FUTURE QUESTIONS

PHYSICS CLASS XII

QUESTION BANK

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COMMON MISTAKES COMMITTED BY THE STUDENTS IN PHYSICS OF CLASS XII

The following area / contents are being given below which are generally some confusable / mistakable for the students in Physics Subject for XII Class syllabus.

UNIT No. 1: ELECTROSTATICS:-

1. Electric field intensity & Electric Potential due to electric dipole.
2. Way for finding the directions of Electric field.
3. Effect of dielectric in capacitors.
4. Numeric Problems based on counter nation of capacitors.
5. Area Vector concept in Gauss Theorem.

UNIT 2: CURRENT ELECTRICITY

1. Factors affecting the resistance of a register (conductor) i.e. Relaxation time Temp. etc.
2. Circuit diagram (Wheatstone Bridge , Meter Bridge , Potentiometer)
3. Numerical on Wheatstone Bridge , Meter Bridge , Potentiometer
4. Combination of resistances

UNIT 3: MAGNETIC EFFECT OF CURRENT

1. Direction of magnetic field in different situation
2. Biota Savant Law (Formula in vector form)
3. Sensitivity of Galvanometer.
4. Magnetic dipole moment & Electric dipole moment.
5. Die & Para magnetic substances.

UNIT 4: E.M.I. & A.C.

1. Applications of Lentz Law
2. Instantaneous, Peak & r m s. value of AC current / voltage.
3. AC through pure inductor & capacitor phase difference between voltage & current
4. Numerical Problems based on LCR series circuit (condition of resonance)
5. Power factor.

UNIT 5: E.M.WAVES

1. Conditions of propagation of E.M. Waves

UNIT 6: OPTICS

1. Numerical Problem based on lens formula.
2. Resolving power; magnifying power of optical instruments.
3. Conditions of Interference & Diffraction
4. Single slit diffraction pattern.
5. Huygens's wave theory explanation for Reflection & Refraction Laws.

UNIT 7: DUAL NATURE OF MATTER & RADIATION

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1. Explanation of laws of Photo Electric Effect using Einstein equation
2. Derision & Germen Experiment (Polar Graphs)

UNIT 8: ATOMIC NUCLEUS

1. Decay law
2. Explanation of Binding Energy curve & numerical problems based on B.E. per nucleus

UNIT 9: SOLID & SEMI CONDUCTOR DEVICES

1. Energy level diagram for Extrinsic & intrinsic semiconductors
2. Biasing of P-N Junction diode
3. Transistors PNP & NPN Biasing
4. Applications of Logic gates.

UNIT 10: PRINCIPLES OF COMMUNICATION

1. Block diagram of transmission and reception system
2. Wave shape of analog and digital signals
3. Wave shape of frequency & amplitude modulated wave for sine and square wave

COMMON ERRORS COMMITTED BY THE STUDENTS (CLASS- XII)

1. After solving the numerical problems don't write SI-Units of the Physical Quantities.
2. Before attempting the Numerical convert all the given Physical Quantities in SI-Units.
3. The answer should be the point.
4. Show ray direction in ray-diagrams & current direction in circuit diagrams.
5. Clearly not show the Polarized & polarized Light.
6. Not aware while drawing a resistance & capacitor in circuit diagrams.
7. Not aware while drawing a resistance & inductor in circuit diagrams.
8. Generally don't write the name of Physical Quantities used in the formula.

DIFFICULT AREAS AND QUESTIONS BASED ON THE TOPICS CLASS XII

UNITS	TOPIC	QUESTION
1. Electro Statics	(a) Gauss Theorem (b) Electric Dipole (c) Capacitor	(1) Explanation of Gauss Theorem & Its applications for plane Conducting sheets. (2) Electric field intensity due to a short dipole at its equation point Axial points. (3) Effect of conducting & Dielectric slab

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		between plates of a parallel plate capacitor.
2. Current Electricity	(a) Kirchhoff' s Law	(1)Numerical based on Law. (2)Calculation of current & charge stored in a capacitor & resistance mixed circuit.
	(b) Dependence of Resistively	(1) Dependence of Resistively on temperature & Relaxation time and its explanation.
3.Magnetic Effect of current & Magnetism	a) Magnetic field	1) Magnetic field at the axis of current carrying circular coil
	b) Galvanometer	1) Conversion of Galvanometer into ammeter & voltmeter of desire range.
	c) Magnet	1) Explanation of mega meridian & Geographic meridian , angle or dip
4. E.M.I. & A.C.	a) Pharos diagrams	1) Expression for LCR – Circuit by pharos diagrams & numerical based on resonant condition
	b) Power factor	1) Derivation of power factor for LCR – Circuit.
	c) Resonance	1) Numerical based on $\nu - 1/(2\Pi\sqrt{LC})$ resonance condition
5. E.M. Waves	a) Transverse Nature	1) Expression & Explanation of Transverse Nature of EM – Waves
6. Optics	a) Wave front b) Refraction c) Lens makers formula d) Diffraction e) Resolving power	1) Concept of wave front & its classification & Explanation. 1) Explanation of Refraction on the basis of wave theory. 1) Derivation of Lens makers Formula with labeled diagram. 1) Diffraction due to a single slit & explanation for central maxima & minima 1) Resolving power of microscope & Telescope
7. Dual Nature of Matter & Radiation	a) Davison German Experiment b) Photo – Electric effect	1) Explanation of D. & G. Experiment. 1) Explanation of Einstein's Photo electric equation
8. Atomic Nucleus	a) Half life b) Binding energy (c) α -Scattering Experiment	1) Calculation of Binding Energy per nuclei for given nuclear Reaction. ($\Delta E = \Delta mc^2$) (1) Explanation of α -Particles scattering.
9. Solid & Semiconductor	(a) PN-Junction	(1) Formation of Depletion Layer in forward &

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Devices	Diode (b) Transistor	reverse biasing of a PN-Junction diode. (1) Zener Diode as a voltage regulator & its curve. (1)Input & Output characteristics curve of NPN & PNP- Transistor. (2) Transistor as oscillator.
10. Principles of Communication	(a) Demodulation (b) Block Diagrams	(1) Concept of Demodulation. (1) Explanation of Receiver & Transmitter on the basis of Block Diagrams. .

UNIT 1 CHAPTER 1 & 2

1. Define electrical susceptibility. How it is related to dielectric constant
2. Define dielectric polarization of electric field. Is it scalar or vector?
3. An electrostatic field line cannot be discontinuous. Why?
4. Draw an equipotent surface in a uniform electric field.
5. How many protons will have the total charge of 1C.?
6. What is the dielectric constant of Silver?
7. Find the electric field b/w 2 metal plates 5mm apart, connected by a 12V battery.
8. Write the value of Coulomb constant (K) and mention its units
9. On which property of electric charge GLE Gold Leaf Electroscope works?
10. What are the properties of electric charge?
11. Can to charge attract each other which have same nature charge?
12. Give the properties of Coulomb's force.
13. Can a positively charged object attract a neutral object? Explain briefly
14. State Coulomb's law in vector form.
15. When 2 capacitors C_1 and C_2 are connected in series the net is 1.2 farad, when connected in parallel the net capacitance is 5 farad. Find C_1 and C_2.
16. Two spherical conductors A and B are having charge densities σ_A and σ_B respectively. if they are joined by a thin wire then what will be the ratio of charge densities finally if the radii are r_A and r_B respectively.
17. How does the presence of dielectric medium, in between the two charges, affect the electrostatic force between them?
18. Electric potential on the surface of a charged spherical shell is 10V. what will be the potential at its center?
19. An electric dipole, when held at 300 with respect to a uniform electric field of 104N/C, experiences a torque of 9 x 10-26Nm. Calculate the dipole moment of the dipole.
20. Force between two point electric charges kept at a distance d apart in air is F. If these charges are kept at the same distance in water, how does the force between them change?
21. An electric flux of -6 x 10^3 Nm^2/C passes normally through a spherical Gaussian surface of radius 10 cm, due to a point charge placed at the centre.
    a. What is the charge enclosed by the Gaussian surface?
    b. If the radius of the Gaussian surface is doubled, how much flux would pass through the surface?

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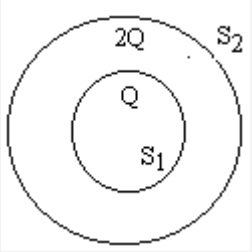
22. What is the force experienced by a positively charges particle Q moving at right angles to a uniform electric field E.
23. What is the angle b/w Electric field and Dipole moment at an axial point?
24. What is the effect on the following on inserting a dielectric in a parallel plate capacitor:
    a. Capacitance
    b. Charge on the plates of the capacitor
25. Dipole is placed parallel to the electric field. If W is the work done in rotating the dipole 60^{o}
26. Charges of magnitudes 2Q and –Q are located at points (a,0,0) and (4a,0,0).Find the ratio of the flux of electric field ,due to these charges, through concentric spheres of radii 2a and 8a centred at the origin.
27. Two point charges +Q & +4Q are separated by a distance of 6a. Find the point on the lining joining the two charges where the electric field is zero?
28. What is the net flux through a closed surface enclosing an electric dipole?
29. Two point electric charges of unknown magnitude and sign are placed a distance'd' apart. The electric field intensity is zero at a point, not between the charges but on the line joining them. Write two essential conditions for this to happen.
30. On the same graph plot the variation of E versus R and V versus R for a point charge.
31. What are the equipotential, give their important property?
32. Using Gauss Theorem find the electric field at the surface of a charged conductor.
33. A 4μF capacitor is charged by 200 V supply. It is then disconnected to another uncharged capacitor of 2 μF capacitor. How much electrostatic energy of capacitor is lost in the form of heat and em radiations?
34. Using gauss law derive expression for field intensity at a distance x from an infinite long line charge having charge density λ. Also plot E- x graph
35. A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80 μ c/m^2 find the charge on the sphere. What is the total flux leaving the surface of the sphere?
36. The two plates of a parallel plate capacitor are 5 mm apart. A slab of a dielectric, of thickness 4mm is introduced between the plates with its faces parallel to them. The distance between the plates is adjusted so that the capacitance of the capacitor becomes equal to its original value. If the new distance between the plates equals 8mm, what is the dielectric constant of the dielectric used?
37. Define 'electric line of force' and give its two important properties.
38. Two point charges $q_A = +3\ \mu C \ and \ q_B = -3\ \mu C$ are located 20 cm apart in vacuum, (i) Find the electric field at the midpoint of the line AB joining the two charges, (ii) If a negative test charge of magnitude $1.5\times10^{-9}\ C$ is placed at the centre, find the force experienced by the test charge.
39. S1 and S2 are two hollow concentric sphere enclosing charges Q and 2Q respectively as shown in fig. What is the ratio of electric flux through S_1 & S_2?



40. An electric dipole is held in a uniform electric field.
    a. Show that no force acts on its.
    b. Derive an expression for the torque acting on it.
41. Two point charges A and B of value +5 x 10-9 C and +3 x 10-9C are kept 6cm apart in air. Calculate the work done, when charge B is moved by 1cm towards charge A.
42. An uncharged insulated conductor A is brought near a charged insulated conductor B .What happens to charge and potential of B?
43. What is the dielectric constant of a conductor?

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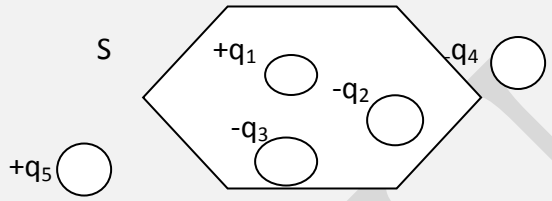
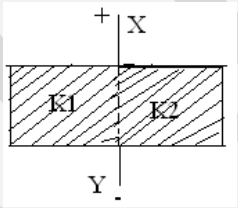
44. Three charges Q, Q and – Q are placed on the vertices of an equilateral triangle of side L. Find the net force experienced by the charge Q and the net force experienced by the charge – Q.
45. Sketch electric field lines for a dipole.
46. An electron is placed inside a capacitor (5μf). It is found to be stationary i.e. its weight is balanced by the electrostatic force. Find the potential difference across the plates of the capacitor if the plate area is A.
47. Equal charges each of 1C are placed at x = 0, 2, 4, 8, 16 cm. Find force experienced by the charge at x=2 cm.
48. Figure shows the five charged lumps of plastic and a Cross section of Gaussian surface S. What is the net flux through the surface if;

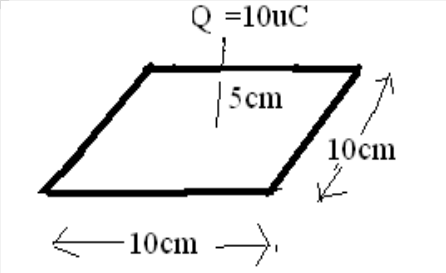
    $q_1=q_4$= +3 n C
    $q_2=q_5$= -5.9 n C
    q_3= -3.1 n C



49. Keeping the voltage of the charging source constant, what would be the percentage change in the energy stored in a parallel plate capacitor if the separation between its plates were to be decreased by 10%.
50. Write the magnitude and direction of electric field intensity due to an electric dipole of length 2a at the mid-point of the tine joining the two charges.
51. A $4\,\mu F$ capacitor is charged by a 200 V supply. The supply is then disconnected- ted and the charged capacitor is connected to another uncharged 2 μF c capacitor. How much electrostatic energy of the first capacitor is lost in the process of attaining the steady situation?
52. Explain the effect of introducing a dielectric slab between the plates of a parallel plate capacitor on its capacitance. Derive an expression for its capacitance with the dielectric slab, what is the effective capacitance across XY of the capacitor of capacitance if the capacitor with air/vacuum between the plates of area A each and distance d apart was C_o.



53. State gauss theorem in electrostatics. Derive an expression for the electric field strength near an infinite plane sheet of charge. A point charge of +10μC is at a distance 5cm directly above the centre of a square of side 10cm as shown in the figure. What is the magnitude of electric flux through the square?



54. Two point charges 4μc and —2μc are separated by a distance of 1m in air. At what point on the line joining the two charges is the electric potential is zero.
55. *X* and *Y* are two parallel plate capacitors having same area of plates and same separation between the plates as shown in the figure. *X* has air between the plates and *Y* has a dielectric of dielectric constant *k=4*.

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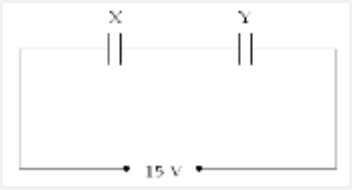
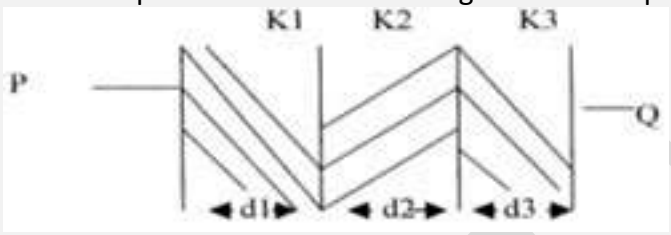
56. 

Calculate the potential difference between the plates of *X* and *Y*.

57. Calculate the capacitance of the following multi slab capacitor.



58. What is the angle between the directions of electric field at any (i) axial point and (ii) equatorial point due to an electric dipole?
59. Two large parallel thin metallic plates are placed close to each other. The plates have surface charge densities of opposite signs and of magnitude 20 x 10^{-12} C/m^2. Calculate the electric field intensity (i) in the outer region of the plates and (ii) in the interior region between the plates.
60. Sketch a graph to show how the capacitance C of a capacitor varies with the charge Q given to it.
61. Define SI unit of Electric flux.
62. A charge Q located at a point is in equilibrium under the combined electric field of three charges q1, q2 and q_3. If the charges q_1, q_2 are located at the points and respectively. Find the direction of the force on Q, due to q_3 in terms of q_1, q_2 q_3.
63. What is the force experienced by a positively charges particle Q moving at right angles to a uniform electric field E.
64. What is the order of voltages that can be built up using a Van De Graff generator?
65. What is the angle b/w Electric field and Dipole moment at an axial point?
66. The dielectric strength of air is 3 x 10^6 V/m. What is the maximum charge that can be safely stored on a sphere of radius 10m?
67. Draw an equipotential surface for a uniform electric field.
68. Two insulated charges copper spheres A and B have their center's separated by a distance of 50 cm and initially contain the same charge, these two spheres are identical, a third sphere of same size but uncharged brought in contact with first, then brought in contact with the second, and finally removed from both what is the force of repulsion between A and B ?
69. A capacitor have capacitance 18 pf , what would happen on the charge and potential if in the capacitor a 3 mm thick mica sheet (of dielectric constant = 6) were inserted between the plates , (i) while the voltage supply remains connected (ii) after the supply was disconnected?
70. Two point charges q_1 and q_2 of 10^{-8}C and -10^{-8}C respectively are placed 0.1 m apart. Calculate the electric fields at points a, b and c as shown in fig.
71. Show that the force on each plate of a parallel plate capacitor has a magnitude equal to $\frac{1}{2}$QE, where Q is the charge on the capacitor , and E is the magnitude of electric field between the plates .explain the origin of the factor 1/2.
72. Two tiny spheres carrying charges 1.5 micro coulomb and 2.5 micro coulomb are located 30 cm apart .find the potential at a point 10 cm from this mid-point in a plane normal to the line and passing through the mid-point. draw the equipotential for two charges q<0 and q<0 ?
73. A 600 pf capacitor is charged by a 200 volt supply .it is then disconnected from the supply and is connected to another uncharged 600pf capacitor. how much electrostatic energy is lost in the process? Find the charge on each capacitor after connection?

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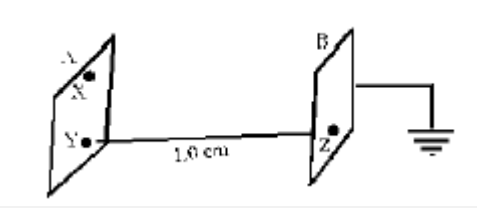
74. The electric field components in are Ex = A+Bx, Ey = Ez = 0, in which A = 800 N/C , B= 100 N/C-m. Calculate (a) the flux through the cube, and (b) the charge within the cube. Assume that a = 0.1 m.
75. Two point charges q_A = 3 μ C and q_B = –3 μ C are located 20 cm apart in vacuum. (a) What is the electric field at the midpoint O of the line AB joining the two charges? (b) If a negative test charge of magnitude 1.5×10^{-9} C is placed at this point, what is the force experienced by the test charge?
76. Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs and of magnitude 17.0×10^{-22} C/m^2. What is E: (a) in the outer region of the first plate, (b) in the outer region of the second plate, and (c) between the plates?
77. A hollow charged conductor has a tiny hole cut into its surface. Show that the electric field in the hole is $(\frac{\sigma}{2}\epsilon o)$ ˆn , where ˆn is the unit vector in the outward normal direction, and σ is the surface charge density near the hole.
78. A particle of mass m and charge (–q) enters the region between the two charged plates initially moving along x-axis with speed v_X , The length of plate is L and an uniform electric field E is maintained between the plates. Show that the vertical deflection of the particle at the far edge of the plate is $qEL^2/2m(v_x)^2$
79. Inside a conducting spherical shell of inner radius 2R and outer radius 3R, a charge q is kept. Charge q is situated at a distance R from centre .what is the electric potential at the centre of the shell?
80. Show that the potential energy of a dipole in a uniform electric field is given by U = -P. E
81. In a parallel plate capacitor with air between the plates has an area of 6 x 10-3 m2 and the distance between the plates is 3mm. calculate the capacitance of the capacitor , if this capacitor is connected to a 100 V supply, what is the charge on each plate of the capacitor
82. A system has two charges q_1=2.5x10^{-7} C and q_2=-2.5x10^{-7} C located at points A (0, 0,-15cm) and B(0,0,+15cm) respectively what are the total charge and electric dipole moment of the system?
83. Sketch three equipotential surfaces for a pt. charge.
84. A charge of 17.7 X 10^{-4} C is distributed uniformly over a large sheet of area 200m^2. Calculate the electric field intensity at a distance 20cm from it in air.
85. An electric dipole of dipole moment P is placed in a uniform electric field E. Write the expression for the torque τ experienced by the dipole. Identify two pairs of perpendicular vectors in the expression. Show diagrammatically the orientation of the dipole in the field for which the torque is (i) maximum (ii) Half the maximum value (iii) Zero.
86. Name the physical quantity whose S.I. unit is :(a) Coulomb/Volt (b) Volt/meter.
87. For a given medium, the dielectric constant is unity. What is its permittivity?
88. A parallel plate capacitor with air between the plates has a capacitance of 6 pF. The separation between the pates is now reduced by one third and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance of the capacitor in the second case.
89. Charges of magnitudes 2Q and –Q are located at points (a,0,0) and (4a,0,0).Find the ratio of the flux of electric field ,due to these charges, through concentric spheres of radii 2a and 8a centered at the origin.
90. Two identical plane metallic surfaces A and B are kept parallel to each other in air separated by a distance of 1.0 cm as shown Surface A is given a positive potential of 10V and the outer surface of B is earthed. (i) What is the magnitude and direction of the uniform electric field between points Y and Z? (ii) What is the work done in moving a charge of 20 C from point X to point Y?



91. Explain the significance of the expression: $E = \lim_{q \to 0}\left(\frac{F}{q}\right)$.
92. Two point charges q1 and q2 are placed in air close to each other. What is the nature of force when q1q2 < 0.
93. What will be the effect on force when a dielectric medium is introduced between the charges?

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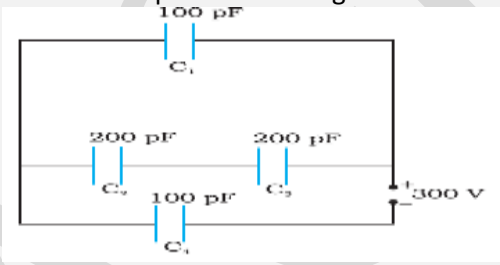
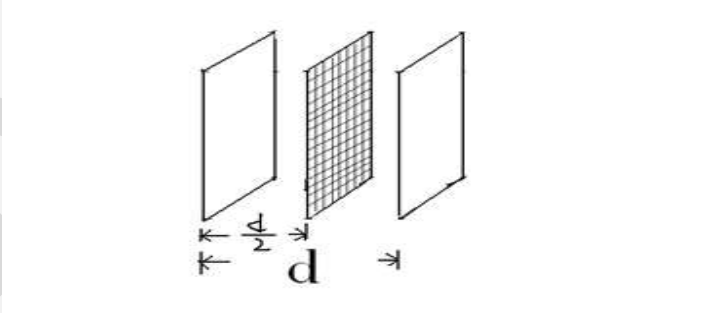
94. A parallel plate capacitor with air between the plates has a capacitance of 8pf. The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance in the second case.
95. What is the force experienced by a positively charges particle Q moving at right angles to a uniform electric field E.
96. Draw an equipotential surface for a (a) point charge (b) electric dipole.
97. You are given an isolated parallel plate capacitor of capacitance C charged to a potential difference V. What will happen to the following when separation distance between the plates is doubled with the help of insulating handle attached to the plates: (a) charge on the plates (b) potential difference across the plates (c) energy stored by the capacitor.
98. When a glass rod is rubbed with a silk cloth, charges appear on both. A similar phenomenon is observed with many other pairs of bodies. Explain how this observation is consistent with the law of conservation of charge.
99. In uniform electric field of strength E, a charges particle Q moves point A to a point B in the direction of the field and back from B to A. Calculate the ratio of the work done by the electric field in taking the charge particle from A to B and from B to A.
100. A parallel plate capacitor with air as dielectric is charged by a D.C. source to a potential 'V'. Without disconnecting the capacitor from the source, air is replaced by another dielectric medium of dielectric constant 10. State with reason, how does (i) electric field between the plates, and (ii) energy stored in the capacitor changes?
101. A point charge of 2.0 μC is at the centre of a cubic Gaussian surface 9.0 cm on edge. What is the net electric flux through the surface?
102. Find the total energy stored in the capacitors in the given network. (Fig)



103. Define electric flux. Write its SI unit. A charge q is enclosed by a spherical surface of radius R. If the radius is reduced to half, how would the electric flux through the surface change?
104. A capacitor has a capacitance given by C_0 when distance Between its plates is d. A conducting wire mesh is placed as shown in figure what is the effect on capacitance and calculate the new capacitance?



105. The given graph shows the variation of charge q versus potential difference V for two capacitors. The two capacitors C_1 and C_2 have same plate separation but the plate area of C_2 is double than that of C_1. Which of the lines in the graph correspond to C_1 and C_2 and why?

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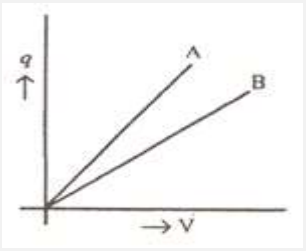
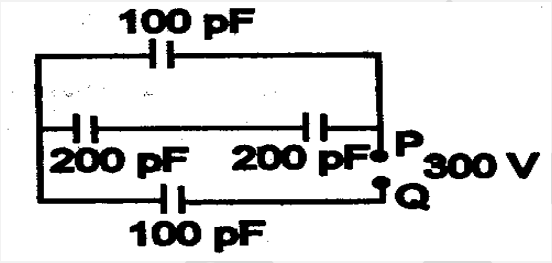


106. An electric dipole of length 2cm is placed with its axis making an angle 60^0 to a uniform electric field of 105 N/C. If it experiences a torque of 8√3 Nm. Calculate the (i) magnitude of the charge on the dipole (ii) potential energy of the dipole.

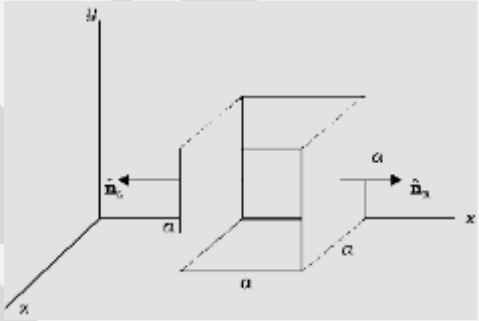
107. In the following network of capacitors, find the equivalent capacitance and total charge and potential difference across each capacitor.

108. 

109. Derive the expression for the energy stored in a parallel plate capacitor of capacitance C with air as medium between its plates having charges Q and — Q. Show that this energy can be expressed in terms of electric field, where A is the area of each plate and d is the separation between the plates. How will the energy stored in a fully charged capacitor change when the separation between the plates is doubled and a dielectric medium of dielectric constant 4 is introduced between the plates?

110. State Gauss' theorem. On the basis of this, prove that, for a point outside a charged spherical shell, it behaves as a point charge.

111. The electric field components in figure are $E_x = \alpha x^{1/2}$, $E_y = E_z = 0$, in which $\alpha = 800$ N/Cm$^{1/2}$. Calculate (a) the flux through the cube, and (b) the charge within the cube. Assume that a = 0.1 m.



UNIT DERIVATIONS

1. Explain what is meant by quantization of charge and conservation of charge, also give the important property of charge ?
2. State and explain coulomb's law, give the vector form of coulomb law.
3. Explain the concept of electric field. Give the relation between electric field strength and force.

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4. Derive expression for electric field intensity at a point due to a point charge.
5. Derive an expression for dipole field intensity at any point on (i) axial line (ii) equatorial line of dipole. (iii) at any point
6. Derive an expression for torque acting on electric dipole in a uniform electric field
7. Derive an expression for potential energy of an electric dipole in a uniform electric field.
8. Derive an expression for potential at a point due to point charge and due to an electric dipole.
9. State gauss's theorem in electrostatics. How will u prove it for spherically symmetric surfaces?
10. Using gauss's theorem , derive an expression for electric field intensity at a point due to a (i) line charge (ii) a uniformly charged spherical shell (ii) an infinite plane sheet of charge
11. Explain the term electric field intensity .electric field inside conductor is zero. Explain.
12. What is a capacitor? Define capacitance. discuss its units
13. Explain the principal of capacitor, Derive an expression for the capacitance of a parallel capacitor.
14. Three condensers C_1, C_2 and C_3 are connected in series. Derive an expression for the equivalent capacitance. Write two applications of capacitor
15. Derive an expression for the energy stored in a capacitor. What is the form of this energy and wherefrom it comes?
16. Three capacitors of capacitances C_1, C_2 and C_3 are connected (i) in series (ii) in parallel. Show that the total energy stored in the series combination is the same as that in parallel combination.
17. Explain what is meant by dielectric polarization. hence establish relation $k= 1+\chi$
18. Deduce the effect of introducing (i) a conducting slab (ii) a dielectric slab in between the plates of a parallel plate condenser on the capacitance of the condenser.
19. Discuss briefly the principal , construction and working of van – degraff generator . How is the leakage minimized from the generator?
20. Derive the expression of capacitance of parallel capacitor when (i) a conducting slab is placed (ii) when a dielectric slab is placed
21. Find the expression for energy stored in capacitor, find the expression for common potential.
22. What are the polar and non-polar dielectrics, how they behave in external electric field, give their example?
23. Find the energy density across the capacitor
24. What are the electric field lines give their important property ?
25. What are the equipotential , give their important property ?

EXTRA MARKS

1. Where the energy of capacitor does resides?
2. Do electrons tend to go to region of low or high potential?
3. What is the net charge on the charged capacitor?
4. A Gaussian surface encloses an electric dipole within it. What is the total flux across sphere?
5. Find the dimension of $\frac{1}{2}\varepsilon_o E^2$.
6. In a certain l m^3 of space, electric potential is found to be V Volt throughout. What is the electric field in this Region?
7. If Coulomb law involves $1/r^3$ instead of $1/r^2$ dependence, would Gauss law be still true?
8. An electrostatic field line can't be discontinuous, why?
9. The given graph shows that the variation of charge versus potential difference V for the two capacitors A & B. The two capacitors have same plate separation but the plate area of B is doubled than that of A.Which of the line in the graph corresponds to A & B and why?

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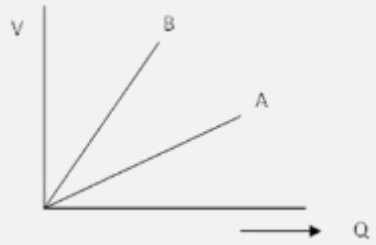

10. Three charges, each equal to +2C are placed at the corners of an equilateral triangle. If the force between any two charges be F, then what will be the net force on either Charge?
11. A point charge q is placed at O as shown in the figure. Is V_P-V_Q +ve or –ve when (i) q>0, (ii) q<0? Justify your answer.
12. An electric dipole of dipole moment 20 X 10^{-6} C.m is enclosed by a closed surface. What is the net flux coming out of the surface?
13. Why does the electric field inside a dielectric decrease when it is placed in an external electric field?
14. Write the magnitude and direction of electric field intensity due to an electric dipole of length 2a at the midpoint of the line joining the two charges
15. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in fig. What is the electric field inside the emptied sphere?
16. A charged particle is free to move in an electric field. Will it always move along an electric line of force?
17. If V (=q/4πεor) is the potential at a distance r due to a point charge q, then determine the electric field due to a point charge q, at a distance r.
18. Can electric potential at any point in space be zero while intensity of electric field at that point is not zero?
19. Devise an arrangement of three point charges separated by finite distances that has zero electric potential energy.
20. Each of the uncharged capacitor in the fig. Has a capacitance of 25μF. What charge shall flow through the meter M when the switch S is Closed?
21. Charge of 2C is placed at the centre of a cube of volume 8 cm3. What is the electric flux passing through one face?
22. A charged particle q is shot towards another charged particle Q which is fixed, with a speed v. It approaches Q up to a closest distance r and then returns. If q were given a speed 2v, then find the closest distance of approach.
23. Two capacitors of capacitance 6mF and 12mF are connected in series with the battery. The voltage across the 6mF capacitor is 2 volt .Compute the total battery voltage.
24. A parallel plate capacitor with air between the plates has a capacitance of 8 pF . The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance of parallel plate capacitor in second case.
25. Five identical capacitors, each of capacitance C are connected between points X and Y as shown in the figure. If the equivalent capacitance of the combination between X and Y is 5mF. Calculate the capacitance of each capacitor.
26. An uncharged capacitor is connected to a battery. Show that half of the energy supplied by the battery is lost as heat while charging the capacitor.
27. What is the angle between the electric dipole moment and electric field strength due to it on the equilateral line?
28. Find the equivalent capacitance between A & B, if capacitance of each capacitor is C.

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29. Eight identically charged drops are joined to form bigger drop. By what factor the charge and potential change?
30. A uniform electric field of 2 kNC^{-1} is in the x-direction. A point charge of 3 μC initially at rest at the origin is released. What is the kinetic energy of this charge at x = 4m?
31. Two identical metal plates are given the charges Q_1 and Q_2 ($Q_2 < Q_1$) respectively. If they are now brought close together to form a parallel plate capacitor with capacitance C then what is the potential difference between them?
32. Three charges Q, +q and +q are placed at the vertices of a right angle isosceles triangle as shown. Find the magnitude of Q for which net electrostatic energy of the configuration is zero.
33. An infinite number of charges each having charge 'q' along x-axis at x=1 ,x=2, x=4 ,x=8 an so on. Find the electric field at x=0 due to these charges.
34. A charge Q is distributed over the two concentric hollow spheres of radii 'r' and 'R' (R>r) such that the surface densities are equal. Find the potential at the common centre.
35. An electric dipole is held in an uniform electric field. Using suitable diagram, show that it doesn't undergo any translatory motion, and (ii)Derive an expression for torque acting on it and specify its direction.
36. The field potential inside a charged ball depends only on the distance from its centre as $V=ar^2+b$,where a and b are constants. Find the space charge distribution r(r) inside the ball.

UNIT 2 CHAPTER 3

1. Name the device used for measuring the internal resistance of a secondary cell?
2. A set of n identical resistors, each of resistance R ohm, when connected in series have an effective resistance X ohm and when the resistors are connected in parallel, their effective resistance is Y ohm. Find the relation between R, X and Y.
3. Name any one material having a small value of temperature coefficient of resistance. Write one use of this material.
4. How does the drift velocity of electrons in a metallic conductor vary with increase of temperature?
5. A carbon resistor marked with rings Blue, yellow and Brown respectively is connected in series with a resistance of 20 Ω and a battery of 10 V. What will be the current through the resistance?
6. A carbon resistor of 47 KΩ is to be marked with rings of different colours for its identification. Write the sequence of colours of rings.
7. Derive Ohm's law in vector form. Draw V-I graph of Gallium Arsenide which depict non ohmic behaviour.
8. Write two advantages and two disadvantages of a secondary cell over a primary cell.
9. State the condition in which terminal voltage across a secondary cell is equal to its emf.
10. Explain why a potentiometer is preferred over a voltmeter for measuring potential differences.
11. The resistivity of a metal X is 3.2×10^{-8} while the free electron density is 5×10^{28} m^{-3}. Find the drift velocity of electrons if a potential gradient of 1 Vm^{-1} is applied across X.
12. Explain mathematically, why the resistance of metals increases while that of semiconductor decreases with the rise in temperature.
13. Find the equivalent resistance between terminals *X* and *Y* of network shown in figure.

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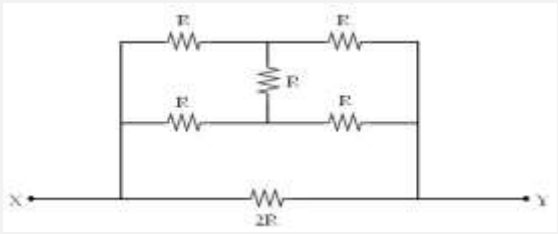
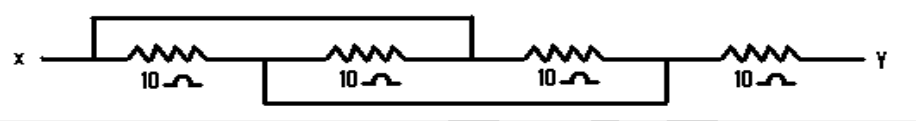
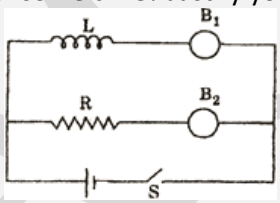


14. On what factors does internal resistance of a cell depend upon?
15. A Potential difference is applied at the ends of copper wire of 1m long. Calculate the average drift velocity of electrons. Compare it with the thermal velocity at 27•C (σ_{cu} =5.81x10^7 siemens and no. density of conduction electrons = 8.5 x $10^{28}/m^3$)
16. A wire is stretched to double its length. What will be the effect on its resistivity?
17. Two cells of same e.m.f. E but of different internal resistances r_1 and r_2 are connected in series with an external resistance R. potential drop across the first cell is found to be zero. What is the value of R?
18. Four resistors of resistance each of 10Ω is connected as given below.

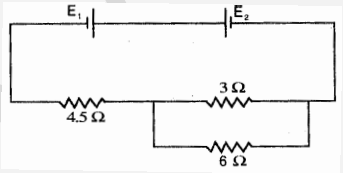


19. A battery of emf 10V and internal resistance 3 Ω connected to a resistor R.If the current in the circuit is 0.5A. Calculate the value of R. What is the terminal voltage of the battery when the circuit is closed?
20. How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reason for each case.
21. In a given circuit, inductor L and resistor R have identical resistance. Two similar electric lamps B 1 and B 2 are connected as shown. When switch S is closed, (i) which one of the lamps lights up earlier, (ii) will the lamps be equally bright after some time? Justify your answer.

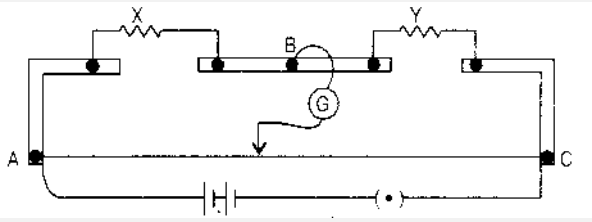


a.

22. Two cells E1 and E2 in the given circuit diagram have an emf of 4V and 8V and internal resistance 0.5Ω and 1.0Ω respectively. Calculate the current flowing through the resistance of 3Ω.



23. The given figure shows the experimental set up of a meter bridge. The null point is found to be 60 cm away from the end A with X and Y in position as shown.



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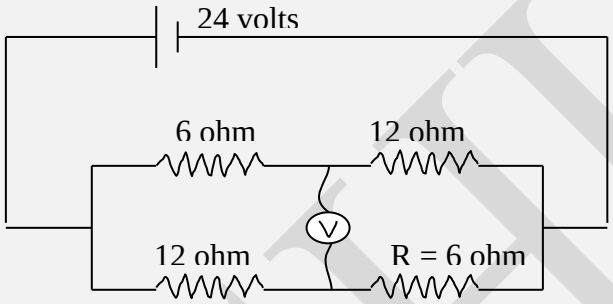
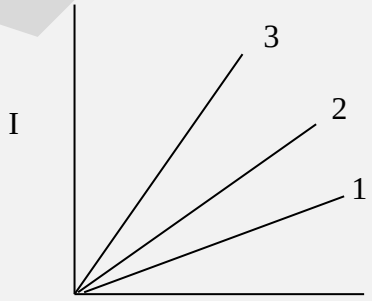
When a resistance of 15Ω is connected in series with 'Y', the null point is found to shift by 10 cm towards the end A of the wire. Find the position of null point if a resistance of 30Ω were connected in parallel with 'Y'.

24. Define mobility and mention its SI unit
25. Two resistors are connected in parallel b/w A and B to give a net resistance of 2 ohms. When one of these resistors is broken, the net resistance becomes 3 ohms. What is the resistance of the resistor that was broken?
26. In a meter bridge experiment with a fixed resistor of 10 ohm, the balance length is found to be 75cm. What resistance should be added in series with this fixed resistor so as to bring the null point in the center of the wire?
27. In the circuit diagram, what is the reading of the voltmeter? (b) What resistance should be connected in series with the R = 6 ohm resistor so that the voltmeter reading become zero?



28. Two wires X, Y have the same resistivity, but their cross-sectional areas are in the ratio 2 : 3 and lengths in the ratio 1 : 2. They are first connected in series and then in parallel to a D.C. source. Find out the ratio of the drift speeds of the electrons in the two wires for the two cases.
29. Explain how the average velocity of free electrons in a metal at constant temperature, in an electric field, remains constant even though the electrons are being constantly accelerated by this electric field?
30. A storage battery of emf 12 volt and internal resistance being charged by a 130 volt dc supply using a series resistor of 15.5 ohm what is the terminal voltage of the battery during charging ? What is the purpose of having a series resistor in the charging circuit?
31. A 10 meter long wore of uniform cross section of 20 Ω resistance is used as a potentiometer wire. This wire is connected in series with a battery of 5 volt, along with an external resistance of 480 ohm. if an unknown emf E is balanced a t 600 cm of this wore calculate (i) the potential gradient of the potentiometer wire and (ii) the value of the unknown emf E
32. Free electrons in a conductor are not at rest. How can you explain the absence of electric current without potential difference across its ends?
33. Why Wheatstone method is considered unsuitable for measurement of very low resistance?
34. The I-V graphs of two resistors and their series combination, are shown below. Which one of these graphs represents the series combination of the other two? Give reasons for your answer.



35. The storage battery of a car has an e.m.f. of 12 V. If the internal resistance of the battery is 0.4 Ω , what is the maximum current that can be drawn from the battery?
36. A wire of uniform cross-section and length l has a resistance of 16 ohm. It is cut into four equal parts. Each part is stretched uniformly to length l and all the four stretched parts are connected in parallel.

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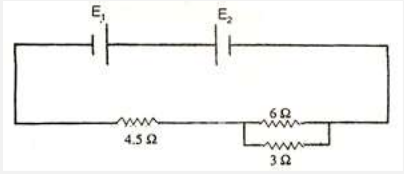
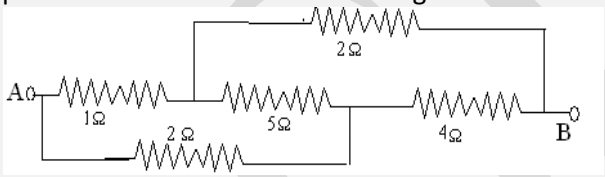
Calculate the total resistance of the combination so formed. Assume that stretching of wire does not cause any change in the density of its material.

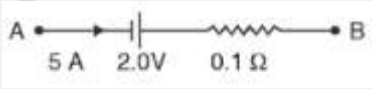
37. Write the mathematical relation between mobility and drift velocity of charge carriers in a conductor. Name the mobile charge carriers responsible for conduction of electric current in (i) an electrolyte (ii) an ionised gas.
38. Calculate the value of current flowing through the resistance of 6 ohm.



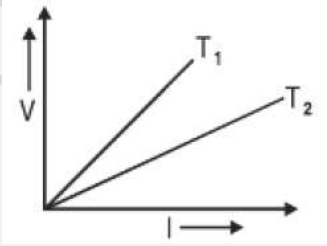
39. A conductor of length l is connected to a dc source of emf V. if the length of the conductor is tripled by stretching it, keeping V constant, explain how do the following factors vary in the conductor.
    a. Drift speed of electron
    b. Resistivity
40. A battery of emf 10V and internal resistance 3 Ω connected to a resistor R.
    (i) If the current in the circuit is 0.5A. Calculate the value of R.
    (ii) What is the terminal voltage of the battery when the circuit is closed?
41. A carbon resistor is marked with yellow violet and red colour strips. What is its resistance?
42. State laws which are used for calculating equivalent resistance of unbalanced wheat stone bridge.
43. Calculate the equivalent resistance of the following circuit.



44. What is the colour code for a resistor of resistance 350mΩ with 5% tolerance?
45. Two cells of emf is 4.5V and 6.0V and internal resistance 6Ω and 3Ω respectively have their negative terminals joined by a wire of 18Ω and positive terminals by a wire of 12Ω resistance. A third resistance wire of 24Ω connects middle points of these wires. Using Kirchhoff's laws, find the potential difference at the ends of this third wire.
46. A battery of emf 2.0 volts and internal resistance 0.1 ohm is charged with a current of 5.0A. What is the potential difference between the terminals of the battery?



47. V-I graph for a metallic wire at two different temperatures T1 and T2 is as shown in the figure. Which of the two temperatures is higher and why?



48. Draw a graph of V vs I for a material that doesn't obey Ohm's Law. Name the material.
49. A parallel combination of three resistors draws a current of 7.5A from a 30V supply. If two resistors are 10Ω and 12Ω. Find the resistance of third one.
50. Define electrical conductivity. How it is related to current density?

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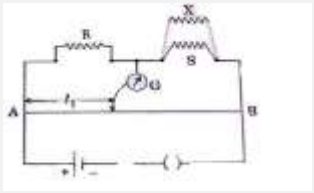
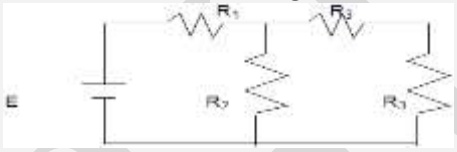
51. In a meter bridge balance point is found at a distance l1 with resistances R and S as shown in figure. When an unknown resistance X is connected in parallel with resistance S, the balance point shifts to a distance l2. Find the expression for X in terms of l1, l2 and S.

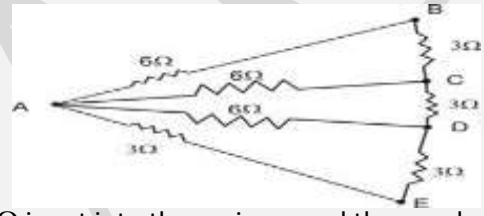


52. The colour bands of a carbon resistor are in sequence yellow, blue, green and silver respectively. Compute the value of its resistance.
53. Three identical resistors, each of resistance R, when connected in series with a D.C. source, dissipate power X. If the resistors are connected in parallel to the same D.C. source, how much power will be dissipated?
54. Determine the voltage drop across the resistance R_1 in the circuit given with E = 65 V. R_1 = 50 ohms, R_2 = 100 ohms, R_3 =100 ohms, R_4 = 300 ohms.

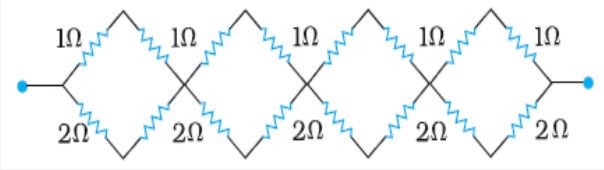


55. Find the value of current drawn from the cell in the circuit shown.

56. A wire of resistance 40 Ohm is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?
57. Calculate the resistance between A and B



58. A wire of resistance 3Ω is cut into three pieces and then each piece is stretched to three times of length. These pieces are connected in parallel and connected across a battery of emf 3 V. Find the current through each resistance.
59. Two cells of emf E_1 and E_2 have internal resistance r_1 and r_2. Deduce an expression for equivalent emf of their parallel combination.
60. A cell of emf (E) and internal resistance (r) is connected across a variable external resistance (R). Plot graphs to show variation of (i) E with R (ii) Terminal p.d. of the cell (V) with R
61. Explain why a potentiometer is preferred over a voltmeter for measuring potential differences.
62. Find the net resistance between two ends.



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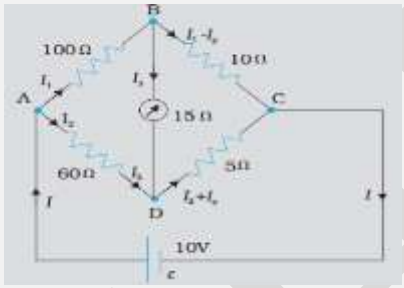
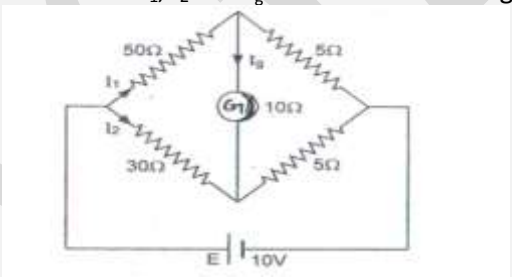
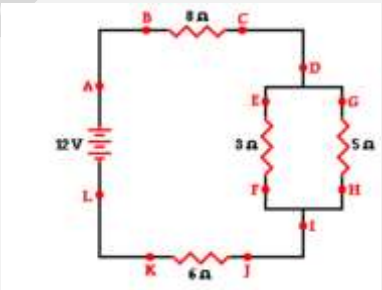
63. Three identical resistors, each of resistance R, when connected in series with a D.C. source, dissipate power X. If the resistors are connected in parallel to the same D.C. source, how much power will be dissipated?
64. 4 identical cells, each of emf 2 v are joined in parallel providing supply of current to external circuit consisting of two 15 Ω resistance joined in parallel. The terminal voltage of the cells, as read by an ideal voltmeter is 1.6 volt. Calculate the internal resistance of each cell.
65. How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reason for each case.
66. The four arms of a Wheatstone bridge have the following resistances: AB = 100Ω, BC = 10Ω, CD = 5Ωand DA = 60Ω. Galvanometer of 15Ωresistance is connected across BD. Calculate the current through the galvanometer when a potential difference of 10 V is maintained across AC.



67. Two cells of emf 1.5 V and 2 V and internal resistance 1 ohm and 2 ohm respectively are connected in parallel to pass a current in the same direction through an external resistance of 5 ohm. (i) Draw the circuit diagram.(ii) Using Kirchhoff's laws, calculate the current through each branch of the circuit and potential difference across the 5 ohm resistor. 3
68. Use Kirchhoff's laws to find the currents I_1, I_2 and I_g in Wheatstone bridge shown in figure.



69. Consider the combination circuit in the diagram at the right. Use the diagram to fill in the blanks with (greater than, equal to or less than). Assume that the voltage drops in the wires themselves in negligibly small. Consider only magnitude of potential difference for each part. Show proper working for each result obtained.



a. The electric potential difference between points B and K is _____ the electric potential difference between points D and I.
b. The electric potential difference between points E and F is _____ the electric potential difference between points D and I.
c. The electric potential difference between points J and K is _____ the electric potential difference between points D and I.

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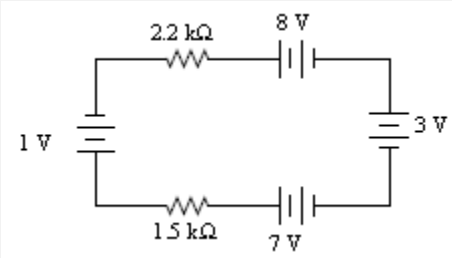
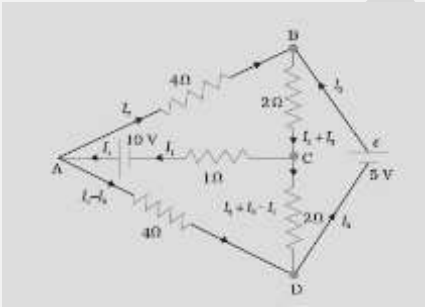
d. The electric potential difference between points L and A is _____ the electric potential difference between points B and K.

70. Given the resistances of 1Ω, 2Ω, 3Ω and 4Ω, how will we combine them to get an equivalent resistance of (a) (25/7) Ω (b) (25/12) Ω (c) (28/11) Ω

71. Calculate the current flowing in the following circuit and the heat loss across 2.2 kΩ resistor in 10 seconds.

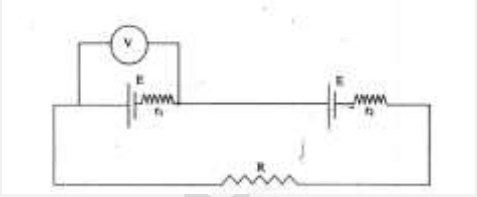


72. Determine the currents I_1 , I_2 , I_3 in the following network using Kirchhoff's laws.(NCERT)



73. Determine the net resistance and current drawn from a 12V supply with internal resistance of 0.5Ω by five resistors which are connected parallel. Each resistor has 1Ω resistance.

74. Two cells of the same emf E, but different internal resistance r_I and r_2 are connected to an external resistance R as shown. in the figure. The voltmeter V reads zero. Obtain an expression for R in terms of r_I and r_2. Calculate the voltage across the cell of internal resistance r_2. (Assume that the voltmeter V is of infinite resistance).



UNIT DERIVATIONS

112. What is drift velocity of electrons and relaxation time of free electrons in a metallic conductor carrying a current ? establish a relation between them .
113. State the ohm's law, derive the relation between resistance and relaxation time
114. Define the current density, prove the relation J=σE where E is the electric field, and σ is the conductivity
115. Define the resistively of the material . state its si unit and discuss with temperature in case of (i) metals (ii) semiconductors and (iii) insulators.
116. Find the total resistance when the various resistors are connected (i) in series and (ii) in parallel
117. State and explain Kirchhoff's law
118. What is potentiometer ? explain its principal of working . how can you compare the emf of two cells using potentiometer?
119. Give the principal of wheat stone bridge. How do you it to measure the unknown resistance ? explain

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120. Derive the Wheatstone bridge condition P/Q=R/S
121. State the principal of potentiometer . with the help of circuit diagram describe a method to find the internal resistance of primary cells and also giet diagram to compare the emf of two cells ?
122. Find the equivalent EMF of two cells when they are connected in series and in parallel, to the external resistance R, and their internal resistance r_1 and r_2

EXTRA MARKS

1.Magnesium is used for making standard resistors, why?
2. The sequence of bands marked on a carbon resistor are: Red, Red, Red, Silver. Write the value of resistance with tolerance.
3. A wire of resistively ρ is stretched to three its initial length, what will be its new resistively.
4. If p.d.v applied across a conductor is increased to 2v, how will the draft velocity of the electrons change?
5. A 10Ω thick wire is stretched so that its length becomes three times. Assuming that there is no change in its density on stretching. Calculate the resistance of new wire.
6. You are given 8 Ω resistor. What length of wire of resistance 120 Ωm-1 should be joined in parallel with it to get a value of 6 Ω ?
7. Three resistance 3Ω,6Ω and 9Ω are connected to a battery. In which of them will the power dissipation be maximum if
a) They are all connected in parallel
b) They are all connected in series
Give reason.
8. A silver wire has a resistance of 2.1Ω at 27.5˚c and a resistance of 2.7Ω at 100˚c. determine the temperature coefficient. of resistivity of silver.
9. Give any two applications super conductors.
10. Two wire of equal length one copper and manganic have same resistance , which wire is thicker?
11. Why manganin is used for making standard resistor?
12. A copper wire of resistivity r is stretched to reduce its diameter to half of its previous value .What will be the new resistances?
13. How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reason for each case.
14. If the length of the wire conductor is doubled by stretching it , keeping potential difference constant by what factor the drift speed of the electron changed.
15. If the temperature of the conductor increases, how does the relaxation time of electron changes.
16. A heater joined in series with the 60W bulb .With change of bulb with 100 W in the circuit, the rate heat produce by the heater will more or less or remain same.
17. What will be the change in the resistance of the circular wire , when its radius is halved and length is reduced by ¼ th of original length.
18. Two 120V light bulbs , one of 25W and another of 200W are connected in series . One bulb burnt out almost instantaneously ?.Which one was burnt and why?.
19. A given copper wire is stretched to reduce its diameter is half of its original value. What will the new resistance?.

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20. A student has two wire of iron and copper of equal length and diameter. He first joins two wires in series and pass electric current through the combination which increases gradually. After that he joins two wires in parallel and repeats the process of passing current. Which wire will glow first in each case?
21. A cylindrical metallic wire is stretched to increase its length by 5% . Calculate the percentage change in resistances.
22. A wire of resistance 4R is bend in the form of circle .What is the effective resistance between the ends of diameter?.
23. Two wires A and B have same lengths and material , have their cross sectional areas 1:4 , what would be the ratio of heat produced in these wires when the voltage across each is constant.
24. Two bulbs whose resistance are in the ratio of 1:2 are connected in parallel to a source of constant voltage. What will be the ratio of power dissipation in these?
25. Total resistance of the circuit is R/3 in which three identical resistors are connected in parallel. Find the value of each resistance?.

UNIT 3 CHAPTER 4 & 5

1. Which are of the following will describe the smallest circle when projected with the same velocity v perpendicular to the magnetic field B (i) α particle and (ii) β particle?
2. A compass needle, pivoted about the horizontal axis, and free to move in the magnetic meridian, is observed to point along the
    a. vertical direction at place A
    b. horizontal direction at a place B. Give the value of the angle of dip at these two places.
3. Name the quantity represents minimum magnetic moment of a revolving electron. Write its expression.
4. Two wires of equal lengths are bent in the form of two loops. One of the loops is square shaped whereas the other loop is circular. These are suspended in a uniform magnetic field and the same current is passed through them. Which loop will experience greater torque? Give reasons.
5. The vertical component of earth's magnetic field at a place is √3 times the horizontal component. What is the value of angle of dip at the place?
6. What will be the effect on angular speed of charge in magnetic field if speed of motion while entering is doubled?
7. The magnetic lines of force prefer to pass through iron than air". Give reason.
8. What is the nature of magnetic field in a moving coil galvanometer?
9. What type of magnetic material is used in making permanent magnets?
10. Horizontal component of Earth's magnetic field at a place is 3 times the vertical component. What is the value of angle of dip at this place?
11. Why do magnetic lines of force prefer to pass through iron than through air?
12. An electron is moving at 10^6m/s in a direction parallel to a current of 5 A, flowing through an infinitely long straight wire, separated by a perpendicular distance of 10 cm in air. Calculate the magnitude of the force experienced by the electrons.
13. Draw the directions of magnetic field lines at point A, B, C and D in the figure given below.

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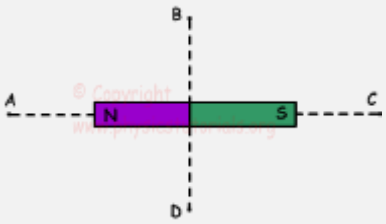

14. Describe the principle, of a moving coil galvanometer.
15. A circular coil of radius r is carrying current I. At what distance from the centre of loop on the axis magnetic field is one light the magnetic field at the centre
16. An electron moving through a magnetic field does not experience a force. Under what condition is this possible?
17. Name two places in India where the magnetic needle shows true north quite accurately.
18. In a cyclotron mutually perpendicular electric field E and magnetic field B are used to accelerate the charged particle only. What is the function of; (a) Electric field E, (b)Magnetic field B
19. Define magnetic susceptibility of a material. Name two elements one having positive susceptibility and other having negative susceptibility.
20. Define the terms 'Magnetic Dip' and 'Magnetic Declination' with the help of relevant diagrams.
21. How can you turn a galvanometer into a voltmeter? Give the necessary equation.
22. A galvanometer having a coil resistance 100 Ω gives a full scale deflection when a current of 1 mA is passed through it. What is the value of the resistance which can convert this galvanometer into a meter giving full scale deflection for a potential difference of 10 V?
23. Give two advantages of the presence of a soft iron core in a moving coil galvanometer.
24. An electron does not suffer any deflection while passing through a region. Are sure that there is no magnetic field?
25. An electron beam projected along +X axis, experiences a force due to a magnetic field along the + Y-axis. What is the direction of the magnetic field?
26. How will a dia & ferro magnetic material behave when kept in a non-uniform external field? Give two examples each.
27. Why should the spring/suspension wire in a moving coil galvanometer have low torsional constant?
28. Define magnetic susceptibility of a material. Name two elements one having positive susceptibility and other having negative susceptibility.
29. A straight wire carries a current of 3A.Calulate the magnitude of the magnetic field at a point 10cm away from the wire. Draw diagram to show the direction of the magnetic field.
30. A galvanometer coil has a resistance of 12 Ω and it shows full scale deflection for a Current of 3mA. How will you convert the galvanometer into a voltmeter of range 0 to 18 volt?
31. P and Q are long straight conductors r distance a part N is a point in the place of wires r/4 distance away from P carrying current I. What is the magnitude & direction of current in the wire Q, so that net magnetic field at N is zero.
32. A bar magnet of magnetic moment Nv held in magnetic field of strength B what is (a) Maximum torque on the magnet (b) Work done in turning it from stable equilibrium to unstable equilibrium.
33. Two long parallel straight wires X and Y separated by a distance of 5 cm in air carry currents of 10 A and 5 A respectively in opposite directions. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y

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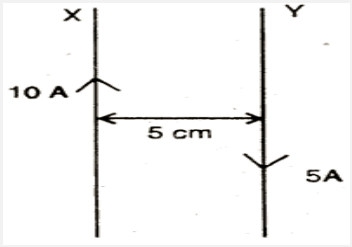

34. Use Ampere's circuital law to derive the formula for the magnetic field due to an infinitely long straight current carring wire.
35. Two protons are entering a magnetic field perpendicular to the magnetic field with velocities in the ration 1:2. What is the ratio of their angular frequencies?
36. The current is set up in a long copper pipe. Is there a magnetic field (i) inside (ii) outside the pipe?
37. An electron does not suffer any deflection while passing through a region of uniform magnetic field. What is the direction of the magnetic field?
38. The permeability of magnetic material is 0.9983 .Name the type of magnetic material it represents.
39. A magnetic needle free to rotate in a vertical parallel to the magnetic meridian has its north tip down at 60^0 with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4G.Determine the magnitude of the earth's magnetic field at the place.
40. A circular coil of100 turns, radius 10 cm carries a current of 5 A. it is suspended vertically in a uniform horizontal magnetic field of 0.5 T, the field lines making an angle of 60^0 with the of the plane of the coil. Calculate of the torque must be applied on it to prevent it from turning.
41. Define angle of dip. If the ratio of the horizontal component of earth's magnetic field to the resultant magnetic field at a place is $1/\sqrt{2}$, what is the angle of dip at that place?.
42. You are given a low resistance R_1, a high resistance R_2 and a moving coil galvanometer. Suggest how you would use these to have an instrument than will be able to measure :
    a. Current
    b. Potential difference
43. No force is exerted by a stationary charge when placed in a magnetic field. Why?
44. a galvanometer of resistance of 15Ω gives full scale deflection for a current of 2mA . calculate the shunt resistance needed to convert it to an ammeter of range 0—5A.
45. State Biot-savart law. An electron is moving at 10^6 m/s in a direction parallel to a current of 5 A flowing through an infinitely long wire at a perpendicular distance of 10 cm in air. Calculate the magnitude of force experienced by an electron.
46. Deduce an expression for torque experienced by a circular coil of radius 'r' carrying current " I " is placed in presence of uniform magnetic field of strength 'B'. Using this expression show that the deflection in galvanometer is directly proportional to the current flowing through it.
47. Give one possible alignment of vectors $\vec{B}$, $\vec{v}$ and $\vec{E}$ such that a charged particle moving with velocity $\vec{v}$ shows helical motion. None of the vectors are zero in magnitude.
48. What is the radius of the path of an electron moving at a speed of 3×10^7 m/s in a magnetic field of 6×10^{-4} T perpendicular to it?
49. A bar magnet, held horizontally, is set into angular oscillations in Earth magnetic field. It has time periods T_1 and T_2 at two places, where the angles of dip are θ_1 and θ_2 respectively. Deduce an expression for the ratio of the resultant magnetic fields at the two places.

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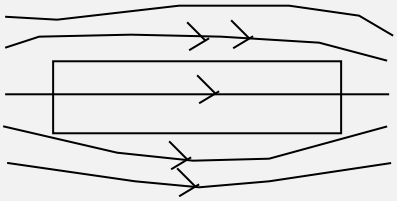
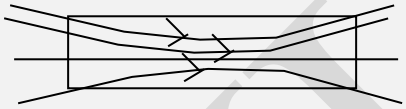
50. An electron is moving with a speed of 10^8 m/sec enters a magnetic field of 5 X 10^{-3} T at right angles to the magnetic field. Find :-
    a. frequency of revolution of electron.
    b. Time period of revolution of electron
51. Deduce an expression for the cyclotron frequency and show that it does not depend on the speed of the charged particle.
52. Prove that in a radial magnetic field, the deflection of the coil is directly proportional to the current flowing in the coil.
53. A uniform magnetic field gets modified as shown below, When two specimens X and Y are placed in it.





Identify the two specimens X and Y

54. What do you mean by the statement that susceptibility of Fe is more than that of Cu?
55. Which one of the two – an ammeter or a milli-ammeter, has greater resistance, when made from identical galvanometers?
56. Force is given by F=q*(V*B) of these name the pairs of vector which are always at right angles to each other.
57. If the current sensitivity of a moving coil – galvanometer is increased by 20%, its resistance also increase by 1.5 times, How will the voltage sensitivity of the galvanometer be affected .
58. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid-air by a uniform horizontal magnetic field B. What is the magnitude of the magnetic field?
59. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 500 turns. It carries a current of 5 A. What is the magnitude of the magnetic field inside the solenoid?
60. A 100 turn closely wound circular coil of radius 10 cm carries a current of 3.2 A. (a) What is the field at the centre of the coil? (b) What is the magnetic moment of this coil? The coil is placed in a vertical plane and is free to rotate about a horizontal axis which coincides with its diameter.
61. A uniform magnetic field of 2T in the horizontal direction exists such that initially the axis of the coil is in the direction of the field. The coil rotates through an angle of 90º under the influence of the magnetic field. (c) What are the magnitudes of the torques on the coil in the initial and final position? (d) What is the angular speed acquired by the coil when it has rotated by 90º? The moment of inertia of the coil is kg m2.
62. A toroid has a core (non-ferromagnetic) of inner radius 25 cm and outer radius 26 cm, around which 3500 turns of a wire are wound. If the current in the wire is 11 A, what is the magnetic field (a) outside the toroid, (b) inside the core of the toroid, and (c) in the empty space surrounded by the toroid.
63. An electron travelling west to east enters a chamber having a uniform electrostatic field in north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path.
64. A straight horizontal conducting rod of length 0.45 m and mass 60 g is suspended by two vertical wires at its ends. A current of 5.0 A is set up in the rod through the wires. (a) What magnetic field should be set up normal to the conductor in order that the tension in the wires is zero? (b) What will be the total tension in the

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wires if the direction of current is reversed keeping the magnetic field same as before? (Ignore the mass of the wires.) g = 9.8 m $s^{-2.}$

65. The wires which connect the battery of an automobile to its starting motor carry a current of 300 A (for a short time). What is the force per unit length between the wires if they are 70 cm long and 1.5 cm apart? Is the force attractive or repulsive?
66. A current carrying loop, free to turn, is placed in a uniform magnetic field B. What will be its orientation relative to B, in the equilibrium state?
67. A uniform magnetic field of 1.5 T exists in a cylindrical region of radius10.0 cm, its direction parallel to the axis along east to west. A wire carrying current of 7.0 A in the north to south direction passes through this region. What is the magnitude and direction of the force on the wire if, (a) the wire intersects the axis, (b) the wire is turned from N-S to northeast-northwest direction, (c) the wire in the N-S direction is lowered from the axis by a distance of 6.0 cm?
68. A solenoid 60 cm long and of radius 4.0 cm has 3 layers of windings of 300 turns each. A 2.0 cm long wire of mass 2.5 g lies inside the solenoid (near its centre) normal to its axis; both the wire and the axis of the solenoid are in the horizontal plane. The wire is connected through two leads parallel to the axis of the solenoid to an external battery which supplies a current of 6.0 A in the wire. What value of current (with appropriate sense of circulation) in the windings of the solenoid can support the weight of the wire? g = 9.8 m s^{-2}.
69. A galvanometer coil has a resistance of 15 Ω and the metre shows full scale deflection for a current of 4 mA. How will you convert the metre into an ammeter of range 0 to 6 A?
70. A short bar magnet placed with its axis at 30º with an external field of 800 G experiences a torque of 0.016 Nm. (a) What is the magnetic moment of the magnet? (b) What is the work done in moving it from its most stable to most unstable position? (c) The bar magnet is replaced by a solenoid of cross-sectional area 2×10^{-4} m2 and 1000 turns, but of the same magnetic moment. Determine the current flowing through the solenoid.
71. A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of 2A. If the number of turns is 1000 per metre, calculate (a) H, (b) M, (c) B and (d) the magnetising current I_m.
72. A domain in ferromagnetic iron is in the form of a cube of side length 1mm. Estimate the number of iron atoms in the domain and the maximum possible dipole moment and magnetization of the domain. The molecular mass of iron is 55 g/mole and its density is 7.9 g/cm3. Assume that each iron atom has a dipole moment of 9.27×10^{-24} Am^2.
73. Paramagnetic material display greater magnetization as their temperature is lowered why?
74. A closely wound solenoid of 800 turns and area of cross section 2.5×10^{-4} m^2 carries a current of 3.0 A. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?
75. If the solenoid in is free to turn about the vertical direction and a uniform horizontal magnetic field of 0.25 T is applied, what is the magnitude of torque on the solenoid when its axis makes an angle of 30° with the direction of applied field?
76. At a certain location in Africa, a compass points 12º west of thegeographic north. The north tip of the magnetic needle of a dip circle placed in the plane of magnetic meridian points 60º above the horizontal. The horizontal component of the earth's field is measured to be 0.16 G. Specify the direction and magnitude of the earth's field at the location.
77. a magnetic dipole is under the influence of two magnetic fields. The angle between the field directions is 60º, and one of the fields has a magnitude of 1.2×10^{-2} T. If the dipole comes to stable equilibrium at an angle of 15º with this field, what is the magnitude of the other field?

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78. Why does a paramagnetic sample display greater magnetization (for the same magnetising field) when cooled? (b) Why is diamagnetism, in contrast, almost independent of temperature? (c) If a toroid uses bismuth for its core, will the field in the core be (slightly) greater or (slightly) less than when the core is empty?
79. State Biot savart law .use it to derive an expression for the magnetic field due to a current carrying circular loop of N turns and radius R, at a point distance x from its centre on the axis of the loop.
80. Two circular coils X and Y having radii R and R /2 respectively are placed in horizontal plane with their centers coinciding with each other. Coil X has a current I flowing through it in the clockwise sense. What must be the current in coil Y to make the total magnetic field at the common centre of the two coils, zero? With the same currents flowing in the two coils, if the coil Y is now lifted vertically upwards through a distance R, what would be the net magnetic field at the centre of coil Y?
81. State Biot-Savart's Law. Using this law, derive the expression for the magnetic field due to current carrying circular loop of radius R, at a point, which is at a distance X from its center along the axis of loop. Consider two parallel co-axial circular coils of same radius R and number of turns N, carrying same current I in same direction, separated by a distance R Show that the field on the axis around the mid-point between the coils in uniform over a distance that is small as compared to R is given by $B= (0.72\mu_0 NI) / R$
82. write the expression for biot savart's law for the magnetic field due to a small current carrying element . using this theorem calculate magnetic field at the centre of current carrying circular coil of radius R having 'n' number of turns.
83. Explain the principle and working of a cyclotron with the help of a Labeled diagram. A cyclotron's oscillator frequency is 10 Mhz. What should be the operating magnetic field for accelerating protons? If the radius of its 'dees' is 60 cm, what is the kinetic energy of the proton beam produced by the accelerator? Express your answer in units of Me V.
84. A beam of electrons passes unelected through mutually perpendicular electric and magnetic fields E and B respectively. If the electric field is cut-off ,the electron beam moves in a circular path of radius 'r'.Derive the expression for e/m of electrons in terms of r,E and B.
85. Explain briefly the cause for helical motion of charged particles in presence of a magnetic field B and derive the expression for the pitch when a particle enters the magnetic field with velocity V.
86. Name the physical quantity which has the unit J/Tesla. Derive the magnetic field intensity at a given point due to straight conductor or coil carrying current. On a smooth inclined plane at 300 with the horizontal a thin current carrying metallic rod is placed parallel to the horizontal ground. The plane is located in a uniform magnetic field of 0.15 tesla in the vertical direction .For what value of current can the rod remains stationary? Mass per unit length is 0.30Kg/m
87. State the principle of working of galvanometer. In galvanometer (i) concave shaped poles are used (ii) phosphor-bronze alloy is used for the suspension wire. Explain why? The current sensitivity of moving coil galvanometer is 5 divisions/mA and voltage sensitivity is 20 division/volt. Calculate the resistance of galvanometer.
88. The graph shows the variation of B with H for a ferromagnetic material. What does each of the following represent in the fig? (i) Ob (ii) Oc.Should the area of the graph be less or more in case of a soft iron and why?

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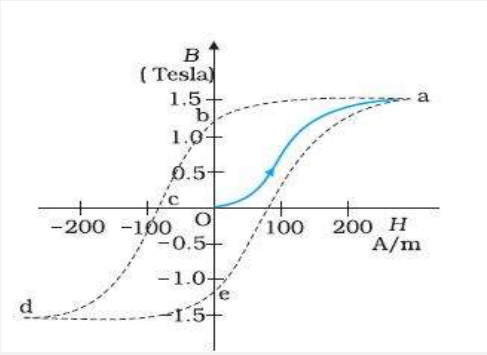

89. A straight thick long wire of uniform cross section of radius 'a' is carrying a steady current I. Use Ampere's circuital law to obtain a relation showing the variation of the magnetic field inside and outside the wire with distance r, (a > r) and (r > a) of the field point from the centre of its cross section. Plot the graph showing the nature of this variation. Calculate the ratio of magnetic field at a point a/2 above the surface of the wire to that at a point a/2 below its surface. What is the maximum value of the field of this wire?

EXTRA MARKS

1.Suppose a helical spring is suspended from the roof of a room and very small weight is attached to its lower end what will happen to the spring when a current is passed through it? Give reason to support your answer?
2. One alpha particle and a deuteron entered perpendicularly in a uniform magnetic field with same velocity. Which one follow the greater circle?
3. Out of Voltmeter and Millivoltmeter, which has the higher resistance?
4. Proton is moving along the axis of a solenoid carrying current of 2 A and 50 number of turns per unit length. What will be the force acting on the particle.
5. Out of Ammeter and Milliammeter, which has the higher resistance?
6. What is the source of magnetic field at point ?
7. Can a Moving Coil Galvanometer can be used to detect an A.C. in a circuit .Give reason.
8. Two wires of equal length are bent in the form of two loops. One loop is square whereas the other is circular. These are suspended in same magnetic field and same current is passed through them. Explain with reason which will experience greater torque?
9. The pole of a magnet is brought near to a stationary charge. What will be the force experienced by pole?
10. A charge particle moving in a magnetic field penetrates a layer of lead and thereby losses half of its kinetic energy. How does the radius of curvature of its path change?
11. A Voltmeter, an ammeter and a resistance are connected in series with a battery. There is some deflection in voltmeter but the deflection of ammeter is zero. Explain why?
12. A Current 'I' flows along the length of an infinitely long straight thin walled pipe. What is the magnetic field at any point on the axis of pipe?
13. The Earth's core contains iron but geologists do not regard this as a source of Magnetic Field, Why?
14.Is the Resistance of Voltmeter larger than or smaller than the resistance of Galvanometer from which it is converted.
15. A Magnetic Field dipole placed in a Magnetic Field experiences a net force. What can you say about the Nature of Magnetic Field?
16. Earth's Magnetic Field does not affect working of moving Coil Galvanometer. Why?

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17. Which type of Magnetism exists in all substances?
18.For what orientation P.E. of a Magnetic dipole placed in uniform Magnetic Field minimum?
19. How does a ferromagnetic material change its Magnetic properties if it is heated beyond its curie temperature?
20.A bar magnet is cut into two pieces, along its length. How will its pole strength be affected?
21.What is the work done by a magnetic force, in displacing a charged particle?
22. What is the net magnetic flux from a north (or south) pole of a magnet (dipole) ?
23. Name the device which works under the principle of velocity selector?
24. What is "Meissner effect"?
25. Two long straight wires are set parallel to each other. Each carries a current I in the same direction and the separation between them is 2r. What is the intensity of the magnetic field midway between them?
26.A proton is about 1840 times heavier than an electron. What will be its kinetic energy when it is accelerated by a potential difference of 1KV?
27. . A circular loop of radius R carrying current I ,lies in X-Y plane with its centre at origin. What is the total magnetic flux through X-Y plane?
28. A charge q moving along x axis with a velocity v is subjected to a uniform magnetic field B acting along the Z axis as it crosses the origin O.Trace its trajectory. Does the charge gain kinetic energy as it enters the magnetic field? Justify your answer.
29. A circular current carrying coil has a radius R. What is the distance from the centre of the coil on its axis where the magnetic field is 1/8 th of its value at the centre?
30. A magnetic needle suspended freely in a uniform magnetic field experiences torque but no net force. A nail made up of iron kept near a bar magnet experience a force of attraction and torque .Give reason.
31.What is the work done by a magnetic field on moving a charge? Give reason.
32. A particle with charge q moving with velocity v in the plane of the paper enters a uniform magnetic field B acting perpendicular to the plane of the paper. Deduce an expression for the time period of the charge as it moves in a circular path in the field . Why does the kinetic energy of the charge not change while moving in the magnetic field.
33. A solenoid of length 0.6m has a radius of 1cm and is made up of 600 turns. It carries a current of 5A.What is the magnetic field inside and at ends of solenoid.?
34. An element dl = dx i is placed at the origin and carries a large current I = 10A.What is the magnetic field on the y axis at a distance of 0.5m,
35. You are given a copper wire carrying current I of length L. Now the wire is turned into circular coil. Find the number of turns in the coil so that the torque at the centre of the coil is to maximum.
36. What is the magnetic field produced at the centre of curvature of an arc of wire of radius r carrying current I subtends an angle P /2radians at its centre.
37. If B is the magnetic field produced at the centre of a circular coil of one turn of length L carrying current I then what is the magnetic field at the centre of the same coil which is made into 10 turns?
38. A copper wire is bent into a square of each side 6cm.If a current of 2A is passed through a wire what is the magnetic field at the centre of the square?
39. Find the magnetic moment of a wire of length l carrying current I bent in the form of a circle.
40. When current is flowing through two parallel conductors in the same direction they attract while two beams of electrons moving in the same direction repel each other. Why?
41. Draw diagrams to show behavior of magnetic field lines near a bar of (i) Alluminium (ii) copper and (iii) mercury cooled to a very low temperature 4.2 K
42. The hysteresis loss for a sample of 6 kg is 150 J/M^2/cycle. If the density of iron is 7500 kg/m3, calculate the energy loss per hour at 40cycle.
43. A current carrying solenoid of 100 turns has an area of cross section 10-4 m2 .When suspended freely through its centre, it can turn in a horizontal plane .what is the magnetic moment of the solenoid for a current of 5A.Also calculate the net force and torque on solenoid if a uniform horizontal field of 10x10-2 T is set up at an angle of 30 degree with axis of solenoid when it is carrying the same current.

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44. Two concentric circular coils A and B of radii 10 cm and 6 cm respectively, lie in the same vertical plane containing the north to south direction. coil A has 30 turns and carries a current of 10 A . Coil B has 40 turns and carries a current of 15 A .the sense of the current in A is anticlockwise and clockwise in B for an observer looking at the coils facing west. Given the magnitude and direction of net magnetic field

45. The vertical component of earth's magnetic field at a given place is 3 times its horizontal component. If the total intensity of earth's magnetic field at a place is 0.4 G , find the value of horizontal component of earth's field and angle of dip.

46. north to south direction. Specify the direction in which the uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path.

47. A straight horizontal conducting rod of length 0.5 m and mass 50 g is suspended by two vertical wires at its ends.A current of 5A is set up in the rod through the wires.(i) What magnetic field should be set up normal to the conductor in order that the tension in the wires is zero?(ii)What will be the tension in the wire if the direction of current is reversed keeping the magnetic field same as before?(neglect the mass take $g=10m/s^2$)

48. A circular coil of 20 turns and radius 10cm is placed in a uniform magnetic field of 0.d10T normal to the plane of the coil. If the current in the coil is 5a,What is the (i)Total torque on the coil (ii) total force on the coil (iii) average ds force on each electron in the coil due to the magnetic field.(coil is made of copper, A= 10-5 m2 ,free electron density in copper is 10^{29} $/m^3$)

49. A Rowland ring of mean radius 15 cm has 3500 turns of wore wound on a ferromagnetic core of relative permeability 800.What is the magnetic field B in the core for a magnetizing current of 1.2 A?

50. A straight wire of mass 200g and the length 1.5m carries a current of 2A. It is suspended in midair by a uniform horizontal magnetic field B. What is the magnitude of B in tesla?

51. A rigid circular loop of radius r and mass m lies in the x-y plane of a flat table and has a current I flowing in it. At this particular place the earth's magnetic field is B = Bxi +Bzk. What is the value of I, so that loop starts tilting?

52. In an ammeter, 10% of main current is passing through the galvanometer. If the resistance of the galvanometer is G, then what is the shunt resistance in ohms?

53. The two rails of a railway track insulated from each other and the ground is connected to a milli voltmeter. What is the reading g of the millivolmeter when the train passes at speed 180km/hr along the track, given that the vertical component of earth's magnetic field is $0.2x10^{-4}$T and rails are separated by 1m

54. A charged particle moving in a magnetic field penetrates a layer of lead and there by loses half of its kinetic energy. How does the radius of curvature of its path changes? Radius r= mV/qB

54. The velocities of two α particles X and Y entering in an uniform magnetic field are in the ratio 2:1.On entering the field ,they move in different circular paths .Give the ratio of the radii of their paths?

55. In an exercise to increase current sensitivity of a galvanometer by 25 % , its resistance is increased by 1.5 times . How does the voltage sensitivity of the galvanometer be affected.

UNIT DERIVATIONS

1. Find the magnetic field at the centre of the circular coil carrying current. Show the sketch of the magnetic field produced.
2. Find the magnetic field at a point due to current flowing in a long straight conductor. Show the sketch of magnetic field produced.

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3. Find the magnetic field at a point on the axis of a circular coil carrying current and hence find the magnetic field at center of circular coil carrying current.
4. State and explain ampere's circuital law and by applying it find the magnetic field at a point well inside the solenoid carrying current.
5. Derive the expression of magnetic field due to toriod
6. State the biot savart law for the magnetic field due to a current carrying element .
7. Describe the motion of charge particle in uniform magnetic field (i) when it is moving perpendicular (ii) when it is moving with some angle ɵ, hence find the time period , velocity , radius of the charge particle,
8. What is cyclotron? Discuss its construction , working and theory . explain cyclotron frequency.
9. Discuss with the help of a neat diagram the construction and theory of moving coil galvanometer.
10. Derive the expression for the force acting on a current carrying conductor placed in a uniform field , name the rule which give the direction of the force . write the condition for which this force will have max. and min.
11. Find the expression for torque on the current carrying rectangular coil.
12. Find the force between two long straight current carrying parallel wire.
13. Find the time period , velocity . frequency of the charged particle when it is moving in perpendicular magnetic field.
14. How we can convert a galvanometer into ammeter and voltmeter explain.
15. Find the expression of magnetic field due to a bar magnet on the axial line and on the equatorial line.
16. Find the expression for torque and potential energy stored in a magnetic dipole in uniform external magnetic field.
17. Explain the angle of declination , dip and horizontal component of earth's magnetic field.
18. Explain the diamagnetic , paramagnetic and ferromagnetic substance. Give at least four property of these substance.
19. Explain the hysteresis curve , how it help to select the ferromagnetic substance.

UNIT 4 CHAPTER 6 & 7

1. In a series LCR circuit the voltage across inductor, a capacitor and a resistor are 30 V, 30 V and 60 V respectively. What is the phase difference between applied voltage and current in the circuit?
2. What is the power factor of an LCR series circuit at resonance?
3. On what conservation law is Lenz's law based ?
4. Define coefficient of mutual inductance for a pair of coils.
5. the power factor of an a.c circuit is .5 what will be the phase difference between voltage and current in this circuit.
6. When an AC of 200V is applied across a device X, a current of 0.5A flows through the circuit and is in phase with the applied voltage. When the same source is applied across another device Y, the same current flows through the circuit but it leads the applied voltage by $\pi/2$. Name the devices X and Y
7. An electrical element x, when connected to an alternating voltage source, has the current through it leading the voltage by $\pi/2$ radii. Identify x and write an expression for its reactance.
8. Why does a metallic plate become very hot when it is surrounded by a coil carrying high frequency alternating current?
9. What do you mean by Quality factor and what is it's significance?
10. A household circuit has a fuse of 5A rating. Calculate the number of bulbs of rating 60W-220V each which can be connected in this circuit.
11. Distinguish between resistance, reactance and impedance for an AC circuit.
12. A rectangular current loop is in an arbitrary orientation in an external uniform magnetic field. Is any work required to rotate the loop about an axis perpendicular to its plane? Explain.

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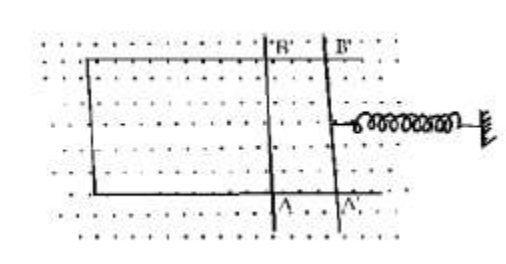
13. What do we mean by the term phasors? Draw a phasor diagram for an AC circuit with a capacitor.
14. Give two advantages of eddy currents in electrical appliances.
15. A lamp is connected in series with an inductor to a d.c. source. What will happen to its glow, when it is connected directly to the same source?
16. A sinusoidal voltage V=200sin 314t is applied to a resistor of 10 ohm resistance. Calculate
    a. Rms value of voltage
    b. Rms value of current
    c. Power dissipated as heat in watt
17. A rectangular wire frame, shown below, is placed in a uniform magnetic field directed upward and normal to the plane of the paper. The part AB is connected to a spring. The spring is stretched and released when the wire AB has come to the position $A\backslash B\backslash$ (t=0). How would the induced emf vary with time? Neglect damping



18. A bulb and a capacitor are connected in series to an a.c. source of variable frequency. How will the brightness of the bulb change on increasing the frequency of the a.c. source? Give reason.
19. the power factor of an a.c circuit is .5 what will be the phase difference between voltage and current in this circuit.
20. If the number of turns of a solenoid is doubled, keeping the other factors constant, how does the self-inductance of the solenoid change?
21. IN INDIA, domestic power supply is at 220 volt, 50 Hz, while in U.S.A. it is 110 volt, 50 Hz. Give one advantage and disadvantage of 220 volt supply over 110 V supply ?Ca lculate the power developed in an ideal inductor of L = 4H and ω = 100 rad/sec.
22. Obtain the resonant frequency ω_r of a series LCR circuit with L=2.0 H, C = 32μ F and R=10Ω. What is the Q value of the circuit.
23. An a.c. voltage of 100 V 50Hz is connected across a 20Ω resistor and 2mH inductor in series . Calculate (i) Impendence of the circuit (ii) r.m.s. current in the circuit.
24. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3Ω, l = 25.48 mH and C = 796 μ. Find the impedance of the circuit the power dissipated in the circuit.
25. A copper rod of length L rotates with an angular speed ω in a uniform magnetic field B. Find the induced emf developed across the two ends of a rod. The field is perpendicular to the motion of a rod.
26. Mention one advantage and one disadvantage of AC over DC.
27. Show that an inductor offers an easy path to d.c and a resistive path to a.c.
28. A long solenoid with 10 turns per cm has a small loop of area 1.0 cm placed inside normal to the axis of the solenoid. If the current carried by the solenoid changes steadily from 1A to 2A in 0.1 sec, what is the induced emf in the loop while the current is changing?
29. State the condition under which the phenomenon of resonance occurs in a series LCR circuit. Plot a graph showing variation of current with frequency of a.c. source in a series LCR circuit.
30. The instantaneous value of voltage from an a.c. Source is given by E=300 Sin 314t. What is the r.m.s. voltage of the source?
31. A bulb and a capacitor are connected in series to an a.c. source of variable frequency. How will the brightness of the bulb change on increasing the frequency of the a.c. source? Give reason.
32. State the condition under which the phenomenon of resonance occurs in a series LCR circuit. Plot a graph showing variation of current with frequency of a.c. source in a series LCR circuit.

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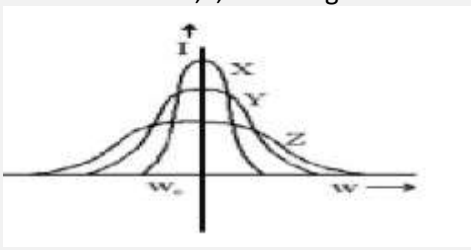
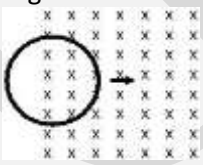
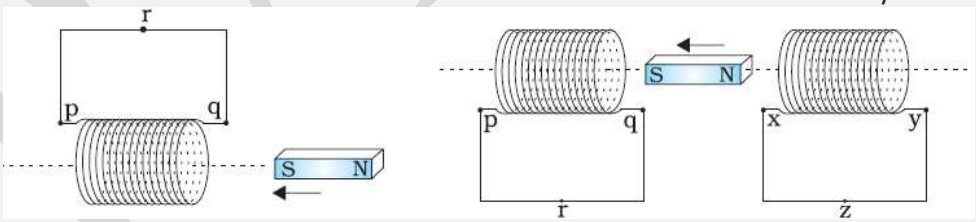
33. "The oscillations in copper disc in a magnetic field are highly damped." Why? Where does the vibrational kinetic energy of the copper disc disappear?
34. The above graph shows the variation of current amplitude vs angular frequency (ω) for a series LCR a.c. circuit obtained for different values of resistances X,Y,Z . Arrange the resistances in increasing order.
35. 

36. A metallic rod of length 'l' and resistance 'R' is moving normal to a uniform magnetic field 'B' with a velocity 'V' . Deduce expressions for (i) the emf induced (n) the induced current in the metallic rod.
37. If a rate of change of current of 2 A/s induces an e.m.f.of 10mV in a solenoid, what is the self -inductance of the solenoid?
38. Show that Lenz's law is in accordance with the law of conservation of energy.
39. Define mutual inductance. State two factors on which the mutual inductance between a given pair of coils depends.
40. What are eddy currents? How are they produced? Give two applications of eddy currents.
41. An armature coil consists of 20 turns of wire, each of area A = 0.09m^2 and total resistance15Ω .It rotates in a magnetic field of 0.5T at a constant frequency of 150/π Hz. Calculate the value of (i) maximum (ii) average induced emf produced in the coil.
42. Draw graph between impedance and frequency for a series LCR circuit.
43. Distinguish between the term 'average value' and 'rms value' of an alternating current.
44. : A conducting loop is pulled in and taken out with a constant velocity in a region of constant (steady) magnetic field of induction B as shown in the figure.



When will the current in the loop flow in (a) Clockwise direction (b) become zero.
45. The coefficient of mutual induction of the two coils is 0.5 H. If the current is increased from 2 to 3 A in 0.1 seconds in one of them, then find the induced EMF in the second coil.
46. State Lenz's law. Predict the direction of induced current in the situations described by the following Figs.



47. When 100 volts d.c is applied across an inductor, a current of 1A flows through it. If the same inductor is connected across 100 v a.c. source, a current reduces to 0.5 A. Why is the current reduced in later case? Calculate the reactance.
48. Write two characteristics of a transformer. Diagrammatically represent step-up and step-down transformer.
49. In the figure given below, a bar magnet moving towards the right or left induces an e.m.f. in the coils (1) and (2). Find giving reason, the directions of the direction of the induced currents through the resistors AB and CD when the magnet is moving (a) towards the right, and (b) towards the left.

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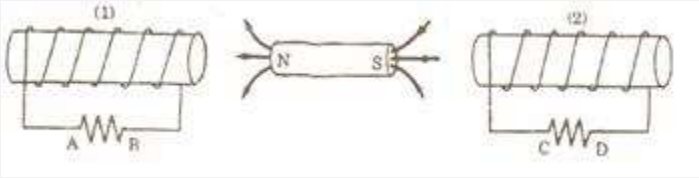
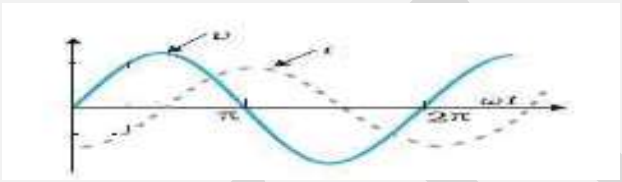
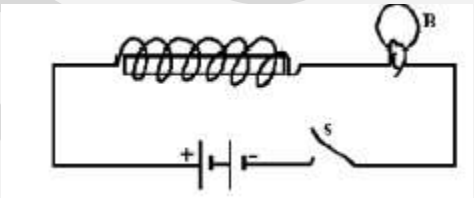


50. An a.c. voltage $E = E_0 \sin \omega t$ is applied across an inductor L. Obtain an expression for current I.
51. When a circuit element 'X' is connected across an a.c. source, a current of A flows through it and this current is in phase with the applied voltage. When another element 'Y' is connected across the same a.c. source, the same current flows in the circuit but it leads the voltage by $\pi/2$ radians. (i) Name the circuit elements X and Y.(ii) Find the current that flows in the circuit when the series combination of X and Y is connected across the same a.c.voltage.(iii) Plot a graph showing variation of the net impedance of this series combination of X and Y as a function of the angular frequency of the applied voltage.
52. The fig. shows the variation of v and i vs ωt for a circuit element connected to A.C mains. Name the. circuit



element and the phase relation between current and voltage
53. Define self-inductance and give its S. I . unit. Derive an expression for self- inductance of a long, air-cored solenoid of length *l,* radius r, and having N number of turns.
54. with the help of a neat labeled diagram , explain the principle ,construction & working of an a.c generator.
55. a rectangular coil of area A , having number of turns N is rotated at ƒ revolutions /second in a uniform magnetic field B ,the field being perpendicular to the coil. Prove that maximum emf induced in the coil is $2\pi fNBA$.
56. A coil with an average diameter of 0.02m is placed perpendicular to a magnetic field of 6000T. If the induced emf is 11V when the magnetic field is changed to 1000T in 4 seconds. What is the number of turns in the coil?
57. In a series L-R circuit $X_L = R$, power factor is P_1. When a capacitor having capacitance such that $X_C = X_L$ connected in series, power factor become P_2. Find the ratio P_1/P_2.
58. Fig. Shows a light bulb (B) and iron-cored inductor connected to a DC battery through a switch (S).



What will one observe when switch (S) is closed? How will the glow of the bulb change when the battery is replaced by an ac source of rms voltage equal to the Voltage of DC battery? Justify your answer in each case.'
59. An electric heater and an electric bulb are rated 500 W, 220 V and 100 W, 220 V respectively. Both are connected in series to a 220 V a.c. mains. Calculate the power consumed by (i) the heater and (ii) electric bulb.
60. A magnetic field exits along –ve z-axis .coil A is kept with the magnetic field with the plane of the coil in the x-y plane and coil b is kept with the plane of the coil in x-z plane. In which coil will there be no induced emf when magnetic field varies with time?
61. Draw the curves showing the variation of inductive reactance and capacitive reactance with applied frequency of an a.c source. A capacitor, a resistor of 5 ohm, and an inductor of 50 mH are in series with an a.c. source marked 100 V, 50 Hz. It is found that voltage is in phase with the current. Calculate the capacitance of the capacitor and the impedance of the circuit.
62. Write Faraday's laws of electromagnetic induction. How will you find the direction of induced emf ? find an expression for induced emf in a rod of length *l* moving with velocity V perpendicular to a magnetic field of induction B.

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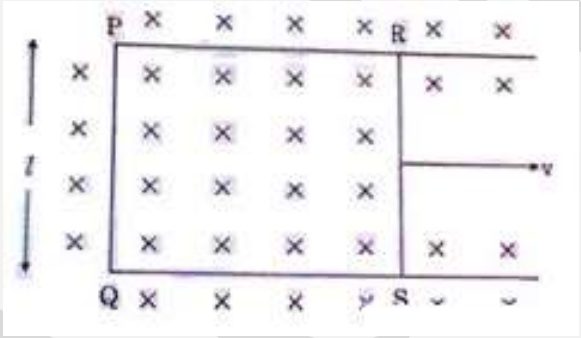
63. With the help of a labeled diagram explain the construction and working of an a.c. generator. Deduce the expression for emf induced. What is average and root mean square value of emf induced ?
64. In L-R series circuit, the potential difference across the inductor 'L' and the resistor 'R' are 120 V and 90 V respectively and rms value of current is 3 A (1) calculate r.m.s voltage across the circuit. (2) Is the algebraic sum of the voltage across two components more than the applied voltage? If yes, explain the reason (3) Calculate the phase angle between the voltage and current
65. A resistor of resistance 400Ω, and a capacitor of reactance 200Ω,are connected in series to a 220V,50Hz a.c. source .If the current in the circuit is 0.49 ampere find the (i) voltage across the resistor and capacitor(ii) value of inductance required so that voltage and current are in same phase.
66. A sinusoidal voltage of peak value 283V and frequency 50Hz is applied to a series LCR circuit in which R = 3Ω, L = 25.48mH and C = 796 μF. Find (a)the impedance of the circuit (b)the phase difference between the voltage across the source and the current (c)the power dissipated and the circuit
67. Give principle, construction and working of Transformer.
68. Figure shows a rectangular conducting loop PQSR in which arm RS of length 'l' is movable. The loop is kept in a uniform magnetic field 'B' directed downward perpendicular to the plane of the loop. The arm RS is moved with a speed 'v'. (a) the emf induced across the arm RS (ii) the external force required to move the arm, and (iii) the power dissipated as heat.
69. Define self-inductance and give its S. I . unit. Derive an expression for self- inductance of a long, air-cored solenoid of length *l,* radius r, and having N number of turns.



70. Describe briefly with the help of a labeled diagram, the working of a step up transformer. Since the transformer increase the voltage, does it violate the principle of conservation of energy?
71. Derive a relation between peak value and rms value of ac.
72. Two identical circular loops made of copper and manganin are rotated in perpendicular magnetic field with same angular velocity. Will the
    a. Induced emf be same in both the loops.
    b. Induced currents be same in both the loops.

    Give reason for your answer in each case.
73. A rectangular coil of N turns and area A is rotated in a uniform magnetic field of intensity B with an angular velocity ω. Obtain an expression for the maximum induced emf in the coil. What would be flux linked with the coil at the instant when the induced emf is maximum?
74. Two coils are being moved out of magnetic field- one coil is moved rapidly and the other slowly. In which case is more work done and why?
75. A bar magnet M is dropped so that it falls vertically through the coil C. The graph obtained for voltage produced across the coil vs time is shown in figure (b). (i) Explain the shape of the graph. (ii) Why is the negative peak longer than the positive peak?
76. How does the self inductance of an air core coil change, when (i) the number of turns in the coil is decreased, (ii) an iron rod is introduced in the coil? A copper coil L wound on a soft iron core and a lamp B are connected to a battery E through a tapping key K. When the key is suddenly opened, the lamp flashes for an instant to much greater brightness. Explain.

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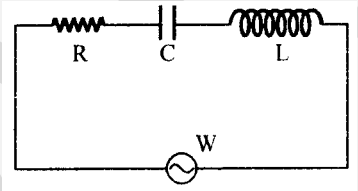
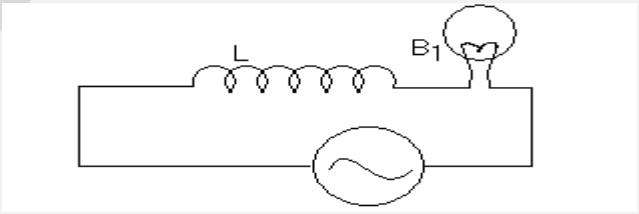
77. How is the mutual inductance of a pair of coils affected when separation between the coils is increased? The number of turns of each coil is increased? A thin iron sheet is placed between the two coils, other factors remaining the same? Explain your answer in each case.
78. Why does metallic piece become very hot when it is surrounded by coil carrying high frequency alternating current?
79. A coil of area A is held perpendicular to a uniform magnetic field B. if the coil is turned through 1800 what will be the change in flux linked with it.
80. The magnetic flux threading a coil changes from 12x10-3 Wb to 6x10-3 Wb in 0.01 s.Calculate the induced emf.
81. When a circuit element 'X' is connected across an a.c. source, a current of √2A flows through it and this current is in phase with the applied voltage. When another element 'Y' is connected across the same a.c. source, the same current flows in the circuit but it leads the voltage by π/2 radians.(i) Name the circuit elements X and Y. (ii) Find the current that flows in the circuit when the series combination of X and Y is connected across the same a.c. voltage.
82. A circuit containing a 80 mH inductor and a 60 μF capacitor in series is connected to a 230 V, 50 Hz supply. The resistance of the circuit is negligible. (a) Obtain the current amplitude and rms values. (b) Obtain the rms values of potential drops across each element. (c) What is the average power transferred to the inductor? (d) What is the average power transferred to the capacitor? (e) What is the total average power absorbed by the circuit?
83. A series LCR-circuit with L = 0.12 H, C = 480 nF, R = 23 Ω is connected to a 230 V variable frequency supply. (a) What is the source frequency for which current amplitude is maximum? Obtain this maximum value. (b) What is the source frequency for which average power absorbed by the circuit is maximum? Obtain the value of this maximum power. (c) For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies? (d) What is the Qfactor of the given circuit?
84. An LC-circuit contains a 20 mH inductor and a 50 μF capacitor with an initial charge of 10 mC. The resistance of the circuit is negligible. Let the instant the circuit is closed be t = 0(a) what is the total energy stored initially. Is it conserved during the LC-oscillations? (b) What is the natural frequency of the circuit? (c) At what times is the energy stored (i) Completely electrical (i.e., stored in the capacitor)? (d) At what times is the total energy shared equally between the inductor and the capacitor? (e) If a resistor is inserted in the circuit, how much energy is eventually dissipated as heat?
85. Define self-inductance in terms of work done against the induced emf.
86. Draw the wave form of out put current. Substantiate your answer
87. An electron beam is deflected in a given field. Identify whether it is an electric field or a magnetic field in the following cases?
    (i) The trajectory of the beam is a parabola and its K.E changes.
    (ii) The trajectory of the beam is circular and its K.E. remains the same. Justify your answer.
88. A resting electron near a stationery bar magnet does not set into motion. But a moving magnet near an electron set it into motion. Why?
89. An irregularly shaped flexible current carrying loop when placed in an external magnetic field will assume a circular shape. Give reason
90. An electromagnet has stored 648 J of magnetic energy when a current of 9A exists in its coils. What average emf is induced if the current is reduced to zero in 0.45 s?
91. A 40 Ohm resistor is connected across a 15 V variable frequency electronic oscillator. Find the current through the resistor when the frequency is (a) 100 Hz and (b) 100 kHz. What is the current if the 40 Ohm resistor is replaced by a 2 mH inductor?
92. Two identical loops, one of copper and another of aluminum are rotated with the same speed in the same M.F.In which case, the induced (a) e.m.f (b) current will be more and why?
93. Why is spark produced in the switch of a fan, when it is switched off?
94. Coils in the resistance boxes are made from doubled up-insulated wire. Why?
95. A galvanometer connected in an A.C. circuit does not show any deflection. Why?

96. A capacitor blocks D.C. but allows A.C to pass through it. Explain. Why?
97. A coil of inductance 0.16 H is connected to a condenser of capacity 0.81 μ F. What should be the frequency of ac. That should be applied so that there is resonance in the circuit. Resistance of the circuit. Is negligible.
98. A jet plane is travelling west at the speed of 1800kmh-1. What is the voltage difference developed between the ends of the wing 25m long, if the earth's magnetic field at the location has a magnitude of $5.0X10^{-4}$ T and the dip angle is 30°?
99. What is the under lying principle of the working of a transformer? How does a transformer help in long distance transmission of electrical energy? Explain briefly.
100. Can we use transformer to step up D.C. voltage? If not, why?
101. The algebraic sum of potential drop across the various – elements in LCR circuit is not equal to the applied voltage. Why?
102. When a series combination of a coil of inductance L and a resistor of resistance R is connected across a 12 V-50 Hz supply, a current of 0.5.A flows through the circuit. The current differs in phase from applied voltage by $\pi / 3$ radian. Calculate the value of L and R.
103. An A.C. generator is connected to a sealed box through a pair of terminals. The box may contain R L C or the series combination of any two of the three elements. Measurements made outside the box reveal that: $E=75 \sin \omega t$ (in volt) and $I= 1.2 \sin (\omega t + \pi / 5)$ (in ampere) Name the circuit elements. What is the Power factor of the circuit? What is the rate, at which energy is delivered by the generator to the circuit?
104. 59. Does the current in an A.C. circuit lag, lead or remain in phase with the voltage of frequency u applied to the circuit when
(i) $u = u_r$ (ii) $u < u_r$ (iii) $u > u_r$
where u_r is the resonance frequency.
105. 60. Two different coils have self-inductance L1=8 mH and L2 = 2 mH. At a certain instant, the current in the two coils is increasing at the same constant rate and the power supplied to the two coils is same. Find the ratio of (a) induced voltage (b) current and (c) energy stored in the two coils at that instant?
106. In the circuit shown below, R represents an electric bulb. If the frequency v of the supply is doubled, how should the values of C and L be changed so that the glow in the bulb remains unchanged



107. Give expression for the average value of the a c voltage $V = V0 \sin \omega t$ over the time interval t = 0 and t =T.
108. An inductor L of reactance XL is connected in series with a bulb B to an A.C. source as shown in the figure. Briefly explain how the brightness of the bulb changes when Number of turns of the inductor is reduced and A capacitor of reactance XC =XL is included in series in the same circuit.
109. An armature coil consists of 20 turns of wire, each of area A = 0.09m2 and total resistance15Ω .It rotates in a magnetic field of 0.5T at a constant frequency of $150/\pi$ Hz. Calculate the value of (i) maximum (ii) average induced emf produced in the coil.



110. Give the direction in which induced current flows in the wire loop, when the magnet is moved towards the loop as shown.

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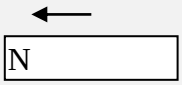
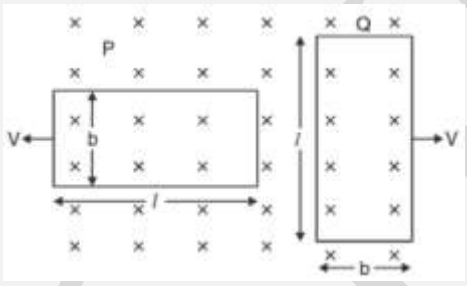


111. Define self-inductance of a coil. Show that magnetic energy required to build up the current I in a coil of self-inductance L is given by ½ LI2.
112. Answer the following questions:
    a. In any ac circuit, is the applied instantaneous voltage equal to the algebraic sum of the instantaneous voltages across the series elements of the circuit? Is the same true for rms voltage?
    b. Why is choke coil needed in the use of fluorescent tubes with ac mains? Why can we not use an ordinary resistor instead of the choke coil?
113. Show that an ideal inductor does not consume any power in an a.c. circuit.
114. In the figure shown coils P and Q are identical and moving apart with the same velocity V. Induced current in coils are



UNIT DERIVATIONS

1. Explain the concept of magnetic flux . discuss its units and dimension .
2. State and explain faraday 's law of electromagnetic induction.
3. State and explain lenz's law . how will you verify its experimentally ? does it obey the principal of energy conservation/
4. What are the eddy currents ? discuss briefly any two application of eddy currents .
5. Explain the phenomenon of self induction . define the coefficient of self induction . calculate the self induction of long solenoid.
6. Derive the expression of mutual induction of two coaxial long solenoid.
7. What is meant by mean value of AC ? derive an expression for mean value of alternating current and emf.
8. What is meant by rms value of AC? Derive an expression for rms value of alternating current and emf.
9. An AC voltage is applied across an (i) resistor ,(ii) inductor (iii) capacitor then find the expression for current and also draw the phasor diagram
10. Explain the electrical oscillation with the help of diagram , prove that how energy is conserved
11. Explain the series resonant frequency . hence define the quality factor.
12. Derive an expression for the average power in LCR circuit connected to AC supply . hence definer power factor.
13. Explain the construction . principal and working of AC generator
14. Explain the construction principal and working of Transformer, explain the various loses of energy .

UNIT 5 CHAPTER 8

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1. Is the magnitude of displacement current less, equal or greater than the conduction current?explain
2. Waves from which portion of EM spectrum are utilized to identify defects in crystals. Write the frequency range corresponding to this zone
3. Find the wavelength of electromagnetic waves of frequency 5 x 1019Hz in free space. Give its two applications.
4. Write any four characteristics of electromagnetic waves. Give two uses each of\
    a. Radio-waves
    b. Micro-waves
5. Write two applications of each, microwaves and infrared rays.
6. Name the characteristics of electromagnetic waves that (i) increases (ii) remains constant.
7. What is the frequency of radio waves?
8. The oscillating field in a plane electromagnetic wave is given by

$$B_y = (8\times10^{-6}) \sin [2\times10^{11} t + 300\ \pi x]\ T$$

    a. Calculate the wavelength of the electromagnetic wave.
    b. Write down the expression for the oscillating electric field.
9. Name the characteristics of electromagnetic waves that (i) increases (ii) remains constant in the electromagnetic spectrum as one moves from radiowave region towards ultravoilet region.
10. Write the relationship between amplitudes of electric and magnetic field in free space for an electromagnetic wave.
11. Electric field of an electromagnetic wave is given by E_y = 72 Sin (1.5 x 10^3 x + 5 x 1 0^{11} t) V/m Write and equation for the magnetic field of the wave and define intensity of an electromagnetic wave.
12. Name the electromagnetic radiations to which the following wavelengths belongs
    (a)10^{-2}m (b) 1A^0
13. Vehicles moving in foggy weather use yellow colour head-lights. Why?
14. Which constituent radiation of the electromagnetic spectrum is used:
    (i) In Radar
    (ii) to photograph internal parts of a human body and
    (iii) For taking photographs of the sky during right and foggy conditions?
15. If the earth did not have an atmosphere, would its average surface temperature be higher or lower than what it is now?
16. Why are microwaves used in Radar?
17. write the equation of Modified Ampere's law involved in em wave.
18. A plane electromagnetic wave travels in vacuum along X-direction. What can you say about the directions of electric and magnetic field vectors? If the frequency of the wave is 10 MHz, what is its wavelength?
19. Differentiate between displacement current and conduction current
20. Name the constituent radiation of electromagnetic spectrum which is: -
    a. Used to kill germs in water purification.
    b. Used in radar Is used to study crystal structure
    c. Take photographs of the sky during night and foggy condition
21. In an electromagnetic wave propagating along +x-axis electric field vector is Ey=4x103 Cos (3x108t-1.5x) v/m. what is
    a. the frequency of em wave
    b. amplitude of magnetic field
22. Name the constituent radiation of electromagnetic spectrum which Is similar to the radiations emitted during decay of radioactive nuclei?
    (ii) has its wavelength range between 390 nm and 770 nm.
    (iii) is used in satellite communication.

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(iv) is absorbed from sunlight by the ozone layer.

23. Why is a quantity $\varepsilon_0 \frac{d \emptyset E}{dt}$ called the displacement current?
24. The following are the observations regarding an unknown beam "X". What does each signify?
    a. "X" shows interference and diffraction.
    b. It travels in vacuum with the speed of 3x108m/s.
    c. It does not get deflected on passing through an electric field.
    d. After passing through a nicol prism, the intensity is reduced.
25. When can a charge act as a source of electromagnetic waves? How are the directions, of the electric and magnetic field vectors, in an electromagnetic wave, related to each other and to the direction of propagation of the wave?
26. Which physical quantity, if any, has the same value for waves belonging to the different parts of the electromagnetic spectrum?
27. In an electromagnetic wave propagating along +x-axis electric field vector is Ey=4x103 Cos (3x108t-1.5x) v/m. what is (i) the frequency of em wave(ii) amplitude of magnetic field
28. Which part of the em spectrum has the largest penetrating power and write its one use.
29. What are heating waves? Name the radiations, which are next to these radiations in electromagnetic spectrum having longer wavelength.
30. Identify the part of the electromagnetic spectrum which is
    i) Suitable for radar systems used in aircraft navigation.
    ii) Used for studying crystal structure.
    iii) Produces intense heating.
    iv) Has its wavelength range between 390nm and 700nm.
    v) Has largest penetrating power.
    vi) Used in microwave ovens.
31. Why radio waves are communication waves .Write two uses of the waves.
32. Write the expression for the velocity of the electromagnetic waves in vacuum.
33. State four properties of electromagnetic waves.
34. Answer the following.
    a. Long distance radio broadcast use short wave bands. Why?
    b. It is necessary to use satellites for long distance T.V transmission. Why?
    c. Optical and radio telescope are built on the ground but X- ray astronomy is possible only from satellites orbiting the earth. Why?
    d. The small ozone layer on the top of the stratosphere is crucial for the human survival. Why?
    e. If earth did not have an atmosphere, would its average surface temperature be higher of lower than what it is now?
    f. Some scientist has predicted that a global nuclear war on the earth would be followed by a severe nuclear winter with devastating effect on life on earth. What might be the basis of this prediction?
35. Give two uses of each of the following radio wave, microwave, infrared, visible light, ultraviolet, X rays and gamma rays.
36. Give the concept of displacement current
37. Give the wavelength range and frequency range of electromagnetic wave also give their important application
38. Suppose that the electric field vector part of an electromagnetic wave in vacuum is

    $E = \{3.1\ N/c\}\cos[(1.8 rad./m)y + (5.4 \times 10^6\ rad./s)t]i$

    a. What is the direction of propagation of the wave?
    b. What is the frequency of the wave?
    c. What is the wavelength of the wave?
    d. What is the amplitude of the magnetic field part of the wave?
    e. Write the equation of the magnetic field part of the wave?

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39. Draw a plane electromagnetic wave propagating in free space. Write its wave equation.
40. Two student A and B prepare the following table about the electromagnetic waves. Rewrite this table in its corrected form.

Students	Direction of			Peak value of	
	Electric field	Magnetic field	Propagation	Electric field	Magnetic field
A	Along X-axis	Along X-axis	Along Y-axis	E	B=cE
B	Along Y-axis	Along Z-axis	Along X-axis	E=cB	B

UNIT 6 CHAPTER 9 & 10

1. What changes in the focal length of a (i) concave mirror and (ii) convex lens occur, when the incident violet light on them is replaced by red light.
2. Light of wavelength $6000A^0$ in air enters a medium of μ=1.5. What will be its frequency in the medium?
3. What focal length should the reading spectacles have for a person for whom the least distance of distinct vision is 50 cm?
4. For the same angle of incidence the angles of refraction in three media A , B , C are 15^0 , 25^0, and 35^0 respectively. In which medium the velocity light is minimum.
5. If one face of a prism of prism angle 30^o and $\mu = \sqrt{2}$ is silvered, the incident ray retraces its initial path. What is the angle of incidence?
6. What you understand by term 'Fresnel's distance'?
7. Two sources of intensity I and 4I are used in an interference experiment. Find the intensity at a point where the waves from two sources superimpose with a phase difference of (a) π (b) $\pi / 2$
8. When light undergoes refraction. What happens to its frequency?
9. A converging lens and a diverging lens are kept in contact and the combination produces a real image. Which of the lens has longer focal length?
10. Which of the following waves can be polarized - X- rays or sound waves? Give reasons.
11. In a telescope, the objective has a large aperture while the eyepiece has a small aperture. Why?
12. Can two wave fronts cross each other? Explain.
13. Two thin lenses of power +6D and -2D are in contact. What is the focal length of the combination?
14. Two Polaroid's are placed 90^o to each other and the transmitted intensity is zero. What happens to the intensity of transmitted light when one more Polaroid is placed between these two bisecting the angle between them?
15. the focal length of objective & eye piece of an astronomical telescope are respectively 75cm & 5cm .
16. Sunglasses can be made by using coloured glass or polaroid's. Which of the two should be preferred?
17. A partially plane polarized beam of light is passed through a Polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the Polaroid.
18. Explain how the polarization takes place? Write two uses of Polaroid's?
19. How is the myopia defect of an eye corrected?
20. Draw diagram of reflecting type of telescope. Write its anyone advantage over refracting type telescope.

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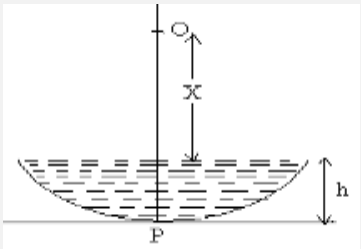
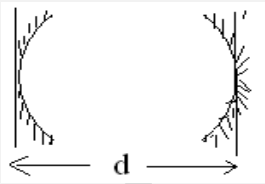
21. Water is poured into a concave mirror of radius R up to a height h as shown in the figure. What should be the value of X so that image of object O is formed on itself? Assuming μ is the refractive index of the water.



22. A point source is placed midway between two concave mirrors having equal focal length (f) as shown in fig. find the values of d for which only one image is formed.



23. Draw a neat labeled ray diagram for the astronomical telescope. Obtain expression for its magnifying power when image is formed at least distance of distinct vision.
24. When light undergoes refraction. What happens to its frequency.
25. A concave lens has the same radii of curvature for both sides and has a refractive index 1.6 in air. In the second case it is immersed inside a liquid of refractive index 1.4. Calculate the ratio of focal length of the lens in the two cases.
26. Define polarizing angle. Derive the relation connecting polarizing angle and the refractive index of a medium.
27. What is interference of light? In Young's double slit experiment deduce the conditions for (i) constructive and (ii) destructive interference.
28. Draw a graph showing the variation of resultant intensity in the interference pattern against position 'x' on the screen.
29. The polarizing angle of a medium is 60^{o}. What is the refractive index of the medium?
30. Sketch the path of light rays in air bubble formed in water.
31. What is the geometrical shape of a wave front when a plane wave passes through a concave lens?
32. The magnifying power of an astronomical telescope in normal adjustment is 9 and the length of tube is 20 cm. What are the focal lengths of the objective and eye-piece?
33. What do you mean by coherent sources of light? Can two 100 W bulbs placed at a small separation be coherent? Explain.
34. An astronomical telescope uses an objective lens of focal length 15 m and eye lens of focal lengths 2 cm. the diameter of objective lens is 10 m. What is resolving power and magnifying power.[Take mean wavelength 6x10 -7 m.]
35. How can you convert polarized light into plane polarized light?
36. When will intensity of transmitted light be maximum if a Polaroid sheet is rotated between two crossed Polaroid's?
37. State two necessary conditions for total internal reflection to take place.
38. Because this defect of an eye a person can focus either in vertical OR horizontal plane at a time. This arises due to distortion in the shape of cornea. Name the defect and suggest the correction for it.
39. How will the focal length of convex lens change, when

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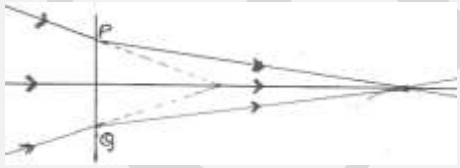
a. Monochromatic light is used in place of white light.
b. Lens is immersed in water?

40. What are coherent sources? Can two sodium lamps act as coherent sources? Justify.
41. Write three differences between interference and diffraction pattern.
42. A convex lens is held under water. How will its power change? Explain.
43. Light is incident at 600 on glass slab. If reflected & refracted rays are perpendicular to each other then what the refractive index of glass is.
44. How does magnifying power of a microscope change on decreasing the aperture of its objective?
45. A point source of light is at the focus of a convex lens. What is the type of refracted wave front?
46. State Huygens's postulates. Draw diagrams to show the refracted wave front from a convex lens if paint source is at F.
47. Which type of waves can be polarized?
48. A screen is placed 80cm from an object. The image of the object on the screen is formed by a convex lens at two different locations, separated by 10cm. Calculate the focal length of the lens used.
49. Violet light is incident on a thin convex lens. If this light is replaced by red light, explain with reason, how the power of this lens would change?
50. Define the term wave front. Draw the wave front and corresponding rays in the case of a (i) Diverging spherical wave . (ii) Plant wave.
51. The line PQ in the adjoining ray diagram represents a lens. State, with proper reason, whether the lens is convex or concave.



52. A microscope is focused on a dot at the bottom of a beaker. Some oil is poured into the beaker to a height of 'α ' cm and it is found necessary to raise microscope through a vertical distance of 'β' cm to bring the dot again into focus. Express refractive index of oil in terms of 'α' and 'β'.
53. The value of Brewster's angle for a transparent medium is different for lights of different colors, why?
54. Write the relation between the angle of incidence (i), the angle of emergence (e), the angle of prism (A) and the angle of deviation (D) for rays undergoing refraction through a prism. What is the relation between and for rays undergoing minimum deviation? Using this relation, write the expression for the refractive index (μ) of the material of a prism in terms of and the angle of minimum deviation (D_m).
55. Light of wavelength 550 nm. is incident as parallel beam on a slit of width 0.1mm. Find the angular width and the linear width of the principal maxima in the resulting diffraction pattern on a screen kept at a distance of 1.1m from the slit. Which of these widths would not change if the screen were moved to a distance of 2.2m from the slit?
56. Give two differences between fringes formed in single slit diffraction and Young's double slit experiment.
57. Light of wavelength 600nm is incident on an aperture of size 2mm. Calculate the distance up to which the ray of light can travel such that its spread is less than the size of the aperture.
58. A ray of light while traveling from a denser to a rarer medium undergoes total internal reflection. Derive the expression for the critical angle in terms of the speed of light in the respective media.

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59. An astronomical telescope consists of two thin lenses set 36 cm apart and has a magnifying power 8. Calculate the focal lengths of the lenses.
60. Use the mirror formula to show that for an object lying between the pole and focus of a concave mirror, the image formed is always virtual in nature.
61. Give reasons for following observations on the surface of moon:
    a. Sun-rise and sun-set are abrupt
    b. Sky appears dark
    c. A rainbow is never observed.
62. A convex lens (of refractive index ng) has focal length f in air. Write an expression for its focal length when immersed in a liquid of refractive index nl. Use the expression to find the focal length of glass lens (n_l=1.5) when immersed in water (n_w=1.33). (The focal length of lens in air is 25 cm.)
63. At what angle should a ray of light be incident on the face of prism of refracting angle 600 so that it just suffers total internal reflection at the other face? (R.I. of material of prism = 1.524)
64. Name two important conditions for interference to take place under Young's Double Slit Experiment .
65. A convex mirror of focal length f produces an image half of the size of the object. What is the distance of the object from the mirror?
66. Draw geometrical shape of a wave front emerging through an equilateral prism.
67. Laser light of wavelength 630nm incident on a pair of slits produces an interference pattern in which the bright fringes are separated by 8.3 mm. A second light produces an interference pattern in which bright fringes are separated by 7.6 mm. Find the wavelength of the second light.
68. What do you mean by the resolving power of an optical instrument? Write the formula for the resolving power of a microscope. How can the resolving power of microscope be increased?
69. Why does dispersion take place in a glass prism? Draw the graph showing the variation of angle of deviation with the angle of incidence of light, incident on one face of a prism.
70. A double convex lens made of glass of refractive index 1.56 has both radii of curvature of magnitude 20 cm. If an object at a distance of 10 cm from this lens, find the position of the image formed.
71. Define 'power of a lens'. Plot the graph showing the variation of power of a lens with the wavelength of the incident light. Prove that the equivalent power of the combination of two thin lenses in contact is the sum of their individual powers.
72. Use Huygens Principle to derive the relation where V_1 and V_2 are velocities in the two mediums.
73. What speed should a galaxy move with respect to us so that the sodium line at 589.0 nm is observed at 589.6 nm?
74. A fish in an aquarium approaches the left wall at a rate of 3 m/s and observes a fly approaching it at 8 m/s. If the refractive index of water is 4/3, find the actual velocity of the fly.
75. Show that if the angle of the prism is twice the critical angle of glass, there will be no emergent ray.
76. A ray enters a glass sphere of R.I. n = √3 at an angle of incidence 600 and is reflected and refracted at the farther surface of the sphere. Calculate the angle between the reflected and refracted ray at this surface.
77. A plane wave front of width X is incident on air –water interface and the corresponding refracted wave front has a width Z as shown. Express the refractive index of air with respect to water, in terms of the dimension shown.

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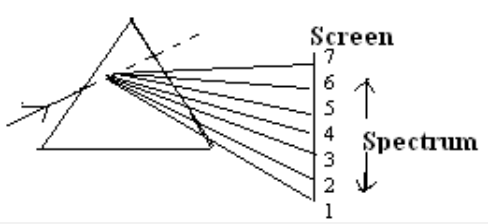
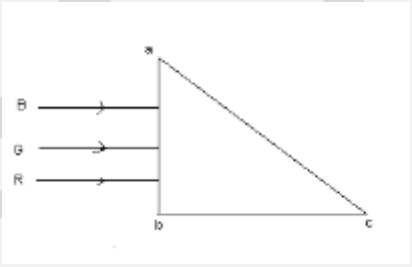
78. A student performs an experiment with prism and he gives following statements. Justify his observations.(1) The colour at position 5 observes less refractive index of the material than the colour at position 3.(2) The colour at position 5 is same as that of light emitted from sodium lamp.



79. A slit of width d is illuminated by white light .For what value of d is the first minimum, for red light of wavelength=650 nm, located at point P? For what value of the wavelength of light will the first diffraction maxima also fall at P
80. Draw the variation of intensity with angle in single slit diffraction experiment. Derive the expression for the central fringe width .How ray optics is a limiting case of wave optics. Determine angular separation between central maximum and first order maximum of the diffraction pattern due to a single slit of width 0.25mm when light of wavelength 5890 A0 is incident on it normally.
81. Draw the shape of the refracted / reflected wave front when a plane wave front is incident on
    a. Prism.
    b. Convex mirror.
    c. Convex lens.
82. Three light rays red (R), green (G) and blue (B) are incident on a right angled prism 'abc' at faces 'ab'. The refractive indices of the material of the prism for red, green and blue wave lengths are1.39, 1.44 and 1.47 respectively. Out of the three, which colour ray will emerge out of the face 'ac'? Justify your answer. Trace the path of the green (G) ray after passing through the face 'ab'.



83. For a ray of light traveling from a denser medium of refractive index n_1 to a rarer medium of refractive index n_2, prove that $c=\sin^{-1}(n_2/n_1)$.Where c is the critical angle of incidence for the media.
84. With the help of a suitable ray diagram, derive the mirror formula for a concave mirror.
85. Consider coaxial system of two thin convex lenses of focal length f each separated by a distance d. Draw a ray diagram for image formation corresponding to an object at infinity placed on the principal axis in the following cases. (i) d< f (ii) d=f (ii)f<d<2f (iv) d=2f
86. A converging lens has a focal length 20cm in air. It is made of a material of refractive index 1.6 .It is immersed in a liquid of refractive index 1.3, what will be its new focal length? Draw the corresponding ray diagram.
87. A ray of light while travelling from a denser to a rarer medium undergoes total internal reflection. Derive the expression for the critical angle in terms of the speed of light in the respective medium.
88. The following are the observations regarding an unknown beam "X". What does each signify?
    a. "X" shows interference and diffraction .
    b. It travels in vacuum with the speed of 3x108m/s

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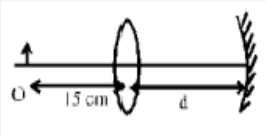
c. It does not get deflected on passing through an electric field
d. After passing through a nicol prism, the intensity is reduced.

89. In a young's double slit experiment, the slits are separated by 0.28mm and the screen is 1.4m away. The distance between central bright fringe and fourth bright fringe is measured to be 1.2 cm. Determine the wave length of light used in the experiment.
90. State the law of Malus. If the angle between the pass axis of polarizer and the analyzer is 450. Find the ratio of intensities of the original light and the transmitted light after passing through the analyzer.
91. A screen is placed 2m away from a single narrow slit. Calculate the slit width if the first minimum lies 5mm on either side of the central maximum. The incident light wave has wave length of 5000 Å.
92. An astronomical telescope consists of two thin lenses set 36 cm apart and has a magnifying power 8. Calculate the focal length of the lenses for normal adjustment.
93. A convex lens of focal length 120 cm in air is immersed in water whose refractive index is 4/3. Find the apparent change in the focal length of the lens.
94. Find the position of an object which when placed in front of a concave mirror or focal length 20 cm, produces a virtual image, which is twice the size of the object.
95. Why is diffraction of sound waves easier to observe than diffraction of light waves? What two main changes in diffraction pattern of a single slit will you observe when the monochromatic source of light is replaced by a source of white light?
96. Deduce lens maker's formula for a thin biconvex lens.
97. Derive Snell's law of refraction by drawing the refracted wave front corresponding to a plane wave front incident on the boundary separating a rarer medium from a denser medium.
98. 22Define resolving power of a compound microscope. How does the resolving power of a compound microscope change when
    a. Refractive index of medium between the object and objective lens increases.
    b. Wavelength of radiation is increased.
99. Derive the expression for the fringe width in Young's double slit interference experiment.
100. Derive an expression for the width of the central maxima for diffraction of light at a single slit. How does this width change with increase in width of the slit?
101. Draw the labeled diagram for the normal adjustment of an astronomical telescope Write expression for its magnifying power. Calculate the focal lengths of the objective and eyepiece as the magnifying power of telescope is 100 in the normal position .The distance between objective and eyepiece is 101cm.
102. Using the relation for refraction at a single spherical refracting surface, derive the lens maker's formula. Calculate the distance d, so that a real image of an object at O, 15cm in front of a convex lens of focal length10cm be formed at the same point O. The radius of curvature of the mirror is 20cm. Will the image be inverted or erect?



103. Light from an ordinary source (say a sodium lamp) is passed through a Polaroid sheet P1 .The transmitted light is then made to pass through a second Polaroid sheet P2 that can be rotated so that the angle (θ) between the two Polaroid sheets varies from 0^0 to 90^0. Show graphically the variation of the intensity of light, transmitted by P_1 and P_2, as a function of the angleθ. Take the incident beam intensity as I0. Why does the light from a clear blue portion of the sky, show a rise and fall of intensity when viewed through a Polaroid, which is rotated?

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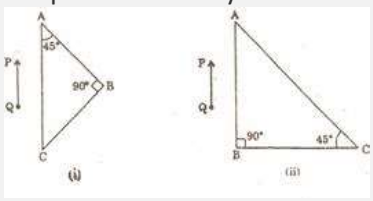
104. A right-angled crown glass prism with critical angle 41^0 is placed before an object PQ, in two positions as shown in the figures (i) and (ii). Trace the paths of the rays from P and Q the prisms in the two cases.



105. Describe diffraction of light due to a single slit. Explain formation of a pattern of fringes obtained on the screen and plot showing variation of intensity with angle θ in single slit diffraction.

106. What is meant by a linearly polarized light? Which type of waves can be polarized? Briefly explain a method for producing polarized light.

107. Two polaroids are placed at 90^0 to each other and the intensity of transmitted light is zero. What will be the intensity of transmitted light when one more Polaroid is placed between these two bisecting the angle between them? Take intensity of unpolarised light as I.

108. Write two differences between diffraction and interference pattern.

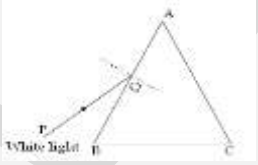
109. What is polarization of light? State Brewster's law for polarization and hence deduce an expression for polarizing angle. A polarizer and an analyzer are oriented so that maximum light is transmitted. What fraction of maximum light is transmitted if analyzer is rotated at 30º and 60º. Write two applications of polarizers.

110. Explain the phenomenon of diffraction of light at a single slit to show the formation of diffraction fringes.

111. A slit of width'd' is illuminated by light of wave length $6500A^0$. For what value of'd' will the first minimum fall at an angle of diffraction of $30^{0.}$

112. Verify Snell's law of refraction using Huygens' wave theory.

113. A white light ray incident on face AB of prism is shown in fig. Complete the path of three rays: red, yellow and blue. At what angle should a ray of light be incident on one face of a prism of refracting angle 60 so that it just suffers total internal reflection at the other face ? The refractive index of material of the prism is 1.524.



114. What do you mean by diffraction of light? State the basic condition for diffraction of light to take place.

115. Find an expression for fringe width in Young's double slit experiment. Sketch the intensity distribution of this interference pattern.

116. Draw a labeled diagram of an astronomical telescope. Write expressions for its resolving power and magnifying power.

117. Explain the formation of a secondary rainbow with the help of a suitable diagram.

118. In a Young's Double Slit Experiment conducted with white light (4000 Å - 7000 Å), consider two points P_1 and P_2 on the screen at $y_1 = 0.2$ mm and $y_2 = 1.6$ mm respectively. Determine the wavelengths which form maxima at these points.

119. Draw a labeled ray diagram of an astronomical telescope, forming an image at infinity. An astronomical telescope uses two lenses of powers 10 D and 1D respectively. State with reason, which lens is preferred as objective and eye-piece. Calculate the magnifying power of the telescope, if the final image is formed at the near point. How does the light gathering power of a telescope change, if the aperture of the objective lens is doubled?

120. Draw a labeled ray diagram showing the image formed by a compound microscope. Write the expressions for its magnifying power. Define the term resolving power of a microscope. How does the resolving power of

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a compound microscope change on decreasing the diameter of its objective lens? Increasing the focal length of its objective lens? Justify your answer in each case.

121. Explain briefly the use of optical fibers as a transmission medium with a suitable diagram.

122. Draw a labeled diagram of a compound microscope. Write expressions for its resolving and magnifying powers. The focal lengths of objective and eye lens of a compound microscope are 2 cm and 5 cm respectively. The tube length is 8 cm. What is its magnifying power?

123. What is the effect on the interference pattern observed in a Young's double slit experiment in the following cases:

a. Screen is moved away from the plane of the slits.
b. Separation between the slits is increased
c. Widths of the slits are doubled
d. Monochromatic Red light is replaced by blue light, Give reasons for your answer.

124. A converging lens of focal length 6.25 cm is used as a magnifying glass. If the near point of the observer is 25 cm from the eye and lens is held close to the eye, calculate (i) the distance of the object from the lens, (ii) the angular magnification (magnifying power). Also find the angular magnification (magnifying power) when the final image is formed at infinity.

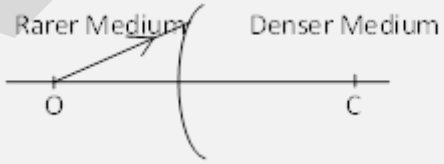
125. Four convex lenses with the following specifications are available :

Lens	Focal Length	Aperture
A	100 cm	10 cm
B	100 cm	5 cm
C	10 cm	2 cm
D	5 cm	2 cm

Which two of the above four lenses should be selected as objective and eye piece of a compound microscope. Draw a labeled ray diagram for the image formed by the microscope. Obtain its magnifying power.

126. In a double slit experiment, the angular width of a fringe is found to be 0.20 on a screen placed 1 m away. The wavelength of the light used is 600 nm. What will be the angular width of the fringe if the entire experimental apparatus is immersed in water? (R.I. of water = 4/3)

127. A spherical surface of radius of curvature R1 separates a rarer and denser medium as shown in the figure. Complete the path of the incident ray of light, showing the formation of a real image. Hence derive the relation connecting object distance 'U', image distance 'V', radius of curvature R and refractive indices n1 and n2 of two media.



128. In Young's double slit experiment, monochromatic light of wavelength 630 nm illuminates the pair of slits and produces an interference pattern in which two consecutive bright fringes are separated by 8.1 mm. Another source of monochromatic light produces the interference pattern in which the two consecutive bright fringes are separated by 7.2 mm. Find the wavelength of light from the second source.What is the effect on the interference fringes if the monochromatic source is replaced by a source of white light?

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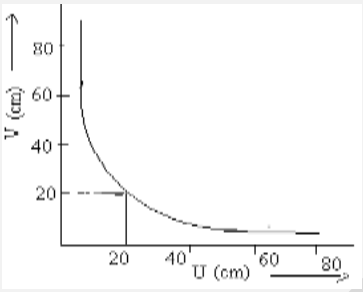
129. Derive the expression for the combined focal length of two closed lens . A lens forms a real image of an object. The graph given below shows the variation of 'V' w.r.t. 'U'. (i) What is the nature of lens? (ii) using graph calculate the focal length of this lens.



UNIT DERIVATIONS

1. Define the wave front, draw the diagram of spherical , plane and cylindrical wave front.
2. Prove the law of reflection and law of refraction with help of snell's law.
3. Explain the young's double slit experiment
4. Derive the expression for resultant amplitude for coherent source. Hence find the condition for bright and dark fringe.
5. Find the expression for fringe width for double slit.
6. What is diffraction , explain the single slit experiment, find width of central maximum
7. What is the polarization? Find the relation between refractive index and polarizing angle
8. Derive the mirror formula; give the Cartesian coordinate of sign convention.
9. Derive the relation between refractive index real depth and apparent depth.
10. Find the relation between image distance, object distance and refractive index, from rare to denser. For convex refracting for real and virtual
11. Expression from denser to rare for convex refracting and concave refracting.
12. Derive the lens maker formula.
13. Derive the lens formula for convex lens for real and virtual image
14. Derive the lens formula for concave lens
15. Derive the lens combination formula.
16. Derive the deviation formula for prism.
17. Derive the prism formula.
18. Draw the labeled diagram for compound microscope at normal adjustment and at least distance of least vision; hence find the expression for magnifying power.
19. Draw the labeled diagram for astronomical telescope at normal adjustment and at least distance of least vision; hence find the expression for magnifying power.
20. What is the reflecting type telescope; give its advantage on refracting type telescope?
21. What is the scattering of light then explain why sun appears of reddish colour, and sky appears blue?
22. Draw the labeled diagram of human eyes. Explain the defects in the eye, how they can be removed, with the help of diagram

EXTRA MARKS

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1. When a photon collides with an electron, which characteristics of the photon increases?
2. Which characteristics do not support the wave nature of light?
3. What are the laws of refraction?
4. A star appears yellow. If it starts accelerating towards earth, how will its colour appears to change.
5. Two points A and B are situated at the same distance from the source of light, but in opposite direction from it.What is the phase difference between the light waves passing through A and B?
6. When the light is polarized by reflection, what is the angle between reflected and refracted rays?
For double refracting crystal the refractive indices, for the ordinary and extraordinary denoted by go and me. What is the relation valid along the optical axis of the crystal?
8. What is the angle between planes of electric and magnetic field oscillation in case of light waves?
9. What is the colour of the interference fringe nearest to the white central maximum in case of white light?
What happens to the fringe pattern when YDS experiment is performed in water instead of air?
11. A man stands in front of a mirror of special shape. He finds that his image has a very small head, a fat body and legs of normal size. What can we say about the shapes of the three arts of the mirror?
12. In which direction relative to the normal, does a ray of light bend, when it enters obliquely a medium in which its speed is increased?
13. For the same angle of incidence, the angles of refraction in three different media A, B and C are 15°, 25° and 35°, respectively. In which medium will the velocity of light be minimum?
14. For what angle of incidence, the lateral shift produced by a parallel sided glass slab is maximum?
15. If a plane glass slab is placed on letters of different colors, the red cultured letters appear more raised up. Why?
16. Does refraction in a water tank make apparent depth same throughout?
17. The critical angle for glass-air interface is i_c. Will the critical angle for glass-water interface be greater than or less than i_c?
18. An air bubble in a jar of water shines brightly. Why?
19.What happens to the shining of diamond if it is dipped in a transparent oil?
20. What type of a lens is a tumbler filled with water?
21. What type of a lens is an air bubble inside water? Give reason also.
22. A lens immersed in a transparent liquid is not visible. Under what condition can this happen?
23. A lens whose radii of curvature are different is forming the image of an object placed on its axis. If the lens is placed with its faces reversed, will the position of the image change?
24. What happens to focal length of a convex lens, when it is immersed in water?
25. How does the focal length of a convex lens change if monochromatic red light is used instead of violet light?
26. The radii of curvature of both the surfaces of a lens are equal. If one of the surfaces is made plane by grounding, how will the focal length and power change?
27. A glass prism is held in water. How is the angle of minimum deviation affected?
28. A ray of light is normally incident on one face of an equilateral prism. Trace the course of the ray through the prism and emerging from it.
29. What will be the colour of the sky in the absence of atmosphere?
30. Why do clouds appear white?
31. Why do sometimes we observe haloes (rings) round the sun or the moon?
32. Bees can see objects in the ultraviolet light while human beings cannot do so. Why?
33. A chicken wakes up early in the morning and goes to sleep by sunset. Why?
35. Why is the focal length of an objective in compound microscope little shorter than the focal length of the eyepiece?
36. You are provided with four lenses of focal length 1 cm, 3cm, 10cm and 100cm. Which two would you prefer for a microscope and which two for a telescope?
37. Can we increase the range of a telescope by increasing the diameter of its objective?
38. A telescope has been adjusted for the relaxed eye. You are asked to adjust it for the least distance of distinct vision, then how will you change the distance between the two lenses?

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39. The distances of an object and its real image, measured from the focus of a concave mirror, are a and b respectively. Show that f2 = ab.
40. A ray of light goes from medium 1 to medium 2. Velocities of light in the two media are c1 and c2 respectively. For an angle of incidence q in medium 1, the corresponding angle of refraction in medium 2 is q/2.
(i) Which of the two media is optically denser and why?
(ii) Establish the relationship between q, c_1 and c_2.
41. A beam of light converges at a point on the screen. A plane parallel glass plate is introduced in the path of this converging beam. How will the point of convergence be affected? Draw the relevant ray diagram.
42. A microscope is focused on a dot at the bottom of a beaker. Some oil is poured into the beaker to a height of y cm and it is found necessary to raise the microscope through a vertical distance of x cm to bring the dot again into focus. Express refractive index of oil in terms of x and y.
43. A ray of light while traveling from a denser to a rarer medium undergoes total reflection. Derive the expression for the critical angle in terms of the speed of light in the respective media.
44. Explain the twinkling of stars. Why do the planets not show twinkling effect?
45. Only the stars near the horizon twinkle while those overhead do not twinkle. Why?
46. Show that a convex lens produces N times magnified image when the objet distances, from the lens, have magnitudes (f ± f / N). Here f is the magnitude of the focal length of the lens. Hence find the two values of object distance, for which a convex lens, of power 2.5D, will produce am image that is four times as large as the object?
47. Use the lens equation to deduce algebraically what you know otherwise from explicit ray diagrams. (a) An object placed within the focus of a convex lens produce a virtual and enlarged image. (b) A concave lens produces a virtual and diminished image independent of the location of the object.
48. A beam of white light on passing through a hollow prism gives no spectrum. Why?
49. Give reasons for the following observations on the surface of the moon: (i) Sunrise and sunset are abrupt. (ii) Sky appears dark. (iii) A rainbow is never formed.
50. The bottom of a container is a 4.0 cm thick glass. (m=1.5) slab. The container contains two immiscible liquids And B of depths 6.0 cm and 8.0 cm respectively. What is the apparent position of a scratch on the outer surface of the bottom of the glass slab when viewed through the container? Refractive indices of A and B are 1.4 and 1.3 respectively.
51. The refractive index of water is 4/3. Obtain the value of the semi vertical angle of the cone within which the entire outside view would be confined for a fish under water. Draw an appropriate ray diagram.
52. A lens forms a real image of an object. The distance of the object to the lens is 4 cm and the distance of the image from the lens is v cm. The given graph shows the variation of v with u. (i) what is the nature of the lens? (ii) Using this graph, find the focal length of this lens.
53. A ray of light passes through an equilateral glass prism, such that the angle of incidence is equal to the angle of emergence. If the angle of emergence is ¾ times the angle of the prism, calculate the refractive index of the glass prism.
54. State the conditions which must be satisfied for two light sources to be coherent.
55. Two independent light sources cannot act as coherent sources. Why?
56. No interference pattern is detected when two coherent sources are infinitely close to one another. Why?
57. If the path difference produced due to interference of light coming out of two slits for yellow colour of light at a point on the screen be 3l/2, what will be the colour of the fringe at the point. Give reason also.
58. What happens to the interference pattern if the phase difference between the two sources varies continuously?
59. Radio waves diffract pronouncedly around the buildings, while light waves, which are e.m. waves do not why?
60. Coloured spectrum is seen, when we look through a muslin cloth. Why.

UNIT 7 CHAPTER 11

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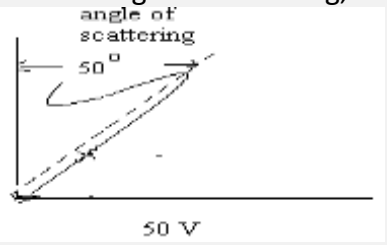
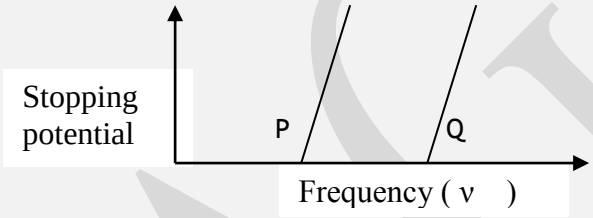
1. The de Broglie wavelengths, associated with a proton and a neutron, are found to be equal. Which of the two has a higher value for kinetic energy?.
2. An electron and a photon have same wavelength, which one of the two has more energy?
3. Ultraviolet light is incident on two photosensitive materials having work functions W1 and W2 (W1 > W2), In which case will the kinetic energy of the emitted electrons be greater? Why?
4. Name the experiment for which the following graph, showing the variation of intensity of scattered electrons with the angle of scattering, was obtained.



5. In the photo electric experiment, the graph between the stopping potential and frequency of incident radiations on two metal plates P and Q are shown in figure.
    a. Which has greater work function?
    b. What does the shape of the line depict?



6. Sketch the graphs, showing the variation of stopping potential with frequency of incident radiations for two photosensitive materials A and B having threshold frequencies $f_1 > f_2$ respectively. (a) Which of the two metals A Or B has higher work function? (b) Will the slope of both curves be same? Justify your answer.
7. Two metals A, B have work-functions 2eV, 4eV respectively. Which metal has lower threshold wavelength for photoelectric effect?
8. An £-particle and a proton are accelerated through the same potential difference. Calculate the ratio of velocities acquired by the two particles.
9. A metal has work function 4 eV. Calculate the threshold wavelength.
10. Draw a graph showing variation of de Broglie wavelength of an electron with the variation of its momentum.
11. Calculate the debroglie wavelength associated with an electron accelerated through a p.d of 100 volt.
12. What are 'matter waves'? With the help of a labeled diagram, describe an experiment to demonstrate the existence of matter waves.
13. Define Threshold frequency.
14. Define work function of a metal.
15. Draw the graph showing the variation of stopping potential & frequency.
16. Derive the relation for the De-Brule's wave-length for the matter particles.
17. An electron & a proton are possessing same K.E. which of the two has greater De-broglie wavelength.
18. The freq. of light incident on the surface of a metal in doubled keeping the intensity same. What is the effect on – (i) K.E. of photo electrons. (ii) Photo electric potential. (iii) Stopping potential. Justify the answer in each case.
19. Derive the wavelength for an electron.

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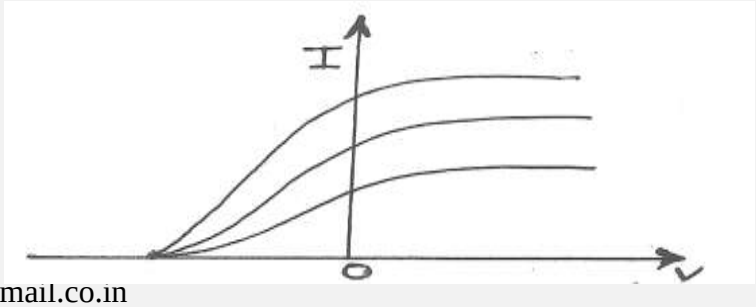
20. What is Einstein's photo electric equation? With the help of this equation. Explain the photo electric effect laws?
21. What are photo electric effect laws?
22. Explain the wave nature of electron with the help of Deviation & Garner experiment.
23. The maximum K.E of emitted photo electron is 15eV. Find its stopping potential.
24. Calculate the : (a) momentum and (b) de Broglie wavelength of the electrons accelerated through a potential difference of 56 V.
25. for a photosensitive surface threshold wavelength is λ_o. Does the photoemission occurs if the wavelength (λ) of the incident radiation is equal to λ_o
26. Justifty.If a proton is accelerated through a potential difference of V. Find the percentage increase or decrease in the de-Broglie wavelength if the potential difference is increased by 21%.
27. Show, on a graph, the nature of variation, of the associated de –Broglie wavelength with the accelerating potential, for an electron initially at rest.
28. The photoelectric cut-off the voltage in a certain photoelectric experiment is 1.5V. What is the maximum kinetic energy of the photoelectrons emitted?
29. Draw a graph showing the vibration of stopping potential with frequency of radiations incident on the metal plate. How can the value of planks constant be determined from this graph.
30. Draw a graph showing the variation of stopping potential with frequency of incident radiations in relation to photoelectric effect. Deduce an expression for the slope of this graph using Einstein's photoelectric equation.

The following table gives the value of work function for a new photosensitive metal. In each of these metals is exposed to radiations of wavelength 300 nm which of them will not emit photoelectrons and why?

S.No	Metal	Work Function (eV)
1	Na	1.92
2	K	2.15
3	Mo	4.17

31. The given graphs show the variation of the stopping potential Vs with the frequency (□) of the incident radiations for two different photosensitive materials M_1 and M_2.(i) What are the values of work functions for M1 and M2? (ii) The values of the stopping potential for M_1 and M_2 for a frequency □3 (>□02) of the incident radiations are V1 and V2 respectively. Show that the slope of the lines equals.
32. In Davisson and Germer experiment, state the observations which led to show the wave nature of electrons and (ii) confirm the de-Broglie relation.
33. X -ray of wavelength λ falls on photosensitive surface emitting electron. Assuming that the work function of the surface can be neglected, prove that de-Broglie wavelength of electron emitted will be $[h \lambda/2mc]^{1/2}$.
34. Explain the laws of photo electric emission on the basis of Einstein's photo electric equation.
35. A 100 W sodium lamp radiates energy uniformly in all directions. The lamp is located at the center of a large sphere that absorbs all the sodium light which is incident on it. The wavelength of sodium light is 589 nm.
    a. What is the energy per photon associated with the sodium light?
    b. At what rate are the photons delivered to the sphere?
36. Draw a labeled diagram of the experimental set up used to study the photoelectric effect. Establish Einstein's photoelectric equation from his theory of photoelectric effect.
37. In an experiment on photoelectric effect, the following graphs were obtained between the photoelectric current (I) and the anode potential difference (V). Name the characteristic of the incident radiation that was kept constant in this experiment.



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38. If the frequency of the incident radiation on the cathode of a photo cell is doubled, how will the following change:
    a. Kinetic energy of the electrons
    b. Photoelectric current
    c. Stopping potential
39. In a photoelectric experiment, the collector plate is at 2.0 V with respect to the emitter plate made of copper (Ψ = 4.5 eV). The emitter is illuminated by a source of monochromatic light of wavelength 200 nm. Find the minimum and maximum kinetic energy of the photoelectrons reaching the collector.
40. Explain photoelectric effect on the basis of Einstein's photo electric equation.

UNIT DERIVATIONS

1. What is photoelectric effect? Explain experimentally the variation of photoelectric current with (i) the intensity of the incident light (ii) the potential difference between the plates and (iii) the frequency of the incident light and hence state the laws of photoelectric emission.
2. Derive the expression for the de broglie wavelength of an electron moving under a potential difference v volt. Describe Davisson and Germer experiment to establish the wave nature of electrons. Draw a labelled diagram of the apparatus used.
3. State the laws of photoelectric emission. Establish Einstein photoelectric relation. Explain the laws of photoelectric emission on the basis of this relation.
4. Explain why wave theory of light could not explain the photoelectric effect
5. State the dependence of work function on kinetic energy of electrons emitted in a photocell. If the intensity of incident radiation is doubled, what changes occur in the stopping potential and photoelectric current?
6. How does the maximum kinetic energy of the emitted electrons vary with the work function?
7. Explain the devasion germer experiment and explain how it prove the wave nature of electron

UNIT 8 CHAPTER 12 & 13

1. Compare the radii of two nuclei with mass number 1 and 27 respectively.
2. The ground state energy of hydrogen atom is -13.6 ev. What is the kinetic and potential energies of the electron in this state?
3. A radioactive isotope has a half-life of T years. How long will it take the activity to reduce (i) 3.125% (ii) 1% of its original value?
4. What is impact parameter? What will be its value for a deflection of 180^0
5. Draw a graph to show the variation of impact parameter (in alpha particle scattering)with scattering angle Θ.
6. Obtain the B.E. of an α –particle in MeV.Given Mass of proton = 1.007825 a.m.u, Mass of neutron = 1.00865 a.m.u, Mass of He nucleus = 4.002800 a.m.u, 1a.m.u=931MeV.
7. Four nuclei of an element fuse together to form a heavier nucleus. If the process is accompanied by release of energy, which of the two - the parent or the daughter nucleus would have a higher binding energy/nucleon?

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8. Define ? decay. Give one example of ? decay.
9. Why neutrino cannot be detected in beta decay?
10. Two nuclei have mass number in the ratio 1:2. What is the ratio of their nuclear density.
11. Write any two properties of Nuclear force.
12. The activity of a radioactive element drops to 1/16th of its initial value in 32 years. Find the mean life of the sample.
13. Write the nuclear equations for α decay of $_{94}Pu^{243}$.
14. What is the radius of first Bohr's orbit?
15. Write nuclear equations for
    a. β^- Decay of $_{15}P^{32}$.
    b. β^+-decay of $_{15}P^{32}$.
16. Drive a relation between decay constant and average life.
17. The ground state energy of hydrogen atom is -13.6 eV. What are the kinetic and potential energies of the electron in this state?
18. A hydrogen atom initially at the ground level absorbs a photon which excites it to the n=4 level. Determine the wavelength and frequency of photon.
19. Show how the amplified modulated carrier wave contains three frequencies. Draw amplitude VS frequency graph for the same.
20. Write the equation for an alpha decay if the parent nucleus is AXZ and the daughter nucleus is Y. Also mention the expression for disintegration energy (Q – value) for α – decay.
21. The radius of the innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. What is the radius of the n = 3 orbit?
22. Find the shortest wavelength of the Lyman series.
23. Define Nuclear Binding Energy. Draw the Binding energy curve.
24. Why heavy nuclei can undergo fission.
25. A beam of 10.4 ev is passed over hydrogen in ground state what are the radiations that can result and they will belong to which series corresponding to hydrogen spectrum.
26. The half-life of a radioactive substance is 30 sec. calculate (i) decay constant and (ii) time taken by the sample to become 1/4th of its initial value.
27. Complete the following disintegration equations:

(i) $_1H^2 + {}_8O^{16} \longrightarrow {}_7N^{14} + ?$

(ii) $_2He^4 + {}_{13}Al^{27} \longrightarrow {}_{14}Si^{30} + ?$

(iii) $_1H^2 + {}_5B^{10} \longrightarrow {}_6C^{11} + ?$

(iv) $_1H^1 + {}_3Li^6 \longrightarrow {}_2He^4 + ?$

28. It is observed that only 6.25% of a given radioactive sample is left undecayed after a period of 16 days. What is the decay constant of this sample, in day^{-1}?
29. Draw energy level diagram of atomic hydrogen. Name and show all he five series found in emission spectrum of hydrogen on his diagram. Also name the regions of spectrum to which these series lie.
30. Draw a graph showing the variation of binding energy per nucleon with mass number of different nuclei. Mark the region where the nuclei are most stable.
31. Explain the origin of spectral lines of hydrogen using Bohr's theory.

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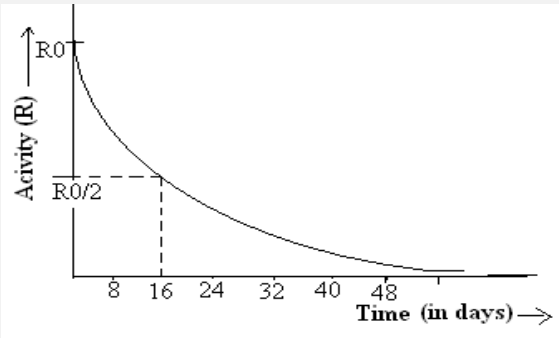
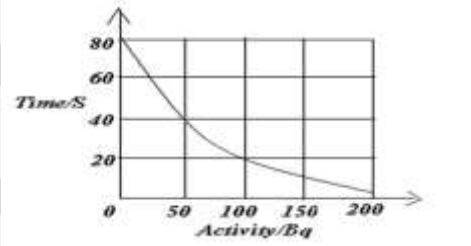
32. The half-life of a radioactive sample is 30 seconds. Calculates (i) the decay constant, and (ii) time taken for the sample to decay to 3/4th of its initial value.
33. In a hydrogen atom, an electron revolves around a proton. Which of these two exerts a greater electrostatic force on the other?
34. Define decay constant. Give the mass number and atomic number of elements on the right hand side of the decay process. $_{86}Ru^{220} \rightarrow Po + He$ The graph shows how the activity of sample of radon-220 changes with time. Using this graph calculate (a) half-life (b) decay constant



35. The half-life of a radioactive sample is 30 seconds. Calculate
    a. The decay constant.
    b. Time taken for the sample to decay to 3/4th of its initial value.
36. The side graph shows how the activity of a radioactive material changes with time. Using the graph, determine
    a. Half-life of the material.
    b. Decay constant.



37. Derive an expression for the frequency of side bands and show them graphically.
38. A carrier wave of peak voltage 12V is used to transmit a message signal. What should be the peak voltage of modulating signal in order to have modulation index of 75%?
39. Derive the relationship between the half-life and decay constant of a radioactive substance. The half-life of radium is 1600 years. After how many years 25% of a radium block remains undecayed?
40. What are nuclear forces? State any two properties of nuclear force. Draw a graph between the P.E of a pair of nucleons as a function of their separation.
41. Name the reaction which takes place when a slow neutron beam strikes $_{92}U^{235}$nuclei. Write the nuclear reaction involved.
42. Explain the process of release of energy in a nuclear reactor. Draw a labelled diagram of a nuclear reactor and write the function of each part.
43. What is the SI unit of radio activity? Express curie in SI unit. The mean life of radioactive substance is 2400yrs. What is its half-life.

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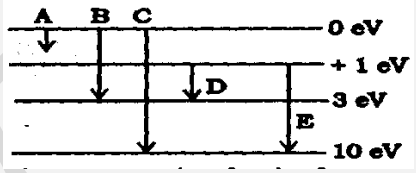
44. In an atom energy of electron in n^{th} orbit is $E_n = -13.6Z^2/n^2$ev, where z is atomic number. What is the shortest & longest wave length of emitted radiation n in singly ionized He+.
45. Define the decay constant of a radioactive substance. Half-life of radioactive substance is T, initial concentration. No and at instants t_1 & t_2 concentrations are N_1 and N_2 respectively. Find concentration at time (t_1+t_2).
46. State the postulates of Bohr Atom model. Verify the second postulate using de-Broglie's concept of matter waves.
47. How long can an electric lamp of 100W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reaction as

$$_1H^2 + _1H^2 \rightarrow {}_2He^4 + n + 3.27\ MeV$$

48. Distinguish between point to point and broadcast communication mode. Give one example of each.
49. Draw a graph showing the variation of potential energy of a pair of nucleons as a function of their separation. Indicate the region in which nuclear force is (i) Attractive and (ii) Repulsive.
50. Define the term decay constant of a radioactive nucleus. Two nuclei P, Q have equal no. of atoms at t = 0. Their half-lives are 3 hours and 9 hours respectively. Compare their rates of disintegration, after 18 hours from the start.
51. Draw the energy level diagram showing the emission of β-particles followed by by a $_{27}Co^{60}$ nucleus.
52. Two radioactive nuclei X and Y initially contain equal number of atoms. Their half life is 1 hour and 2 hour respectively. Calculate ratio of their rates of disintegration after two hours.
53. The values of ground state energy of hydrogen atom is -13.6 eV.
    a. What does the negative sign signify?
    b. How much energy required taking an electron in this atom from the ground state to the first excited state?
54. The energy levels of an atom of element are shown in the following diagram. Which one of the level transitions will result in the emission of photons of wavelength 620 nm ? Support your answer ith mathematical calculations.



55. Explain the origin of spectral lines of hydrogen using Bohr's theory. Mark transactions corresponding Lyman and Balmer series The wavelength of the second line of the Balmer series in the hydrogen spectrum is 4861 A^0 .Calculate the wavelength of the first line.
56. A radioactive sample contains 2.2 ing of pure $_6C^{12}$which has half-life period of 1224 seconds. Calculate
    a. The number of atoms present initially.
    b. The activity when 5 μg of the sample will be left.

EXTRA MARKS

1.what conclusions were drawn from the observation in which few alpha-particle were seen rebounding from gold foil?

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2. which observation led to the conclusion in the α-particle scattering exp. That atom has vast empty space?
3. Compare the radii of two nuclei with mass number 1 and 27 respectively.
4. Two nuclei have mass numbers in the ratio 1:8.What is the ratio of their nuclear radii?
5. Which have greater ionizing power:α-particles or β-particles?
6. The half-life of a radioactive substance in 30 days. What is the time taken for ¾ of its original mass to disintegrate?
7. Why neutrons are considered as ideal particle for nuclear reactions?
8. Does the ratio of neutrons and protons in the nucleus increase, decreases or remain the same after the emission of ά – particles?
9. Why is the ionization power of ά – particle of greater than γ – rays?
10. A radio isotope of silver has a half-life of 20 minutes. What fraction of the original mass would remain after one hour?
11. What changes takes place in the nucleus when a γ – rays is emitted?
12. Can a single nucleus emit ά – particle, β – particle and a γ – rays together?
13. Two nuclei have mass no. in the ratio 1:2. What is the ratio their nuclear densities?
14. Establish the relationship between half-life of a radio- active substance and decay constant.
15. Explain how ά particle scattering experiment led to Rutherford to estimate the size of the nucleus.
16. The activity of a radioactive material drops to 1-16th of its initial value in 30 days. Find its half life.
17. In a particular fission reaction, a U 235 nucleus captures a slow neutron. The fission products are 3 neutrons, a La 142 and fission products X y z .What is the value of Y and Z.
18. You are given two nuclides Xb. Which one of the two is likely to be more stable? Give reason.
19. A certain radioactive substance has a half-life of 30 days. What is the disintegration constant? Find its average life.
20. Find the time required to decay 3/4th of a radioactive sample whose half-life is 60 days.
21. Neon -23 decays in the following way $^{23}Ne_{10}$ ----------$^{23}Ne_{10} + {}^{0}e_{-1} + \gamma$ find the minimum and maximum kinetic energy that the β-particle can have.
The atomic masses of $^{23}Ne_{10}$ and $^{23}Ne_{10}$ are 22.99454 and 22.98984 respectively.
22. The disintegration rate of a certain radioactive sample at any instant is 4750 disintegrations per minute. Five minutes later the rate becomes 2700 per minute. Calculate a. Decay constant b. Half-life of the sample
23. Explain with an example, whether neutron-proton ratio increases or decreases during beta decay.
24. The half-life period of radioactive element A is the same as the mean half time of another radioactive element B.Initially both of them have the same number of atoms. The radioactive element B decays faster than A. Explain why?
25. Obtain the binding energy of a nitrogen nucleus from the following data m_H=1.007834; m_n=1.00867; m_N=14.03074 Give your answer in MeV.
26. Write nuclear equations for
a. The α-decay of $^{226}Ra_{88}$
b. The β- -decay of $^{32}P_{15}$
c. The β+ decay of $^{32}P_{15}$
27. A neutron is absorbed by a $^{6}Li_{3}$ nucleus with the subsequent emission of an alpha particle.
i. Write the corresponding nuclear reactions.
ii. Calculate the energy released in MeV, in this reaction.
Given mass $^{6}Li_{3}$=6.0151264; mass (neutron. =1.00966544
Mass (alpha particle.=4.00260444 and mass(triton.=3.01000004

UNIT DERIVATIONS

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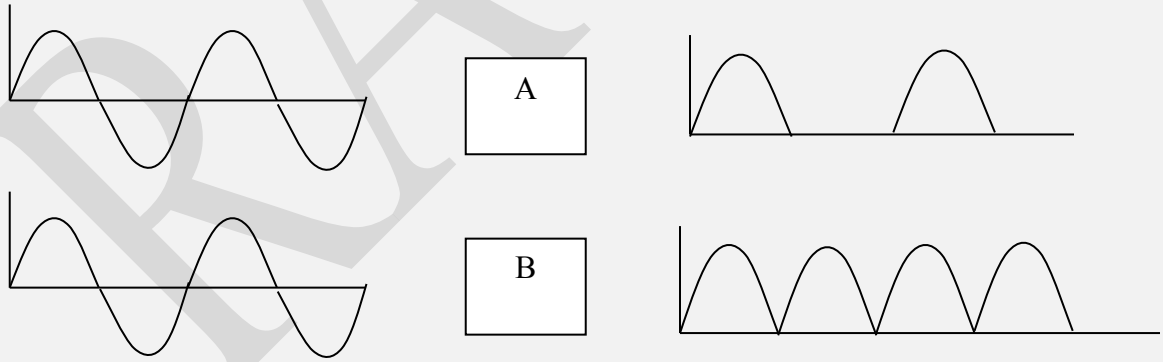
1. Discuss Geiger-Marsden experiment on scattering of alpha particles. How is the size of the nucleus estimated in this experiment ?
2. Explain distance of closest approach and impact parameter with illustrations.
3. Describe Rutherford atom model. What are the drawbacks of this model ?
4. State the basic postulates of Bohr's theory of atom spectra, hence obtain an expression for radius of orbital electron in hydrogen atom.
5. Draw the energy level diagram of hydrogen spectrum on the basis of Bohr's theory.
6. Explain nuclear size and nuclear density is same for all the nuclei.
7. What do you understand by isotopes, isobars and isotones? explain with the example
8. Explain the concept of nuclear binding energy. Draw a curve between mass number and average binding energy per nucleon. Explain the energy release in the process of nuclear fission from the plot.
9. Draw the graph showing the variation of potential energy between a pair nucleon as a function of their separation. indicate the region in which the nuclear force is (i) attractive (ii) repulsive
10. Explain the concept of nuclear force. Give their important properties.
11. State and explain the laws of radioactive disintegration. Hence define the disintegration constant and half life period. Explain relation between them.
12. Prove the relation $N=N_o e^{-\lambda t}$ or decay law,
13. What is the meant by average life of radioactive element? Derive an expression for it.
14. Explain the α , β and γ decay and give their important property.
15. What is the function of moderator and control rod in nuclear reaction
16. What is the nuclear fission and nuclear fusion , give difference between them

UNIT 9 CHAPTER 14

1. Why a p-type semiconductor crystal is electrically neutral, although $n_h >> n_e$.
2. An a.c signal is fed in to two circuits A and B to get out put wave forms as in figure. Identify the circuits A and B and name the basic component used in both



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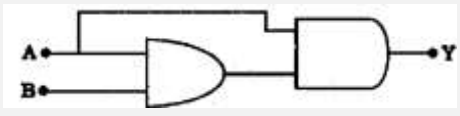
3. Write the truth table for the following combination of gates :



4. How does the energy gap in a semiconductor vary, when doped with a pentavalent impurity?
5. What type of charge carriers are there in an n type semiconductor and p type semiconductor.
6. Which type of biasing results in very high resistance of a P N Junction?

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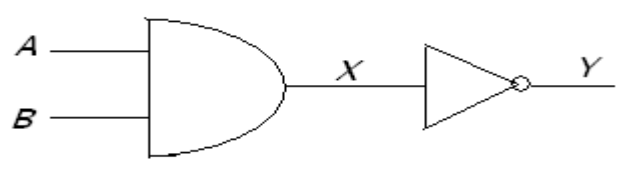
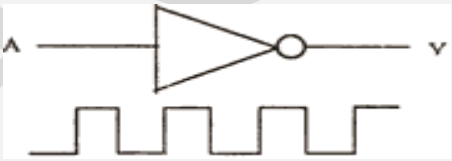
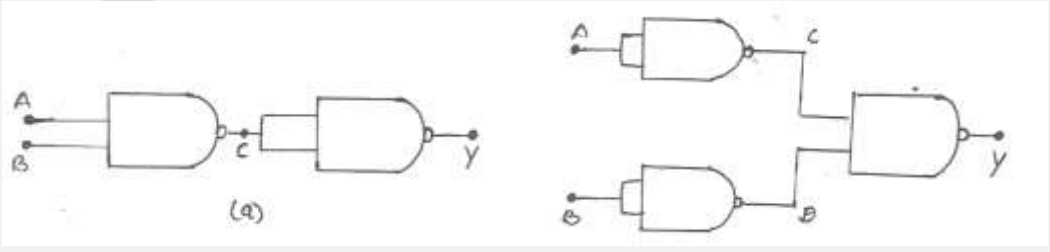
7. Why a common emitter is generally preferred over a common base amplifier.
8. Name a diode used to regulate voltages. Draw the graph for the same. Explain briefly the internal cause for this regulation of the voltages.
9. How is a solar cell different from a photodiode? Give the principle of the photodiode. Why do we need reverse bias for the photodiode to work?
10. Draw energy band diagram of n type and p type semiconductor.
11. With the help of circuit diagram explain the working principle of a full wave Testifier.
12. Draw energy band diagram of metal, Insulator and Semiconductor.
13. Define dynamic resistance for a diode.
14. Draw symbolic diagrams for p-n-p and n-p-n transistor.
15. Draw a circuit diagram of full wave rectifier.
16. Explain the role of filter circuits in rectification.
17. How a junction diode is formed.
18. Why the conductivity of n-type semiconductor is is more than the p-type semiconductor even both of them has same level of doping.
19. Neither writes the symbol and truth table of NOR gate.
20. How a OR gate is realized from the NOR gate. Draw diode circuit of OR gate. Find the output at Y if (i) A=1, B=0 (ii) A=0, B=1



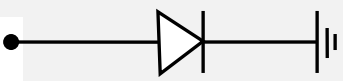
21. Carbon and silicon are known to have similar lattice structures. However, the four bonding electrons of carbon are present in second orbit while those of silicon are present in its third orbit. How does this difference result in a difference in their electrical conductivities?
22. In which biasing does the junction resistance of p-n junction increase?
23. In the figure below, circuit symbol of a logic gate and input wave from is shown. (a) Name the logic gate, (b) write its truth table and (c) give the output wave form.



24. State two reasons why a common emitter amplifier is preferred to a common base amplifier.
25. Define 'trans-conductance' of a transistor.
26. What is a light emitting diode (LED)? Mention two important advantages of LEDs over conventional lamps.
27. You are given two circuits as shown in fig. which consists of NAND gates. Identify the logic operation carried out by the two circuits.



28. If the LC circuit produces electromagnetic waves of frequencies 100Hz at resonance with a capacitor of capacitance $(20/\pi^2)$ μF. What should be the self-inductance of the inductor?
29. In the given diagram, is the diode D forward or reversed biased?



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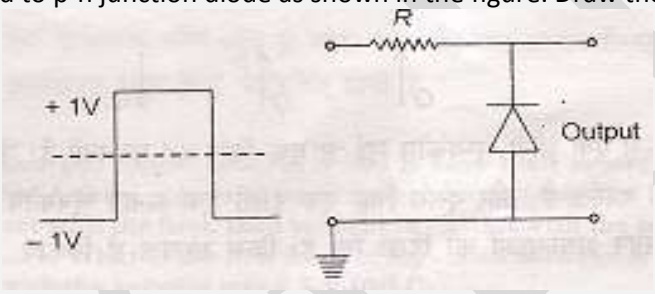
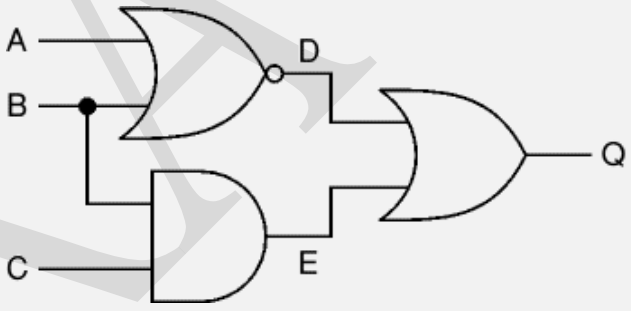
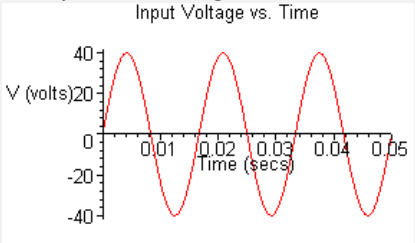
30. If a change of 100μA in the base current of an n-p-n transistor causes a change of 10mA in its collector current. What is its a.c. current gain?
31. Give the ratio of the number of holes and the number of conduction electrons in an intrinsic semiconductor.
32. Explain the term 'minority carrier injection' under forward bias in a p-n junction diode.
33. How does the collector current change in a junction transistor, if the base region has larger width?
34. What is the difference between diffusion current and drift current?
35. Draw a logic circuit diagram showing how a NAND gate can be converted into a NOT gate.
36. There is a potential barrier of 0.7 V at the junction in an unbiased p-n junction. Can you measure it directly by a multimeter?
37. Explain the terms threshold voltage and reverse saturation current.
38. What is a photodiode?
39. Give the logic symbol and truth table for AND gate. Explain, with the help of a circuit diagram, how this gate is realized in practices.
40. Why the output voltage is out of phase with the input voltage in a common emitter transistor amplifier.
41. A square wave is applied to p-n junction diode as shown in the figure. Draw the output waveform.



42. The output of a 2-input NOR gate is fed to a NOT gate. Draw the logic circuit of this combination of gates and write the truth table for the output of the combination for all inputs.
43. Draw the voltage current characteristics of a Zenger diode.
44. Why are n and p type semiconductors neutral even if they have excess of electron and holes respectively?
45. Write truth table for output Q in the given circuit:



46. Give two differences between a photo diode and a LED. Also, sketch and I – V characteristics of a photodiode for different intensities.
47. Draw the graph for the following once it passes through a half wave rectifier.



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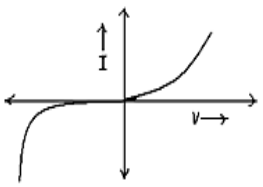
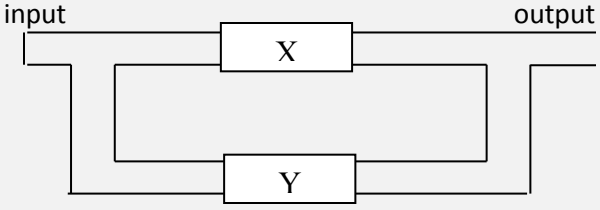
48. Explain input and output characteristics of a common emitter transistor graphically. Draw the circuit diagram.
49. Study the given truth table and name the logic gate which represents it?

INPUT		OUTPUT
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

50. Two amplifiers are connected one after the other in series (cascaded).The first amplifier has a voltage gain of 10 and the second has a voltage gain of 20. If the input signal is 0.01 volt, calculate the output ac signal.
51. What is a zener diode? As compared to a normal diode are the following higher or lower in the zener diode?
    a. Doping
    b. Depletion width
    c. Potential barrier.
52. How is a Zener diode fabricated to make it a special purpose diode? Draw I-V characteristics and explain the significance of the the breakdown voltage.
53. For a transistor connected in common emitter mode, the voltage drop across the collector is 1.5 v and base is 50. Find the base current if R_c is 1.5 kΩ.
54. What is the magnitude of potential barrier for (a) Ge Junction (b) Si Junction
55. Explain zener diode.
56. What is an intrinsic semiconductor? Why does its conductivity increase with rise of Temperature?
57. What is an N-P-N transistor? How does it differ from P-N-P transistor? Give their symbols. Explain it action.
58. Explain through a labeled circuit diagram the working of a transistor as amplifier (common emitter configuration.
59. The figure on right side shows the V-I characteristic of a semiconductor device.
    a. Identify the semiconductor device used here.
    b. Draw the circuit diagram to obtain the given characteristics of this diode.
    c. Briefly, explain how this device is used as a voltage regulator.



60. The block diagram given below is of a set up that can produce a signal of any desired frequency without any external input signal. Identify the components X and Y of this set up and write the function of each.



61. Explain through a labeled circuit diagram, the working of a transistor as an oscillator.
62. Explain transistor as a switch with circuit diagram.

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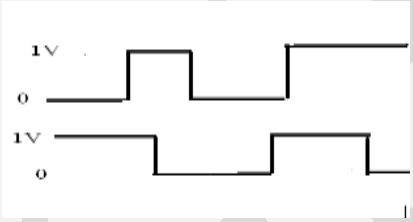
63. The input resistance of a common emitter amplifier is 2k and a c. current gain is 20. If the load resister used is 5k, calculate (i) the voltage gain of the amplifier. (ii) The Trans conductance of the transistor used.
64. Draw a circuit diagram for a two input or and AND gate and explain its working with the help of Input and output wave form.
65. Define the terms 'potential barrier' and 'depletion region' for a p – n junction. Explain, with the help of a circuit diagram, the use of a p – n diode as a full wave rectifier. Draw the input and output wave forms.
66. Draw a labeled circuit diagram of a common emitter amplifier using a p-n-p transistor. Define the term voltage gain and write an expression for it. Explain how the input and output voltages are out of phase by 180^0 for common-emitter transistor amplifiers.
67. Draw the input and output characteristics of a transistor in its common emitter configuration. Explain briefly the meaning of the term 'active region' in these characteristics. For what practical use, do we use the transistor in this 'active region'?
68. With the help of a circuit diagram explain the working of transistor as oscillator.
69. Draw a circuit diagram & explain half wave rectifier.
70. Explain briefly with the hell) of a circuit diagram how V - I characteristics of a p-n junction diode are obtained in (i) forward bias, and (ii) reverse bias.
71. Discuss how i) AND gate ii) NOT gate are realized in practice. Two signals A and B shown in the figure are used as two inputs of NAND gate. Obtain the output waveform for the tome 0 to T.



72. A photodiode is fabricated from a semiconductor with a band gap of 2.8 eV. Can it detect wavelength of 6000. nm? Justify.
73. With the help of circuit diagram, explain the working of a p-n junction diode as full wave rectifier. Show the input and output wave forms.
74. Explain with the help of a circuit diagram the working principle of a transistor as an amplifier in the common emitter configuration .Derive the expression for the voltage gain of the amplifier.
75. How a junction diode is formed. Explain the working when it is reverse and forward biased with circuital and graphical diagram. A given table is represented with voltage and current values calculate dynamic forward and reverse bias resistance

Forward biasing	2V 4V	60mA 80mA
Reverse biasing	0V -2V	0μA -0.25μA

76. Drawing a labeled circuit diagram, explain how a NPN transistor can be used as an amplifier in common base configuration.
77. What is a photodiode? Explain its working. A photodiode is fabricated from a semiconductor with a band gap of 2.8 eV. Can it detect a wavelength of 6000 nm?

EXTRA MARKS

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1. What is the order of energy gap in a conductor, semiconductor, and insulator?
2. Why does the conductivity of a semiconductor change with the rise in temperature?
3. Is the number of electrons greater than, less than (or) equal to the number of holes in an Intrinsic semiconductor?
4. Show in an energy band diagrams the donor level for an N-type semiconductor.
5. Draw in an energy band the acceptor level for a P-type semiconductor.
6. What is knee voltage in a junction Diode?
7. In transistor a current controlled or) temperature controlled device?
8. State the reason, why GaAs is most commonly used in making of a solar cell.
9. For a transistor connected in common emitter mode, the voltage drop across the collector is 2 V and β is 50. Find the base current, if RC is 2 KΩ.
10. The ratio of number of free electrons to holes n_e/n_h for two different materials A and B are 1 and <1 respectively. Name the type of semiconductor to which A and B belongs.
11. In half wave rectification, what is the output frequency if the input frequency is 50 hz. What is the output frequency of a full wave rectification for the same input frequency?
12. How can you relate drift velocity and mobility of an electron?
13. Show by the graph how does the current vary with the voltage change for a junction diode.
14. Why do semiconductors obey OHM'S law for only low fields?
15. Mention the factors upon which conductance of a transistor depend.
16. For faster action which transistor is used and why?
17. What are input and output characteristics of a transistor? Draw the graphs.
18. A germanium diode is preferred to a silicon one for rectifying small voltages. Explain why?
19. The output of an OR gate is connected to both the inputs of a NAND gate. Draw the logic circuit of this combination of gates and write its truth table.
20. Write the Boolean equation and truth table for the circuit shown below. What is the output when all the inputs are high?
21. For a common emitter amplifier, current gain = 50. If the emitter current is 6.6mA, calculate collector and base current. Also calculate current gain, when emitter is working as common base amplifier.
22.The base current is 100mA and collector current is 3mA.
a) Calculate the values of b, Ie, and a
b) A change of 20mA in the base current produces a change of 0.5mAin the collector current. Calculate ba.c.
23. In NPN transistor circuit, the collector current is 5mA. If 95% of the electrons emitted reach the collector region, what is the base current? In a transistor circuit shown the figure, the emitter current is 5mA and collector current 4.75 mA. Calculate the base current and the value of Rb.
24. For a transistor working as a common base amplifier, current gain is 0.96. If the emitter current is 7.2mA, then calculate the base current. 30. For a common emitter amplifier, the current gain is 70. If the emitter current is 8.8mA, calculate the collector and base current.
25. The base current of a transistor is 105 mA and collector current is 2.05 mA.
a) Determine the value of β ,Ie , and α
b) A change of 27 μA in the base current produces a change of 0.65 mA in the collector current . Find βa.c.
26. In a silicon transistor, a change of 7.89mA in the emitter current produces a change of 7.8 mA in the collector current. What change in the base current is necessary to produce an equivalent change in the collector current?

UNIT DERIVATIONS

1. Draw the Diagram and explain.
    a. Energy band diagram of conductor.
    b. Energy band diagram of insulator.
    c. Energy band diagram of semiconductor.
    d. Energy band diagram of p type semiconductor.

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e. Energy band diagram of n type semiconductor.
f. Forward biasing and reverse biasing characteristic.
g. Half wave rectifier and full wave rectifier.
h. Input and Output characteristics of common emitter TRANSISTOR of pop and npn.
i. Common emitter Amplifier.
j. Transistor act as switch.
k. Transistor act as an oscillator.
l. Zener diode.
m. Truth table and logic symbol for LOGIC GATE- OR, AND, NOT, NAND, NOR.

2. Give the difference between p type semiconductor and n type semiconductor.
3. Explain the term potential barrier and depletion layer.

UNIT 10 CHAPTER 15

1. Draw the block diagram of a communication system. What are analog and digital signals?
2. How the detection of Amplitude modulated wave is done. What is the function of rectifier in detection?
3. What is modulation index? Write its expression.
4. Draw frequency spectrum of Am wave.
5. Broadcast frequencies should be sufficiently spaced out why?
6.
7. The height of a TV tower is 400m. Calculate the range upto which signal can be received from the tower.
8. What is modulation? Explain why modulation is necessary in communication.
9. Why is the transmission of signals using ground waves restricted to frequencies upto 1500 kHz?
10. Distinguish between analog signal and digital signal.
11. What is modulation?
12. What is the various method of modulation?
13. Define modulation factor.
14. What should be the length of the dipole antenna for a carrier wave of frequency 3 x 108 HZ?
15. What does the term LOS communication mean? Name the type of waves that are used for this communication. What happens to the range of transmission, if height of the antenna is doubled?
16. What is amplitude modulation?
17. Show graphically amplitude modulation.
18. What are the limitations of amplitude modulation?
19. What is the importance of modulation index?
20. Draw a sketch to illustrate the basic elements required to transmit and receive an audio signal.
21. Why do we need modulation?
22. It is necessary to use satellites for long distance T.V. Transmission. Give one reason.
23. Derive the height of antenna h up to which the T.V. signal can be directly received from a T.V.
24. Explain amplitude modulation. How is it modulated & detected.
25. Distinguish between point to point and broadcast communication modes. Give one example of each.
26. Why sky wave propagation of electromagnetic waves cannot be used for TV transmission? Suggest two methods by which range of TV transmission can be increased.
27. If in an amplitude modulated wave maximum or minimum voltage are 12V and 3V respectively. Determine the modulation index.

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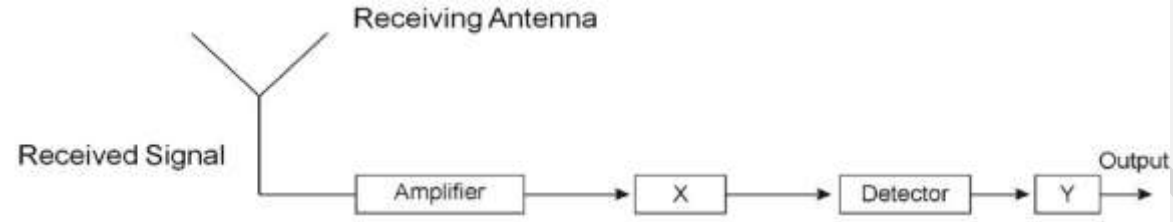
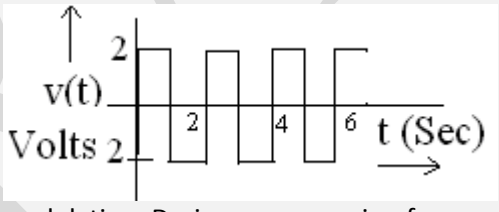
28. In case the signal frequency is 20Khz and carrier frequency is 5Mhz then determine the frequency of side bands.
29. Show that the range of transmission `d' of a T.V. tower of height `h' is given by the relation d = √(2Rh) , where `R' is the radius of the Earth.

30. Define the term modulation. Name three different types of modulation used for a message signal using a sinusoidal continuous carrier wave. Explain the meaning of any one of these.
31. Find the expression of amplitude modulated wave.
32. Block diagram of receiver is given. (a) Identify X and Y (b) State their functions.



33. What is the need of a detector and which semiconducting device forms the important component of detector.
34. A message signal of frequency 10 KHz and peak voltage of 10 volts is used to modulate a carrier of frequency 1MHz and peak voltage of 20 volts. Determine (a) nodulation index (b) the side bands produced.
35. Explain surface wave and sky wave propagations of radio waves. Why is short wave communication over long distances not possible by surface wave propagation?
36. Why we need a carrier wave of very high frequency in the modulation of signals? A carrier wave of peak voltage 20 V is used to transmit a message signal. What should be the peak voltage of modulating signal for achieving modulation index?
37. For amplitude modulated wave the maximum amplitude is found to be 14 V and the minimum amplitude is found to be 6V.Determine the modulation index (μ).What would be the value of μ if the amplitude of modulating signal is zero.
38. A modulating signal is a square wave as shown in the figure. The carrier wave is given by y(t) = 4 sin (6πt) volts. Draw the amplitude modulated wave.



i.
39. Explain the need of modulation. Derive an expression for covering range of TV transmission towers.
40. What is satellite wave propagation? Which two communication methods make use of this mode of propagation? If the sum of the heights of transmitting and receiving antennae in line of sight of communication is fixed at h, show that the range is maximum when the two antennae have a height h/2 each.
41. Distinguish between analog and digital communication. Write any two modulation techniques employed for the digital data. Describe briefly any one of the techniques used.
42. A ground receiver station receiving a signal at (a) 5 MHz and (b) 100 MHz, transmitted from a ground transmitter at a height of 300 M located at a distance of 100 Km
43. Identify whether it is coming via space wave or sky wave propagation or satellite transponder.
44. Explain the following term: Ground wave, Space wave and sky wave.

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UNIT DERIVATIONS

1. Define the basic term modulator, amplification ,bandwidth ,repeater, transducer, antenna , noise and attenuation
2. What is the communication system explain the basic elements of communication and explain them with the help of block diagram
3. Why we need the modulation, describe the amplitude modulation and frequency modulation,
4. Explain the ground wave propagation , space propagation , and sky wave propagation
5. Explain the demodulator or receiver with the help of block diagram.

EXTRA MARKS

1. Why are micro wave used in radars?
2. Why sky waves are not used in the transmission of television signals?
3. What should be the desirable characteristic of a diode detector?
4. Give a velocity factor of a line.
5. Why is delta modulation a convenient method of digital modulation.
6. Where the two wire transmission line, Coaxial cable, Optical fiber are employed.
7. What is heterodyning?.
8. What is population inversion? How is it achieved?.
9. Enumerate the various types of Lasers?.
10. Lists some of the applications of Lasers?.
11. Name the prime elements of a telecommunications network.
12. Audio signal cannot be transmitted directly in to the space why?
13. What is pulse modulation?
14. What is precisely meant by the term channel in a communication system "?
15. Why does the electrical conductivity of earth's atmosphere increase with altitude ?
16. Explain numerical aperture in fiber optical
17. Differentiate between (i) PAM and (II) PPM .
18. Why the transmission of signal is not possible for frequency greater than 20Mhz .
19. How does the effective power radiated by the antenna vary with wavelength?
20. What should be the length of the dipole antenna for a carrier wave of 5 X 10 8hz ?
21. By how much should the height of the antenna be increased to double the coverage range R= 6400 Km.
22. A TV Tower has a height of 100 m. How much population is covered by the TV Broadcast if the average population density around the tower is 1000/km^2
23.Ground receiver station is receiving a signal at (i) 5MH and (ii 100MHz transmitted from a round transmitter at a height of 300 m, located at a distance of 100 km from the receiver station. Identify whether the signal is coming via space wave or sky wave propagation or satellite transponder. Radius of earth = 6.4 x 106 m. N_{max} of the Ionosphere = 10^{12} m^3
24.A schematic arrangement for transmitting a message signal (20 Hz to 20kHz. is given below:
Give two drawbacks from which this arrangement suffers. Describe briefly with the help of a block diagram the alternative arrangement for the transmission and reception of the message signal.
25. The maximum peak-to-peak voltage of an AM wave is 16mV and the minimum peak-to peak voltage is 4mV.Calculate the modulation factor.

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26. An AM wave is represented by the expression: v = 5(1+0.6cos6280t) sin 221 X 104t volts
(i) What are the maximum and minimum amplitudes of the AM wave?
(ii) What frequency components are contained in the modulated wave?
27. An audio signal of 1 kHz is used to modulate a carrier of 500 kHz. Determine
(i) Sideband frequency.
(ii) Bandwidth required.
28. The antenna current of an AM transmitter is 8A when only carrier is sent but it increases to 8.93A when the carrier is sinusoid ally modulated. Find the percent-age modulation index.
29. A 100 MHz carrier is modulated by a 12 kHz sine wave so as to cause a frequency swing of +50kHz. Find the modulation index.
30. The TV transmission tower at a particular place has a height of 160m. What is its coverage range? By how much should the height be increased to double its coverage range? Given that radius of earth = 6400 km.
31. A TV tower has a height of 110m. How much population is covered by the TV broadcast if the average population density around the tower is 1000 km-2? Given that radius of Earth = 6.4 X 106m.
32.A microwave telephone link operating at the central frequency of 10 GHz has been established .If 2 % of this is available for microwave communication channel, then how many telephones channels can be simultaneously granted if each telephone is allotted a band width of 8 KHz .
33. You are given three semiconductors A, B, C with respective band gaps of 3eV, 2eV and 1eV for use in a photo detector to detect λ = 1400nm. Select the suitable semiconductor. Give reasons.
34. Frequencies higher than 10MHz are found not to be reflected by the ionosphere on a particular day at a place. Calculate the maximum electron density of the ionosphere

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