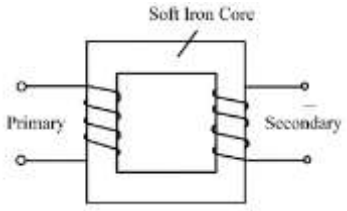
1. **State and explain faraday's law of electromagnetic induction**.
Statement: "The magnitude of the induced emf in a circuit is equal to the time rate of change of magnetic flux through the circuit".

Explanation: $\varepsilon = -\frac{d\phi_B}{dt}$ $\varepsilon \rightarrow$ induced emf. $d\phi \rightarrow$change of flux $dt \rightarrow$time

2. **Obtain an expression for motional emf.**
3. **What is an ac generator? On which principle does it work. Obtain an expression for ac. Represent ac in a waveform.**

Alternating Current

1. **What is a transformer? Write its principle. Explain the working of a transformer.**
Definition: Transformer is a device which is used to change the amplitude of alternating voltage.
Principle: Transformer works on the principle of mutual induction.
Working:



For a transformer , $\frac{\upsilon_s}{\upsilon_p} = \frac{i_p}{i_s} = \frac{N_s}{N_p} = T$ .....(5)

If $N_s > N_p$ then it is called step up transformer. It increases the amplitude of alternating voltage.

If $N_s < N_p$ then it is called step down transformer. It decreases the amplitude of alternating voltage.

Efficiency of a transformer is given by $\eta = \frac{\text{Output Power}}{\text{Input Power}} = \frac{V_s I_S}{V_p I_p}$

2. **Write any three sources of energy loss in a transformer**
(a) Energy loss due to eddy current
(b) Energy loss due to flux leakage
(c) Energy loss due to resistance of wires.

Wave Optics

1. **Type of wave fronts by different sources.**

Source	Point Source	Linear Source	Point or linear source at infinity
Wavefront	Spherical	Cylindrical	Plane

2. **Write any two applications of polaroids**
(a) To produce polarized light (b) in Sun glasses (c) in 3D movie cameras

Dual nature of radiation and matter

- **Name any three types of electron emission.**
(i) Thermionic emission (ii) Field emission (iii) Photoelectric emission

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- **Define any three types of electron emission.**
  Thermionic emission: Electrons are removed from the surface of a metal by supplying heat energy. This process is called thermionic emission.
  Field emission: Electrons are removed from the surface of a metal by applying very strong electric field. This process is called field emission.
  Photo electric emission:Electrons are removed from the surface of a metal by applying radiation of suitable frequency. This process is called field emission.
- **Three properties of Photon:** (a) Photons are electrically neutral. (b) Photons carry energy (c) Photons travel with a speed of 3x108m/s in vacuum
- **Write Einstein's photoelectric equation. What are the explanations given by Einstein on the observations of photoelectric effect?**

Atoms

1. Write three postulates of Bohr's atom model.

a) Electrons revolve in certain stable orbits called non radiating orbits.

b) Non radiating or stationary orbits are those in which the angular momentum of electron is some integral multiple of **h/2Π**.

$$\therefore mvr = \frac{nh}{2\pi}$$

c) If an electron makes a transistion form higher energy level of energy E_f to lowe energy level of energy E_i, a photo will be emitted. $h\nu = E_i - E_f$

2. Write any three limitations (drawbacks) of Bohr's theory:

1) It is applicable to only hydrogenic atoms.
2) Fine structure of certain spectral lines is not explained
3) Intensities of spectral lines is not explained

Nuclei

1. Write any three characteristics of nuclear force

Nuclear force
(a) is a strongest force in nature (b) does not depend on charge (c) is a short range force.

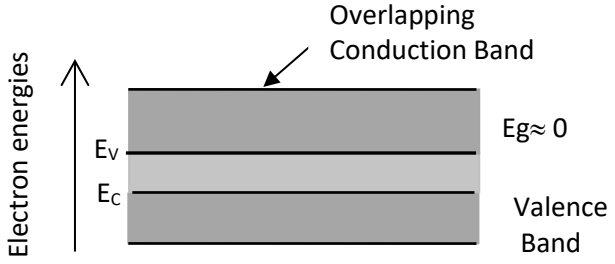
2. Differences between fission and fusion

	Fission	Fusion
1	Heavy nucleus splits into two or more lighter nuclei and energy is released	Two lighter nuclei combine together to form a heavy nucleus and energy is released.
2	High temperature is not required for fission	High temperature is required for fusion
3	Energy released for per fission is more	Energy released per fusion is less

Semiconductors

3. Distinguish between Conductors, semiconductors and insulators on the basis of band theory.

Conductors: Metals are allow current to flow through them.
In metals the conduction and valance bands overlap.
Hence energy gap = 0
A large number of electrons are available for electrical conduction.
Resistance of such materials is low.



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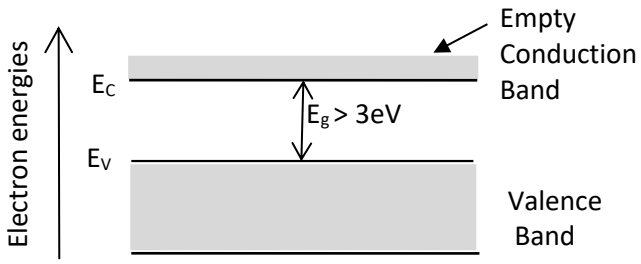
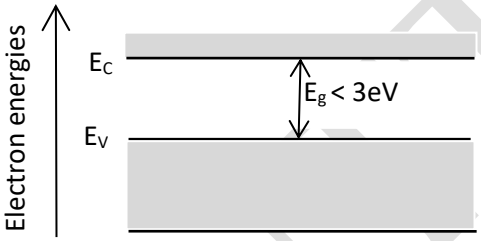
Insulators:
They do not allow electrons through them.
Conduction band and valence band are separated by large energy gap, E_g>3eV
No free electrons are available in conduction band.
Hence insulator have large resistance.



Semiconductors:
Semiconductors have conducting property between conductors and insulators.
Energy gap between conduction band and valence band is less than 3eV.
Very few free electrons are found in conduction band.
Resistance of semiconductors is not as high as that of the insulators.



1. Distinguish between intrinsic and extrinsic semiconductors.

Intrinsic Semiconductor	Extrinsic semiconductor
It is a pure semiconductor crystal	It is a semiconductor doped with impurities
Contains same number of holes and electrons	Number of electrons and holes are not same
Conductivity is because of both the electrons and holes	Conductivity is mainly due to the majority charge carriers.

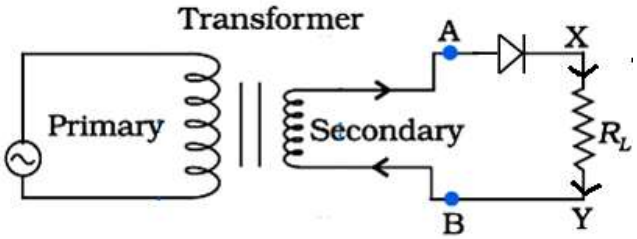
2. Give any three differences between p-type and n-type semiconductors.

P-type semiconductor	N-type semiconductor
semiconductor doped with trivalent impurity	Semiconductor doped with pentavalent impurity
Contains more number of holes than electrons	Contains more number of electrons than holes
Conductivity is mainly because of holes	Conductivity is mainly because of electrons
Holes are majority carriers electrons are minority carriers	Electrons are the majority carriers Holes are minority carriers

3. Differences between forward bias and reverse bias.

	Forward Bias	Reverse Bias
1	Resistance of diode is very less	Resistance of diode is very high
2	Large current flows through the diode	Very small current flows through the diode
3	Width of depletion region decreases	Width of depletion region increases

4. What is a Half wave rectifier? Explain with a circuit diagram.
The circuit which converts ac into dc is called a rectifier.
Half wave rectifier gives rectified output voltage corresponding to only one-half cycle of the ac input.



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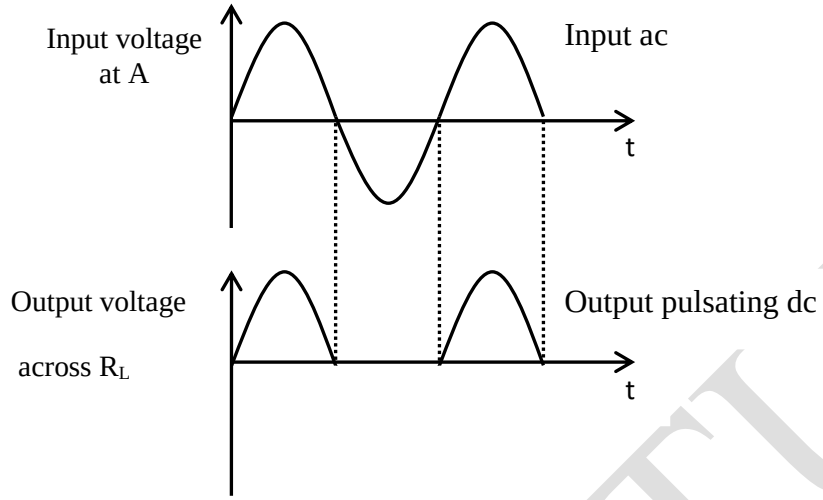
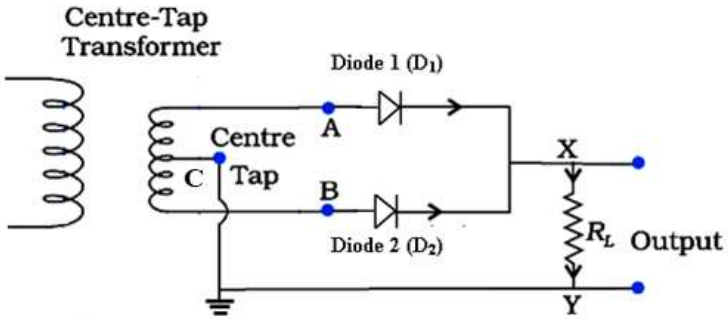
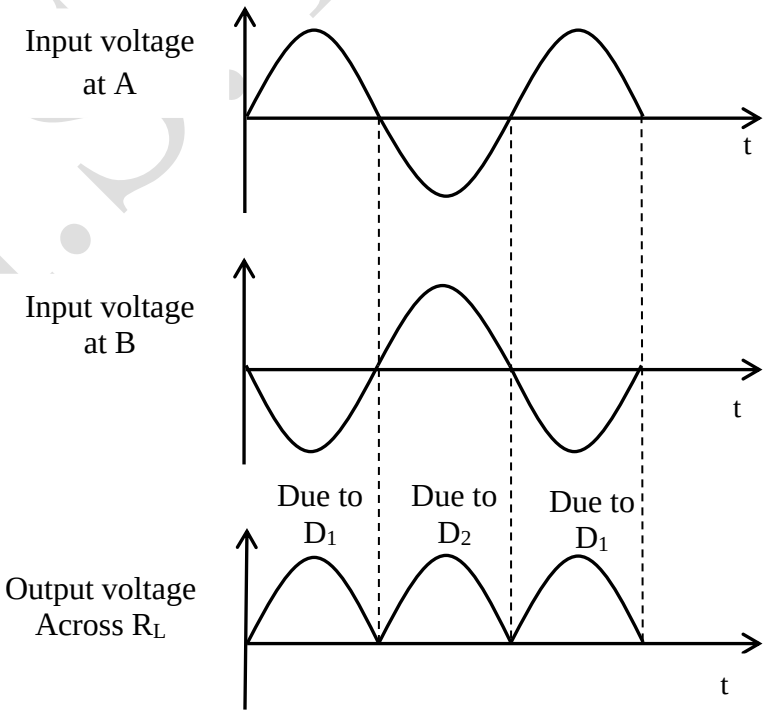
When A is positive, diode is forward biased and it conducts.
Current flows through the load resistor R_L from x to Y
When A is negative, the diode is reverse-biased and it does not conduct.
No current flows through R_L.
Current flows through R_L in one direction only. Hence output is DC



5. **What is a rectifier? With relevant circuit diagram and waveforms explain the working of P-N junction diode as full-wave rectifier.**





The circuit which converts ac into dc is called a rectifier.
Full wave rectifier gives out put corresponding to corresponding to both the half cycle of the ac input.

When A is positive with respect to the C diode D_1 gets forward biased and it conducts.
D_2 is reverse biased and will not conduct.
Current flows through R_L from x to y.
When A is negative with respect to C, diode D_1 is reverse biased and it does not conduct.
Diode D_2 is forward biased and it conducts.
Current flows through R_L from x to Y
Always current flows in same direction through R_L. Hence output is dc.

- **Some devices and their principles**
  - **Optic fiber-Total internal reflection**
  - **AC dynamo – electromagnetic induction- Conversion of mechanical energy to electrical energy**
  - **Transformer – Mutual Induction**
- **Possible problems and formulas to solve them.**

. $R=R_oA^{1/3}$
Mass defect $=[Zm_p + (A-Z)\, m_n] - M$
Binding energy $= \Delta m.\ 931.5MeV$

. **Problem from electric potential:** $V = \frac{1}{4\pi \in_o}\frac{q}{r}$, $W = qV$

Problem from electric potential and capacitor:

Q=CV, $C_p= C_1+C_2$ $C_s = \frac{C_1C_2}{C_1 + C_2}$, $U = \frac{1}{2}cv^2$,

. **Problem from current electricity:**

$V=IR$, $R = \frac{\rho \ell}{A}$, $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$, $r_{eq} = r_1+r_2$, $\varepsilon_{eq} = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ $r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$

. **Problem from Alternating current:**

$X_L = 2\pi\nu L$, $X_C = \frac{1}{2\pi\nu C}$, $Z = \sqrt{R^2 + (X_c - X_L)^2}$, $\tan\varphi = \frac{X_C \quad X_L}{R}$

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