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1. ELECTROSTATICS

OBJECTIVE QUESTIONS

1. When a glass rod rubbed with silk cloth acquires a charge $+1.6 \times 10^{-19}$ coulombs what is the charge on the silk cloth? **(H.P.B.2004)**
(a) 1.6×10^{-19} (b) -1.6×10^{-19}
(c) 1.6×10^{-18} (d) $1.6 \times 10^{19} C$

2. Dimensional formula for electric potential is **(H.P.B.2017)**
(a) $[ML^2T^3A]$ (b) $ML^2T^{-3}A^{-1}$ (c) $[M^{-1}L^{-2}T^3A]$ (d) $ML^{-2}T^{-3}A^{-1}$

3. Name the property which tells about the existence of charge in packets **(H.P.B.2000)**
(a) conservations of charge (b) invariance of charge
(c) quantization of charge (d) none of these

4. Intensity of electric field at a point is defined as the electrostatic force per units positive charge acting on a vanishing positive test charge placed at **(H.P.B.2000)**
(a) any point (b) that point (c) the charge (d) none of these

5. Which law asserts that electric field lines cannot form closed path? **(H.P.B.2000)**
(a) Coulomb's Law (b) Superposition Law
(c) Conservation Law (d) Gauss Law

6. In coulomb's law on what factors the value of electrostatic force constant (K) depends? **(H.P.B.2001)**
(a) nature of medium (b) system of units (c) both a and b (d) none of these

7. Is it safe to be inside a car during a thunder storm? **(H.P.B.2001)**
(a) cannot say (b) yes
(c) statement is incomplete (d) no.

8. P and Q are points equidistant from an electric dipole. The point P is on axial line and point Q is on the equatorial line. What is the ratio of $\frac{E_P}{E_Q}$? **(H.P.B.2001)**
(a) 1:1 (b) 1:2 (c) 2:1 (d) 2:3

9. S.I. unit of potential gradient is **(H.P.B.2010)**
(a) Vm^{-1} (b) Vm (c) $C\ m$ (d) weber

10. Angle between equipotential surface and electric field lines is **(H.P.B.2014)**
(a) zero (b) 180° (c) 90° (d) 45°

11. A stationary charge produces **(H.P.B.2014)**
(a) an electric field only (b) a magnetic field only
(c) both electric and magnetic field (d) none of these

12. SI unit of electric charge is **(H.P.B.2015)**
(a) coulomb (b) ampere (c) weber (d) volt.

13. When a body becomes negatively charged its mass **(H.P.B.2016, 15)**
(a) decreases (b) increases (c) remains same (d) none of these

14. Which of the following is the unit of Electric field
(a) Coulomb (b) Newton (c) Volt (d) NC^{-1} **(H.P.B. 2024)**

15. The S.I. unit of electric dipole moment is
(a) Cm (b) C (c) Cm^{-1} (d) Nm^{-1} **(H.P.B. 2024)**

16. SI unit of ε_0 will be:
(a) $N^{-1}m^{-2}C^{-2}$ (b) $Nm^{-2}C^{2}$ (c) $N^{-1}m^{-2}C^{2}$ (d) $Nm^{-2}C^{-2}$ **(H.P.B. 2024)**

17. The electric potential is constant in a region. What can you say about electric field there.
(a) 0 (b) ∞ (c) 0 to ∞ (d) none of these

18. Dimensional formula for electric potential is
(a) $[ML^2\ T^3A]$ (b) $[ML^2\ T^{-3}A^{-1}]$ (c) $M^{-1}\ L^{-2}\ T^3A]$ (d) $[ML^{-2}\ T^{-3}A^{-1}]$

19. Dimensional formula for potential difference is
(a) $[M^0\ L^{\ 2}T^{-3}A^{-1}]$ (b) $[ML^2\ T^{-2}A^{-1}]$ (c) $[ML^2\ AT^4]$ (d) $[MLT^{-2}A]$

20. Electric field intensity due to an electric dipole at a point of distance from its centre varies as
(a) r (b)r^2 (c) r^3 (d) r^{-3}

21. Dimensional formula of electric field intensity is
(a) $[MLT^{-3}\ A^{-1}]$ (b) $[M^2LT^{-3}\ A^{-1}]$ (c) $[ML^2T^{-2}\ A^1]$ (d)) $[ML^2T^{-3}\ A^{-1}]$

22. The number of electrons in one coulomb of charge is
(a) 6.25×10^{18} (b) 6.25×10^{19} (c) 6.25×10^{21} (d) 6.25×10^{23}

23. In SI, unit of electric field (intensity) is
(a) Am^{-1} (b) NC^{-1} (c) Cm^{-1} (d) Cm^{-2}

24. The angle between dipole moment and net electric field due to an electric dipole on equatorial line is:
(a) 0° (b) 90° (c) 120° (d) 180°

25. A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge.
(a) remains a constant because the electric field is uniform.
(b) increases because the charge moves along the electric field.
(c) decreases because the charge moves along the electric field.
(d) decreases because the charge moves opposite to the electric field.

26. Name CGS unit of the charge:
(a) stat coulomb (b) henry (c) ohm (d) C/m^3

27. Dimensional formula of absolute permittivity of free space $\in_0$
(a) $[M^{-1}\ L^{-3}\ T^4\ A^2]$ (b) $[ML^3\ TA^2]$ (c) $[M^2\ L^{-3}\ T^4\ A]$ (d) $[M^{-1}\ L^{-3}\ TA^2]$

28. A body gets positively charged, it means that:
(a) it has gained the electrons (b) it has lost the electrons
(c) neither gain nor loss (d) none of above.

29. Electric flux due to an electric dipole
(a) $q/\in_0$ (b) $q/\in$ (c) Zero (d) $2q/\in_0$

30. A spherical conductor of radius 12 cm has a charge of 16 × 10^{-7} C distributed uniformly on its surface. What is the electric field inside the sphere?
(a) 10^6 NC (b) $10^{-6}NC$ (c) 10^5NC^{-1} (d) Zero

31. The dielectric constant of metal is
(a) Zero (b) 1 (c) 0.5 (d) infinite

32. In which orientation a dipole placed in a uniform electric field is in unstable equilibrium ?
(a) when p is parallel to E i.e., ϕ = 0
(b) when p is antiparallel to E ie., ϕ = 180°
(c) when p is perpendicular to E
(d) Both (a) and (b).

33. For a point charge located in space, equipotential surface are.
(a) Concentric circles (b) Concentric spheres
(c) parallel planes (d) parallel linear lines

ANSWER KEY

1.(b) 2.(b) 3.(c) 4.(b) 5.(d) 6.(c) 7.(b) 8.(c) 9.(a) 10.(c)
11.(a) 12.(b) 13.(a) 14.(d) 15.(a) 16.(c) 17.(a) 18.(b) 19.(c) 20.(d)
21.(a) 22.(a) 23.(b) 24.(d) 25.(c) 26.(a) 27.(a) 28.(b) 29.(c) 30.(d)
31.(d) 32.(b) 33.(b)

SUBJECTIVE QUESTIONS

1. What is meant by quantization and conservation of charge? **(H.P.B.2018, 05, 03)**

2. State coulomb's law of electrostatic force in vector form. **(H.P.B.2011, 03)**

3. What is importance of coulomb's law in vector form. **(H.P.B.2013)**

4. Calculate the Coulomb's force between an alpha particle and a proton separated by $3.2 \times 10^{-15}m$. **(H.P.B.2011, 02)**

5. What is meant by electric lines of force? Give two properties of lines of force. **(H.P.B.2003)**

6. Give important properties of electric lines of force. **(H.P.B.2011, 04)**

7. The safest way to save yourself from lighting is to be inside a car. Comment **(H.P.B.2003)**

8. How many electrons are present in one coulomb of charge? **(H.P.B.2018, 16, 03)**

9. Vehicles carrying inflammable materials usually have metallic ropes during motion. Why? **(H.P.B.2003)**

10. A charge is distributed uniformly over a ring of radius r. Obtain an expression for the electric intensity E at a point on the axis of the ring. Also show that for points at large distance the ring behaves as a point charge. **(H.P.B.2005)**

11. Explain why two electric field lines never cross each other at a point? **(H.P.B. 2024)**

12. State Coulomb's law in Electrostatics. Give its vector form. Calculate Coulomb's force between two α-particles separated by a distance of 3.2 x 10^{-15} m. **(H.P.B. 2024)**

13. State Gauss' theorem and use it to derive expression for electric field intensity at a point due to line charge. **(H.P.B.2011, 05. 06, 07)**

14. What is electric flux? Write its S.I. units using Gauss theorem, derive an expression for Electric field at a point due to uniformly charged infinite plane sheet? **(H.P.B. 2024)**

15. State Gauss' theorem in electrostatics. Use this to find the electric field inside the spherical shell. **(H.P.B.2001)**

16. Compare mass and electric charge. **(H.P.B. 2021, 2022)**

17. State and prove Gauss theorem in Electrostatics. **(H.P.B. 2005)**

18. (a) Using Gauss' theorem, drive an expression for electric field intensity at a point due to an infinite sheet of positive charge.
(b) what is the electric potential at the surface of an iron nucleus? The radius of the nucleus is 4.2 x10 $^{-15}$ m and the atomic number is 26. **(H.P.B. 2005)**

19. State Gauss theorem in electrostatics. Derive an expression for electric field due to a uniformly charged spherical shell. (i) at a point outside the shell. (ii) at a point on the surface of the shell and (iii) at a point inside the shell. **(H.P.B. 2010)**

20. Define Gauss's theorem. Using it derive an expression for electric field intensity at a point due to an infinitely long straight uniformly charged wire. **(H.P.B. 2018, 11, 05)**

21. Define the Electric potential. Obtain an expression for it, due to a point charge 'q' at a point 'p' at a distance 'r' from 'q'? **(H.P.B. 2024)**

22. What is meant by equipotential surface? Give its important properties**.** **(H.P.B. 2016, 21)**

23. What is meant by equipotential surface? Show that work done in moving a test charge along the equipotential surface is zero. **(H.P.B.2016, 08)**

24. Define electric field intensity at a point and find expression for it at point due to an electric dipole, on the axial line.

25. Derive a relation for the electric field of an electric dipole at a point on its equatorial line. **(H.P.B.2011, 05)**

26. Define electric potential energy and derive an expression for potential energy of a system of two charges. **(H.P.B.2010)**

27. Show that work done in moving a test charge from one point to another point on an equipotential surface is zero. **(H.P.B. 2020,16)**

28. Establish relation between electric field and potential gradient. **(H.P.B. 2020, 21)**

29. Explain electrostatic shielding. Give an example. **(H.P.B. 2021)**

31. A polythene piece rubbed with wool is found to have a negative charge of $3.2 \times 10^{-7} C$.Estimate the number of electrons transferred from which to which? **(H.P.B.2004)**

33. Find magnitude of electric field which just balances a deuteron of mass $3.2 \times 10^{-27} kg$ **(H.P.B.2004)**

35. No two equipotential surfaces intersect each other. Why? **(H.P.B.2013)**

36. What is meant by potential energy of an electric dipole; When placed in an external electric field? Show that potential energy U of an electric dipole moment $\vec{p}$ in a uniform field is given by $U = -\vec{p} \cdot \vec{E}$. **(H.P.B. 2014)**

37. Obtain an expression for the electric field due to an electric dipole at a point on the line passing through the centre of the dipole and perpendicular to the dipole axis. **(H.P.B. 2014)**

2. CAPTACITANCE

OBJECTIVE QUESTIONS

1. On What factors the capacitance of a capacitor depends.
(a) nature of dielectric (b) area of plate
(c) distance between plates (d) All **(H.P.B. 2003)**

2. If n capacitor are connected in parallel to a V volt source then total energy of the system is
(a) CV (b) $\frac{1}{2}CV^2$ (c) $\frac{1}{2}nCV^2$ (d) $\frac{1}{2n}CV^2$ **(H.P.B. 2012)**

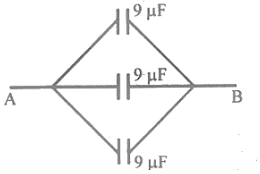
3. Relation between dielectric constant 'K' and electric susceptibility χ_e is
(a) $\chi_e = 1 + K$ (b) $\chi_e = K - 1$ (c) $\chi_e = \frac{1}{(1+K)}$ (d) $\chi_e = \frac{1}{(1+\chi_e)}$ **(H.P.B. 2012)**

4. If the distance between two plates of a parallel plates capacitor is doubled, then its capacitance:
(a) decrease two times (b) increase two times
(c)increase 4 times (d) decrease 4 times **(H.P.B. 2021, 22)**

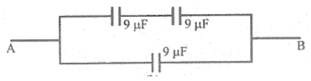
5. The length of conductor is halved its conductivity will be
(a) Changed (b) Remain unchanged (c) Become ½ (d) None of above
(H.P.B. T-1 2021, 22

6. When a thick plate of dielectric is placed in the air space of a parallel plate capacitor then.
(a) Capacitance decreases (b) Capacitance increases (c) Remains same (d) None
(H.P.B. T-1 2021, 22)

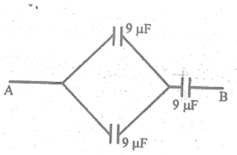
7. What will be the resultant capacitance of capacitor connected as shown in figure between A and B?
(a) 3 μF (b) 27 μF (c)18 μF (d) 9 μF
(H.P.B. 2013)



8. What will be the resultant capacitance of capacitors connected as shown in figure between A and B.
(a)15.3μF (b) zero
(c) 13.5μF (d) None of these. **(H.P.B. 2013)**



9. What will be the resultant capacitance of capacitor connected as shown in figure between A and B?
(a) 6 μF (b) 27 μF (c) 9μF (d) 18 μF
(H.P.B. 2013)



10. Capacitance (C) is the ratio of electric charge (Q) to the corresponding potential (V) i.e. $C = \frac{Q}{V}$. Its S.I. units is
(a) Coulomb (b) Farad (c) Henry (d) Ohm **(H.P.B. 2007)**

11. Capacitance of earth is considered to be
(a) 711 μF (b) 0 (c) D (d) uncertain

12. S.I. units of potential gradient is
(a) Vm^{-1} (b) Vm (c) C m (d) weber

13. Dimensional formula of dielectric strength is

(a) $[MLT^3\ A^{-1}]$ (b) $[ML^3\ TA^{-1}]$ (c) $[MLT^{-3}\ A^{-1}]$ (d) $[MLT^{-3}\ A^1]$

14. Electric potential is
(a) scalar and dimensional quantity
(b) vector and dimensional quantity
(c) scalar and dimensionless quantity
(d) vector and dimensionless quantity.

15. Electric potential V due to a dipole is related to the distance of the observation point as:
(a) $V \propto r$ (b) $V \propto r^{-1}$ (c) $V \propto r^2$ (d) $V \propto r^{-2}$

16. The work done by an agency to carry a−10 C charge from infinity to a point in electrostatic field is 50 J. The potential at that point is:
(a) 0.2 V (b) 5 V (c)−5 V (d) 250 V

17. The electrostatic potential energy of a charge of 5 C at a point in the electrostatic field is 50 J. The potential at that point is:
(a) 0.1 V (b) 5 V (c) 10 V (d) 250 V

18. The work done in displacing a charge of 2C through 0.5 m on an equipotential surface is
(a) zero (b) 1 J (c) 4 J (d) None of these

19. One of the plates of the capacitor is connected to a source at +20 V. The other plate P is properly earthed. What is the potential of the plate P?
(a)−20 V (b) +20 V (c) zero (d) none of the above

20. Introduction of a slab of which of the following will decrease the capacitance of a capacitor?
(a) Zinc (b) Copper (c) Aluminium (d) None of the above.

21. The unit $C^2\ J^{-1}$ is equivalent to the unit of
(a) Potential (b) Electric field (c) capacitance (d) dipole moment

ANSWER KEY

1.(d)	**2.(c)**	**3.(b)**	**4.(b)**	**5.(a)**	**6.(b)**	**7.(b)**	**8.(c)**	**9.(a)**	**10.(b)**
11.(a)	**12.(a)**	**13.(c)**	**14.(c)**	**15.(d)**	**16.(c)**	**17.(c)**	**18.(a)**	**19.(d)**	**20.(d)**
21.(c)									

SUBJECTIVE QUESTIONS

1. What do you understand by polarization of a dielectric? Hence establish the relation K=1+x_e. **(H.P.B. 2013, 2021)**

2. Derive an expression for the capacity of a parallel plate capacitor with a dielectric slab placed in between the plates of capacitor. **(H.P.B. 2021)**

3. Show that the force on each plate of a parallel 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. **(H.P.B. 2023)**

4. What is a parallel plate capacitor? Derive a relation for capacitance of a parallel plate capacitor with di-electric slab introduced in between its plates **(H.P.B. 2024)**

5. DefIne capacitnace, give its S.I. unit and dimensional formula. **(H.P.B. 2007)**

6. What happens to the capacitance of a capacitor when charge q on it is doubled? **(H.P.B. 2014)**

7. Net charge on a capacitor is always zero. Then what does a capacitor store? Explain. **(H.P.B. 2014)**

8. Show that capacitance of an isolated spherical conductor is directly proportional to the radius of the spherical conductor.

9. What are the factors on which the capacity of a parallel plate capacitor depends? **(H.P.B)**

10. What is resultant capacitance if number of capacitor are connected in series. **(H.P.B)**

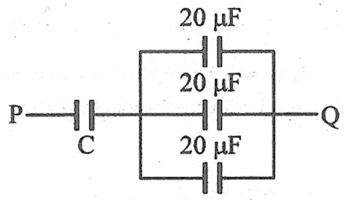
11. Find minimum number of capacitances of 2μF each required to obtain a capacitance of 5μF. **(H.P.B. 2000)**

12. Three capacitors each of capacity 2μF are connected in series. Find resultant capacity is farad. **(H.P.B. 2003)**

13. Assuming the earth to be a spherical conductor of radius 6400 km? Calculate its capacitance. Given $\frac{1}{4\pi\varepsilon} = 9 \times 10^9\ Nm\ C^{-2}$. **(H.P.B. 2017,04)**

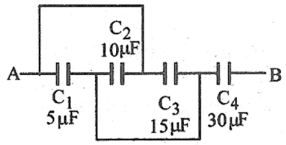
14. What is the effective capacitance of the network $C_1 = 10\mu F, C_2 = 20\mu F,$ and $C_3 = 30\mu F$? **(H.P.B. 2005)**

15. Calculate the capacitance of capacitor C. The equivalent capacitance of the combination between P and Q is 30μF.



(H.P.B. 2008)

16. Calculate the equivalent capacitance between points A and B in the combination. **(H.P.B. 2008)**



17. What do you mean by dielectric polarization? **(H.P.B. 2013)**

18. In 12pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor? **(H.P.B. 2021-22)**

3. CURRENT ELECTRICITY

OBJECTIVE QUESTIONS

1. Name units of conductance and conductivity
(a) ohm, ohm meter (b) mho, mho meter
(c) mho, ohm meter (d) mho, mho per meter **(Based on H.P.B)**

2. How many electrons pass in one second when current is 1 A?
(a) 5.26×10^3 (b) 6.25×10^{18} (c) 2.96×10^{16} (d) 2.65×10^{18}
(H.P.Board 2003, 13)

3. What do you mean by a linear resistor? A resistor which obeys
(a) Ohm's law (b) Joule's law (c) coulom's law (d) none of these

4. If the radius of copper wire is doubled, what will be the effect on its specific resistance? It will
(a) remain same (b) increase (c) decrease (d) cannot say.
(H.P.Board 2003)

5. SI unit of current is
(a) milli ampere (b) micro ampere (c) ampere (d) none **(H.P.Board 2004)**

6. Why constantan or manganin are chosen for the construction of standard resistances? Because they have
(a) High resistivity (b) high melting point
(c) high temperature coefficient (d) all of these **(H.P.Board 2004, 11)**

7. If a wire is stretched to thrice its original length without loss of mass, how will the resistivity of the wire be influenced?
(a) three times (b) one-third (c) unchanged (d) none of these
(H.P.Board 2004)

8. Calculate number of joule in 1 kWh.
(a) $3.6 \times 10^6\ J$ (b) $6.3 \times 10^6 J$ (c) $6.3 \times 10^3 J$ (d) $3.6 \times 10^3 J$
(H.P.Board 2002, 04)

9. Find the current flowing through a lamp of 60 W operating at 220 V.
(a) $\frac{1}{2}\ A$ (b) 2 A (3) $\frac{1}{3} A$ (d) $\frac{1}{4}\ A$
(Based on H.P.B)

10. What is the resistance of 1 kW heater marked for 220 V?
(a) 4.84 Ω (b) 0.484 Ω (c) 48.4 Ω (d) none of these
(Based on H.P.B)

11. Three bulbs 40W, 60W, 100W are connected to 220 volt mains. Which will glow brightly, if they are joined in series?
(a) 40 W (b) 60 W (c) 100 W (d) all
(Based on H.P.B)

12. Joule's law of heating states that amount of heat produced in a conductor is directly proportional to
(a) square of current passing through the conductor
(b) resistance of the conductor and (c)time of passage of current (d) all **(Based on H.P.B)**

13. Why copper thick wires are used as connecting wires?
(a) copper is good conductor of electricity (b) thick copper wires ensure low voltage drop
(c) they gives low power loss (d) all of these

14. Calculate number of kWh is one joule.
(a) 6.3×10^6 kWh (b) $2.8 \times 10^{-8} kWh$ (c) 3.6×10^3 kWH (d) 6.3×10^3kWH
(H.P.B. 2004)

15. Why are resistance connected in series and parallel?
(a) to increase the equivalent resistance
(b) to decrease the equivalent resistance
(c) a and b respectively
(d) b and c respectively **(H.P.B. 2005)**

16. What is the unit of electromotive force?
(a) volt (b) newton (c) joule (d) none of these
(H.P.B. 2005)

17. Physical conditions (like temperature, pressure etc.) remaining same, the potential drop across a conductor is directly proportional to current flowing through it. It is
(a) Ohm' law (b) Kirchhoff' law (c) Lenz's law (d) Ohm's law. **(H.P.B. 2005)**

18. If a wire of resistivity p is stretched to double its length, then its new resistivity will
(a) be half (b) be double (c) be four times **(d) not change**
(H.P.B. 2008)

19. A wire of length L is drawn to a length 2L. Then the resistance will
(a) increases 4 times (b) decrease to $\frac{1}{4}$ th (c) increase two times (d) not change
(H.P.B. 2017,08)

20. The heat produced by a 100 W heater in 2 minutes is equal to
(a) $4 \times 10^3 J$ (b) $6 \times 10^3 J$ (c) $10 \times 10^3 J$ (d) $12 \times 10^3 J$
(H.P.B. 2008)

21. Number of electrons in IC charge is
(a) 6.25 (b) 6.25×10^{-18} (c) 6.25×10^{18} (d) 6.25×10^{-19}
(H.P.B. 2010)

22. Three copper wires of lengths and crossectional areas are $\left(\frac{l}{A}\right)$; $\left(2l, \frac{A}{2}\right)$ and $\left(\frac{l}{2}, 2A\right)$. Resistance is minimum is
(a) wires of crossectional area $\frac{A}{2}$ (b) wire of crossectional area A.
(c) wire of crossectional area 2A (d) same in all three wires **(H.P.B. 2011)**

23. S.I. units of conductivity is
(a) $\Omega\, m$ (b) $\Omega^{-1} m^{-1}$ (c) $\Omega^{-1}\, m$ (d) $\Omega\, m^{-1}$
(H.P.B. 2011)

24. If length of a wire is doubled and its cross-sectional area remains same, then the resistance of the wire will be
(a) unchanged (b) quadrupled (c) doubled (d) halved.
(H.P.B. 2011)

25. Kirchhoff's first and second laws are respectively based on law of resistance of the wire will be
(a) momentum and energy (b) charge and energy
(c) mass and energy (d) none **(H.P.B. 2012)**

26. kWh is the unit of
(a) Current (b) voltage (c) Electric power (d) Electric energy
(H.P.B. 2013)

27. Dimensional formula of electrical resistance is
(a) $[ML^2T^{-3}A^{-1}]$ (b) $[ML^2T^{-3}A^{-2}]$ (c) $[ML^3T^{-3}A^{-2}]$ (d) $[ML^2T^{-3}A]$
(H.P.B. 2019)

28. Resistance of a conductor increases with the rise of temperature, because,
(a) relaxation time decrease (b) relaxation time increases
(c) electron density decrease (d) electron density increases **(H.P.B. 2019)**

29. If a charge flowing through a cross-section of a wire can be written as $q = 6t^2 + 5t$, then calculate the electric current at t =0 sec. **(H.P.B. 2021)**
(a) $I = 0A$ (b) $I = 3A$ (c) $I = 5A$ (d) 20 A

30. If a charge flowing through a cross-section of a wire can be written as $q = 5t^2 + 8t$, then calculate the electric current at t =2 sec. **(H.P.B. 2021)**
(a) $I = 25A$ (b) 26 A (c) 27 A (d) 28 A

31. Resistivity of a conductor depends upon: **(H.P.B. 2021)**
(a) its material (b) its cross section (c) its length (d) both (b) and (c)

32. kWh is the unit of **(H.P.B. 2020)**
(a) current (b) voltage (c) electric power (d) electric energy

33. The unit of electric power is **(H.P.B. 2021)**
(a) volt (b) joule (c) watt (d) kwh

34. Kirchhoff's first, second laws are respectively based on law of conservation of
(a) momentum and energy (b) charge and energy
(c) mass and energy (d) none of these. **(H.P.B. 2018, 15, 14, 21)**

35. If a charge flowing through a cross section of wire can be given as $q=5t^2+81$ (where 'q' charge and 't' is time), then calculate the Electric current at t = 2s.
(a) 20 A (b) 36 A (c) 13 A (d) 28 A **(H.P.B. 2024)**

36. Calculate current through a lamp of 60W operating at 220V:
(a) 2.73 A (b) 27.3 A (c) 0.0273 A (d) 0.273 A **(H.P.B. 2024)**

ANSWER KEY

1.(d)	**2.(b)**	**3.(a)**	**4.(a)**	**5.(c)**	**6.(d)**	**7.(c)**	**8.(a)**	**9.(a)**	**10.(c)**
11.(a)	**12.(d)**	**13.(d)**	**14.(b)**	**15.(c)**	**16.(a)**	**17.(a)**	**18.(d)**	**19.(a)**	**20.(d)**
21.(c)	**22.(c)**	**23.(b)**	**24.(c)**	**25.(b)**	**26.(d)**	**27.(b)**	**28.(a)**	**29.(c)**	**30.(d)**
31.(a)	**32.(c)**	**33.(c)**	**34.(b)**	**35.(a)**	**36.(d)**				

SUBJECTIVE QUESTIONS

1. Define the drift velocity and derive an expression for it. **(H.P.B. 2024)**

2. Define the term drift velocity and derive an expression for it. Also establish the relation between current and drift velocity. **(H.P.B. 2015)**

3. Define resistivity of a conductor and discuss the factors on which it depends. **(H.P.B. 2011)**

4. A given wire having resistance R is stretched so as to reduce to half the diameter of previous value. What will be new resistance and resistivity? **(H.P.B. 2011)**

5. Discuss the nature of charge carries in solids, liquids and gases. **(H.P.B. 2001)**

6. How many electron pass through a lamp in one minute if current is 300 mA? **(H.P.Board 2015, 10)**

7. What is Ohm's law? What are ohmic and non-ohmic conductor ? **(H.P. B. 2013)**

8. Define Ohm's law? Give the graph for showing the variation of current with voltage for a conductor. **(H.P.B. 2020, 21)**

9. State Ohm's law and hence define resistance. Give the units and dimensional formula of resistance. **(H.P. B. 2014)**

10. What do you understand by Electric resistance of a conductor? Prove that resistance of a conductor is given by $R = \frac{ml}{ne^2 \pi A}$ Where π is average relaxation time. **(H.P. B. 2019)**

11. Define drift velocity and derive the expression for it in a conductor n terms of relaxation time. **(H.P.B. 2020, 21)**

12. What is drift velocity? Prove that drift velocity is in a direction opposite to the electric field applied across two ends of conductor. **(H.P. B. 2012)**

13. Define resistance of a conductor. What is its cause? What are factor on which the resistance of a conductor depends? **(H.P.B. 2020, 21)**

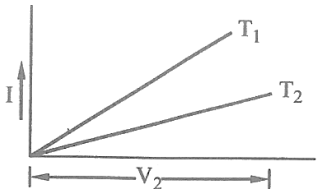
14. Deduce the relation between current and drift velocity of electrons **(H.P.B. 2004)**

15. Prove that electric current flowing through a conductor is proportional to the drift velocity of electron. **(H.P. Board 2004)**

16. A wire of resistance 1 ohm is stretched to double its lengths. What is the new resistance? **(H.P.B. 2010, 12, 13, 14)**

17. A wire having a resistance of 1 ohm is cut into three equal parts. The three equal parts are then joined in parallel. What is the value of the resistance of the combination? **(H.P.B.)**

18. V-1 graph for a metallic wire at two difference temperature T_1 and T_2 is as shown in the figure. Which of the two temperature T_1 and T_2 is higher and why? **(H.P. B. 2000)**



19. Find the total resistance of a circuit in which three resistance R_1, R_2 and R_3 are connected in (i) series and (ii) parallel. **(H.P. B. 2014)**

20. Find the equivalent resistance of three resistors R_1, R_2 and R_3 When they are connected
(i) In parallel (ii) in Series **(H.P. B. 2015)**

21. A wire has a resistance of 90Ω and is cut into three equal parts. If they are connected in parallel the resistance of combination is …….. **(H.P. B. 2013)**

22. A wire has resistance 90 Ω and it is cut into three pieces having equal lengths. If these are now connected in parallel, find the resistance of the combination. **(H.P. B. 2016)**

23. A wire a resistance 5 ohm is drawn out so that its length is increased to twice of its original length. Calculate its new resistance. **(H.P. B. 2019)**

24.. A series combination of three resistors takes current 2A from a 24V supply. If the resistors are in the ratio 1:2:3. Find the value of unknown resistors. **(H.P.B. 2019)**

25. A wire having resistance R ohm is stretched to double its length. What is the new resistance? **(H.P.B. 2020)**

26. Define resistivity of a material and discuss the factors on which it depends. **(H.P. B. 2018)**

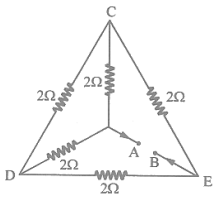
27. A negligibly small current is passed through a wire of length 15 m and uniform cross-section 6×10^{-7} m^2 and its resistance is measured to be 5Ω. What is the resistivity of the material at the temperature of the experiment? **(H.P.B. 2021)**

28. Three resistor of 2Ω, 4Ω and 5Ω are combined in parallel. What is the total resistance of combination? **(H.P.B. 2021)**

29. When two resistance are in series, they have value 25 ohm and in parallel 4 ohm. Find each. **(H.P.B. 2020)**

30. A letter A consists of a uniform wire of resistance of one ohm per cm. The sides of the letter are each 20 cm long and cross piece in the middle is 10 cm long, while the apex angle is 60°. Find resistance of the letter between two ends of the legs. **(H.P.B. 2013, 10, 07)**

31. A potential difference of 2 volt is applied between the points A and B shown in the network Drawn in the figure. Calculate
(i) Equivalent resistance of network across the points A and B.
(ii) The magnitude of currents flowing in the arms AFCEB and AFDEB.



32. A battery of 10V and negligible internal resistance is connected across the diagonally opposite corner of a cubical network consisting of 12 resistances, each of 1 Ω. Determine the equivalent resistance of network and current along each edge of cube? **(H.P. B. 2003)**

33. Find the effective e.m.f of cells when connected in series **(H.P. B. 2016)**

34. Define internal resistance of a cell. Prove that $r = \left(\frac{E}{V} - 1\right)$ R, where is the external resistance used. **(H.P.B. 2020,, 18, 17, 15, 12)**

35. Define terminal potential difference of a cell. What are its units? **(H.P.B. 2016, 21)**

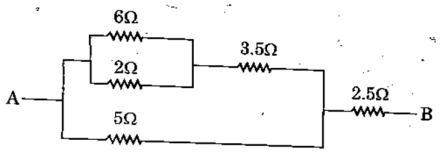
36. State and explain Kirchhoff's laws in electricity. **(H.P.B. 2019, 12, 21)**

37. State and explain Kirchhoff's second law. **(H.P. B. 2015, 03)**

38. Deduce wheatstone Bridge principle using Kirchhoff's law. **(H.P,B. 2008)**

39. Apply Kirchhoff's laws to obtain the condition of balanced wheatstone's bridge. **(H.P. B. 2019)**

40. (a) State Kirchhoff's laws in Electricity
(b) What is the Net resistance between points A and B in the circuit shown? **(H.P.B. 2024)**



41. State and explain Joule's law of heating. **(H.P. B. 2005, 04)**

42. What is the difference between the nature of heating wire and fuse wire. **(H.P. B. 2003)**

43. Two electric lamps are rated 220V, 40 W and 220 V, 60 W. Find the heat generated in each lamp per second when they are connected in series across 220 V. **(H.P. B. 2003)**

44. Of the bulbs in a house, one glows brighter than the other, which has larger resistance? **(H.P. B. 2003)**

45. A house is fitted with 10 lamps of 60 W each, 10 fans consuming 0.5 A each and an electric kettle of 110 Ω. If the energy supplied at 220V and costs $Rs.$ 2.50 per kWh, calculate the bill for 10 days, if the appliances are used for 6 hours daily. **(H.P. B. 2008)**

46. A heater rated as 220 V, 880W. What is the current drawn by the heater when connected to a 220V a.c. mains? Calculate the resistance of the heater. **(H.P.B. 2020)**

47. Derive an expression for current in the circuit having mixed grouping of cells. What is the condition for maximum current in the circuit? **(H.P.B. 2008, 04)**

48. Derive a relation between emf, potential difference and internal resistance of a cell.

49. State and explain Kirchhoff's laws in electricity and apply them to obtain the condition for a balanced Wheatstone bridge. **(H.P.B. 2008, 04)**

4. MAGNETISM

1. Why is diamagnetism independent of temperature?
(a) Net dipole moment is zero (b) They do not heat up
(c) Net dipole moment is maximum (d) None of these **(H. P. B. 2018)**

2. Why does a paramagnetic sample display greater magnetization (for same magnetizing field) when cooled?
(a) Thermal effect on dipoles is more (b) Thermal effect on dipoles is less
(c) Cannot say (d) None **(Based on H.P.B)**

3. What happens is a bar magnet is cut into two equal pieces transverse to its length?
(a) Pole strength is same (b) Magnetic moment is half
(c) Magnetic moment is double (d) (a) and (b) **(H. P. B. 2002)**

4. What happens to dipole moment if a bar magnet is cut into two equal pieces parallel to its length?
(a) Pole strength will be half (b) Dipole moment will be half
(c) (a) and (b) (d) None of these **(H. P. B. 2002)**

5. What is the unit of magnetic dipole moment
(a) A m (b) $A\ m^2$ (c) A^2m (d) Am^{-2} **(H. P. B. 2003)**

6. Why two magnetic lines do not cross each other?
(a) They are very weak (b) The repel each other
(c) There will be two direction of field then (d) None **(H. P. B. 2003)**

7. SI unit for magnetic moment is
(a) JT^{-2} (B) TJ^{-1} (c) Am^2 (d) $A^{-1}m^2$ **(H. P. B. 2008)**

8. Tesla is unit of
(a) electric flux (b) magnetic flux (c) electric field (d) magnetic field
(H. P. B. 2010, 2013)

9. One tesla is equal to
(a) 10^7 gauss (b) 10^{-4} gauss (c) 10^4 gauss (d) 10^{-8} gauss
(H. P. B. 2011)

10. A bar magnet is kept in a uniform magnetic field. It expressions
(a) a torque but not a net force (b) A net force but not a torque
(c) both a net force and a torque (d) none of these (**H. P. B. 2012)**

11. Two parallel wires carry current in the same direction. They will
(a) neither attract nor repel each other (b) repel each other
(c) attract each other (d) none of these **(H. P. B. 2012)**

12. Curie temperature is the temperature of above which
(a) a ferromagnetic material becomes paramagnetic (b) a paramagnetic material becomes diamagnetic
(c) a ferromagnetic material become diamagnetic (d) a paramagnetic material become ferromagnetic
(H. P. B. 2013)

13. The S.I. unit of magnetic pole strength is
(a) ampere metre $^{-1}$ (b) ampere metre (c) ampere metre ^{2} (d) ampere metre $^{-2}$

14. Torque acting on a magnetic dipole of magnetic moment ($\vec{M}$) placed in uniform magnetic field ($\vec{B}$) is
(a) $\vec{\tau} = \vec{B} \times \vec{M}$ (b) $\vec{\tau} = \vec{M} \times \vec{B}$ (c) $\vec{\tau} = \vec{B}.\vec{M}$ (d) $\vec{\tau} = \vec{M}.\vec{B}$

15. Torque acting on a bar magnet held at angle θ with magnetic field is maximum when θ =
(a) 90° (b) 180° (c) 360° (d) 0°

16. Potential energy of a magnetic dipole of magnetic moment ($\vec{M}$) placed in uniform magnetic field is $\vec{B}$
(a) U = $\vec{M}.\vec{B}$ (b) U = $-\vec{B} \times \vec{M}$
(c) $\tau = \vec{B} \times \vec{M}$ (d) U = $-\vec{M}.\vec{B}$

17. The magnetic dipole moment of a current carrying coil does not depend upon
(a) number of turns of coil (b) cross-sectional area of coil
(c) current flowing through coil (d) material of the turns of the soil .

18. S.I unit of magnetic susceptibility is
(a) Am (b) Am^{-1} (c)Hm^{-1} (d) No units

19. The S.I unit of magnetic permeability is
(a) Wb A $^{-1}$ m (b) Wb A $^{-1}$ m^{-1} (c) Hm (d) Tm $^{-1}$ A.

20. For paramagnetic substances
(a) $\mu_r = 1$ (b) $\mu_r = 0$ (c) $\mu_r > 1$ (d) $\mu_r = \infty$

21. For a paramagnetic substance
(a) Xm = T^2 (b) Xm $\propto$ T (c) Xm = T^0 (d)) Xm $\propto$ T^{-1}

22. Nickel is a
(a) diamagnetic (b) paramagnetic (c) ferromagnetic (d) None of these

23. Magnetic susceptibility of platinum is 0.0001. Its relative permeability is
(a) 1.0000 (b) 0.9999 (c) 1.0001 (d) 0.
[Hint: ($\mu_r = 1 + Xm$]

24. For diamagnetic substance $Xm\ is$
(a) Small and negative (b) small and positive (c) large and positive (d) none of these

25. Magnetic moment has dimensions of
(a) [LA] (b) [L ^{2} A] (c) [LT $^{-1}$ A] (d) [L^{2}T^{-1} A]

26. If the magnetic moment of substances is zero then the substance is
(a) diamagnetic (b) paramagnetic (c) ferromagnetic (d) anti ferromagnetic

27. Susceptibility is positive and small for
(a) Paramagnetic (b) Ferromagnetic (c) Diamagnetic (d) Non magnetic

28. Susceptibility is positive and large for
(a) Paramagnetic (b) Ferromagnetic (c) Diamagnetic (d) Non magnetic

29. The magnetic susceptibility of a ferromagnetic substance is
(a) small and positive (b) small and negative (c) high and positive (d) none of these

ANSWER-KEY

1. (a) 2. (b) 3. (b) 4. (b) 5. (b) 6. (c) 7. (c) 8. (d) 9. (c) 10. (a) 11. (c) 12. (a) 13. (b) 14. (b) 15. (a) 16. (d) 17. (d) 18. (d) 19. (b) 20. (c) 21. (d) 22. (c) 23. (c) 24. (a) 25. (b) 26. (a) 27. (a) 28. (b) 29. (c)

SUBJECTIVE QUESTIONS

1. What is a magnet?

2. Define the term magnetic dipole moment. Give its S.I. unit.

3. State Coulomb's law of magnetic force. Hence define the unit of magnetic pole.

4. What is a natural magnet and artificial magnet? Write four properties of magnet.

5. What are the properties of magnetic line of force? Give their important properties.

6. What is uniform and non uniform magnetic field? Draw the lines of force for such a field.

7. Derive an expression for the magnetic field intensity at any point on the axial line of magnetic dipole.

8. Derive an expression for the magnetic field intensity at any point on the equatorial line of magnetic dipole.

9. Derive an expression for the torque experienced by a magnetic dipole in uniform magnetic field. Hence obtain the expression for potential energy of dipole.

10. A bar magnet is cut into two equal halves transverse to its length. What happens to its dipole moment? Explain. **(H.P.B. 2005)**

11. What are magnetic lines of force? Explain why two magnetic lines of force cannot intersect each other? **(H.P.B. 2005)**

12. Derive an expression for the magnetic moment associated with the orbital motion of an electron in an atom. Find an expression for magnetic dipole moment of an atom. **(H.P.B. 2010)**

14. Explain Domain theory of ferromagnetism. **(H.P.B. 2001)**

15. What are ferromagnetic substance? Explain briefly domain theory to explain ferromagnetism. **(H.P.B. 2008, 02)**

16. Explain diamagnetism on the basis of electron theory. How diamagnetism depends on temperature? **(H.P.B. 2007, 05)**

17. What are diamagnetic substances? Write any two properties. **(H.P.B. 2013)**

18. What are ferromagnetic substances. Write any two properties.

19. Explain how does an atom behave as magnetic dipole. Derive an expression for its magnetic dipole moment.

20. (a) State Gauss law in magnetism. Explain its significance.
(b) Write four properties of the magnetic field lines due to a bar magnet

5. ELECTROMAGNETIC INDUCTION

OBJECTIVE QUESTIONS

1. What is basic cause of induced e.m.f.? **(Based on H.P.B)**

(a) Change in electric flux linking with a coil.
(b) Change in magnetic flux linking with a coil.
(c) (a) and (b)
(d) None

2. Why is spark produced in the switch of a fan when it is put off? **(Based on H.P.B)**

(a) Small e.m.f. is reduced in the air gap.
(b) Large e.m.f. is induced in the air gap.
(c) Due to temperature change int the air gap.
(d) None

3. The number of turns of a coil is doubled. How will its self-inductance be effected. **(H.P.B 2001)**

(a) Remains same (b) doubles
(c) become 4 times (d) becomes half.

4. When is the magnetic flux linked with a coil held in magnetic field zero? When θ is **(H.P.B 2003 S)**

(a) 90° (b) 0° (c) 45° (d) 30°

5. Is source of magnetic field analogue to the source of electric field? **(H.P.B 2004)**

(a) yes (b) no (c) cannot say (d) none of these

6. Does Lenz's law violate the principle of energy conservation? **(H.P.B 2007)**

(a) Yes, energy is created (b) No, there is simple transformation of energy
(c) Cannot say (d) None of these

7. Whenever changing current is passed through a conductor, an e.m.f. is induced, this is

(a) Newton's Law (b) Ohm's Law (c) Kirchhoff Law (d) Faraday's Law **(H.P.B 2011)**

8. Induction furnace makes use of

(a) self induction (b) mutual induction (c) eddy currents (d) magnetic flux **(H.P.B 2012)**

9. A transformer works on the principle of **(H.P.B 2012)**

(a) total internal reflection (b) converter
(c)inverter (d) mutual induction

10. Dynamo works on the principle of **(H.P.B 2013)**

(a) electromagnetic induction (b) heating effect of current
(c) chemical effect of current (d) none of these

11. Eddy currents are produced in **(H.P.B 2019)**

(a) Induction furnace (b) electromagnetic brakes
(c) speedometer (d) all of these

12. Dimensional formula for magnetic flux is: **(H.P.B. 2022)**
(a) $ML^2T^{-2}A^{-2}$ (b) $ML^2T^2A^{-1}$ (c) $ML^2T^{-2}A^{-1}$ (d) $ML^{-2}T^{-2}A^{-1}$

13. Lenz law is a consequence of the law of conservation of: **(H.P.B.2022)**
(a) Charge (b) Mass (c) Momentum (d) Energy

14. Dimensional formula for self-inductance is: **(H.P.B. 2022)**
(a) $ML^2T^{-2}A^{-3}$ (b) $ML^2T^{-2}A^{-2}$ (c) $ML^2T^{-2}A^{-1}$ (d) $ML^{-2}T^{-2}A^{-1}$

15. The self inductance L of a solenoid of length l and area of cross-section A, with a fixed number of turns N increases as: **(H.P.B. 2022)**
(a) l and A increase (b) $\boldsymbol{l}$ decreases and $\boldsymbol{A}$ increase
(c) l increases and A decrease (d) Both l and A decrease.

16. The direction of included e.m.f. is given by
(a) Fleming's left hand rule (b) Fleming's right hand rule (c) Lenz's rule (d) Biot Savart's law

17. The cause of included e.m.f. is
(a) magnetic flux (b) magnetic field (c) area (d) change in magnetic flux

18. S.I. unit of magnetic flux is
(a) henry (b) weber (c) coulomb (d) volt.

19. Choose the correct relation
(a) $dQ = (d\phi)\,R$ (b) $dQ = \frac{\boldsymbol{d\phi}}{\boldsymbol{R}}$ (c) $d\phi = R^2\,dQ$ (d) $dQ = \frac{d\phi}{R^2}$

20. Choose the correct relation
(a) 1 henry = $\frac{1\ volt}{1\ ampere}$ (b) 1 henry = $\frac{1h}{1\ amp.sec}$
(c) 1 henry = $\frac{\boldsymbol{1\ volt}}{\boldsymbol{1\ ampere \times sec^{-1}}}$ (d) 1 henry = $\frac{1\ volt}{1\ ampere \times sec}$

21. The self inductance of straight conductor is
(a) Zero (b) infinity (c) very small (d) very large

22. In electromagnetic induction, the induced e. m. f. is independent of
(a) change in flux (b) time (c) number of turns in coli (d) resistance of coil

ANSWER-KEY
1. (b) 2. (b) 3. (c) 4. (a) 5. (b) 6. (b) 7. (d) 8. (c) 9. (d) 10. (a) 11. (d) 12. (c) 13. (d) 14. (b) 15. (b) 16. (b) 17. (b) 18. (b) 19. (b) 20. (c) 21. (c) 22. (d)

SUBJECTVE QUESTIONS
1. Define magnetic flux. Write its unit and dimensions.

2. State and explain Faraday's laws of electromagnetic induction? **(H.P.B 2015, 08, 05, 02, 09)**

3. Show that Lenz law is a direct consequence of the law of conservation of energy?

4. An induced e.m.f has no direction of its own, why? **(H.P.B. 2005)**

5. The magnetic flux through a coil perpendicular to its plane is varying according to the relation , $\phi(t) = 5t^3+4t^2+2t-5$Wb. Calculate induced current through the coil at t = 2 s, if the resistance of coil is 5 Ω. **(H.P.B. 2007)**

6. What do you mean by term motional e.m.f. ? Derive an expression for the induced e.m.f produced by changing the area of rectangular coil placed perpendicular to the magnetic field.

7. Derive an expression for induced e.m.f. developed in a conductor of length l moving with velocity v in transverse magnetic field of strength B. **(H.P.B. 2005)**

8. What are eddy currents? How are they produced? Give two applications. **(H.P.B. 2013, 08, 05, 03, 01)**

9. A wire of length 0.1 m moves with speed of 10 m/s perpendicular to a magnetic field of induction 1 wb/m^2. Calculate induced e.m.f.

10. Define self-inductance and mutual inductance. State their units in S.I. **(H.P.B 2005, 2000)**

11. Current in a circuit falls from 5.0 A to 0.0 A in 0.1 s. If an average emf of 200 V is induced in the circuit. Calculate the self inductance of the circuit. **(H.P.B. 2022)**

12. A current passing through 20 H inductor changes from 9A to 8A in 20 x 10^{-3} s. what will be the value of self induced e.m.f. ? **(H.P.B. 2007, 05)**

13. Magnetic flux of 5μ Wb is linked with a coil when a current of 1 mA flows through it. What is the self inductance of the coil? **(H.P.B. 2007, 05)**

14. Derive an expression for self inductance of a long solenoid.

15. Define mutual inductance and write its S.I. units.

16. Obtain an expression for the mutual inductance of two long coaxial solenoids S_1 and S_2 wound over one another number of turns per unit length when current I is set up in outer solenoid S_2.

17. On what factors the magnitude of the e.m.f. included in the circuit due to magnetic flux depends?

18. Define the unit of self inductance.

19. Why self induction is called inertia of electricity ?

20. A coil intercepts a magnetic flux of 0.2×10^{-2} Wb in 0.1 s. What is the e.m.f. included in the coil?

21. Could a current be induced in a coil by rotating a magnet inside the coil ? If so, how ?

6. ELECTROMAGNETIC WAVE

OBJECTIVE QUESTIONS

1. Arrange the following radiations in descending order of wavelength
(i) $\gamma -$ rays (ii) infra-red rays (iii) red light (iv) yellow light, (v) radio waves
(a) (i), (ii), (iii), (iv), (v) (b) (v), (iv), (iii), (ii), (i)
(c) (v), (ii), (iii), (iv), (i) (d) (i), (ii), (v), (iii), (iv) **(H. P. B. 2002)**

2. Ozone layer acts as a protective blanket for earth's life.' Comment, how?
(a) it blocks X – rays (b) It blocks UV rays
(c) It blocks IR rays (d) None of these **(H. P. B. 2000).**

3. The charging current for a capacitor is 0.25 A. What is the displacement current?
(a) 0.25 A (b) 0.25/2
(c) 0.25 x 2A (d) None of these **(H. P. B. 2004)**

4. Write an expression for speed of e.m. wave in free space.
(a) $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ (b) $c = \frac{E_0}{B_0}$
(c) $c = \frac{E}{B}$ (d) All of these (H. P. B. 2008)

5. What is electromagnetic spectrum?
(a) Arrangement of radiations on the basis of frequency
(b) Arrangement of radiations on the basis of wavelength.
(c) Arrangement of radiations on the basis of speed in media
(d) (a) and (b) **(H. P. B. 2006)**

6. The nature of electromagnetic wave is **(H. P. B. 2008)**
(a) transverse (b) longitudinal (c) horizontal (d) vertical

7. Radiowaves of constant amplitude can be generated with **(H. P. B. 2008)**
(a) filter (b) rectifier (c) FET (d) oscillator

8. Velocity of e.m. wave is perpendicular to **(H. P. B. 2008)**
(a) $\vec{B} \times \vec{E}$ (b) $\vec{E} \times \vec{B}$ (c) $\vec{E}$ (d) $\vec{B}$

9. Which are not e.m. waves? **(H. P. B. 2010)**
(a) cosmic rays (b) $\gamma - rays$ (c)$\beta - rays$ (d) X – rays

10. The e.m. waves used in telecommunication are **(H. P. B. 2013)**
(a) ultraviolet (b) microwaves (c) visible rays (d) infrared rays

11. Which of the following has highest frequency? **(H. P. B. 2014)**
(a) $\gamma - rays$ (c) $X - rays$ (c) $\beta - rays$ (d) ultraviolet rays

12. The ratio of speed of X-rays to $\gamma - rays$ in vacuum is **(H. P. B. 2014)**
(a) 1 (b) Greater than 1 (c) Less than 1 (d) None of these

13. Infra-red spectrum lies between **(H. P. B. 2014)**
(a) Radiowave and microwave region (b) Microwave and visible region
(c) Visible and ultraviolet region (d) Ultraviolet and X-ray region

14. E.M wave are produced by **(H. P. B. 2015,18)**
(a) static charge (b) chargeless particle (c) accelerating charge (d) None

15. The dimensions of E/B are same as that of **(H. P. B. 2015)**
(a) Acceleration (b) velocity (c) Charge (d) current

16. The cause of green house effect is **(H. P. B. 2016, 18)**
(a) Infrared rays (b) UV rays (c) α –rays (d) radio waves

17. The value of velocity of light in vacuum is **(H. P. B. 2016)**
(a) $\sqrt{\frac{\mu_0}{\epsilon_0}}$ (b) $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ (c) $\sqrt{\mu_0 \epsilon_0}$ (d) $\sqrt{\frac{\epsilon_0}{\mu_0}}$

18. Electromagnetic waves are transverse in nature, it is evident by: **(H. P. B. 2019)**
(a) Polarization (b) interference (c) reflection (d) Diffraction

19. Which of the following has maximum wavelength **(H. P. B. 2019)**
(a) $X - rays$ (b) Unltraviolet rays (c) $\gamma - rays$ (d) none of these

20. According to Maxwell's hypothesis, a changing electric field gives rise to changing **(H. P. B. 2019)**
(a) an e.m.f (b) electric current (c) magnetic field (d) pressure gradient

21. Out of the following options, which can referred as heat waves **(H. P. B. 2022, term-II)**
(a) Radio waves (b) Microwaves (c) Infrared waves (d) Visible rays

22. Out of the following options which can be used to produce a propagating electromagnetic wave? **(H. P. B. 2022, term-II)**
(a) A charge moving at constant velocity (b) A stationary charge
(c) A chargeless particle (d) An accelerating charges

23. In a plane an wave the electric field oscillates sinusoidally at a frequency of 2 x 10^{10} Hz. The wave length of the wave is **(H. P. B. 2021, term-I)**
(a) 1.5 x 10^{-2} m (b) 1.5 x 10^{-3} m (c) 1.5 x 10^{2} m (d) 1.5 x 10^{3} m

24. The ratio of speed of X-rays to that of $\gamma - rays$ in vacuum is **(H. P. B. 2020, term-II)**
(a) 1 (b) Greater than 1 (c) Less than 1 (d) None of these

25. Which of the following has highest wavelength? **(H. P. B. 2020, term-II)**
(a) X- rays (b) U.V. rays (c) Microwave (d) $\gamma - rays$

26. What is approximate wavelength of X-rays?
(a) 1×10^{-10} m (b) 3×10^{-8} m (c) (a) and (b) (d) None of these

27. Which part of electromagnetic spectrum does the wavelength 10^{-10} m correspond to?
(a) X-rays (b) y-rays (c) X rays to y-rays (d) None of these

28. Name of electromagnetic radiations used for viewing objects through haze and fog.
(a) ultraviolet rays (b) infrared rays (c) gamma rays (d) None of these

29. Write the frequency limit of visible range of e.m. spectrum in kHz.
(a) 4×10^{14} Hz (b) 7.7×10^{14} Hz (c) (a) to (b) (d) None of these

30. Name the electromagnetic radiations used for studying crystal structure of solids
(a) y-rays (b) UV rays (c) IR rays (d) X-rays

31. Name the part of electromagnetic spectrum which is used in 'green house' to keep plants warm
(a) UV rays (b) infrared rays (c) y-rays (d) radio waves

32. Which part of e.m. spectrum is used in operating a Radar?
(a) Radio waves (b) UV rays (c) Microwaves (d) None of these

33. Which is the range of frequencies used for T.V. transmission?
(a) 50 MHZ to 550 MHz (b) 20 MHz to 220 MHz (c) 20 kHz to 550 MHz (d) 20 Hz to 20 kHz

34. What oscillates in electromagnetic waves?
(a) Charge (b) Photon (c) (a) or (b) (d) None of these

35. Which is the ratio of speed of gamma rays and radio waves in vacuum?
(a) ∞ (b) 0 (c) 1 (d) None of these

36. What is the name given to that part of electromagnetic spectrum which is used for taking photographs of earth under foggy conditions from great heights ?
(a) UV rays (b) Infrared rays (c) Radio waves (d) X-rays

ANSWER-KEY

1. (c) 2. (b) 3. (a) 4. (d) 5. (d) 6. (a) 7. (d) 8. (b) 9. (c) 10. (b) 11. (a) 12. (a) 13. (b)
14. (c) 15. (b) 16. (a) 17. (b) 18. (a) 19. (b) 20. (c) 21. (c) 22. (d) 23. (a) 24. (a) 25. (c) 26. (c)
27. (c) 28. (b) 29. (a) 30. (d) 31. (b) 32. (c) 33. (a) 34. (b) 35. (c) 36. (b)

SUBJECTIVE TYPE QUESTIONS

1. Why did Maxwell introduce the concept of displacement current? Explain **(H. P. B. 2005)**

2. Sate – Maxwell's modification of Ampere's circuital law. **(H. P. B. 2001)**

3. Discuss Hertz experiment briefly. What important conclusion was drawn form this experiment. **(H. P. B. 2003)**

4. What do you understand by electromagnetic wave? **(H. P. B. 2015, 07, 05, 02)**

5. Mention four important properties of e.m. waves. What is source of displacement current. **(H. P. B. 2018, 16,15,11,10,03)**

6. What are Maxwell's equations? **(H. P. B. 2002)**

7. In a plane electromagnetic wave, the electric field oscillates sinusoidally at a frequency of 2×10^{10} Hz and amplitude 48 V/m. **(H. P. B. 2000)**
(a) Find wavelength of wave (b) What is the magnitude of oscillating magnetic field?

8. What is the wavelength of a television station, which transmits vision on 500 MHz?
(Given $c = 3 \times 10^8$ ms^{-1}) **(H. P. B. 2014)**

9. Electromagnetic wave of frequency 5×10^{14} Hz are passed through a liquid. The wavelength of wave in liquid is measured to be 4.5×10^{-7} m. Calculate the velocity of electromagnetic waves in vacuum. **(H. P. B. 2019)**

10. what are e.m. waves? Show that an accelerated charge is must for producing e.m. wave**. (H. P. B. 2012)**

11. What is electromagnetic spectrum? Name the important parts of the e.m. spectrum.

12. What is electromagnetic spectrum? Arrange following radiations in descending order of wavelength. λ- rays, infrared rays, red light, radio waves. **(H. P. B. 2019, 16, 15, 13)**

13. Give use of each **(H. P. B. 2019, 16, 04)**
(i) Infrared rays (ii) Gamma rays (iii) Microwaves (iv) Ultraviolet radiation

14. What are micro waves? Write one application of microwaves. **(H. P. B. 2018, 2016)**

15. Give two properties and four uses of infrared rays. **(H. P. B. 2018, 2022, (term -II)**

16. Write two properties and two uses of microwaves. **(H. P. B. 2019, 2022, (term -II**)

17. Give four uses of X-rays. **(H. P. B. 2016, 15)**

18. How is radio wave produced? Give uses of radio waves. **(H. P. B. 2015)**

19. A radar transmitter generates waves, whose frequency is 3 x 10^9 Hz. What is the wavelength of the wave? **(H. P. B. 2015)**

20. Write two uses of Ultraviolet rays **(H. P. B. 2019)**

21. Write a short note on radio waves. **(H. P. B. 2020, 2022 (term-II)**

22. Write short notes on **(H. P. B. 2016, 2015)**
(i) Infra rad waves (ii) visible rays (iii) Ultraviolet rays (iv) X-rays (v) Gamma rays

23. Ozone layer is essential for human survival, why? **(H. P. B. 2004)**

24. Explain green house effect. **(H. P. B. 2003, 2003, 2002)**

7. ALTERNATING CURRENT

OBJECTIVE QUESTIONS

1. What is the frequency of direct current? **(Based on H.P.B)**
(a) 50 Hz (b) ∞ (c) 0 (d) None of these

2. Can A.C. be used for electrolysis? Why? **(H.P.B 2005)**
(a) No, no fixed polarity (b) Yes, no fixed polarity
(c) Yes, fixed polarity (d) None of these

3. The instantaneous current form a.c. source is I=5 sin 314t. What is the peak value of current?
(a) $\frac{5}{\sqrt{2}}\ A$ (b) $5\sqrt{2}A$ (c) 5 A (d) None of these **(H.P.B 2005)**

4. Why is the core of a transformer laminated? Explain. **(H.P.B 2002)**
(a) to reduce iron losses (b) To reduce copper losses
(c) to reduce eddy current losses (d) (a) and (c)

5. Why can't transformer be used to step up d.c. voltage? **(H.P.B 2002, 18)**
(a) d.c. has zero frequency (b) d.c. does not produce changing field
(c) d.c. has less energy (d) (a) and (b)

6. Why is there no power loss in an ideal inductor? **(H.P.B 2002)**
(a) P.F. of an ideal inductor is unity (b) P.F. of an ideal inductor is zero
(c) Material is less free (d) None of these

7. The instantaneous voltage from an a.c. source is given by 300 sin 314 t. What the r.m.s voltage of the source? **(H.P.B 2004)**
(a) 300 V (b) $\frac{300}{\sqrt{2}}$ (c) $300\sqrt{2}$ (d) None of these

8. What is the condition of resonance? **(H.P.B 2007)**
(a) When $X_L = X_C$ (B) When $X_L < X_c$ (c) When $X_L > X_C$ (d) none of these

9. What will be the power of circuit having (i) Only R (ii) Only L **(H.P.B 2007)**
(a) I^2R, 0 (b) I^2R, I^2X_L (c) 0, 0 (d) IR, IX_L.

10. Transformer is a device which works on the principle of
(a) Converter (b) invertor (c) mutual induction (d) Self induction **(H.P.B 2011)**

11. When a.c. passes through pure resistor then e.m.f. **(H.P.B 2012)**
(a) leads current by $\pi/2$ (b) lags current by $\pi/2$
(c) and current are in phase (d) leads current by $\pi/4$

12. A capacitor **(H.P.B 2013)**
(a) offers easy path to a.c but blocks d.c. (b) offers easy path to d.c. but blocks a.c.
(c)offers easy path to both a.c. and d.c (d) blocks a.c.

13. Dynamo works on the principle of **(H.P.B 2013)**
(a) electromagnetic induction (b) heating effect of current
(c) chemical effect of current (d) none of these

14. Phase difference between voltage and current in ac circuit having resistor only is **(H.P.B 2015)**
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) zero

15. Energy dissipated in LCR circuit is **(H.P.B 2016)**
(a) L only (b) C only (c) R only (d) all of above

16. A transformer is a device which gives only **(H.P.B 2016)**
(a) dc voltage (b) ac voltage (c) ac and dc voltage (d) none of these

17. Average power dissipated in pure capacitor in ac circuit is **(H.P.B 2016)**
(a) $(1/2)\ CV^2$ (b) CV^2 (c) $2\ CV^2$ (d) Zero

18. The r.m.s. value of a.c. is 220 V. Nearly the peak value of a.c. is **(H.P.B 2017)**

(a) 220 V (b) 311 V (c) 211 V (d) 50 V

19. In step-up transformer, relation between number of turns in primary (N_p) and number of turns in secondary (N_s) is: **(H.P.B. 2022)**
(a) $N_s > N_p$ (b) $N_p > N_s$ (c) $N_s = N_p$ (d) $N_s^3 = N_p^2$

20. For the current in LCR circuit to be maximum **(H.P.B 2019)**
(a) $X_L = 0$ (b) $X_c = 0$ (c) $X_L = X_c$ (d) $R = X_L + X_c$

21. When an AC voltage of 220 V is applied to the capacitor C:
(a) the maximum voltage between plates is 220 V
(b) the current is in phase with the applied voltage
(c) the charge on the plates is not in phase with the applied voltage
(d) power delivered to the capacitor is zero. **(H.B.P. 2022)**

22. The line that draws power supply to your house from street has:
(a) 220 V average voltage (b) Voltage and current out of phase by $\pi/2$
(c) Voltage and current are in phase (d) Zero average current. **(H.P.B. 2022)**

23. When a.c passes through an inductor, the voltage: **(H.P.B. 2020)**
(a) is in same phase with current (b) leads current by phase π
(c) leads current by phase $\pi/2$ (d) lags behind current by phase $\pi/2$

24. What is the frequency of house hold supply of a.c. in India?
(a) Zero (b) 60 Hz
(c) 50 Hz (d) 100 Hz

25. D.C. can't flow through
(a) inductor (b) capacitor
(c) resistor (d) semiconductor

26. Choose the physical quantity whose S.I. unit is not ohm
(a) Resistance (b) Reactance
(c) Capacitance (d) Impedance

27. When a.c. is passed through capacitor, the current
(a) leads the applied voltage by phase angle π
(b) are in same phase with voltage
(c) leads the applied voltage by phase angle $\boldsymbol{\pi}/2$
(d) lags the voltage by a phase angle $\pi/2$

28. Q-factor at resonance is given by
(a) $\frac{\mathbf{1}}{\boldsymbol{R}}\sqrt{\frac{\boldsymbol{L}}{\boldsymbol{C}}}$ (b) $\frac{1}{R}\sqrt{\frac{C}{L}}$ (c) $\frac{1}{L}\sqrt{\frac{R}{C}}$ (d) $\frac{1}{C}\sqrt{\frac{L}{R}}$

29. Power factor of an a.c. circuit is given by $\cos\Phi$ =
(a) $\frac{\boldsymbol{R}}{\boldsymbol{Z}}$ (b) $\frac{Z}{R}$ (c) $\frac{R}{X_L}$ (d) $\frac{R}{X_C}$

30. Inductive reactance varies with frequency as
(a) $X_L \propto v$ (b) $X_L \propto \frac{1}{v}$ (c) $X_L \propto v^2$ (d) None of these

31. The phase difference between voltage drop across L and C in series LCR circuit is
(a) 0° (b) 90° (c) 180° (d) 60°

32. Power in an a.c. circuit is given by
(a) $I_{rms}\ E_{rms}$ (b)) $\boldsymbol{I_{rms}\ E_{rms}} \cos\boldsymbol{\phi}$
(c)) $I^2{}_{rms}\ E_{rms}$ (d))) $I_{rms}\ E_{rms}/\cos\phi$

33. The relation between root mean square and peak value of alternating current of
a) $I_{rms} = \sqrt{2}\ 1_0$ (b) a) $I_{rms} = \frac{1_0}{2}$
(c) $\boldsymbol{I_{rms}} = \frac{\mathbf{1_0}}{\sqrt{\mathbf{2}}}$ (d) $I_{rms} = 21_0$

34. The split ring arrangement is used in
(a) a.c. generator (b) d.c. generator (c) choke coil (d) transformer

35. Which of the following does not cause loss of energy in a transformer ?
(a) Heating (b) Eddy currents
(c) Mechanical motion (d) Hysteresis

36. Power factor of purely capacitive circuit is
(a) 1 (b) $\sqrt{2}$ (c) $\frac{1}{2}$ (d) Zero

ANSWER-KEY
1. (c) 2. (a) 3. (c) 4. (b) 5. (d) 6. (b) 7. (b) 8. (a) 9. (a) 10. (c) 11. (c) 12. (a) 13. (a) 14. (d)
15. (c) 16. (b) 17. (d) 18. (b) 19. (a) 20. (c) 21. (d) 22. (b) 23. (c) 24. (c) 25. (b)
26. (c) 27. (c) 28. (a) 29. (a) 30. (a) 31. (c) 32. (b) 33. (c) 34. (b) 35. (c) 36. (d)

SUBJECTVE QUESTIONS

1. Define the terms phasor and phasor diagram.

2. What do you mean by average or mean value of a.c. ? Obtain a relation between peak value and mean value of a.c.

3. What is meant by root mean square or virtual or effective value of a.c.? Derive a relation between it and its peak value.

4. Show that the phase difference between voltage and current in an a.c circuit containing pure resistor is zero. **(H.P.B. 2022)**

5. An a.c voltage $v = v_m \sin \omega t$ is applied across an inductance L. Show that in an inductance, voltage leads the current by 90^0 or $\pi/2$. **(H.P.B. 2022)**

6. What is inductive reactance X_L in a.c. circuit? What is its value for d.c.? **(H.P.B. 2014)**

7. At what frequency will a 0.5 H inductor have inductive reactance of 1000 Ω? **(H.P.B. 2002)**

8. An alternating e.m.f. is applied across a capacitor. Show mathematically that current in it leads the applied e.m.f. by a phase angle of $\pi/2$. What is the capacitive reactance? Draw the time and phasor diagrams. What is the power dissipated? **(H.P.B. 2022)**

9. A capacitor blocks d.c. but allows a.c. to pass through it. Explain why? **(H.P.B. 2012)**

10. At very high frequency of a.c., a capacitor behaves like a conductor. Why? **(H.P.B. 2000)**

11. A 15.0 μF capacitor is connected to a 220 V, 50 Hz source. Find the capacitive reactance and the current (rms and peak) in the circuit. If the frequency is doubled, what happens to the capacitive reactance and the current? **(H.P.B. 2022)**

12. What type of reactance will it be if current leads the voltage by a phase angle of $\frac{\pi}{2}$ in an electric circuit? Explain. **(H.P.B. 2014)**

13. What is the difference between ohmic resistance and impedance of an a.c. circuit. Derive an expression for the impedance of an a.c. circuit containing LCR in series. Also find the resonant frequency of this circuit. **(H.P.B. 2020)**

14. Derive an expression for the impedance of an a.c. circuit containing resistor (R) and inductor (L) joined in series to the source of e.m.f.

15. A source voltage $V = V_0 \sin \omega t$ is connected to a series combination of a resistor 'R' and capacitor 'C' . Draw the phasor diagram and obtain the expression for (i) Impedance of circuit (ii) phase angle.

16. A series LCR circuit is connected to an a.c. source of variable frequency. Draw a suitable phasor diagram to obtain deduce the expression for the amplitude of the current and phase angle.

17. Obtain condition for the resonance of LCR circuit and show that resonance frequency is $(1/2\pi\sqrt{LC})$

18. What is a series resonant circuit? Derive an expression for resonance frequency**. (H.P.B. 2012)**

19. A series circuit with $L = 0.12\ H$, $C = 0.48\ mF$ and R = 25Ω is connected a 220 V variable frequency power supply. At what frequency is current in the circuit maximum? **(H.P.B. 2005)**

20. What is quality factor? **(H.P.B. 2005)**

21. A pure inductor of 25.0 mH is connected to a source of 220 V. Find the inductive reactance and r.m.s. current in the circuit, if the frequency of the source is 50 Hz. **(H.P.B. 2022)**

22. Prove mathematically that average value of a.c. over one complete cycle is zero. **(H.P.B. 2014)**

23. What are LC oscillations? Show that energy is conserved in LC oscillations.

24. What do you mean by term electric powder ? Obtain an expression for average power of the series LCR circuit. Hence define power factor for series LCR circuit.

25. What do you mean by wattles and wattful currents in any LCR circuit ?

26. Draw a schematic arrangement for winding of primary and secondary coils in a transformer with the two coils on separate limbs of the core. State its underlying principle and find the relation between the primary and secondary voltages in terms of the number of turns of the primary and secondary windings, How are the currents in the primary and secondary coils related to the voltages in the case of an ideal transformer? **(H.P.B. 2020)**

27. Describe the principle, construction and theory of a step up transformer. **(H.P.B. 2014)**

28. Give four reasons for energy loss in a transformer. **(H.P.B. 2013)**

29. Why is the core of transformer laminated? **(H.P.B. 2020)**

30. Which is an a.c. generator ? Explain with the help of diagram principle and working of a generator. Write an expression for the e.m.f. generated in the coil in terms of its speed of rotation.

31. Write some advantages and disadvantages of a.c. over d.c. **(H.P.B. 2014)**

8. RAY OPTICS

OBJECTIVE QUESTIONS

1. To get nine images of a single object one should have two plane mirror at an angle of:
(a) 40° (b) 36° (c) 90° (d) 120°. **(H.P.B. 2018)**

2. To get five images of a single object one should have two plane mirror at an angle of:
(a) 30° (b) 60° (c) 90° (d) 120°. **(H.P.B. 2018)**

3. The velocity of light in vacuum can be changed by changing
(a) Frequency (b) Amplitude (c) Wavelength (d) None of these.
(H.P.B. 2020)

4. Focal length of plane mirror is
(a) Positive (b) Negative (c) Infinite (d) None of these.
(H.P.B. 2020, 15, 12)

5. If angle between two plane mirrors is 60°, then number of images formed are
(a) 5 (b) 6 (c) Infinite (d) None of these. **(H.P.B. 2017)**

6. To get three images of a single object one should have two plane mirror at an angle of
(a) 30° (b) 60° (c) 90° (d) 120°. **(H.P.B. 2016)**

7. The blue colour of the sky is due to the phenomenon of
(a) Reflection (b) Refraction (c) Scattering (d) Dispersion.
(H.P.B. 2019)

8. The sky appears blue, because
(a) Red light is absorbed (b) Blue light is scattered the most
(c) It is a natural colour (d) Blue light is absorbed.
(H.P.B. 2020)

9. A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first colour to emerge is:
(a) Blue (b) Green (c) Violet (d) Red.
(H.P.B. 2022, Term-II)

10. The reddish appearance of the sun at sunrise and sunset is due to:
(a) The dispersion of light (b) The scattering of light
(c) The diffraction of light (d) The polarisation of light.**(H.P.B. 2022, Term-II)**

11. When a ray of light enters of glass slab, then
(a) Its frequency and velocity change (b) Its frequency does not change
(c) Its frequency and wavelength change(d) Only frequency changes.**(H.P.B. 2022, Term-II)**

12. Pencil in a beaker filled with water seems to be broken or bent due to
(a) Reflection (b) Diffraction (c) Total internal reflection (d) Refraction. **(H.P.B. 2017, 2016)**

13. Glittering of diamond is due to
(a) Total internal reflection (b) Dispersion (c) Diffraction (d) None of these.
(H.P.B. 2019, 2014)

14. Phenomenon of mirage is observed in desert due to
(a) Diffraction of light (b) Reflection of light
(c) Total internal reflection of light (d) Interference of light. **(H.P.B. 2019)**

15. When a ray is refracted, which of the following does not change?
(a) Frequency (b) Wavelength (c) Velocity (d) Amplitude. **(H.P.B. 2017, 2016)**

16. Total internal reflection takes place, when light travels from
(a) Water to glass (b) Glass to diamond (c) Water to air (d) Air to mercury.
(H.P.B. 2022, Term-I

17. An endoscope is employed by a Physician to view the internal parts of a body organ. It is based on the principle of:
(a) Refraction of light (b) The scattering of light
(c) Total internal reflection (d) The polarisation of light. (H.P.B. 2022, Term-II)

18. Match the following:

1.	Reddish appearance at sunset or sunrise due to	a.	Refraction
2.	Optical fibres	b.	Scattering
3.	Splitting of light through prism in seven colours	c.	Total internal reflection
4.	Twinkling of stars	d.	Dispersion

(a) 1-a, 2-b, 3-c, 4-d (b) 1-b, 2-c, 3-d, 4-a (c) 1-c, 2-d, 3-a, 4-b (d) 1-b, 2-c, 3-a, 4-d.

(H.P.B. 2022, Term-II)

19. The image formed by the objective of a compound microscope is

(a) Virtual and large (b) Virtual and diminished (c) Real and diminished (d) Real and enlarged.

(H.P.B. 2016)

20. Match the following:

1.	Brilliance of diamond	a.	Refraction
2.	Appearance of sun before actual sunrise	b.	Scattering
3.	Rainbow	c.	Total internal reflection
4.	Cloud are generally white	d.	Dispersion, refraction and reflection

(a) 1-a, 2-b, 3-c, 4-d (b) 1-c, 2-a, 3-d, 4-b (c) 1-c, 2-d, 3-a, 4-b (d) 1-b, 2-c, 3-d, 4-a.

(H.P.B. 2022, Term-II)

21. In vacuum, speed of light depends upon

(a) wavelength (b) frequency (c) colour (d) None of the above

22. The branch of optics dealing with the formation of images using the concept of straight line propagation of light is called:

(a) corpuscular optics (b) physical optics (c) geometrical optics (d) quantum optics

23. The minimum value of relative refracting index is :

(a) zero (b) less than 1 but not zero (c) 1 (d) more than 1

24. A blue coloured object when seen in white light appears:

(a) brown (b) blue (c) white (d) violet

25. A convex lens forms real image of an extended object. The image is coloured due to chromatic aberration. What will be the colour of the image of least size?

(a) Red (b) Yellow (c) Green (d) Blue

26. To obtain an achromatic combination using the lenses of same material the two lenses should be:

(a) put in correct (b) separated from each other

(c) convex (d) one convex ; other concave

27. Why do we keep the prism in minimum deviation position while studying the spectrum?

(a)sharp (b) visible (c) magnified (d) straight

28. Dispersive power depends on :

(a) angle of prism (b) shape of prism (c) material of prism (d) none of the above

29. Why the light is dispersed on passing through a prism?
(a) Light has seven wave-lengths (b) Prism in triangular in shape
(c) Velocity of light is less in glass than in air
(d) Refractive index is different for different colours

30. For which colour the focal length of a convex lens is more ?
(a) Red (b) Yellow (c) Green (d) Blue

31. For which colour the angle of deviation is the least?
(a) Violet (b) Blue (c) Red (d) Yellow

32. To produce a pure spectrum on a screen with the help of a prism, which of the following is NOT required?
(a) Extended source of light (b) Colour filter
(c) Convex lens (d) Narrow slit

33. Which colour has the least speed in glass?
(a) Red (b) Violet (c) Black (d) White

34. For which of the following dispersive power is zero?
(a) Lens (b) Slab (c) Prism (d) None of the above

35. What differentiates red light from blue light?
(a) Velocity in vacuum (b) Intensity (c) Amplitude (d) Wavelength

ANSWER-KEY

1. (b) 2. (b) 3. (c) 4. (c) 5. (a) 6. (c) 7. (c) 8. (b) 9. (d) 10. (b) 11. (b) 12. (d) 13. (a)
14. (c) 15. (a) 16. (c) 17. (c) 18. (b) 19. (d) 20. (b) 21.(d) 22. (c) 23. (b) 24. (b) 25. (a) 26. (d)
27. (c) 28. (a) 29. (d) 30. (a) 31. (c) 32. (b) 33. (b) 34. (d) 35. (d)

SUBJECTIVE QUESTIONS

1. Derive the mirror formula using the ray diagram for the formation of real image by a concavemirror. **(H.P.B. 2020, 2024)**

2. An object is placed in front of a concave mirror of radius of curvature 40cm at a distance of 10cm. find the position and nature of image formed. **(H.P.B. 2020, 2017)**

3. What is refraction? **(H.P.B. 2015)**

4. Define refractive index of a transparent medium. **(H.P.B. 2015)**

5. Refractive index of glass is 1.5. Find the speed of light in glass and critical angle for glass. **(H.P.B. 2020)**

6. A converging lens has a focal length of 20 cm in air. It is made of a material of refractive index 1.5. If it is immersed in water of refractive index 4/3, what will be the new focal length? **(H.P.B. 2022, Term-II)**

7. What is total internal reflection? What are the necessary conditions for it? **(H.P.B. 2019, 2015, 2013, 2023, 2024)**

8. What is the critical angle for the material of refractive index $\sqrt{2}$? **(H.P.B. 2020)**

9. How do you explain the mirage effect produced in very hot deserts? **(H.P.B. 2017, 2013)**

10. Explain the brilliance of diamond. **(H.P.B. 2017, 2015)**

11. Derive the expression $-\frac{n_2}{u}-\frac{n_1}{v}=\frac{n_2-n_1}{R}$, when the refraction occurs from rarer to denser medium at convex spherical refracting surface $(n_1 < n_2)$. (Where u, v, R, are object distance, image distance and radius of curvature of spherical surface respectively.) **(H.P.B. 2020, 2019, 2024)**

12. Prove that $\frac{n_1}{-u}+\frac{n_2}{v}=\frac{n_2-n_1}{R}$, when refraction occur from rarer to denser medium at a concave spherical refracting surface. **(H.P.B. 2019, H.P BOARD MARCH 2022 (TERM-2)**

13. Derive the lens maker's formula for convex lens stating sign conventions used. **(H.P.B. 2017, 2016, 2015, 2013, 2022 term-2, 2024)**

14. Derive lens formula for convex lens stating sign conventions when image formed is real. **(H.P.B. 2020, 2012)**

15. By stating sign conventions and assumptions derive the expression for lens Maker's formula for convex lens i.e. $\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ (**H.P.B.2023)**

where the letters have their usual meanings.

16. A needle placed 45 cm from a lens forms an image on a screen placed 90 cm on the other side length. What is the size of the image, if the size of the needle is 5 cm? **(H.P.B. 2015)**

17. If two lens of power – 15D and + 5D are in contact with each other, what is the focal length of this combination. **(H.P.B. 2017, 2016)**

18. Define power of a lens. What is one diopter? **(H.P.B. 2016, 2014)**

19. An object of size 3.0 cm is placed 14 cm in front of a concave lens of focal length 21 cm. Describe the image produced by the lens. **(H.P.B. 2022, (term -2)**

20. Derive the relation $\delta = A(\mu-1)$ for prism of small angle. **(H.P.B. 2018, 15,12)**

21. Draw a graph to show variation of angle of deviation δ with that of angle of incidence i for a monochromatic ray of light passing through a glass prism of reflecting angle A. Hence deduce the relation $\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin A/2}$. **(H.P.B. 2015, 2024)**

22. What is dispersion of light? **(H.P.B. 2019, 2015)**

23. What is the cause of dispersion of light? **(H.P.B.2015)**

24. Why does sky appear blue? What will it look like on moon? (**H.P.B.2019, 18, 16, 13, 2024)**

25. Sun appear reddish at sunset and sunrise. Why? **(H.P.B.2016)**

26. Why danger signals are red, while the eye is most sensitive to yellow colour? **(H.P.B.2012)**

27. Discuss the principle of simple microscope and derive the expression for its magnifying power. **(H.P.B.2020, 17, 15)**

28. The focal lengths of objective and eye lens of a compound microscope are 2 cm and 6.25 cm respectively. The distance between the lenses is 15 cm
(i) How far from the objective lens, will the object be kept so as to obtain the final image at the near point of the eye (i.e. 25 cm)
(ii) Also calculate its magnifying power. **(H.P.B.2022 (term – 2)**

29. An object of size 3.0 cm is placed 14 cm in front of a concave lens of focal length 21 cm. Describe the image produced by the lens. (**H.P.B.2023)**

30. A diver under water, looks obliquely at a fisherman standing on the bank of a lake. Would the fisherman look taller or shorter to the diver than what he actually is? Explain.
(**H.P.B.2023)**

31. Prove that $\frac{-n_1}{u} + \frac{-n_2}{v} = \frac{n_2\ n_1}{R}$ when refraction R U V occurs from rarer to denser medium at a convex spherical refracting surface. (**H.P.B.2023)**

32. A 4.5 cm needle is placed 12 cm away from a convex mirror of focal length 15 cm. Give the location of the image and magnification. (**H.P.B.2023)**

33. Why must both the objective and eyepiece of compound microscope have short focal lengths?
(**H.P.B.2023)**

34. Define magnifying power of a compound microscope. Draw a ray diagram to show the image formation in a compound microscope. Find an expression for its magnifying power.
(H.P.B.2017, 16, 14, 12)

35. Draw a course of rays through a compound microscope. Obtain an expression for the magnifying power.
(H.P.B.2016, 2024)

36. What is telescope? Draw a ray diagram for astronomical telescope showing the formation of final image at infinity and obtain expression for magnifying power in normal adjustment position.
(H.P.B.2018, 15, 2024)

37. An object is placed in front of concave mirror of radius of curvature 30 cm at a distance 10 cm. Find the position and magnification of image. **(H.P.B.1999)**

38. An object is placed in front of a concave mirror of radius of curvature 20 cm at a distance of 5 cm. Find the position and magnification of image. **(H.P.B.2005)**

39. Give laws of refraction. **(H.P.B.2002)**

40. Show that the case in prism $A + \delta = i + e$, where the symbols have their usual meaning.
(H.P.B.1977,2002, 2005, 2023)

41. Eye is more sensitive to yellow colour. Why are then the danger signals red? **(H.P.B.2002 2006)**

42. A mirror has power −1.5 D. Find its focal length and nature of mirror used. **H.P.B.2003)**

43. How will you explain twinkling of stars? (**H.P.B.2013)**

44. Double convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of same radius of curvature. What is the radius of curvature required if focal length of lens is to be 20 cm. (**H.P.B.2023)**

45. The refractive index of diamond is mucj greater than that of ordinary glass. Is this fact of some use to a diamond cutter? (**H.P.B.2023)**

46. Explain refraction of light on the basis of Huygen's principle and deduce Snell's law
(**H.P.B.2023)**

9. WAVE OPTICS

OBJECTIVE QUESTIONS

1. The shape of the wavefront emitted by a light source in the form of a narrow slit is
(a) Cylindrical (b) Spherical (c) Plane (d) None of these **(H.P.B.2015)**

2. The phase difference between two point situated on the same wavefront is:
(a) 2π (b) π (c) 0 (d) $\frac{\pi}{2}$ **(H.P.B.2022 Term -2)**

3. The coherence of two light sources means that the light wave emitted have
(a) same frequency (b) Same intensity (c) constant phase difference (d)same velocity **(H.P.B.2022 Term -2)**

4. In Young's double slit experiment, the separation between the slits is halved and distance between the slits and screen is doubled. The fringe width is
(a) Unchanged (b) halved (c) doubled (d) quadrupled **(H.P.B.2022 Term -2)**

5. To demonstrate the phenomenon of interference we require two source which emit radiation:
(a) Of different wavelength (b) of the same frequency
(c) of nearly the same frequency
(d) of the same frequency and having a definite phase relationship. **(H.P.B.2022 Term -2)**

6. What is the nature of the wave front associated with a parallel beam of light ?
(a) Plane (b) Spherical (c) Elliptical (d) None of the above

7. Huygen's principle of secondary waves is used to :
(a) obtain the wave front geometrically
(b) explain polarisation (c) obtain focal length of thick lenses
(d) explain dispersion of light

8. Huygen's concept of secondary waves is useful in :
(a) explaining polarisastion b) determining focal length of the lens
(c) reflection, refraction and interference (d) None of the above

9. The laser beam can be used to measure large distances because it is:
(a) coherent (b) monochromatic (c) not absorbed (d) unidirectional

10. Which of the following generates a plane wave front?
(a) Nearby point source (b) Extended source
(c) Monochromatic source (d) None of the above

11. What is the nature of graph between fringe width and the distance between the slits of Young's double slit experiment ?
(a) Straight line (b) Parabola (c) Hyperbola (d) Ellipse

12. Which of the following produces highly coherent beam of light?
(a) Biprism (b) Lloyd's mirror (c) Laser (d) Michelson interferometer.

13. What is the main condition to produce interference of light ?
(a) Sources should be coherant (b) Sources should be pin holes
(c) Sources should be of white light (d) None of these

14. What are coherent sources of light?
(a) Sources which emit of same frequency (b) Sources which emit waves of same frequency
(c) (b) or having constant phase difference (d) All of these

15. What is the effect on interference fringes in a Young's double slit experiment if the monochromatic source is replaced by another monochromatic source of shorter wavelength ? **(H.P.B.2000)**
(a) Become large (b) Remain same (c) Become small (d) None of these

16. Give one difference between interference and diffraction of light. **(H.P.B.2001)**
(a) interference involves two slits (b) diffraction involves two slits.
(c) diffraction involves one slit (d) Both (a) and (c)

17. What is the phase difference corresponding to path difference λ of two waves reaching a point?
(a) 0° (b) 30° (c) 45° (d) 90° **(H.P.B.2004)**

18. Which of the following does not support wave nature of light? **(H.P.B.2010)**
(a) interference (b) diffraction (c) polarisation (d) photoelectric effect

ANSWER-KEY
1. (a) 2. (c) 3. (c) 4. (d) 5. (d) 6.(d) 7. (a) 8. (c) 9. (d) 10. (d) 11. (c) 12. (c) 13. (a) 14. (d) 15. (c) 16. (d) 17. (a) 18. (d)

SUBJECTIVE QUESTIONS

1. What is wavefront? State its relation with ray of light. **(H.P.B.2014)**

2. What is the phase difference between any two points on a wavefront? **(H.P.B.2018, 17, 15, 13)**

3. State and explain Huygen's principle. **(H.P.B.2020, 2022, 2024)**

4. Using Huygen's principle, derive the laws of refraction. **(H.P.B.2020, 2018, 2017, 2016, 2014, 2022)**

5. What are the coherent sources of light? What are the conditions for obtaining two coherent sources of light? **(H.P.B.2016, 2015)**

6. Can independent sources of light be coherent. **(H.P.B.2015)**

7. What is interference of light? What is constructive and destructive interference of light? **(H.P.B.2013, 12)**

8. Derive the conditions for constructive and destructive interference. **(H.P.B.2020)**

9. Show that in Young's double slit experiment for interference of light, the widths of bright and dark fringes are equal. **(H.P.B.2020, 2012, 2022 Term-II)**

10. State the two necessary conditions for the sustained interference. **(H.P.B.2017)**

11. Two slits are made one millimeter apart and the screen is placed one meter away. What is the fringe separation when blue green light of wavelength 500 nm is used?
What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations?
(A) The screen is moved away from the plane of the slits.
(B) The (Monochromatic) source is replaced by another (Monochromatic) source of shorter wavelength.
(C) The separation between the two slits is increased
(D) The monochromatic source is replaced by a source of while light. **(H.P.B.2022-TERM-II)**

12. Discuss diffraction at a single slit. Explain energy distribution in this diffraction pattern. **(H.P.B. 2020, 2022-TERM-II)**

13. Prove that for diffraction at a single slit, width of central maximum is twice as that of secondary maximum. What is the essential condition for diffraction of wave. **(H.P.B. 2020,2024)**

14. Distinguish between interference and diffraction of light. **(H.P.B. 2020, 2018, 2015)**

15. What is sustained interference? **(H.P.B. 2019)**

16. What are polaroids? Explain their one use. **(H.P.B. 2017, 2014)**

17. Light wave can be polarised but sound wave cannot be polarised. Why? **(H.P.B. 2018)**

18. What do you understand by the polarization of light? Describe an experiment to demonstrate the transverse nature of light. **(H.P.B. 2018, 2015)**

19. What is plane polarised light? Name any two methods to produce plane polarised light. **(H.P.B. 2024)**

20. What is polarizing angle? **(H.P.B. 2022 Term -02)**

21. Show using proper diagram how unpolarized light can be linearly polarised by reflection from a transparent glass surface. **(H.P.B. 2022 Term -02)**

22. When a low flying aircraft passes overhead, we some times notice a slight shaking of the picture on our TV screen. Suggest a possible explanation. **(H.P.B.2023)**

23. Define Polarising angle. Derive the relation connecting Polarising angle and refractive index of the medium. **(H.P.B.2023)**

24. What is Fringe width? Derive an expression for fringe width using Young's double slit experiment for interference of light. **(H.P.B.2023)**

25. In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band? **(H.P.B.2023)**

26. (a) What is linearly polarized light? Describe briefly using a diagram how sunlight is polarised.
(b) Unpolarised light is incident on a polaroid. How would intensity of transmitted light change when the polaroid is rotated. **(H.P.B. 2022 Term -02)**

27. What are the two assumptions on which Huygen's principle is based? Explain Huygen's geometrical construction for wavelength? **(H.P.B.1996)**

28. Coloured spectrum is observed, when we see through a muslin cloth. **(H.P.B. 1997, 2005)**

29. In diffraction of single slit a screen is placed 2 m away from lens to obtain pattern. If the slit width is 0.2 mm and the first minimum lies 5 mm on either side of central maximum, find wavelength of light. **(H.P.B. 2003)**

30. Define polarising angle and relate it to critical angle. **(H.P.B.2010)**

31. In what way is diffraction from each slit related to interference pattern in a double-slit experiment? **(H.P.B.2023)**

32. What is diffraction of Light? Find conditions for maxima and minima, when diffraction of light takes place at single slit. **(H.P.B.2023)**

33. State necessary conditions for sustained interference. Derive an expression for fringe width using Young's Double slit experiment. **(H.P.B.2024)**

10. ATOMIC PHYSICS

OBJECTIVE QUESTIONS

1. Large angle scattering of alpha particles (α –particle) could not be explained by:
(a) Rutherford model (b) Thomson model
(c) Both Rutherford model and Thomson model
(d) Neither Rutherford model nor Thomson model.

2. Define impact parameter.
(a) It is the normal distance of scalar velocity of a far off particle from the nucleus.
(b) Impact parameter is the perpendicular distance of the 'vector velocity' of a far off particle from the centre of the nucleus.
(c) It is the normal distance of velocity vector of a near by particle from nucleus
(d) None of these

3. What would happen, if the electron, in an atom were stationary
(a) Nothing (b) it will fuse with nucleus
(c) it will move away from nucleus (d) None of these

4. What is Bohr's quantization condition for the angular momentum of an electron in the second orbit?
(a) $mv = \frac{nh}{2\pi r}$ (b) $mvr = \frac{3nh}{4\pi}$ (c) $mvr = \frac{2nh}{x}$ (d) none of these

5. In Bohr model of hydrogen atom, which of the following is quantized?
(a) Linear momentum of electron
(b) Linear velocity of electron
(c) Angular momentum of electron
(d) Angular velocity of electron.

6. The ratio of atomic volume of nuclear volume is of the order of
(a) 10^{15} (b) 10^{-12} (c) 10^{8} (d) 10^{-8}

7. Large angle scattering of alpha particles (α-particles) could not be explained by:
(a) Rutherford model
(b) Thomson model
(c) Both Rutherford model and Thomson model
(d) Neither Rutherford model nor Thomson model.

ASSERTION AND REASON TYPE QUESTIONS

Select the most appropriate answer from the options given below (A stands for assertion and R for reason)
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false
(d) Both A and R are false.

8. **Assertion (A):** The average angle of deflection of a-particles by a thin gold foil predicted by Thomson is almost the same as predicted by Rutherford.
Reason (R) : It is about the same because angle of deflection is taken as average

9. **Assertion (A):** Keeping other factors fixed, it is found experimentally that for small thickness 1, the number of a-particles scattered at moderate angles is proportional to t.
Reason (R): The scattering of a-particles is primarily because of multiple collisions.

10. **Assertion (A):** In Thomson's model of atom, multiple collisions of a-particles are required to be considered.
Reason (B) : Positive charge is spread throughout in the Thomson's model causing multiple collisions of a-particles

11. The nuclear model of atom was proposed by
(a) J.J. Thomso (b) E. Rutherford (c) Neils Bohr (d) Sommerfield.

12. According to classical theory, Rutherford model of atom is
(a) stable (b) unstable (c) semi stable (d) meta stable

13. Electrons in the atom are held due to
(a) Coulomb forces (b)Nuclear forces (c) Gravitational forces (d) vander Waal's forces

14. In Rutherford's scattering experiment, what will be the correct angle for a-scattering for an impact parameter b = 0
(a) 90° (b) 270 ° (c) 0 ° (d) 180 °

15. The radius innermost electron orbit of a hydrogen atom is 5.3 x 10^{-11} m . The radius of n = 3 orbit is
(a) 1.01 × $10^{-10}m$ (b) 1.59 × $10^{-10}\ m$ (c) 2.12 × $10^{-10}\ m$ (d) 4.77 × $10^{-10}\ m$

16. When hydrogen atom is in first excited level, its radius is
(a) same (b) half (c) twice (d) four times.

17. The angular momentum of orbital electron is integral multiple of
(a) h (b) $2\pi h$ (c) $h/2\pi$ (d) None of these

18. According to Bohr's postulate which of the following take discrete values?
(a) Kinetic energy (b) potential energy
(c) angular momentum (d) Linear momentum

19. The ratio of the radii of orbits corresponding to first and second excited states of hydrogen atom is
(a) 1 (b) 1 :2 (c) 2 : 3 (d) 4:9

20. Radius of first Bohr orbit is What is the radius in second Bohr orbit r_0
(a) $4r_0$ (b) $2r_0$ (c) $8r_0$ (d) $2\sqrt{2\,r_0}$

21. The ratio of wavelength of last line of Balmer series to the last line of Lyman series is
(a) 1 (b) 4 (c) 0.5 (d) 2

22. For an atom in the second orbit of hydrogen atom, the angular momentum is
(a) $2\pi h$ (b) πh (c) h/π (d) $4/\pi$

23. The radius of Bohr's first orbit is r_0 . The electron in the th orbit has the radius.

(a) $n\,r_0$ (b) r_0/n (c) $n^0\,r_0$ (d) r_0/n^2

24. Band spectrum is produced by
(a) H (b) He (c) H_2 (d) Na

25. Taking the Bohr's radius as a 53 pm, the radius of ion in its ground state, on the basis of Bohr's model, be about.
(a) 53 pm (b) 27 pm (c) 18 pm (d) 13pm

26. The total energy of electron in n^{th} stationary orbit of hydrogen atom is
(a) $\frac{13.6}{n^2}$ joule (b) $\frac{13.6}{n^2}\ eV$ (c) $-\frac{13.6}{n^2}$ joule (d) $\frac{-13.6}{n^2}$ eV

27. The diameter of first orbit of hydrogen atom is of the order of
(a) 0.5 Å (b) 1 Å (c) 2 Å (d) 4 Å

ANSWER KEY

1.(b) 2.(b) 3.(b) 4.(a) 5.(c) 6.(b) 7.(b) 8.(a) 9.(d) 10.(c)
11.(b) 12.(b) 13.(a) 14.(d) 15.(d) 16.(d) 17.(c) 18.(d) 19.(d) 20.(a)
21.(b) 22.(c) 23.(c) 24.(c) 25.(c) 26.(d) 27.(b)

SUBJECTIVE QUESTIONS:-

1. What is Rutherford's nuclear model of atom? **(H.P.Board 2015)**
2. What are the drawbacks of Rutherford's model of atom? **(H.P.Board 2015)**
3. State the postulates of Bohr's atomic model. **(H.P.Board 2015)**
4. What are the limitations of Bohr's model of an atom? **(H.P.Board 2015)**
5. Calculate the radius of nth orbit of hydrogen atom? **(H.P.Board 2011)**
6. Calculate the total energy of electron of the hydrogen atom. **(H.P.Board 2009)**

7. State the Postulates of Bohr's atomic model. **(H.P.Board 2023)**
8. On the basis of Bohr's atomic model, find an expression for radius of nth orbit of a hydrogen atom. **(H.P.Board 2023)**
9. Define (i) Impact parameter (ii) Distance of closest approach.

10. Obtain Bohr's quantization condition of angular momentum on the basis of the Bohr's atomic model. **(H.P. Board 2023)**

11. Using the Bohr's postulates, derive the expression for the
(a) Speed of the electron in the n^{th} orbit.
(b) Radius of the n^{th} orbit of the electrons in hydrogen atom. **(H.P. Board 2019)**

12. The radius of the innermost electron orbit of hydrogen atom is 2.3×10^{-11} m. What are the radii of the n=2 and n= 3 orbits?

13. A hydrogen atom initially in the ground level absorbs a photon, which excites it to the n=4 level. Determine the frequency of Photon.

14. The ground state energy of Hydrogen atom is $-13.6\ eV$. What are the kinetic and potential energies of the electrons in this state? **(H.P. Board 2022)**

11. NUCLEAR PHYSICS

OBJECTIVE QUESTIONS

1. How many joules are there in 1 MeV?
(a) 1.602×10^{-12} J (b) 1.602×10^{-19} J (c) 1.602×10^{-13} J (d) None of these
(H.P.Board 2007)

2. Define the impact parameter
(a) It is the normal distance of scalar velocity of a far off particle from the nucleus.
(b) Impact parameter is a perpendicular distance of the 'vector velocity' of a far off particle
(c) It is normal distance of velocity vector of a near by particle from nucleus.
(d) None of these **(Based on H.P.Board)**

3. Complete the following nuclear reaction
$_5B^{10} + {}_zX^A \longrightarrow {}_3Li^7 + {}_2He^4$
(a) Z= 0, A=1 (b) Z= 1, A=0 (c) Z= 1, A=1 (d) Z= 0, A=0 **(H.P.Board 2007)**

4. Give the relation between a.m.u. and MeV
(a) 1 MeV = 391 a.m.u (b) MeV = 931 a.m.u
(c) 1 a.m.u= 391 MeV (d) 1 a.m.u. = 931 MeV **(H.P.Board 2002)**

5. Name the phenomenon by which energy is produced in sun.
(a) Nuclear fission reaction (b) Nuclear fusion reaction
(c) Chemical reactions (d) Physical reactions. **(H.P.Board 2005)**

6. The energy equivalent to mass of neutron is
(a) 9.39 MeV (b) 0.939 MeV
(c) 93.95 MeV (d) 939.57 MeV **(H.P.Board 2011)**

7. The energy equivalent to mass of an electron is
(a) 0.511 MeV (b) 5.11 MeV (c) 51.1 MeV (d) 511 MeV **(H.P.Board 2011)**

8. Which of the following are the most penetrating radiations?
(a) a-rays (b) y-rays (c) B-rays (d) X-rays. **(H.P.B. 2012)**

9. The binding energy per nucleon is maximum in case of
(a) $_2He^4$ (b) $_{26}Fe^{56}$ (c) $_{56}Ba^{141}$ (d) $_{92}U^{235}$ **(H.P.B. 2024, 12)**

10. The average binding energy per nucleon of a nucleon inside an atomic nucleus is about
(a) 8 MeV (b) 8 eV (c) 8 joule (d) 8 erg. **(H.P.B. 2013)**

11. When $_3Li^7$ nuclei are bombarded by protons, the resultant nuclei are $_4Be^8$, the particles emitted will be
(a) α –particles (b) β - particles (c) γ – particles (d) neutron.
(H.P.B. 2016, 14)

12. In nuclear transformation
$_aX^b + {}_0n^1 \longrightarrow {}_3Li^7 + {}_2He^4$
Which one is the nucleus of element X?
(a) $_5B^{10}$ (b) $_5B^9$ (c) $_4Be^{11}$ (d) $_7C^{12}$ **(H.P.B. 2016)**

13. A deutron is bombarded on $_80^{16}$ nucleus then a particle is emitted the product nucleus is
(a) $_7N^{14}$ (b) $_5B^{10}$ (c) $_2Be^9$ (d) $_7N^{13}$ **(H.P.B. 2016)**

14. Atom bomb works on the principle of
(a) Nuclear fission (b) Nuclear fusion (c) B-decay (d) a-decay **(H.P.B. 2016)**

15. Electron capture is common in the case of heavy nuclei. The reason is
(a) electrostatic force are very large (b) nuclear forces are very large
(c) Angular momentum of electron (d) Angular velocity of electron. **(H.P.B. 2022)**

16. A hydrogen bomb is based on the principle of
(a) nuclear fission (b) $\beta - decay$ (c) nuclear fusion (d) none of these **(H.P.B. 2024)**

17. A = atomic mass number, Z = atomic number. The number of neutrons in the nucleus is
(a) Z + A (b) Z – A (c) A – Z (d) None of these

18. Which of the following can NOT be an elementary particle?
(a) $\alpha - particle$ (b) $\beta - particle$ (c) $\gamma - particle$ (d) Muon

19. Which of the following is not conserved in nuclear reactions ?
(a) Charge (b) Mass (c) Momentum (d) Nucleons

20. What is the number of neutrons in $_{17}C^{37}$ poles.
(a) 17 (b) 20 (c) 37 (d) 54

21. Given M = mass of the nucleus, A = atomic mass. The packing fraction is
(a) $\frac{M-A}{A}$ (b) $\frac{A-M}{A}$ (c) $\frac{A-M}{M}$ (d) $\frac{M-A}{M}$

22. The binding energy per nucleon is palmost.constant for many nuclei. To what characteristic of the nuclear force does it point?
(a) Saturative nature (b) Short range (c) Attractive nature (d) Exchange force

23. Which of the following is NOT the inverse square law force?
(a) Electric force (b) Gravitational force (c) Nuclear force
(d) Magnetic force between two poles

24. Which of the following is NOT the property of the atomic nucleus ?
(a) Sharp boundary (b) Definite charge (c) Definite number of particles
(d) Characteristics atomic number

25. The volume of the nucleons is proportional to
(a) atomic number (b) number of neutrons (c) Number of protons (d) Mass number

26. Who discovered nuclear fission ?
(a) Rutherford (b) Bohr (c) Hahn and Strassmann (d) Becquerel.

27. A fusion bomb involves
(a) Breaking of a heavy nucleus into lighter ones.
(b) Synthesis of lighter nuclei into heavier ones
(c) Explosion of TNT
(d) Burning of huge amount of coal.

28. The temperature at which the fusion occur is
(a) 3×10^2K (b) 3×10^3K (c) 3×10^5K (d) 3×10^6K

29. The fusion occurs at high temperature because
(a) atoms are ionised at high temperature
(b) molecules break up at high temperature
(c) nuclei break up at high temperature
(d) kinetic energy is high enough to overcome repulsion between nuclei.

30. Nuclear holocaust means
(a) Formation of a nuclear bomb
(b) Making holes in a metallic case by nuclear radiations
(c) nuclear atmosphere
(d) the aftermath of an atomic explosion

31. Positronis a particle with
(a) same mass as that of proton and with positive charge
(b) same mass as that of a proton but with a negative charge
(c) same mass as that of an electron but with positive charge
(d) same mass as that of an electron but with positive charge.

32. The nuclear of $_{92}U^{238}$ has all the following except
(a) 92 protons (b) 238 nucleons
(c) 156 neutrons (d) 92 electrons

33. The most unstable of these is
(a) Electron (b) Proton (c) Neutron (d) $\alpha - particle$

34. The helium atom does not contain
(a) two protons (b) two neutrons (c) two neutrons (d) six nucleons

35. The cause of the fractional atomic weight of elements is
(a) Isotopes (b) Isobars (c) Nucleons (d) Electrons

36. The nuclei $_{6}C^{13}$ and $_{7}N^{14}$ can be described as
(a) isotones (b) isobars (c) isotopes of carbon (d)Isotopes of nitrogen

ANSWER KEY

1.(c) 2.(b) 3.(b) 4.(b) 5.(b) 6.(d) 7.(a) 8.(b) 9.(b) 10.(a)

21.(a) 22.(c) 23.(c) 24.(a) 25.(d) 26.(d) 27.(c) 28.(d) 29.(d) 30.(b)

31.(a) 32.(c) 33.(d) 34.(d) 35.(a) 36.(a)

SUBJECTIVE QUESTIONS

1. 200 MeV energy is released in the fission of single $_{92}U^{235}$ nucleus. How may fissions must occur per second to produce a power of 1kW? **(H.P.B)**

2. Two masses of $_{26}Fe^{56}$ and $_{86}Bi^{209}$ nuclei are 55.934939 μ and 208.980388 μ and masses of neutron = 1.008665 μ. Calculate the binding energies of these nuclei and show which nucleus is more stable. **(H.P. Board 2002, 2024)**

3. What is the source of solar energy, explain? Explain the role of moderator in a nuclear reactor. **(H.P. Board 2004)**

4. What is the principle of atom bomb? Differentiate between nuclear fission and fusion. **(H.P. Board 2005)**

5. The ground state energy of Hydrogen atom is $-13.6\ eV$. What are the kinetic and potential energies of the electrons in this state? **(H.P. Board 2022)**

6. Define atomic mass unit (u). Fine its energy equivalent in MeV. **(H.P. Board 2015)**

7. How many joules are there in 1 MeV? **(H.P. Board 2015)**

8. Explain nuclear size and nuclear density. Show that nuclear density is the same for all nuclei. **(H.P. Board 2015, 13)**

9. Define mass defect and binding energy of nucleus. **(H.P. Board 2016, 15, 2023)**

10. Define binding energy per nucleon. Draw the curve between mass number and average binding energy. **(H.P. Board 2017, 16, 15, 14)**

11. What are nuclear forces? Given their properties. **(H.P. Board 2017, 16)**

12. What is nuclear fission? **(H.P. Board 2014)**

13. What is nuclear fusion? **(H.P. Board 2014)**

14. Define the Nuclear size and Nuclear density. Show that Nuclear density is same for all Nuclei.

Or

Calculate the binding energy per Nucleons of $_{26}Fe^{56}$, given mass of $_{26}Fe^{56}$ is 55.934949 amu, mass of Neutron is 1.008665 amu, mass of proton is 1.007825 amu. **(H.P.Board 2024)**

15. A Neutron is absorbed by $_3Li^6$ nucleus with subsequent emission of a-particle. Write the corresponding nuclear reaction. Calculate the Energy released in this reaction in MeV.

OR

Given:
mass of $_3Li^6$ = 6.015126 amu, mass of $_2He^4$ = 4.0026044 amu, mass of neutron ($_0n^1$)= 1.0086654 amu, mass of tritium ($_1H^3$)= 3.016049 amu **(H.P.Board 2024)**

16. Define (a) Isotopes (b) Isobars (c) Isotones (d) isomers

12. SEMICONDUCTOR

OBJECTIVE QUESTIONS

1. Why is a semiconductor damaged by a strong current?
(a) Strong current brings flood of holes
(b) Strong current brings flood of electrons
(c) (a) and (b)
(d) None of these. **(Based on H.P.B. 2018, 03)**

2. What type of impurity is added to obtain n-type semiconductor?
(a) Pentavalent (b) Arsenic (c) (a) and (b) (d) None.
(Based on H.P.B.)

3. What is a hole? Which doping creates a hole?
(a) A slit, pentavalent (b) Place for neutron, tetravalent
(c) Vacancy of an electron, trivalent (d) None **(H.P.B. 2003)**

4. Doping silicon with indium leads to which type of semiconductor?
(a) p-type (b) n-type (c) Neutral (d) Intrinsic **(H.P.B. 2003)**

5. A.C. is converted into D.C. by
(a) transistor (b) amplifier (c) rectifier (d) none of these **(H.P.B.sample)**

6. At zero degree kelvin, a piece of Germanium
(a) becomes semiconductor (b) becomes good conductor
(c) becomes bad conductor (d) has maximum conductivity. **(H.P.B. 2010)**

7. In p-type semiconductor, majority carriers are
(a) holes (b) electrons (c) protons (d) neutrons **(H.P.B. 2011, 10)**

8. Depletion layer in p-n junction diode consists of
(a) electrons (b) immobile ions (c) holes (d) both (a) and (c). **(H.P.B. 2024, 11)**

9. To obtain a p-type Germanium semiconductor, it should be doped with
(a) arsenic (b) antimony (c) indium (d) phosphorus. **(H.P.B. 2011)**

10. A semiconductor doped with donor impurity is
(a) P-type (b) N-type (c) n-p-n type (d) p-n-p type **(H.P.B. 2013)**

11. A pure semiconductor behaves slightly as a conductor at
(a) high temperature (b) room temperature
(c) low temperature (d) none of the above. **(H.P.B. 2013)**

12. The energy band gap is maximum in
(a) metals (b) superconductors
(c) insulators (d) semiconductor. **(H.P.B. 2013)**

13. Boron is added as impurity to silicon, the resultant semiconductor is
(a) n type semiconductor (b) p type semiconductor
(c) n type semiconductor (d) none of these. **(H.P.B. 2020, 16)**

14. N type semiconductor is obtained by doping intrinsic germanium with
(a) Phosphorous (b) Aluminium (c) boron (d) gold. **(H.P.B. 2016)**

15. An N type semiconductor is
(a) Neutral (b) negatively charged (c) positively charged (d) none of these **(H.P.B. 2017)**

16. When arsenic is added as an impurity to silicon, the resulting material is:
(a) n-type semiconductor (b) p-type semiconductor
(c) Intrinsic semiconductor (d) None of these **(H.P.B. 2019)**

17. Which of the following elements is a semiconductor?
(a) Na (b) Ba (c) Sr (d) Ge **(H.P.B. 2019)**

18. When a p-n junction diode is reverse biased, then
(a) High current flows (b) The depletion region is increased
(c) The height of potential barrier is reduced (d) The depletion region is reduced

19. In an unbiased pa junction, holes diffuse from the p region to n region, because of:
(a) The potential difference across the junction
(b) The attraction of free electron of n region
(c) The higher hole concentration of p region than that in region
(d) The higher concentration of electrons in the region than that in the p region.

20. When a forward bias is applied to a p-n junction, it
(a) Raises the potential barrier
(b) Reduces the majority carrier current to zero
(c) Lowers the potential barrier
(d) None of the above.

21. In an n-type silicon, which of the following statement is true:
(a) Electrons are majority carriers and trivalent atoms are the dopants
(b) Electrons are minority carriers and pentavalent atoms are the dopants

(c) Holes are minority carriers and pentavalent atoms are the dopants
(d) Holes are majority carriers and trivalent atoms are the dopants

22. PN junction diode is
(a) Ohmic resistance (b) Non ohmic resistance
(c) Negative resistance (d) Positive resistance. **(H.P.B. 2023)**

ASSERTION AND REASON TYPE QUESTIONS

Directions. In the following questions, a statement of assertion is followed by a statement of reason. While answering a question, you are required to choose the correct one out of the given four responses and mark it as:
(a) if both assertion and reason are true and reason is the correct explanation of the assertion.
(b) if both assertion and reason are true, but reason is not correct explanation of the assertion.
(c) if assertion is true,but reason is false.
(d) if both assertion and reason are false.

23. **Assertion:** If a heavy nucleus is split into two medium sized parts, each of the nuclei will have more binding energy per nucleon than the original nucleus.
Reason : Joining two light nuclei together to give a single nucleus of medium size means more binding energy per nucleon than the two nuclei. **(H.P.B. T-II 2022)**

24. **Assertion :** A pure semiconductor has negative temperature coefficient of resistance.
Reason : On raising the temperature, more charge carriers are released, conductance increases and resistance decreases. **(H.P.B. T-II 2022)**

25. **Assertion:** Nuclei having mass number about 60 are most stable.
Reason : When two or more light nuclei are combined into a heavier nucleus, then the binding energy per nucleon will increase. **(H.P.B. T-II 2022)**

26. **Assertion:** The energy gap between the valence band and conduction band is greater in silicon than in germanium.
Reason : Thermal energy produces fewer minority carriers in silicon than in germanium **(H.P.B. 2023)**

ANSWER KEY

1.(d) 2.(c) 3.(c) 4.(a) 5.(c) 6.(c) 7.(a) 8.(b) 9.(c) 10.(b)
11.(b) 12.(c) 13.(b) 14.(a) 15.(a) 16.(a) 17.(d) 18.(d) 19.(d) 20.(c)
21.(c) 22.(b) 23.(b) 24.(a) 25.(b) 26.(b)

SUBJECTIVE QUESTIONS

1. Distinguish between intrinsic and extrinsic semiconductors. **(H.P. Board 2015)**

2. What is meant by the term doping of an intrinsic semiconductor? How does it affect the conductivity of semiconductor? **(H.P. Board 2014)**

3. What are doped semiconductor or extrinsic (impure) semiconductors? **(H.P. Board 2013)**

4. Explain the energy band diagram for p-type and n-type semiconductor? **(H.P. Board 2013)**

5. Distinguish between n-type and p-type semiconductor. **(H.P. Board 2015, 16)**

6. Using the concept of electron current and hole current derive an expression for conductivity of semiconductor. **(H.P. Board 2012)**

7. Describe the formation of depletion layer and potential barrier in a p-n junction diode.

(H.P. Board 2012)

8. Distinguish clearly between forward biasing and reverse biasing of a diode.

(H.P. Board 2015, 14, 12)

9. What do you mean rectification? Draw a neat and labelled circuit diagram to show how junction diode acts as half wave rectifier. **(H.P. Board 2018, 16, 12)**

10. What is the principle of rectifier? Explain with the help of a circuit diagram, the use of junction is a full wave rectifier. **(H.P. Board 2017, 15, 12)**

11. How does electrical conductivity change with rise of temperature in case of semi-conductor and why?

(H.P.B. 2014)

12. What is extrinsic semiconductor? Explain how p-type and n-type semiconductor are formed.

(H.P.B. 2007, 2021)

13. Distinguish between n-type and p-type semiconductor on the basis of energy band diagram.

(H.P.B. 2013)

14. Explain the formulation of energy bands in solids. On the basis of energy band, distinguish between (i) a metal (ii) an insulator (iii) a semi –conductor. **(H.P.B. 2018, 12, 08, 07, 05, 02, 2000 c)**

15. What is zener diode? How it can be used as a voltage regulator?