LEARNING HORIZON

PHYSICS MCQ
CLASS 12TH

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ELECTRIC CHARGES AND FIELDS -1

(i) Multiple Choice Questions

1. Two charges $3.\times10^{-5}C$ and $5\times10^{4}C$ are placed at a distance 10 cm from each other. Find the value of electrostatic force acting between them.

   (a) $13.5\times10^{11}N$ (b) $40\times10^{11}N$

   (c) $180\times10^{9}N$ (d) $13.5\times10^{10}N$

Ans. (a)

Applying

2. What is the S. I. unit of electric flux?

   (a) $\frac{N}{C}\times m^2$ (b) $N\times m^2$ (c) $\frac{N}{m^2}\times C$ (d) $\frac{N^2}{m^2}\times C^2$

Ans. (a)

Remembering

3. What is the value of minimum force acting between two charges placed at 1 m apart from each other

   (a) Ke^2 (b) Ke (c) $\frac{Ke}{4}$ (d) $\frac{Ke^2}{2}$

Ans. (a)

Applying

4. A glass rod acquires charge by rubbing it with silk cloth. The charge on glass rod is due to :

   (a) Friction (b) Conduction (c) Induction (d) Radiation

Ans. (a)

Understanding

5. If $\oint E.ds = 0$, inside a surface, that means :-

   (a) there is no net charge present inside the surface

   (b) Uniform electric field inside the surface

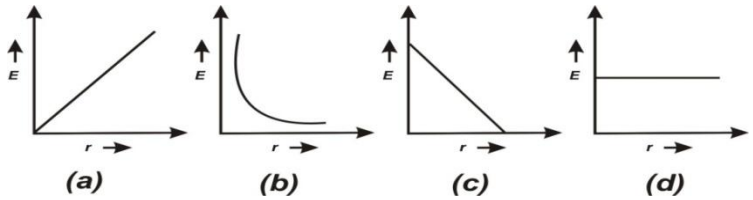
   (c) Discontinues field lines inside the surface

   (d) Charge present inside the surface

Ans. (a)

Understanding

7. For a point charge, the graph between electric field versus distance is given by : -



Ans. (b)

Understanding

8. What will be the value of electric field at the centre of the electric dipole : -

(a) Zero

(b) Equal to the electric field due to one charge at centre

(c) Twice the electric field due to one charge at centre

(d) half the value of electric field due to one charge at centre

Ans. (c)

Applying

9. Charge on a conducting metal sphere present at : -

(a) On the surface of sphere (b) Inside the sphere

(c) Outside the sphere (d) both inside and outside of sphere

Ans. (a)

Understanding

10. The value of electric field inside a conducting sphere having radius R and charge Q will be :

(a) $\frac{KQ}{R^2}$ (b) $\frac{KQ}{R}$

(c) *Zero* (d) $\frac{KQ^2}{R^2}$

Ans. (c)

Understanding

11. Which physical quantity have unit Newton /coulomb.

(a) Electric charge (b) Electric field

(c) Electric force (d) Electric potential

Ans. (b)

Analysing & Evaluating

12. In the process of charging, the mass of the negatively charged body-

(a) Increases (b) Decreases

(c) Remains Constant (d) None of the above

Ans. (a)

Understanding

13. Charge on a body is integral multiple of $\pm e$. It is given by the law of -

(a) Conservation of charge (b) Conservation of mass

(c) Conservation of energy (d) Quantisation of charge

Ans. (d)

Remembering

14. Four charges + 8Q, - 3Q +5Q and -10Q are kept inside a closed surface. What will be the outgoing flux through the surface.

(a) 26 V-m (b) 0 V-m (c) 10 V-m (d) 8 V-m

Ans. (b)

[Applying]

15. Which Quantity is vector Quantity among the following -

(a) Electric flux (b) Electric charge (c) Electric field (d) Electric potential

Ans. (b)

Analysing & Evaluating

16. Charge Q is kept in a sphere of 5 cm first than it is kept in a cube of side 5 cm. the outgoing flux will be-

(a) More in case of sphere (b) More in case of cube

(c) Same in both case (d) Information Incomplete

Ans. (c)

Analysing & Evaluating

17. Electric field intensity due to a short dipole remains directly proportional to – (r → distance of a point from centre of dipole)

(a) r^2 (b) r^3

(c) r^{-2} (d) r^{-3}

Ans. (d)

Understanding

18. On charging a neutral Balloon its size -

(a) Increases

(b) Decreases

(c) Remains same

(d) No relation between charge & size

Ans. (a)

Understanding

19. Electric field lines contracts lengthwise, It shows

(a) repulsion between same charges

(b) Attraction between apposite charges

(c) No relation between force & contraction.

(d) Electric field lines does not moves on straight path.

Ans. (b)

Understanding

(ii) Completion Type Questions

1. The expression $q = ne$ is due to _____ of electric charge.

Ans. Quantisation

Remembering

2. A silk cloth rubbed with a glass rod has a charge $\left(q = -1.6 \times 10^{-19} C\right)$, then the charge on the glass rod will be _____ C.

Ans. $\left(+1.6 \times 10^{-19}\right)$

Analysing & Evaluating

3. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the electric_____ will remain same.

Ans. Flux

Applying

4. An electric dipole is placed inside uniform electric field. When it is rotated from unstable equilibrium to stable equilibrium in a uniform electric field, its potential energy _____.

Ans. Decreases

Applying

5. S. I. Unit of electric field is _____ .

Ans. (N/C)

Remembering

6. Two point charges are separated by some distance inside vacuum. When space between the charges is filled by some dielectric, the force between two point charges _____?

Ans. Decreases

Understanding

7. Net electrostatic field inside a positively charged conductor is _____.

Ans. Zero

Remembering

8. Electric flux is a _____ quantity.

Ans. Scalar

Understanding

9. Two pointy charges, one Coulomb each are separated by vacuum and placed 1 meter apart from each other. The force acting between them is _____.

Ans. $\left(9\times10^{9}N\right)$

Analysing & Evaluating

10. Electric field lines never _____ each other

Ans. Intersect

Understanding

11. Net electric flux from a closed surface does not depends upon distribution of _____ inside the surface.

Ans. Charges

Understanding

12. Direction of electric field intensity due to a dipole on equatorial point is _____ to the direction of dipole moment.

Ans. Opposite

Analysing & Evaluating

13. The unit of electric flux is _____ volt × meter.

Ans. Electric flux

14. Net charge within an isolated system always remains constant. It is called as law of _____ of charge.

Ans. Conservation

Understanding

15. Net Electric field inside the charged spherical shell is _____ .

Ans. Zero

Analysing & Evaluating

16. Electric force acting between two charges also depends upon the _____between them.

Ans. Medium

Understanding

17. An electric dipole is placed inside uniform electric field. Net _____on it is always zero.

Ans. Force

[Applying]

18. Two unequal charges exerts _____ magnitude force on each other.

Ans. Equal

Understanding

19. Electric dipole moment is a _____ quantity.

Ans. Vector

Remembering

20. A sphere of radius 100 cm has a charge of $(2\pi/3)\mu C$. Its surface density of charge is _____ .

Ans. $1.67\times10^{-7}C/m^2$ **(** $\sigma = \frac{Q}{4\pi R^2} = \frac{(2\pi/3)\times10^{-6}}{4\pi\times(1)^2} = 1.67\times10^{-7}C/m^2$ **)**

Applying

21. A proton and an alpha particle enter into a region of uniform electric field. The ratio of the force on the proton to that on the alpha particle is _____.

Ans. 1 : 2 ($\frac{F_p}{F\alpha} = \frac{eE}{(2e)E} = 1:2$ **)**

Applying

22. Two equal and opposite charges of magnitude $0.2\times10^{-6}C$ are 15 cm apart, the magnitude and direction of the resultant electric intensity E at a point midway between the charge is _____.

Ans. $6.4\times10^5 N/C$ **, towards the –ve charge**

Applying

(iii) True/False Type Questions

1. Two identical metallic spheres of exactly equal masses are taken. One is given a positive charge Q Coulombs and the other an equal negative charge. Their masses after charging are different.

Ans. True

Analysing & Evaluating

2. Electrostatic force is a conservative in nature.

Ans. True

Remembering

3. Quantisation of charge can be neglected at macroscopic level.

Ans. True

Understanding

4. S. I. unit of electric flux is $\frac{N}{C}$.

Ans. False

Remembering

5. The electric force between two charges changes, if we bring a third charge closer to them.

Ans. False

Understanding

6. Two electric field lines never intersect each other.

Ans. True

Remembering/ Understanding

7. Electric field on the axis of a short dipole at a distance *r* from the dipole is given by $\frac{kp^2}{r^2}$.

Ans. False

Understanding

8. Electrostatic force is both attractive and repulsive.

Ans. True

Remembering/ Understanding

9. Electrostatic force at a point due to multiple charges is equal to algebraic sum of forces due to all charges at that point.

Ans. False

Understanding

10. Charge on a body can have any value greater than $1.6\times10^{-19}C$.

Ans. False

Understanding

11. Electric field intensity due to an Infinite charge sheet decreases by increasing distance.

Ans. False

Understanding

12. It is possible that two similarly charged bodies can attract each other.

Ans. True

App

13. Charge given to a spherical conductor is uniformly distributed in its entire volume.

Ans. False

Analysing & Evaluating

14. Gauss law is valid only for the fields which follows inverse square law.

Ans. True

Understanding

15. Electric flux is a vector quantity.

Ans. False

Remembering

16. The minimum field required to produce breakdown of air is $3.0\times10^{6}V/m$. Therefore a conducting sphere 10 cm in radius can easily hold a charge of $4\times10^{-6}C$ in air without breakdown.

Ans. False (Electric field at the top of the sphere $E=\frac{KQ}{R^2}=\frac{9\times10^{9}\times4\times10^{-6}}{\left(10^{-1}\right)^2}=3.6\times10^{6}N/C$ **which is more than** $3.0\times10^{6}N/C$**, so the sphere cannot hold charge** $4\times10^{-6}C$**.)**

Applying

17. Three equal charges ('Q' each) are placed at the corners of an equilateral triangle of side 'a'. The force on any one of the charge is $\frac{Q^2\sqrt{3}}{4\pi\varepsilon_0 a^2}$.

Ans. True $F_A=\sqrt{(F_{AB})^2+(F_{AC})^2+2(F_{AB})\times(F_{AC})\cos 60}$

$$=\sqrt{\left(\frac{KQ^2}{a^2}\right)^2+\left(\frac{KQ^2}{a^2}\right)^2+2\left(\frac{KQ^2}{a^2}\right)\times\left(\frac{2KQ^2}{a^2}\right)^2\times\frac{1}{2}}$$

$$=\frac{KQ^2\sqrt{3}}{a^2}$$

Applying

(iv) Matching type Questions

1. (i) Direction of dipole moment
   (ii) Direction of electric field lines

(a) positive charge to negative charge
(b) negative charge to positive charge
(c) positive charge to positive charge

Ans. (i) (b), (ii)(a)

Remembering

2. (i) As a body acquires positive charge, its mass
   (ii) As a body acquires negative charge, its mass

(a) Increases
(b) Remain same
(c) Decreases
(d) First increase then decrease.

Ans. (i) (c), (ii) (a)

Understanding

3. (i) S.I. unit of electric flux is
   (ii) S.I. unit of electric field is

(a) $\frac{N}{C^2}$
(b) $\frac{N}{C}$
(c) $\frac{N}{C} \times m^2$
(d) $\frac{N}{m^2} \times C$

Ans. (i) (c), (ii)(b)

Remembering

4. (i) Electric field intensity on the surface of charged conducting sphere
   (ii) Electric field intensity due to infinite charged sheet

(a) $\frac{\sigma}{\in_0}$
(b) $\frac{\sigma}{2 \in_0}$
(c) $\frac{\sigma}{4 \in_0}$
(d) $\frac{\sigma}{6 \in_0}$

Ans. (i) (a), (ii)(b)

Remembering

5. (i) Glass rod is rubbed with silk clothe and get charged
   (ii) A metal sphere is get charged by another charged sphere by no actual contact between

(a) Friction
(b) Conduction
(c) Induction

Ans. (i) (a), (ii)(c)

Understanding

6. (i) Electric field lines due to a point like positive charge
(ii) Electric field lines due to a point like negative charge

(a) radically inward
(b) radically outward
(c) parallel to charge
(d) perpendicular to charge

Ans. (i) (b), (ii)(a)

Remembering

7. (i) Electrostatic force is
(ii) Gravitational force is

(a) Always attractive
(b) Always repulsive
(c) Both attractive and repulsive

Ans. (i) (c), (ii)(a)

Remembering

8. (a) Electric field
(b) Electric flux

(a) Volt × metre
(b) Volt /sec
(c) Volt / metre

Ans. (i) (c), (ii)(a)

[Remembering]

9. (a) Charging by friction
(b) Charging by Induction

(a) Both bodies must be charged
(b) One of the body should be charged
(c) Both bodies may not be charged

Ans. (i) (a), (ii)(b)

[Understanding]

10. (i) Direction of electric field intensity on axial point of dipole.
(ii) Direction of electric field intensity on equatorial point of dipole

(a) Along the direction of electric dipole moment
(b) Perpendicular to the direction of electric dipole moment
(c) Opposite to the direction of dipole moment

Ans. (i) (a), (ii)(c)

[Remembering]

11. (i) Electric field intensity due to an infinite charged sheet
(ii) Electric field intensity on the surface of charged sphericalshell

(a) $\frac{\sigma}{\varepsilon_0}$
(b) $\frac{\sigma}{2\varepsilon_0}$
(c) $\frac{2\sigma}{3\varepsilon_0}$

Ans. (i) (b), (ii)(a)

[Remembering]

12. (i) Electric charge
(ii) Electric flux

(a) volt/ metre
(b) Remains Quantised
(c) Scalar Quantity

Ans. (i) (b), (ii)(c)

[Understanding]

13. (i) Gauss Law
(ii) Coulombs Law

(a) $\oint \vec{E}.\overrightarrow{dS} = \frac{\sigma}{\varepsilon_0}$

(b) $\oint \vec{E}.\overrightarrow{dS} = \frac{q}{\varepsilon_0}$

(c) $F = \frac{kq_1q_2}{r^2}$

Ans. (i) (b), (ii)(c)

[Applying]

14. (i) Net force on a dipole is zero
(ii) A scale rubbed with hair attracts small pieces of paper.

(a) Dipole in non uniform electric field
(b) Dipole in uniform electric field
(c) Charging by conduction.

Ans. (i) (b), (ii)(a)

[Applying]

15. (i) Two similarly charged bodies
(ii) Two oppositely charged bodies

(a) Always repel each other
(b) Always attract each other
(c) May attract or repel each other

Ans. (i) (c), (ii)(b)

[Understanding]

16. (i) Direction of electric field lines
(ii) Direction of electric dipole moment

(a) Positive to negative charge
(b) Negative to positive charge
(c) perpendicular to the line joining both charges

Ans. (i) (a), (ii)(b)

[Remembering]

ELECTROSTATIC POTENTIAL AND CAPACITANCE - 2

(i) Multiple Choice Questions

1. When charge is supplied to a conductor, its potential depends upon

   (a) the amount of charge (b) Geometry & size of conductor

   (c) both (a) & (b) (d) only on (a)

Ans. (c)

Understanding

2. A parallel plate capacitor is charged by a battery. Once it is charged battery is removed. Now a dielectric material is inserted between the plates of the capacitor, which of the following does not change?

   (a) electric field between the plates (b) potential difference across the plates

   (c) charge on the plates (d) energy stored in the capacitor.

Ans. (c)

Analysing & Evaluating

3. A dipole is placed parallel to electric field. If W is the work done in rotating the dipole from 0° to 60°, then work done in rotating it from 0° to 180° is

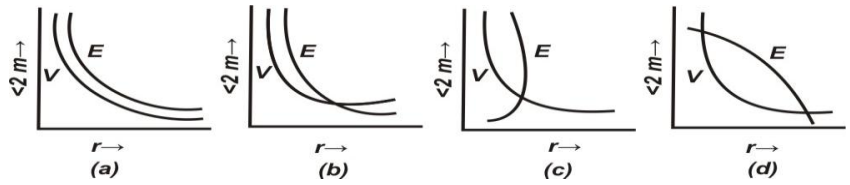
   (a) 2 W (b) 3 W

   (c) 4 W (d) $\frac{W}{2}$

Ans. (c)

Applying

4. The variation potential V with r & electric field with r for a point charge is correctly shown in the graphs.



Ans. (b)

Understanding

5. A charge Q is supplied to a metallic conductor. Which is true?

   (a) Electric field inside it is same as on the surface.

   (b) Electric potential inside is zero.

   (c) Electric potential on the surface is zero

   (d) Electric potential inside it is constant

Ans. (d)

Analysing& Evaluating/ Understanding

6. A parallel plate capacitor C has a charge Q. The actual charges on the plates are

(a) Q, Q (b) $Q/2, Q/2$

(c) $Q, -Q$ (d) $\frac{Q}{2}, \frac{-Q}{2}$

Ans. (c)

Understanding

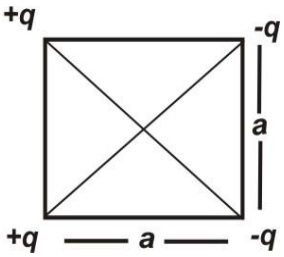
7. Three capacitors of capacitances 1μf, 2μF & 3μF are connected in series and a potential difference of 11V is applied across the combination them the potential difference across the plates of 1μF capacitor is

(a) 2V (b) 4V (c) 1V (d) 6V

Ans. (d)

Applying

8. The potential at the centreof the square is-



(a) Zero (b) $\frac{kq}{a\sqrt{2}}$

(c) $\frac{kq}{a^2}$ (d) $\frac{kq}{2a^2}$

Ans. (a)

Applying

9. Two conducting spheres A and B of radii a & b respectively are at the same potential. The ratio of surface charge densities of A and B is

(a) $\frac{b}{a}$ (b) $\frac{a}{b}$ (c) $\frac{a^2}{b^2}$ (d) $\frac{b^2}{a^2}$

Ans. (a)

Applying

10. Work done to bring a unit positive charge un-accelerated from infinity to a point inside electric field is called :

(A) Electric field (B) Electric potential

(C) Capacitance (D) Electric flux

Ans (B)

Remembering

11. Electric potential due to a point charge –q at distance x from it is given by:

(A) Kq/x^2 (B) Kq/x

(C) $-Kq/x^2$ (D) $-Kq/x$

Ans.- (D)

Understanding

12. Electric field is always :

(A) Parallel to equipotential surface

(B) Perpendicular to equipotential surface

(C) It can be perpendicular and parallel as well

(D) It does not depends on distribution of charge

Ans.- (B)

Understanding

13. Electric field and electric potential inside a charged spherical shell :

(A) $E = 0; V = 0$ (B) $E = 0 ; V \neq 0$

(C) $E \neq 0 ; V = 0$ (D) $E \neq 0 ; V \neq 0$

Ans.- (B)

Understanding

14. Shape of equipotential surface in uniform electric field will be :

(A) Spherical normal to electric field

(B) Random

(C) circular normal to electric field

(D) Equidistant Planes normal to electric field

Ans.- (D)

Understanding

15. On reducing potential across or capacitor, its capacitance of an object :

(A) Decreases (B) Increases

(C) Remains constant (D) First increases then decreases

Ans- (C)

Understanding

16. Energy stored in a in a charged capacitor is given by :

(A) $U = CV/2$ (B) $U = CV^2/2$

(C) $2CV^2$ (D) $VC^2/2$

Ans.- (B)

Remembering]

17. If n number of equal capacitors each of capacitance C are connected in series then equivalent capacitance will be given as :

(A) $n \times C$ (B) C/n

(C) $n+C$ (D) n^2C

Ans.- (B)

Applying

18. Capacitance of parallel plate capacitor when there is no medium between the plates is C_0. If capacitor is now completely filled with dielectric matter of constant K then capacitance :

(A) C_0/K (B) KC_0

(C) K^2C_0 (D) $2KC_0$

Ans.- (B)

Applying

(ii) Completion Type Questions

1. Electric field E at a point is perpendicular to the _____ surface through the point.

Ans. Equipotential

Understanding

2. The potential energy of a charge q in an placed at potential $V(r)$ is _____.

Ans. $\{qV(r)\}$

Remembering

3. It is safer to be inside the car rather than standing outside under a trace during lightening is based on _____ concept.

Ans. Electrostatic shielding

Understanding

4. A capacitor plates are charged by a battery. After charging battery is disconnected and a dielectric slab is inserted between the plates, the charge on the plates of capacitor _____ .

Ans. Remain same

Applying

5. The amount of work done is bringing a charge q from infinity to a point un-accelerated and is equal to _____ acquired by the charge.

Ans. Electrostatic potential energy

Remembering

6. The value of potential energy of an electric dipole in uniform electric field along the dissection of field is _____ .

Ans. $U = -\vec{p}.\vec{E}$

Remembering

7. Electric field is always …… to the equipotential surface.

Ans. (perpendicular)

Understanding

8. Work done to bring a unit positive charge un-accelerated from infinity to a point in electric field is called …….

Ans. (electric potential)

Remembering

9. Unit of capacitance is …….

Ans. (Farad)

Remembering

10. Unit of electric potential is ……

Ans. (Volt)

Remembering

11. A capacitor is charged and is not connected to a battery; Potential between plates of the capacitor ……. when it is filled with dielectric.

Ans. (Decrease)

Analysing & Evaluating

12. Equipotential surface due to a point charge will be ……. in shape.

Ans. (Spherical)

Remembering

13. Equipotential surfaces due to long linear charge distribution will be ……. in shape.

Ans. (Cylindrical)

Remembering

14. Two capacitors each of capacitance 2μF are connected in series. Equivalent capacitance will be ……..

Ans. (1μF)

Applying

(iii) True/False Type Questions

1. For a charged particle moving from point P to point Q, the net work done by an electrostatic field on the particle is independent of the path connecting point P to point Q.

Ans. True

Understanding

2. A conducting hollow sphere of radius 10 cm has an electric potential on the surface be 10V. Then the electric potential at the centre of the hollow sphere will be zero.

Ans. False

Understanding

3. The work done in rotating the electric dipole in uniform electric field from $\theta = 0$ to $\theta = 60°$ will be negative.

Ans. False

Applying

4. Electric potential due to an electric dipole on equatorial line is $\frac{kp}{r^3}$

Ans. False

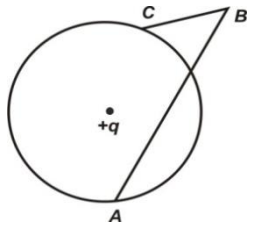
Remembering

5. Electric field inside the dielectric material is always less because induced electric field is set up within it, which is in a direction opposite to original electric field.

Ans. True

Understanding

6. Charge q is placed at the center of an imaginary sphere as shown following. Work done in moving a charge from A to B is greater than taking the charge from B to C.



Ans. False

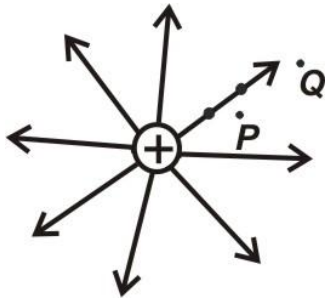
Applying

7. When two capacitors with unequal capacitances are joined in parallel and connected across a battery then charge on each capacitor will be same.

Ans. False

Understanding

8. The potential difference $V_P - V_Q$ will be positive.



Ans. True (An $V \propto \frac{1}{r}$ $V_P > V_Q$**)**

Analysing& Evaluating

9. The electrostatic field at the surface of charged conductor must be tangential to the surface at any point.

Ans. False (Electric field should be normal to the surface at any point)

Understanding

10. We can place a metal sphere of capacitance 1Farad inside an almirah.

Ans. False

Understanding

11. Work done to displace any electric charge from one point to another point on equipotential surface is always zero.

Ans. True $W_{if} = q_o[V_f - V_i]$

Understanding

12. Two equipotential surfaces never intersect each other.

Ans. True

Understanding

13. If two capacitors having equal capacitance are connected in series then equivalent capacitance doubles.

Ans. False $C_s = \left(\frac{1}{C_1} + \frac{1}{C_2}\right)^{-1} = \frac{C}{2}$

Applying

14. Electrostatic force is a conservative force.

Ans. True $\oint \vec{E}..d\vec{l} = 0$

Understanding

15. Four capacitor each of capacitance 16μF are connected in series. Equivalent capacitance will be 4μF.

Ans. True $C_s = \left(\frac{1}{16} + \frac{1}{16} + \frac{1}{16} + \frac{1}{16}\right) = 4\mu F$

Applying

16. Electric field is always perpendicular to equipotential surface.

Ans. False

Understanding

17. Electric field intensity outside parallel plate capacitor is zero.

Ans. True

Understanding

(iv) Matching type Questions

1. (a) Electric field due to a single charge $(P)\ E \propto \frac{1}{r}$

   (b) Electric field due to an electric dipole $(Q)\ E \propto \frac{1}{r^2}$

   $(R)\ E \propto \frac{1}{r^3}$

Ans. (a) –Q , (b)– R

Understanding

2. (a) In series combination of capacitors — (P) potential difference across each capacitor is same

   (b) In parallel combination of capacitors — Q) energy stored by each capacitor is same

   (R) charge on each capacitor is same.

Ans. (a)- R, (b) – P

Understanding

3. (a) On inserting dielectric slab between — (P) capacity remains same plates of capacitor

   (b) On replacing mica by air between — (Q) capacity decreases plates of capacitor

   (R) capacity increases

Ans. (a) –R , (b)- Q

Understanding

4. (a) Equipotential surfaces for a point charge — (P) Coaxial cylindrical

   (b) Equipotential surface for a linear charge — (Q) Concentric spherical

   (R) concentric circular

Ans. (a) –Q , (b)- P

Remembering

5. (a) Equivalent capacitance of 3 equal capacitors $(P)\ 3C$

   in series combination $(Q)\ \frac{2C}{3}$

   (b) Equivalent capacitance of 3 equal capacitors, $(R)\ \frac{C}{3}$

   two in parallel & one in series with it

Ans. (a) –R, (b)- Q

Applying

6. (a) SI unit of potential difference (P) $\frac{Nm^2}{C}$

(b) SI unit of Electric field (Q) $\frac{N}{C}m$

(R) $\frac{kgm}{\sec^2 C}$

Ans. (a) –Q , (b)- R

Remembering

7. (a) Electric field inside a metallic conductor (P) constant

(c) Electric potential inside the conductor (Q) zero

(R) Less than that on surface

Ans. (a) –Q , (b)- P

Understanding

8. (a) The value of electric field just outside the charged conductor is (P) $\frac{\sigma}{2\epsilon_0}$

(b) The value of electric field inside a charged capacitor is (Q) $\frac{\sigma}{\epsilon_0}$

(R) $\frac{2\sigma}{\epsilon}$

Ans. (a) –Q , (b)- R

Understanding

9. (a) Unit of dielectric constant K (P) Nm^2c^{-2}

(b) Unit of electrical permittivity (Q) no unit

(R) $N^{-1}m^{-2}C^2$

Ans. (a) – Q, (b) – R

Remembering

CURRENT ELECTRICITY -3

(i) Multiple Choice Questions

1. Kirchhoff's II law for the electric network is based on:

   (a) Law of conservation of charge

   (b) Law of conservation of energy

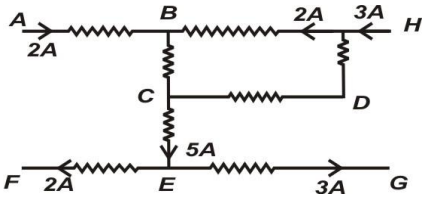
   (c) Law of conservation of angular momentum

   (d) Law of conservation of mass

Ans. B

Remembering

2. In the circuit diagram, calculate the electric current through branch BC:



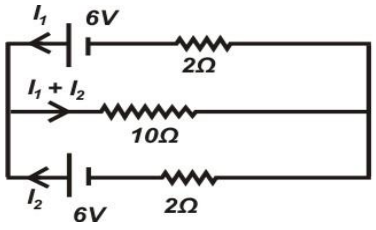
   (a) 4 amp (b) 2 amp

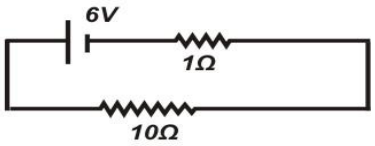
   (c) 5 amp (d) 10 amp

Ans. A

Apply

3. Electric current through resistance 10 Ω, in the given circuit is:





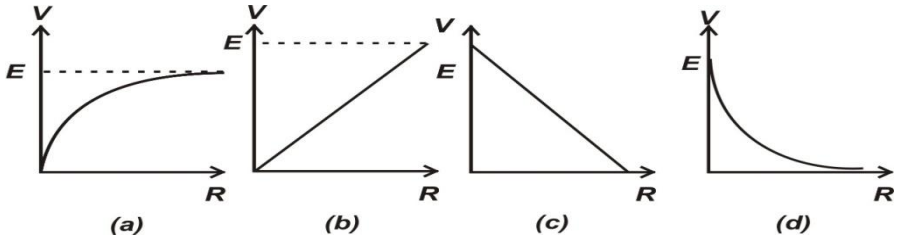
   (a) 0 amp (b) 0.5 amp

   (c) 6/11 amp (d) 2 amp

Ans. C

Applying

4. A cell of emf E and internal resistance r is connected across an external resistor R. The graph showing the variation of P.D. across R versus R



Ans.

Analysing & Evaluating

5. We use alloy for making of resistors, because they have :

	Temp. coefficient	**Resistivity**
(a)	Low	Low
(b)	High	High
(c)	High	Low
(d)	Low	High

Ans. A

Remembering

(a) The wire, which has maximum resistance

(c) The loop, which has net zero potential

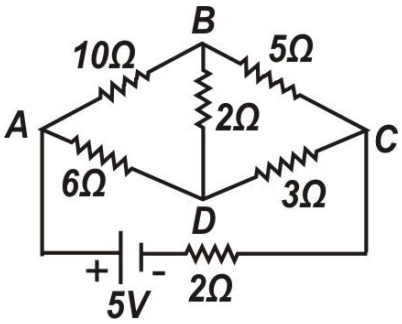
(c) A point, where two wires are joined together

(d) A point, where there two or more wires are joined together

Ans. D

Remembering

7. Determine the electric current through branch BD of the electric network:



(a) 0.6 amp (b) 0 amp

(c) 1 amp (d) 10 amp

Ans. B

Applying

8. WSB experiment is most sensitive, when:

(a) All four resistances are approximately equal

(b) One of the resistances is very high as compare to others

(c) One of the resistances is very low as compare to others

(d) Any two resistances are equal to infinity.

Ans. A

Understanding

9. In a Whetstone's bridge, all the four arms have equal resistance R. If resistance of the galvanometer arm is also R, then equivalent resistance of the combination is

(a) R (b) 2R

(c) $\frac{R}{2}$ (d) $\frac{R}{4}$

Ans. (a) [As $\frac{P}{Q}=\frac{R}{S}$, so resistance of the galvanometer can be omitted (P & Q are in series = 2R, R & S are also in series =2R) . Now the equivalent resistance $=\frac{2R\times 2R}{4R}=R$]

Applying

10. For a cell of e.m.f. 2 V, a balance is obtained for 50 cm of the potentiometer wire. If the cell is shunted by a 2 Ω resistor and the balance is obtained across 40 cm of the wire, then the internal resistance of the cell is

(a) $1\,\Omega$ (a) $0.5\,\Omega$

(c) $1.2\,\Omega$ (d) $2.5\,\Omega$

Ans. (b) [$r=R\left(\frac{l_1-l_2}{l_2}\right)=2\times\left(\frac{50-40}{40}\right)=0.5\Omega$]

Applying

11. In a metre bridge experiment, resistance box (with $R=2\Omega$) is connected in the left gap and the unknown resistance S in the right gap. If balancing length be 40 cm, calculate value of S.

(a) 2Ω (b) $3\,\Omega$ (c) $4\,\Omega$ (d) $2.5\,\Omega$

Ans. (b) [$\frac{2}{40}=\frac{5}{60}\quad\Rightarrow\quad S=3\Omega$]

Applying

12. How much work is required to carry a 6 μC charge from the negative to the positive terminal of a 9V battery?

(a) 54×10^{-3} J (b) 54×10^{-6} J

(c) 54×10^{-9} J (d) 54×10^{-12} J

Ans. (b) [$W=qV=54\mu J$]

Applying

13. For a cell, the terminal potential difference is 3.6 V, when the circuit is open. If the potential difference reduces to 3 V, when cell is connected to a resistance of 5 Ω, the internal resistance of cell is

(a) $1\,\Omega$ (b) $2\,\Omega$ (c) $4\,\Omega$ (d) $8\,\Omega$

Ans. (a) [$r=R\left(\frac{E-V}{V}\right)=5\left(\frac{3.5-3}{3}\right)=1\Omega$]

Applying

14. A cell supplies a current of 0.9 A through a $2\,\Omega$ resistor and a current of 0.3 A through $7\,\Omega$ resistor. The internal resistance of the cell is

(a) 2.0 Ω (b) $1.5\,\Omega$

(c) $1.0\,\Omega$ (d) $0.5\,\Omega$

Ans. (d) **[** $E = 0.9(2+r)$ & $E = 0.3\,(7+r)$. **solve to get** $r = 0.5\Omega$ **]**

Applying

15. Kirchhoff's I law for the electric junction is based on:

(a) Law of conservation of charge

(b) Law of conservation of energy

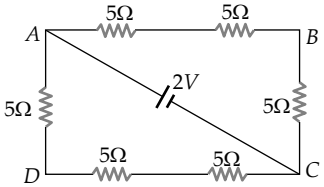
(c) Law of conservation of angular momentum

(d) Law of conservation of mass

Ans. A [Kirchhoff's I law for the electric junction is based on the law of conservation of charge]

Remembering

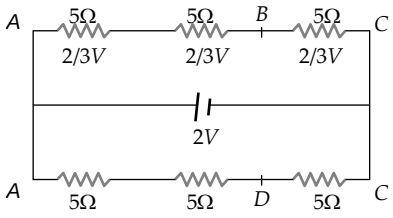
16. The potential difference between points A and B of adjoining figure is



(a) $\frac{2}{3}V$ (b) $\frac{8}{9}V$

(c) $\frac{4}{3}V$ (d) $2\,V$

Ans. (c) **The given circuit can be redrawn as follows**



For identical resistances, potential difference distributes equally among all. Hence potential difference across each resistance is $\frac{2}{3}V$, **and potential difference between** A **and** B **is** $\frac{4}{3}V$.

Analysing & Evaluating

17. Two resistors of resistance R_1 and R_2 having $R_1 > R_2$ are connected in parallel. For equivalent resistance R, the correct statement is

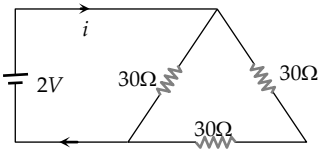
(a) $R > R_1 + R_2$ (b) $R_1 < R < R_2$

(c) $R_2 < R < (R_1 + R_2)$ (d) $R < R_1$

Ans. (d) **Equivalent resistance of parallel resistors is always less than any of the member of the resistance system.**

Analysing & Evaluating

18. The current in the adjoining circuit will be



(a) $\frac{1}{45}ampere$ (b) $\frac{1}{15}ampere$

(c) $\frac{1}{10}ampere$ (d) $\frac{1}{5}ampere$

Ans. (c) $R_{\text{equivalent}} = \frac{(30+30)30}{(30+30)+30} = \frac{60\times 30}{90} = 20\Omega \quad \therefore i = \frac{V}{R} = \frac{2}{20} = \frac{1}{10}ampere$

Applying

19. The temperature coefficient of resistance for a wire is $0.00125/°C$. At $27°K$ its resistance is 1 *ohm*. The temperature at which the resistance becomes 2 *ohm* is

(a) 1154 *K* (b) 1100 *K*

(c) 1400 *K* (d) 1127 *K*

Ans. (b) $R_2 = R_1[1+\alpha(t_2 - t_1)]$

$2 = 1[1+0.00125(t_2 - 27)] \Rightarrow t_2 = 827°C \text{ or } 1100\ K$

$\Rightarrow t = 854°C \Rightarrow T = 1127K$

Applying

20. Drift velocity v_d varies with the intensity of electric field as per the relation

(a) $v_d \propto E$ (b) $v_d \propto \frac{1}{E}$

(c) $v_d = \text{constant}$ (d) $v_d \propto E^2$

Ans. (a) $v_d = \frac{e}{m}\times\frac{V}{l}\tau$ **or** $v_d = \frac{e}{m}.\frac{El}{l}\tau$ **(Since** $V = El$**)**

$\therefore v_d \propto E$

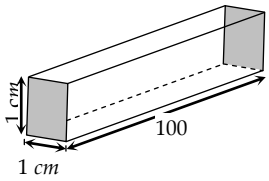
Understanding

21. Dimensions of a block are $1cm\times 1cm\times 100cm$. If specific resistance of its material is $3\times 10^{-7}ohm-m$, then the resistance between the opposite rectangular faces is

(a) $3\times 10^{-9}ohm$ (b) $3\times 10^{-7}ohm$

(c) $3\times 10^{-5}ohm$ (d) $3\times 10^{-3}ohm$

Ans. (b) **Length** l **= 1** $cm = 10^{-2}\ m$



Area of cross-section A **= 1** $cm\times$ **100** cm

$= 100\ cm^2 = 10^{-2}m^2$

Resistance $R = 3\times 10^{-7}\times\frac{10^{-2}}{10^{-2}} = 3\times 10^{-7}\Omega$

Applying

22. The colour sequence in a carbon resistor is red, brown, orange and silver. The resistance of the resistor is

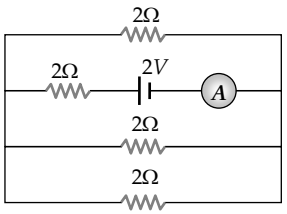
(a) $21 \times 10^3 \pm 10\%$ (b) $23 \times 10^1 \pm 10$

(c) $21 \times 10^3 \pm 5\%$ (d) $12 \times 10^3 \pm 5\%$

Ans. (a) **Red, brown, orange, silver red and brown represents the first two significant figures. Third digit represents power of 10 and fourth digit gives tolerance. So R = $21 \times 10^3 \pm 10\%$.**

Applying

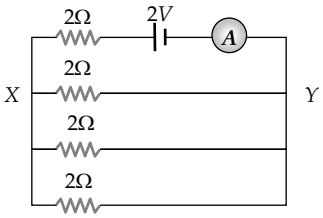
23. The reading of the ammeter as per figure shown is



(a) $\frac{1}{8}A$ (b) $\frac{3}{4}A$

(c) $\frac{1}{2}A$ (d) 2 A

Ans. (b) **Resistance across $XY = \frac{2}{3}\Omega$**



Total resistance

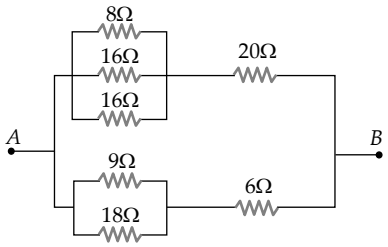
$= 2 + \frac{2}{3} = \frac{8}{3}\Omega$

Current through ammeter

$= \frac{2}{8/3} = \frac{6}{8} = \frac{3}{4}A$

Applying

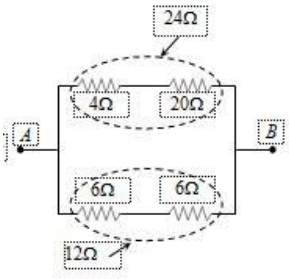
24. The equivalent resistance of the arrangement of resistances shown in adjoining figure between the points A and B is



(a) 6 *ohm* (b) 8 *ohm*

(c) 16 *ohm* (d) 24 *ohm*

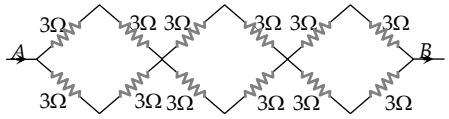
Ans. **(b)** **[8Ω, 16Ω, 16Ω are in parallel then equivalent is 4Ω, 9Ω & 18Ω are in parallel their equivalent is 6Ω]**



$R_{AB} = \frac{24 \times 12}{(24+12)} = 8\Omega$

Applying

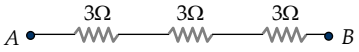
25. In the network of resistors shown in the adjoining figure, the equivalent resistance between A and B is



(a) 54 *ohm* (b) 18 *ohm*

(c) 36 *ohm* (d) 9 *ohm*

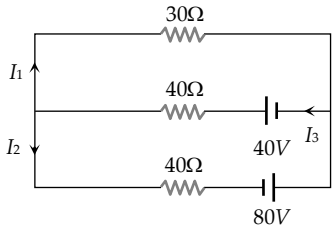
Ans. **(d) The network can be redrawn as follows**



$\Rightarrow R_{eq} = 9\Omega$

Applying

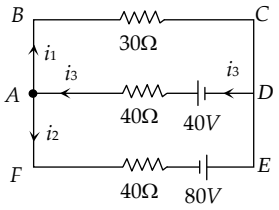
26. In the given circuit the current I_1 is



(a) 0.4 *A* (b) – 0.4 *A*

(c) 0.8 *A* (d) – 0.8 *A*

Ans. (b) The circuit can be simplified as follows



Applying *KCL* at junction *A*

$i_3 = i_1 + i_2$ **.....(i)**

Applying Kirchoff's voltage law for the loop ABCDA and solving

$\Rightarrow \quad 7i_1 + 4i_2 = 4$ **.....(ii)**

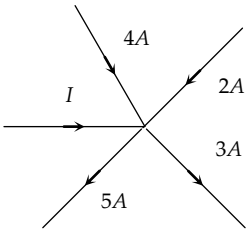
Applying Kirchoff's voltage law for the loop *ADEFA* and solving

$\Rightarrow \quad i_1 + 2i_2 = 3$ **.....(iii)**

On solving equation (ii) and (iii) $i_1 = -0.4A$**.**

Applying

27. In the given current distribution what is the value of I



(a) 3*A* (b) 8 *A*

(c) 2*A* (d) 5*A*

Ans. **(c)**

$\Rightarrow 4 + 2 + i - 5 - 3 = 0 \Rightarrow i = 2\,A$

Understanding

28. Two cells when connected in series are balanced on 8*m* on a potentiometer. If the cells are connected with polarities of one of the cell is reversed, they balance on 2*m*. The ratio of e.m.f.'s of the two cells is

(a) 3 : 5 (b) 5 : 3

(c) 3 : 4 (d) 4 : 3

Ans. (b) $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2} = \frac{(8+2)}{(8-2)} = \frac{5}{3}$

Applying

29. A cell of internal resistance 3 *ohm* and *emf* 10 *volt* is connected to a uniform wire of length 500 *cm* and resistance 3 *ohm*. The potential gradient in the wire is

(a) 30 *mV/cm* (b) 10 *mV/cm*

(c) 20 *mV/cm* (d) 4 *mV/cm*

Ans. (b) **Potential gradient =** $\frac{e.R}{(R+r).L} = \frac{10 \times 3}{(3+3) \times 5}$.

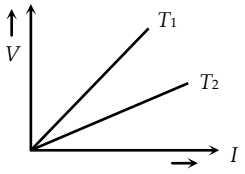
$= 1V/m = 10\,mV/cm.$

Applying

30. The voltage *V* and current *I* graph for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is

(a) $T_1 > T_2$ (b) $T_1 \approx T_2$

(c) $T_1 = T_2$ (d) $T_1 < T_2$



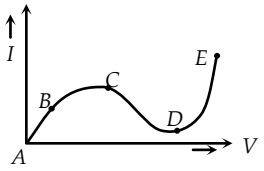
Ans. (a) $T_1 > T_2$

Understanding

31. From the graph between current *I* and voltage *V* shown below, identify the portion corresponding to negative resistance

(a) *AB* (b) *BC*

(c) *CD* (d) *DE*



Ans.* (c)** ***CD

Understanding

32. The resistivity of alloys $= R_{alloy}$; the resistivity of constituent metals R_{metal}. Then, usually

(a) $R_{alloy} = R_{metal}$ (b) $R_{alloy} < R_{metal}$

(c) There is no simple relation between R_{alloy} and R_{metal}

(d) $R_{alloy} > R_{metal}$

Ans. (d)

Remembering

33. Masses of three wires of copper are in the ratio of 1 : 3 : 5 and their lengths are in the ratio of $5:3:1$. The ratio of their electrical resistances are

(a) 1 : 3 : 5 (b) 5 : 3 : 1

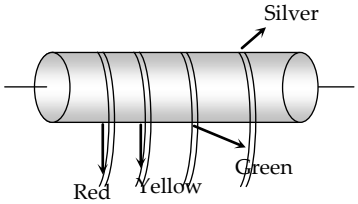
(c) 1 : 15 : 125 (d) 125 : 15 : 1

Ans. (d) $R \propto \frac{l^2}{m} \Rightarrow R_1 : R_2 : R_3 = \left(\frac{l_1}{m_1}\right)^2 : \left(\frac{l_2}{m_2}\right)^2 : \left(\frac{l_3}{m_3}\right)^2$

$= \frac{25}{1} : \frac{9}{3} : \frac{1}{5} = 25 : 3 : \frac{1}{5} \Rightarrow 125 : 15 : 1$.

Applying

34. In the figure a carbon resistor has bands of different colours on its body as mentioned in the figure. The value of the resistance is



(a) $24\times10^6\Omega\pm5\%$ (b) $35\times10^6\Omega\pm10\%$

(c) $5.6\ k\Omega$ (d) $24\times10^6\Omega\pm10\%$

Ans. (d) $24\times10^6\Omega\pm10\%$.

Applying

35. Two wires of same material have length L and $2L$ and cross–sectional areas $4A$ and A respectively. The ratio of their specific resistance would be

(a) 1 : 2 (b) 8 : 1

(c) 1 : 8 (d) 1 : 1

Ans. (d) Specific resistance doesn't depend upon length and area.

Understanding

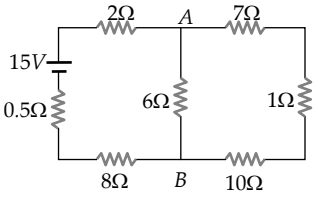
36. The current from the battery in circuit diagram shown is

(a) 1 A

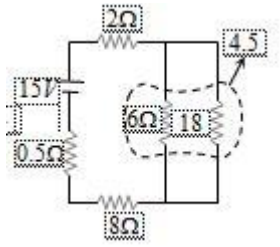
(b) 2 A

(c) 1.5 A

(d) 3 A



Ans. **(a) The given circuit can be simplified as follows**



Hence current from the battery $i = \frac{15}{15} = 1A$

Applying

37. Masses of 3 wires of same metal are in the ratio 1 : 2 : 3 and their lengths are in the ratio 3 : 2 : 1. The electrical resistances are in ratio

(a) 1 : 4 : 9 (b) 9 : 4 : 1

(c) 1 : 2 : 3 (d) 27 : 6 : 1

Ans. (b) This is a balanced Wheatstone bridge circuit. So potential at *B* and *D* will be same and no current flows through 4*R* resistance.

Applying

(ii) Completion Type Questions

1. Kirchhoff's I law for electric network is based on _____ .

Ans. Conservation of charge)

Remembering

2. Kirchhoff's II law for electric network is based on _____.

Ans. Conservation of energy

Remembering

3. A cell of emf E and resistance r is connected across an external resistance R. the potential difference across the terminals of a cell for r =R is _____.

Ans. E/2

Apply

4. The alloys which are used for making resistances have very low Temperature coefficient of resistance and high _____.

Ans. Resistivity

Understanding

5. Wheat Stone Bridge experiment is most sensitive when all the resistances are of _____.

Ans. Same Order

Understanding

6. In slide wire bridge experiment, copper strips are used in place of copper wires, due to their low _____.

Ans. Conductivity

Apply

7. EMFs of two cells can be compared using _____ apparatus

Ans. Potentiometer

Remembering

8. Meter bridge works on the principle of _____.

Ans. Wheat Stone Bridge

Remembering

9. As per Kirchhoff's II law, the algebraic sum of emfs is equal to algebraic sum of product of _____.

Ans. Current and Resistance

Remembering

10. A battery of e.m.f. 2 volt and internal resistance 0.1 Ω is being charged with a current of 5 ampere. The p.d. between the two terminals of the battery is _____ volt.

Ans. 2.5 volt ($V = E + Ir$ **,** $= 2 + 5 \times 0.1 = 2.5\ volt$ **)**

Applying

11. There is a metal block of dimensions $20\times10\times15 cm$. The ratio of the maximum and minimum resistance of the block is _____ .

Ans. **4 : 1** ($R_{max}=\rho\frac{20}{10\times15}, R_{min}=\rho\frac{10}{20\times15}, \frac{R_{max}}{R_{min}}=\rho\frac{20}{10\times15}\times\frac{20\times15}{10}$ **= 4 : 1)**

Applying

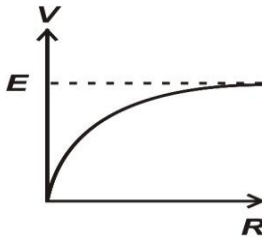
(iii) True/False Type Questions

1. Kirchhoff's Junction law is a reflection of the fact that the net charge accumulate at the junction is zero.

Ans. True

Remembering

2. The graph between P.D. across R versus R, when a cell of emf E and internal resistance r across an external resistance R is:



Ans. True

Understanding

3. The alloys, which are used for making of resistors have low temperature coefficient of resistance and high resistivity.

Ans. True

Applying

5. Wheat Stone Bridge experiment is most sensitive when all the four resistors are approximately equal.

Ans. True

Applying

6. In a meter bridge experiment, copper plates are used due to their low conductivity.

Ans. False

Understanding

7. Potentiometer works on the principle of Wheat Stone Bridge.

Ans. False

Understanding

8. The emf of a cell depends upon the internal resistance of a cell.

Ans. False

Remembering

9. When a manganin conductor is heated, its resistance decreases rapidly.

Ans. False (manganin is an alloy. Its resistance is almost independent of temperature $= \alpha \approx 0$**)**

Understanding

10. If the e.m.f. of a battery is E and internal resistance be r, the maximum current that can be drawn from it is $i = E/r$.

Ans. True ($i = \dfrac{E}{R+r} \Rightarrow i_{\max} = \dfrac{E}{r}$ **for R = 0)**

Applying

11. Temperature coefficient of resistance of a good conductor is negative.

Ans. False ($\alpha = +ve$ **for conductors)**

Remembering

(iv) Matching type Questions

1. (i) SI unit of Power
   (ii) SI unit of Electric Current

   (a) Joule
   (b) Watt
   (c) Ampere

Ans. [(i) = B] [(ii)=C

Remembering

2. (i) Conductance is reciprocal of
   (ii) Resistivity is reciprocal of

   (a) Conductivity
   (b) E. F. Intensity
   (c) Resistance

Ans. [(i) = C] [(ii) = A]

Understanding

3. (i) Kirchhoff's I law based upon
   (ii) Kirchhoff's II law based upon

   (a) Law of Conservation of mass
   (b) Law of Conservation of charge
   (c) Law of Conservation of energy

Ans. [(i) = B] [(ii) = C]

Remembering

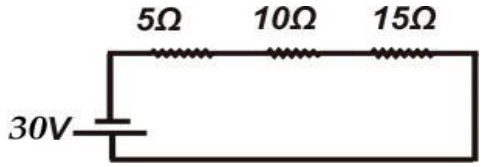
4. (i) Ohm's law is applicable for
   (ii) Ohm's law is not applicable for

   (a) Alloys
   (b) Carbon resistors
   (c) Diodes

Ans. [(i) = A,B] [(ii) = C]

Understanding

5. In Given circuit



   (i) P.D. across 10 Ω
   (ii) P.D. across 5 Ω

   (a) 5 V
   (b) 15 V
   (c) 10 V

Ans. [(i) =C] [(ii) =A]

Applying

MOVING CHARGES AND MAGNETISM -4

(i) Multiple Choice Questions

1. In a certain region of space, electric field $\vec{E}$ and magnetic field $\vec{B}$ are perpendicular to each other. An electron enters perpendicularly to both the fields and moves undeflected. The velocity of electron is

   (a) $\frac{E}{B}$ (b) $\frac{B}{E}$ (c) $\vec{E}\times\vec{B}$ (d) $\vec{E}\,.\,\vec{B}$

Ans. [A]

Analysing & Evaluating/ Creating

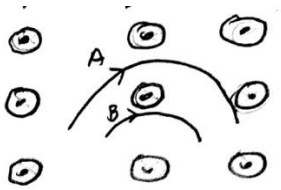
2. A deuteron of kinetic energy 50 keV is describing a circular orbits of radius 0.5 m in a plane perpendicular to the magnetic field $\vec{B}$. The kinetic energy of the proton that describes a circular orbit of same radius and inside same $\vec{B}$ is

   (a) 25 kev (b) 50 kev (c) 200 kev (d) 100 keV

Ans. [D] **[K=** $\frac{q^2B^2r^2}{2m}\Rightarrow K\propto\frac{1}{m}\Rightarrow K_2\,100\,K\,eV$ **]**

Applying

3. Two particles A and B with same charges and different masses (m_A *and* m_B respectively) are moving in a plane inside uniform magnetic field which is perpendicular to the plane. The speed of the particles are V_A *and* V_B respectively and the trajectories are as shown in figure. Then



   (a) $m_AV_A < m_BV_B$ (b) $m_AV_A > m_BV_B$

   (c) $m_A < m_B$ *and* $V_A < V_B$ (d) $m_A = m_B$ *and* $V_A < V_B$

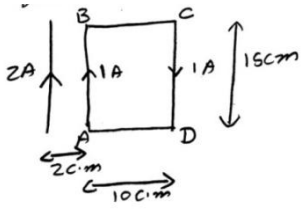
Ans. [b] **[** $r_A > r_B \Rightarrow \frac{m_Av_A}{qB} > \frac{m_Bv_B}{qB} \Rightarrow m_Av_A > m_Bv_B$ **]**

Applying

4. A rectangular coil ABCD is placed near a long straight current carrying straight wire as shown. What is the net force on the rectangular coil?

   (a) 25 x 10^{-7} N towards the wire (b) 25 x 10^{-7} N Away from the wire

   (c) 35 x 10^{-7} N, towards the wire (d) 35 x 10^{-7} N away from the wire



Ans. [A]

Applying

5. To convert a moving coil galvanometer into on ammeter of given range, we must connect:

(a) A suitable low resistance in series (b) A suitable low resistance in parallel

(c) A suitable high resistance in parallel (d) A suitable high resistance in series

Ans. [b] [s= $\frac{I_g - G}{I - I_g}$ **]**

Understanding

6. Two wires of same length are shaped into a square and a circle if they carry same current, ratio of magnetic moment is :

(a) $2 : \pi$ (b) $\pi : 2$

(c) $\pi : 4$ (d) $4 : \pi$

Ans. [c] [$M_1 : M_2 = a^2 : \pi r^2 \Rightarrow \mathrm{M_1 : M_2 = \pi : A}$ $\left(\text{use r} = \frac{2a}{\pi}\right)$ **]**

Analysing & Evaluating

7. Current sensitivity of a galvanometer can be increased by decreasing :

(a) Magnetic field B (b) number of turns N

(c) torsional constant K (d) Area A

Ans. [c]

Understanding

8. An electric current passes through a long straight copper wire. At a distance 5 cm from the straight wire, the magnetic field is B. The magnetic field at 20 cm from the straight wire would be

(a) $\frac{B}{6}$ (b) $\frac{B}{4}$

(c) $\frac{B}{3}$ (d) $\frac{B}{2}$

Ans. (b) $\left[B \propto \frac{1}{r} \Rightarrow B^1 = \frac{B}{A} \right]$

Understanding

9. A wire in the form of a circular loop, of one turn carrying a current, produces magnetic induction B at the centre. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic induction at the centre is

(a) B (b) 2 B

(c) 4 B (d) 8 B

Ans. (c) $\left[B = \frac{\mu_0 I}{2r}, \quad B^1 = \frac{\mu_0 (2) I}{2(r/2)} = 4B \right]$

Applying

10. A circular coil of radius a carries an electric current. The magnetic field due the coil at a point on the axis of the coil located at a distance r from centre of the coil, such that r>> varies

(a) $\frac{1}{r}$ (b) $\frac{1}{r^2}$ (c) $\frac{1}{r^3}$ (d) $\frac{1}{r^{3/2}}$

Ans. (c) **[** $B = \frac{\mu_0 I a^2}{2\left(a^2 + r^2\right)^{3/2}} \approx \frac{\mu_0 I a^2}{2r^3}$ **for** $r^2 + a^2 \approx r^2$ **]**

Understanding

11. A solenoid has 1000 turns per metre length. If a current of 5A is flowing through it, then magnetic field inside the solenoid is

(a) $2\pi \times 10^{-3} T$ (b) $2\pi \times 10^{-5} T$

(c) $4\pi \times 10^{-3} T$ (d) $4\pi \times 10^{-5} T$

Ans. (a) **[** $B = \mu_0 nI = A\pi \times 10^{-7} \times 5 \times 1000 = 2\pi \times 10^{-3} T$ **]**

Applying

12. Currents of 10 A and 2 A are flowing in opposite directions through two parallel wires A and B respectively. If the wire A is infinitely long and wire B is 2 m long, then force on wire B which is situated at 10 cm from A, is

(a) $8 \times 10^{-5} N$ (b) $6 \times 10^{-5} N$

(c) $4 \times 10^{-5} N$ (d) $2 \times 10^{-5} N$

Ans. (a) **[** $F = \frac{\mu_0 I_1 I_2}{2\pi r} l = \frac{4\pi \times 10^{-7} \times 10 \times 2}{2\pi \times 0.1} \times 2 = 8 \times 10^5 N$ **]**

Applying

13. If distance between two current- carrying wires is doubled, then force between them is

(a) halved (b) doubled

(c) tripled (d) quadrupled

Ans. (a) **[** $B \propto \frac{1}{r}$ **]**

Understanding

14. Two thin, long parallel wires, separated by a distance (d) carry a current of (i) A in the same direction. They will

(a) Attract each other with a force of $\mu_0 i^2 / (2\pi d)$

(b) repel each other with a force of $\mu_0 i^2 / (2\pi d)$

(c) attract each other with a force of $\mu_0 i^2 / \left(2\pi d^2\right)$

(d) repel each other with a force of $\mu_0 i^2 / \left(2\pi d^2\right)$

Ans. (a) **[current in some direction so attraction]**

Understanding

15. The coil of a moving coil galvanometer is wound over a metal frame in order to

(a) reduce hysteresis (b) increase sensitivity

(c) increase moment of inertia (d) provide electromagnetic damping

Ans. (d) [arrangement provided damping to in direction of eddy currents]

Understanding

16. If in a moving coil galvanometer, a current I in its coil produces a deflection θ, then

(a) $I \propto \theta$ (b) $I \propto \theta^2$

(c) $I \propto \sqrt{\theta}$ (d) $I \propto \tan\theta$

Ans. (a) [$\theta \propto I$]

Remembering

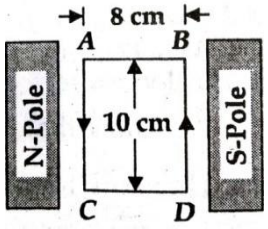
17. The ratio of voltage sensitivity (V_S) and current sensitivity (I_S) of a moving coil galvanometer is

(a) $\frac{1}{G}$ (b) $\frac{1}{G^2}$ (c) G (d) G^2

Ans. (a) $\left[V_S = \frac{C_S}{G} \Rightarrow \frac{V_S}{C_S} = \frac{1}{G}\right]$

Applying

18. A 100 turns coil shown in the figure carries a current of 2 A in a magnetic field of $0.2 Wb - m^{-2}$. The torque acting on the coil is



(a) 0.32 N-m tending to rotate the side AC into the page

(b) 0.32 N-m tending to rotate the side AC out of the page

(c) 0.64 N-m tending to rotate the side AC into the page

(d) 0.64 N-m tending to rotate the side AC out of the page

Ans. (b) $[\tau = NIAB \sin 90° = 100 \times 2 \times (80 \times 10^{-4}) \times .2$ **= .32 N-m]**

Applying

(ii) Completion Type Questions

1. Current sensitivity of a galvanometer can be increased by decreasing _____.

Ans. [Cs = $\frac{NBA}{C}$] Torsional Constant or restoring couple per unit twist.

Understanding

2. To convert galvanometer in to a voltmeter of given range, a suitable high resistance should be connected in _____ with the galvanometer.

Ans. Series R = $\left(\frac{V}{I_g} - G\right)$

Understanding

3. When a magnetic dipole of moment $\vec{M}$ rotates freely about its axis from unstable equilibrium to stable equilibrium in a magnetic field $\vec{B}$, the rotational kinetic energy gained by it is_____.

Ans. 2 MB [$\Delta K = \Delta U = MB - (-MB)$ **]**

Applying

4. An electron passes undeflected when passes through a region with electric and magnetic fields. When electric field is switched off its path will change to _____.

Ans. Circular

Understanding

5. The ratio of angular momentum (L) to magnetic moment (M) of an electron revolving in a circular orbit is _____.

Ans. M = $\frac{e}{2m}$ **L**

Applying

6. The path of charged particle moving perpendicularly with $\vec{B}$ is _____.

Ans. Path of the charged particle will be circular.

Understanding

7. There is no change in the _____ as a charged particle moving in a magnetic field, although magnetic force is acting on it.

Ans. When a charge particle moves through the magnetic field, its kinetic energy remains constant.

Understanding

8. Two linear parallel conductors carrying currents in the opposite direction ----------each other.

Ans. (repel)

Understanding

9. When a coil carrying current is set with its plane perpendicular to the direction of magnetic field, then torque on the coil is----------.

Ans. (zero)

Understanding

10. A linear conductor carrying current if placed parallel to the direction of magnetic field, then it experiences ---------- force.

Ans. (No) F = IlB sinθ and θ = 0^o

Understanding

11. Electric current flows through a thick wire. Magnetic field at a point on its surface is $\left(B = \mu_o I / 2\pi R\right)$ and is_____ on its axis.

Ans. (zero)

Understanding

12. Torque on a current carrying rectangular coil inside a galvanometer is maximum and constant irrespective of its orientation as it is suspended inside _____ magnetic field.

Ans. (radial)

Understanding

(iii) True/False Type Questions

1. Two parallel wires carrying current in the same direction attract each other.

Ans. [True]

Understanding

2. A charge moves in a circle inside magnetic field. The time period of revolution is independent of mass of particle:

Ans. [False] [T=$\frac{2\pi m}{qB}$]

Applying

3. Electron enters into a magnetic field at an angle of 60 degree. Its path will be Parabola.

Ans. [False]

Applying

4. To convert a moving coil galvanometer into an ammeter of a given range we must connect a suitable low resistance in parallel.

Ans. [True]

Understanding

5. A wire of length '*l*' carries a current I along X-axis .a magnetic field exists given by $B = B_0(\hat{i} + \hat{j} + \hat{k})T$. The magnitude of magnetic force acting on wire is $\sqrt{2}lI / B_o$

Ans. [True]

Applying

6. The magnetic field due to a very long wire carrying a current decreases as the square of the distance from the wire.

Ans. [False] [B=$\frac{\mu_o I}{2\pi r}$]

Remembering

7. Magnetic field lines always form closed loop.

Ans. [True]

Understanding

8. The resistance of milli-ammeter is greater than that of ammeter

Ans. [True] [$R_A \approx$ S = $\frac{I_g G}{I - I_g}$]

Analysing & Evaluating

9. Static charge is a source of electric field but not of magnetic field

Ans. [True]

Remembering

10. The net charge in a current carrying conductor is zero, even then it experiences magnetic force, when placed inside magnetic field.

Ans. [True]

Applying

11. When a current carrying rectangular loop is placed inside magnetic field, net force on it always zero.

Ans. [True]

Applying

12. The two linear parallel conductors carrying currents in the opposite direction attract each other

Ans. [False]

Analysing & Evaluating

13. A solenoid tend to shrink when a current passes through it

Ans. [True]

Analysing & Evaluating

14. When a current carrying rectangular loop is placed inside magnetic field, net torque on it always zero.

Ans. [False]

Understanding

15. The two linear parallel conductors carrying currents in the same direction attract each other

Ans. [False]

Analysing & Evaluating

(iv) Matching type Questions

1. For the path of a moving charged particle, which enters perpendicularly inside

(a)	In uniform electric field is	(P) Elliptical
(b)	In uniform magnetic field	(Q) Parabola
		(R) Circle

Ans (A) Q (B) R

Understanding

2. Match the following

(a)	Magnetic moment	(P) Weber
(b)	Magnetic field	(Q) Amp.m^2
		(R) Weber/m^2

Ans (A) Q (B) R

Remembering

MAGNETISM AND MATTER - 5

(i) Multiple Choice Questions

1. Which of the following is weakly repelled by a magnet field:

(a) Iron (b) Cobalt (c) Steel (d) Copper

Ans- (d) Copper [Copper is diamagnetic]

Remembering

2. If a diamagnetic material is placed in a magnetic field, the magnetic field inside the material compared to that outside will be

(a) Slightly less (b) Slightly more (c) Very high (d) Same

Ans- (a) Slightly less

Remembering

3. The permanent magnetic material is characterised by:-

(a) Narrow hysteresis loop (b) Broad hysteresis loop

(c) High mechanically hardness, all over (d) mechanically hard surface

Ans-(b) Broad hysteresis loop

Understanding

4. The area of B-H loop for soft iron , as compared to that for steel is:-

(a) More (b) Less (c) Equal (d) zero

Ans-(b) Less

Understanding

5. A stationary magnet does not interact with:-

(a) iron rod (b) moving charge (c) magnet (d) stationary charge

Ans-(d) stationary charge

Understanding

6. The value of the magnetic susceptibility for a super-conductors is:-

(a) zero (b) Infinity (c) +1 (d) -1

Ans-(d) -1

Remembering

7. A bar magnet AB with magnetic moment M is cut into two equal parts perpendicular to its axis. One part is kept over the other so that end B is exactly over A. What will be the magnetic moment of the combination so formed?

(a) Zero (b) M/4 (c) M (d) 3M/4

Ans.- (a) [$\vec{M} = \left(\frac{1}{2}\vec{M}\right) + \left(-\frac{1}{2}\vec{M}\right) = \vec{0}$ **]**

Applying

8. Two unlike magnetic poles of strength 10 A-m each are held in air at a distance of 0.10 m from each other. What is the magnetic force of attraction between them?

(a) $3x10^{-5}$ N (b) $2.5X10^{-5}$ N (c) $1.5X10^{-5}$ N (d) $1X10^{-5}$ N

Ans.- (d)

Applying

9. S.I. unit of magnetic pole strength is

(a) Ampere/meter (b) Ampere-meter

(c) volt/meter (d) Ampere/meter2

Ans.- (b)

Understanding

10 . Which of the following is an example for diamagnetic substances?

(a) copper (b) nickel (c) aluminum (d) iron

Ans. (a)

Remembering

11. The domain formation is a necessary feature of

(a) diamagnetism (b) paramagnetism

(c) ferromagnetism (d) all of these

Ans. (c)

Remembering

12. The susceptibility of a ferromagnetic material is χ at 27°C. At what temperature will its susceptibility be 0.5 χ .

(a) 54°C (b) 327°C

(c) 600°C (d) 237°C

Ans. (b) $\left[\frac{X_1}{X_2}=\frac{T_2}{T_1} \Rightarrow \frac{X}{0.5X}=\frac{T}{300} \; or \; T=600K \; or \; 327°C\right]$

Applying

(ii) Completion Type Questions

1. You can determine the sense of magnetic field lines surrounding a straight current carrying conductor by applying ..... rule.

Ans. The right hand thumb

Understanding

2. The ability of a material to retain magnetism after removal of magnetizing field is called as ……...

Ans. Retentivity

Understanding

3. S.I. unit of magnetic pole strength is.....

Ans. Ampere-meter

Remembering

4. The magnetic field lines of a magnet form ..... loops unlike electric field lines.

Ans. Closed loop

Remembering

5. The magnetic field strength at a point due to a short bar on its axis varies ..... as cube of distance of the point from the centre of magnet.

Ans. inversely

Applying

6. Inside the body of a magnet the direction of magnetic field lines is from .....

Ans. South pole to North Pole

Remembering

7. No two magnetic field lines can …… each other.

Ans. Intersect

Remembering

8. For paramagnetic materials magnetic susceptibility is related with temperature as inversely proportional to …….....

Ans.- T^{-1}

Remembering

9. Magnetic susceptibility is slightly negative for ..... type substances.

Ans.- Diamagnetic

Remembering

10. There is no effect of temperature on ……....type of materials.

Ans.- Diamagnetic

Remembering

11. Ferromagnetism can be explained on the basis of formation of ……... within the materials.

Ans- domains

Remembering

(iii) True /False Type Questions

1. A solenoid acts like a bar magnet.

Ans: True

Remembering

2. SI unit of magnetic field intensity at a place is Wb / m^2.

Ans: True [B= ϕ / A]

Remembering

3. The magnetic field at the centre of a circular current carrying loop is zero.

Ans: False. The magnetic field at the centre of a circular current carrying loop is non zero. [B = $\frac{\mu_0 nI}{2r}$]

Remembering

4. The magnetic needle kept in a non-uniform magnetic field experiences only torque.

Ans: False. The magnetic needle kept in a non-uniform magnetic field experiences torque as well as force.

Remembering

5. A non-zero work has to be done to rotate a unit north pole around a current carrying wire.

Ans: True [Magnetic field is a non-conservative form]

Remembering

6. Magnetic susceptibility of diamagnetic substances is always negative.

Ans: True

Remembering

7. A superconductor exhibits perfect diamagnetism.

Ans: True. A superconductor exhibits perfect diamagnetism.

Remembering

8. Soft iron is used in transformer cores.

Ans: True

Remembering

9. Soft iron is used in making permanent magnets.

Ans: False. Steel is used in making permanent magnets.

Remembering

10. Steel is used in electromagnetic cranes.

Ans: False. Soft iron is used in electromagnetic cranes.

Remembering

11. For a diamagnetic substance, the magnetic dipole moment of each of its constituent atom is zero

Ans- True

Remembering

12. Soft iron retains magnetism once magnetic field is switched off.

Ans- False

Understanding

13. At a temperature higher than Curie temperature, ferromagnetic substance behaves to as paramagnetic substance.

Ans. True

Remembering

14. Non-magnetic materials can be can acquire magnetism when placed inside magnetic field.

Ans- False

Remembering

15. For making electromagnets, soft iron is preferred over steel as it has high permeability and low retentivity.

Ans. True

Understanding

16. For making electromagnets, steel is preferred over soft iron as it has high retentivity as well as high coercivity.

Ans. False

Understanding

17. For making permanent magnet, steel is preferred over soft iron as it has high retentivity as well as high coercivity.

Ans- True

Understanding

18. The susceptibility of a diamagnetic material does not depend on temperature

Ans- True

Understanding

19. The susceptibility of a paramagnetic material is inversely proportional to absolute temperature.

Ans- True

Understanding

20. Magnetic poles are always found in pairs.

Ans. True

Remembering

21. The nature of magnetic field inside a moving coil galvanometer is radical.

Ans. True

Understanding

22. The magnetic field lines form closed loop?

Ans. True

Remembering

23. A bar magnet is held perpendicular to a uniform field (Assume magnetic field along X- axis and the magnetic moment of the magnet pointing along Y- direction). If the couple acting on the magnet is to be halved, we can do it by rotating it by 30degree.

Ans. False

Analysing & Evaluating

(iv) Matching type Questions

1. (a) Ferromagnetic (p) $0 < \mu_r < 1$

(b) Diamagnetic (q) $\mu_r >>> 1$

(r) $\mu_r = 0$

Ans. (a) – (q), (b)—(p)

Remembering

2. (a) Ferromagnetic (p) $\chi = CT$

(b) Diamagnetic (q) $\chi = C/(T-T_C)$

(r) $\chi = C/T$

Ans- (a) – (q), (b)—(r)

Understanding

3. (a) paramagnetic (p) Al

(b) Ferromagnetic (q) Al-Ni-Co

(r) Copper

Ans- (a) – (p), (b)—(q)

Remembering

4. (a) Steel (p) High Retentivity, High Coercivity

(b) Soft iron (q) Low Retentivity, Low Coercivity

(r) low Retentivity, High Coercivity

Ans- (a) – (p), (b)—(q)

Remembering

5. Substance near a Magnet

(a) Para magnetic (p) highly Attracted

(b) Diamagnetic (q) weakly Attracted

(r) weakly Repelled

Ans- (a) – (p), (b)—(q)

Remembering

6. (a) Permeability (p) Henry

(b) Magnetic induction (q) Henry/ meter

(r) Amp/m

Ans- (a) – (q), (b)—(r)

Remembering

7. (a) Diamagnetic material
(p) They move from weaker region to strong region when placed inside non uniform magnetic field

(b) Ferromagnetic material
(q) The value of susceptibility is zero
(r) They move from strong region to weaker region when placed inside non uniform magnetic field

Ans. a=p and b=r

Remembering

8. (a) Hard magnetic material
(p) Permanent magnet

(b) Soft magnetic material
(q) core of transformer
(r) the value of

Ans. a=p,r and b=r,q

Analysis

9. Susceptibility is negative

(a) magnetic moment
(p) scalar physical quantity

(b) permeability
(q) vector physical quantity
(r) tensor physical quantity

Ans. a=q and b=p

Remembering

10. (a) Bi
(p) Diamagnetic

(b) AlNiCo
(q) Paramagnetic
(r) Ferromagnetic

Ans. a= p and b=r

Remembering

11. (a) Permanent magnet
(p) High permeability & low retentivity

(b) Electromagnets
(q) High retentivity& high coercivity
(r) Low melting point

Ans. a=q and b=p

Understanding

ELECTROMAGNETIC INDUCTION -6

(i) Multiple Choice Questions

1. Due to relative motion of a magnet with respect to a coil, an emf is induced in the Coil, identify the Principle involved-

(a) Ampere's circuital law (b) Faraday's law

(c) Gauss law (d) Biot-Savart law

Answer- (b) Faraday's law of electromagnetic induction

Remembering

2. In Faraday's experiment on electromagnetic induction, more deflection will be shown by galvanometer, when

(a) Magnet is in uniform motion towards the coil

(b) Magnet is in uniform motion away from the coil

(c) Magnet is in accelerated motion towards the coil

(d) Magnet is at rest near the coil

Answer- (c) Magnet is in accelerated motion towards the coil [e = $\frac{-d\phi}{dt}$]

Understanding

3 . If both the number of turns and core length of an inductor is doubled keeping other factors constant, then its self-inductance will be-

(a) Unaffected (b) doubled

(c) halved (d) quadrupled

Answer- b) doubled, [as L= $\mu_0 \frac{N^2}{l} A$]

Understanding

4. Oscillating metallic pendulum in a uniform magnetic field directed Perpendicular to the plane of oscillation-

(a) Slows down (b) becomes faster

(c) remains unaffected (d) oscillates with changing frequency

Answer-(a) Slows down [Eddy current]

Understanding

5. A metallic cylinder is held vertically and then or small magnet is dropped along its axis. It will fall

with-

(a) acceleration a>g (b) acceleration a<g

(c) acceleration a=g (d) constant velocity a=0

Answer- b) acceleration a<g [Eddy current]

Understanding

6. An emf of 200V is induced in a circuit when current in the circuit falls from 5A to 0. A in 0.1 second. The self-inductance of the circuit is-

(a) 3.5 H (b) 3.9 H

(c) 4 H (d) 4.2

Answer-(c) 4 H $L=\left(\frac{e}{\left(\frac{\Delta I}{\Delta t}\right)}\right)=\frac{200}{\left(\frac{5}{0.1}\right)}=4$

Applying

7. The magnetic flux linked with a coil at any instant t is $\phi=(6t^2-8t+5)$ Wb, the emf induced in the coil at t= 2 second is-

(a) -16V (b) -24V

(c) +24V (d) +16V

Answer- (a) -16V [e = $\frac{-d\phi}{dt}=-(12t-8)+-16V$ **]**

Applying

9. A conducting circular ring is placed in a uniform magnetic field B with its plane Perpendicular to the field. The radius of the ring starts shrinking at the rate (da/dt).

Then induced-emf at the instant when the radius is *a* is-

(a) $(\pi a^2/2)^2$ B(da/dt) (b) πaB(d*a*/dt)

(c) πa^2 (dB/dt) (d) $2\pi a$B(d*a*/dt)

Answer- d) $2\pi a$B(d*a*/dt)

Analyzing & Evaluating

10 . A small piece of metal wire is dragged across the gap between the poles of a magnet in 0.4 s. If change in magnetic flux in the wire is 8×10^{-4}Wb, then e.m.f. induced in the wire is

(a) 8×10^{-3} V (b) 6×10^{-3} V

(c) 4×10^{-3} V (d) 2×10^{-3} V

Ans. (d) $\left[e=\frac{\Delta\phi}{\Delta t}=\frac{8\times10^{-4}}{0.4}=2\times10^{-3}V\right]$

Applying

11. If the no. of turns per unit length of the coil of a solenoid is doubled keeping other dimensions same, then its self-inductance will be

(a) Halved (b) doubled

(c) four times (d) eight times

Ans. (c) $\left[L = \mu_0 n^2 lA \ \Rightarrow L \propto n^2\right]$

Understanding

12. The energy stored in coil carrying current I is u. If current is halved, then energy stored in the coil will be

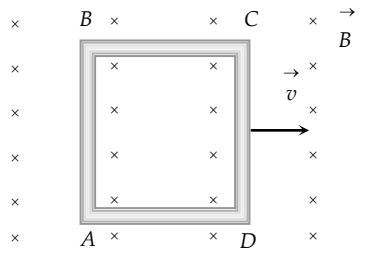
(a) $\frac{U}{2}$ (b) $\frac{U}{4}$

(c) $2U$ (d) $4U$

Ans. (b) $\left[U = \frac{1}{2} LI^2 \ \Rightarrow U^1 = U/4\right]$

Understanding

13. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere. The current induced in the loop is



(a) $\frac{Blv}{R}$ clockwise

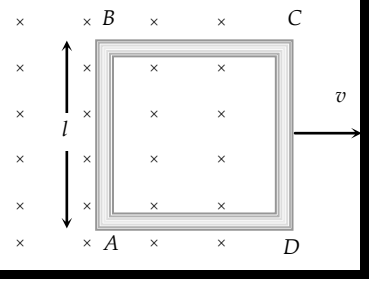
(b) $\frac{Blv}{R}$ anticlockwise

(c) $\frac{2Blv}{R}$ anticlockwise

(d) Zero

Ans. (d) No flux change is taking place because magnetic field exists everywhere and is constant in time and space.

14. A conducting square loop of side l and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane at the loop exists everywhere with half the loop outside the field, as shown in figure. The induced e.m.f. is



(a) Zero (b) RvB

(c) VBl/R (d) VBl

Ans. (d)

Understanding

15. A wheel with ten metallic spokes each 0.50 *m* long is rotated with a speed of 120 *rev/min* in a plane normal to the earth's magnetic field at the place. If the magnitude of the field is 0.4 Gauss, the induced e.m.f. between the axle and the rim of the wheel is equal to

(a) $1.256\times10^{-3}\ V$ (b) $6.28\times10^{-4}\ V$

(c) $1.256\times10^{-4}\ V$ (d) $6.28\times10^{-5}\ V$

Ans. (d) $e = Bl^2\pi\nu = 0.4\times10^{-4}\times(0.5)^2\times(3.14)\times\frac{120}{60}$

Applying

16. In a circuit with a coil of resistance 2 *ohms*, the magnetic flux changes from 2.0 *Wb* to 10.0 *Wb* in 0.2 second. The charge that flows in the coil during this time is

(a) 5.0 *coulomb* (b) 4.0 *coulomb*

(c) 1.0 *coulomb* (d) 0.8 *coulomb*

***Ans.* (b)** $\Delta Q = \frac{\Delta\phi}{R} = \frac{(10-2)}{2} = 4C$

Applying

17. The direction of induced current is such that it opposes the very cause that has produced it. This is the law of

(a) Lenz (b) Faraday

(c) Kirchhoff (d) Fleming

Ans. (a)

Remembering

18. The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in time Δt, Then the total quantity of electric charge Q, which passing during this time through any point of the circuit is given by

(a) $Q = \frac{\Delta\phi}{\Delta t}$ (b) $Q = \frac{\Delta\phi}{\Delta t}\times R$

(c) $Q = -\frac{\Delta\phi}{\Delta t} + R$ (d) $Q = \frac{\Delta\phi}{R}$

Ans. We know that $e = \frac{d\phi}{dt}$

But *e=iR* and $i = \frac{dq}{dt} \Rightarrow \frac{dq}{dt}R = \frac{d\phi}{dt} \Rightarrow dq = \frac{d\phi}{R} \Rightarrow \Delta q = \frac{\Delta\phi}{R}$

Applying

19. A coil having an area A_0 is placed in a magnetic field which changes from B_0 to $4B_0$ in a time interval *t*. The e.m.f. induced in the coil will be

(a) $\frac{3A_0B_0}{t}$ (b) $\frac{4A_0B_0}{t}$ (c) $\frac{3B_0}{A_0t}$ (d) $\frac{4B_0}{A_0t}$

Ans. (a) $e = -\frac{d\phi}{dt} = \frac{-3B_0A_0}{t}$

Applying

(ii) Completion type Questions

1 S.I. unit of mutual inductance is _____.

Answer- Henry

Remembering

2 Two coils have mutual inductance of 1.5 Henry if the current in the primary Circuit is raised by 5A in one millisecond after closing the circuit, then the Induced emf in secondary coil is _____ volt .

Answer- 7.5 X 10^3 V [e = L $\frac{\Delta I}{\Delta t}=1.5\times\frac{5}{10^{-3}}=7.5\times10^{-3}V$ **]**

Applying

3 Two concentric circular coils one of small radius a_1 and the other of large Radius a_2, such that $a_1 << a_2$ are placed co-axially with centers coinciding.

The mutual inductance of the arrangement is _____.

Answer- $\mu_0 \pi a_1^2/2a_2$ **[M** $I_2=\left(\frac{\mu_0 I_2}{2\pi a_2}\right)\times\pi a_1^2$ **]**

Understanding

4 Self- inductance of a long solenoid (A,N,*l*) with core material of magnetic relative Permeability μ_r is_____ . (where A= Area of each turn, N= No of turns , L= Length)

Answer- $\mu_0\mu_r N^2 A/l$

Remembering

5 A closed loop moves normal to the constant electric field between the plates of a large capacitor, henno _____ is induced in the loop.

Answer- Current [No change in magnetic flux]

Understanding

(iii) True/False Type Questions

1. The magnetic flux passing through a plane surface area, which is held perpendicular to a magnetic field is maximum.

Answer- True [$\phi = BACos\theta$ *here* $\theta = \angle\vec{B}, \angle\vec{A} = 0^o$ **]**

Understanding

2 The rate of change of magnetic flux through a coil is maximum when a magnet is held stationary near the coil.

Answer- False [as e = $\frac{d\phi}{dt} = 0$ **]**

Understanding

3 The magnetic flux passing through a coil becomes twice when the number of turns becomes two times.

Answer- True [$\phi = NBACos\theta$ **]**

Understanding

4 AC generator is based on the principle of electromagnetic induction.

Answer- True

Understanding

5 Self-inductance of a coil increases when iron core is introduced in the core of the Coil.

Answer-True [L′ = μ_r **L]**

Understanding

6 Cutting slots in the copper plate, oscillating between the magnetic poles reduces the effect of eddy currents.

Answer- True

Understanding

7 Eddy currents are produced in the copper plate, when it is held static between the poles of magnet.

Answer- False [No change in magnetic flux linked with copper plate]

Understanding

(iv) Matching type Questions

1. An increasing current is flowing through wire PQ. The direction of induced current in coils A and B are

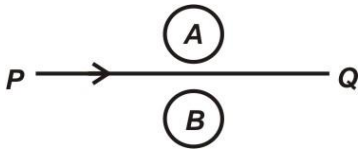


Table A (Coils)	Table B (direction of induced current)
(a) Coil A	P) Clock wise
(b) Coil B	Q) Anti clock wise
	R) No current induced in A

Answer- (a)→(P) ; (b) →(Q) **[Use lenz law]**

Understanding

ALTERNATING CURRENT - 7

(i) Multiple Choice Questions

1. In a series LR-circuit, the inductive reactance is equal to the resistance R of the circuit. An emf $E = E_0\cos(\omega t)$ is applied to the circuit. The power consumed in the circuit is

   (a) $\frac{E_0^2}{R}$ (b) $\frac{E_0^2}{2R}$

   (c) $\frac{E_0^2}{4R}$ (d) $\frac{E_0^2}{8R}$

Ans- (c)

Analysing & Evaluating

2. One 60 V, 100 W bulb is to be connected to 100 V, 50 Hzac- source. The potential drop across the inductor is (f = 50 Hz)

   (a) 80 V (b) 40V

   (c) 10 V (d) 20V

Ans- (a)

Analysing & Evaluating

3. An AC voltage source of variable angular frequency ω and fixed amplitude V connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased

   (a) The bulb glows dimmer

   (b) The bulb glows brighter

   (c) Net impedance of circuit is unchanged

   (d) Total impedance of the circuit increases

Ans- (b)

Understanding

4. An alternating e.m.f. of angular frequency ω is applied across an inductance. The instantaneous power developed across it has an angular frequency

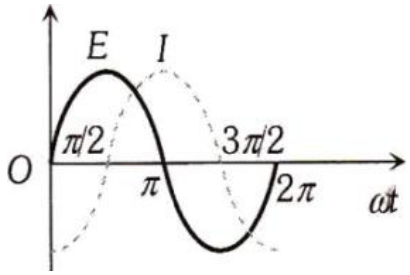
   (a) ω/4 (b) ω/2

   (c) ω (d) 2 ω

Ans- (d)

Understanding

5. The variation of the instantaneous current *I(t)* and the instantaneous emfE(t) in a circuit is as shown in the following fig. Which of the following statements is correct



(a) The voltage lags behind the current by $\pi/2$

(b) The voltage leads the current by $\pi/2$

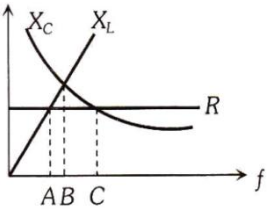
(c) The voltage and the current are in phase

(d) The voltage leads the current by π

Ans- (b)

Remembering

6. The figure shows variation of R, X_L and X_C with frequency f in a series L, C, R circuit. Then for what frequency point, the circuit is inductive.



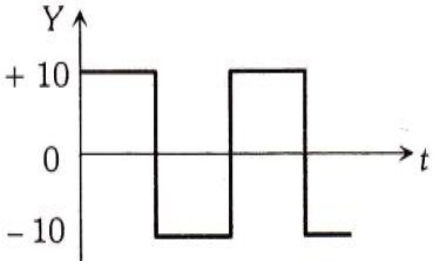
(a) A (b) B

(c) C (d) A and B

Ans- (c)

Understanding

7. The r.m.s. voltage of the wave form shown is



(a) 10 V (b) 7 V

(c) 6.37 V (d) 12 V

Ans- (a)

Analysing & Evaluating

8. In electric arc furnace Cu or Iron is melted due to variation of

(a) current (b) magnetic field

(c) voltage (d) electric field

Ans - (b)

Remembering

9. When AC source is connected across seris R-C combination, the ac- current may lead ac-voltage by

(a) 0^0 (b) 180^0

(c) 30^0 (d) 90°

Ans. (c) $\tan\theta = \frac{X_C}{R}$

Understanding

10. High voltage transmission line is preferred as

(a) Its appliances are less costly (b) Thin power cables are required

(c) Idle current very low (d) Power loss is very less

Ans- (d) [Weak current flows through the transmission line hence tow power loss I^2R]

Analysing & Evaluating

11. In series R-L-C circuit, quality factor can be improved by

(a) decreasing L (b) increasing C

(c) decreasing R (d) decreasing R & L

Ans. (c) $Q = \left[\frac{1}{R}\sqrt{\frac{L}{C}}\right]$

Application

12. When ac- source is connected across series R-L-C combination, maximum power loss will occur provided

(a) current and voltage are in phase (b) Current from source is minimum

(c) Inductance is minimum (d) Capacitance is maximum

Ans. (a) $I_0 = (I_0)_{max} = \frac{E_0}{R}$

Analysing & Evaluating

13. In R-L-C series ac-circuit, impedance cannot be increased by

(a) increasing frequency of source (b) decreasing frequency of source

(c) increasing the resistance (d) increasing the voltage of the source

Ans. (d) $Z = \sqrt{R^2 + (X_L - X_C)^2}$

Understanding

14. In highly inductive load circuit, it is more dangerous when

(a) we close the switch (b) open the switch

(c) increasing the resistance (d) decreasing the resistance

Ans- (b)

Analysing & Evaluating

15. In electric sub-station in township, large capacitor banks are used

(a) to reduce power factor (b) to improve power factor

(c) to decrease current (d) to increase current in the circuit

Ans- (b)

Application

16. In a purely resistive a.c. circuit, the current

(a) is in phase with the e.m.f.

(b) leads the e.m.f. by a difference of π radians phase

(c) leads the e.m.f. by a phase difference of $\pi/2$ radians

(d) lags behind the e.m.f. by phase difference of $\pi/4$ radians

Ans. (a)

Remembering

17. A capacitor of capacitance C has reactance X. If capacitance and frequency become double, then the capacitive reactance will be

(a) 2X (b) 4X

(c) $\frac{X}{2}$ (d) $\frac{X}{4}$

Ans. (d) $X_C = \frac{1}{2\pi\nu C} \Rightarrow X_C^1 = \frac{1}{2\pi(2\nu)\ (2C)} = \frac{X_C}{4}$

Applying

18. Reactance of a capacitor of capacitance C for an alternating current of frequency $\frac{400}{\pi}$ Hz is 25 Ω. The value of C is

(a) 25 μF (b) 50 μF

(c) 75 μF (d) 100 μF

Ans. (d)

Applying

19. The core of a transformer is laminated, so as to

(a) make it light weight (b) make it robust and strong

(c) increase the secondary voltage (d) reduce energy loss due to eddy current

Ans. (d)

Remembering

20. The ratio of no. of turns of primary coil to secondary coil in a transformer is 2:3. If a cell of 6 V is connected across the primary coil, then voltage across the secondary coil will be

(a) 3 V (b) 6 V

(c) 9 V (d) 12 V

Ans. (c)

Applying

21. In a transformer, the no. of turns of primary and secondary coil are 500 and 400 respectively. If 220 V is supplied to the primary coil, then ratio of currents in primary and secondary coils is

(a) 4:5 (b) 5:4

(c) 5:9 (d) 9:5

Ans. (a) $\left[\frac{I_P}{I_S}=\frac{V_S}{V_P}=\frac{N_S}{N_P}=4:5\right]$

Applying

22. An LC-circuit contains 10 mH inductor and 25 mF capacitor with given initial charge. The resistance of the circuit is negligible. The energy stored in circuit is completely magnetic at time (in milliseconds) the time is measured from the instant when the circuit is closed

(a) $0,\frac{\pi}{2},\frac{2\pi}{2}...etc$ (b) $\frac{\pi}{3},\frac{2\pi}{3},\frac{5\pi}{3}...etc$

(c) $\frac{\pi}{4},\frac{3\pi}{4},\frac{5\pi}{4}...etc$ (d) $0,\frac{\pi}{8},\frac{\pi}{4}...etc$

Ans. (c) **[at** $t=0,\frac{T}{2},T,\frac{3T}{2}....$ **energy is electrostatic & at** $t=\frac{T}{4},\ \frac{3T}{4},\frac{5T}{4}$ **… energy totally magnetic. Here ,** $T=\frac{1}{\nu}=2\pi\sqrt{LC}=\pi/1000$ **]**

Analysing & Evaluating

(ii) Completion Type Questions

1. We can reduce the eddy current losses in transformer by using …….

Ans. Laminated soft iron core

Analysing & Evaluating

2. In ac- circuit, the average power consumed by a pure capacitor during in one cycle in pure capacitance is ……..

Ans. Zero

Remembering

3. If the power loss in a circuit is zero, the current is called …….

Ans. Wattless current

Remembering

4. A choke is preferred over resistance in an ac- circuit to decrease ac- current because it consumes practically …….power.

Ans. Zero

Understanding

(iii) True/False Type Questions

1. In R-L-C series circuit, phase angle between voltage and current cannot be zero.

Ans. – False $\theta = \tan^{-1}\frac{|X_L - X_C|}{R}$

Understanding

2. In ac-generator, the phase difference between magnetic flux linkage and induced emf is $\frac{\pi}{2}$ and between magnetic flux and induced current is also $\frac{\pi}{2}$

Ans. True

Understanding

3. Among commonly available materials, steel is preferred over soft iron to make transformer.

Ans. – False

Remembering

4. In primary winding of transformer if we connect D.C. supply source then we get no power output.

Ans. – True [No electromagnetic induction where dc supply is connected at the input]

Understanding

5. A pure inductor connected across ac- source has maximum power factor

Ans. – False [$Cos\theta = \frac{R}{Z}$; *for pure L* $Cos\theta = 0$, *for pure R* $Cos\theta = 1$]

Analysing & Evaluating

6. If we decrease frequency of source in series R-L-C circuit, impedance may increase or decrease.

Ans. – True [$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega c}\right)^2}$

Analysing & Evaluating

(iv) Matching type Questions

1.	(a)	220V, 50 Hz is more dangerous than 220 V DC supply source	(p)	peak value of 220 V ac supply is equal to 311 V.
	(b)	At resonance in series R-L-C circuit	(q)	peak value of 220 V ac supply is equal to 220 V but it gives larger shock
			(r)	Impedance is minimum.

Ans- (a) - (p) , (b) – (r)

Understanding

2.	(a)	For melting of metal in arc furnace very high frequency AC source is used	(p)	Due to very fast changing magnetic field stronger induced current developed
	(b)	For decreasing power losses ferromagnetic material to be use	(q)	Due to high frequency less impedance and less power loss occurs
			(r)	For decreasing power loss solid iron piece required as iron core
			(s)	Laminated, insulated soft core to be used

Ans- (a) - (p) , (b) – (s)

Application

3.	(a)	Unit of L/R is	(p)	second
	(b)	Power factor in a circuit	(q)	Ohm
			(r)	0, ∞
			(s)	varies between 0 to 1

Ans- (a) - (p) , (b) – (s)

Analysing & Evaluating

4.	(a)	Speed of dynamo is doubled then peak value of induced emf	(p)	becomes half
			(q)	doubles
	(b)	Principle of generator	(r)	electromagnetic induction

Ans- (a) - (q) , (b) – (r)

Understanding

5.	(a)	Unit of impedance	(p)	Ohm
	(b)	Unit of suceptance	(q)	Ohm-m
			(r)	Watt-hour
			(s)	Mho

Ans- (a) - (p) , (b) – (s)

Remembering

ELECTROMAGNETIC WAVES -8

(i) Multiple Choice Questions

1. What is wavelength of signal weather frequency of 300 megahertz?

(a) 2m (b) 20m

(c) 10m (d) 1m.

Ans. D **[** $\lambda = \frac{c}{\upsilon} = \frac{3\times10^8}{3\times10^8} = 1m$ **]**

Application

2. If $\lambda_x, \lambda_m, \lambda_v$ represents wavelength of X-Rays, microwaves & visible rays then

(a) $\lambda_m > \lambda_x > \lambda_v$ (b) $\lambda_m > \lambda_v > \lambda_x$

(c) $\lambda_v > \lambda_x > \lambda_m$ (d) $\lambda_v > \lambda_m > \lambda_x$

Ans. B

Understanding

3. Human body radiate

(a) microwave (b) X-rays

(c) infrared rays (d) gamma rays.

Ans. C

Remembering

4. EM waves can be produced by a charge:

(a) An accelerated charged particles

(b) A charged particles moving with constant speed

(c) at rest.

(d) either at rest or moving with constant velocity.

Ans. (a)

Remembering

5. In EM spectrum minimum wavelength is of:

(a) gamma rays (b) radio waves

(c) visible rays (d) microwave.

Ans. A

Understanding

6. Properties of EM radiation are identified by using there:

(a) colour (b) their use

(c) speed (d) frequency or wavelength

Ans. D

Understanding

7. Light wave constitutes:

(a) mechanical waves (b) magnetic waves

(c) electromagnetic waves (d) longitudinal waves

Ans. C

Understanding

8. Which of the following transport by EM waves:

(a) charge & momentum (b) frequency & wavelength

(c) energy & momentum (d) wavelength & energy

Ans. C

Understanding

(ii) Completion Type Questions

1. Human body radiate…….. of EM spectrum

Ans. IR radiation

Remembering

2. Shorter the wavelength of an electromagnetic waves ,…….. energy it carries

Ans. More [$E = \frac{hc}{\lambda}$ **]**

Understanding

3. Waves used to transmit cellular telephone message are…….

Ans. microwaves

Analysing & Evaluating

4. In EM waves transport both……and……. takes place.

Ans. Energy, momentum [E = $h\upsilon$ & $p = \frac{h}{\lambda}$ **]**

Understanding

5. EM waves are produced by…….. charges.

Ans. Accelerated/Oscillated

Understanding

6. To study structure of crystals…….. are used.

Ans. X-rays

Application

7. Human eye can detect…….. part of electromagnetic spectrum.

Ans. visible

Remembering

8. To treat cancer and tumor in radiography…….. rays are used.

Ans. γ **-rays**

Remembering

9. During the propagation of an EM wave in a medium electrical energy density is _____ magnetic energy density.

Ans. Equal

Understanding

10. For an EM wave propagating alongx –axis Emax =30V/m, the maximum value of magnetic field is _____.

Ans. 10^{-7}T

Application

11. The conduction current is same as _____ _____ whether the source is a.c. or D.C.

Ans. Displacement current

Understanding

12. An oscillating charge particle radiates _____.

Ans. EM wave

Understanding

(iii) True/False Type Questions

1. An EM radiation has energy of 11.5 keV is belonging to ultraviolet region of spectrum.

Ans. False [$\lambda = \frac{12.42 \times 10^{-7}\ evm}{11.5 \times 10^{3}} = 1.08\ \overset{o}{A}$ **, so x-rays]**

Application

2. For all frequencies, speed of EM waves is same.

Ans. True

Remembering

3. Radio waves generally lies in frequency range 500 gigahertz to 1000 gigahertz.

Ans. False [$\lambda = \frac{c}{\upsilon} = \frac{3 \times 10^{8}}{500 \times 10^{9}} = 6 \times 10^{-4}\ m$ **]**

Understanding

4. Longer the wavelength of an EM wave, more the energy it carries.

Ans. False [E = $\frac{hc}{\lambda}$ **]**

Understanding

5. Waves used to transmit cellular telephone message are microwaves.

Ans. True

Remembering

6. A variable frequency AC source is connected to a capacitor, the displacement current remains same with the increase in frequency.

Ans. False

Evaluation and analysis

7. A plane electromagnetic wave travels along y-axis in vacuum, its electric and magnetic field vectors are along z-axis and x-axis.

Ans. True

Evaluation and analysis

8. Intensity of an electromagnetic waves is proportional to cube of electric or magnetic field.

Ans. False

Application

9. Velocity of an EM wave in vacuum is given by $\sqrt{\mu\varepsilon}$.

Ans. False

Application

10. Charges in uniform motion can be sources of EM waves.

Ans. False

Understanding

11. The speed of propagation of a wave is given by ω/k.

Ans. True

Remembering-recalling specific fact

12. The frequency of an EM wave is greater than frequency of oscillation of charge.

Ans. False

Understanding of a concept

13. Magnetic field for a plane EM wave is given by

$= 5x10^{-7} \sin(0.8x10^{4} x + 2.5 x 10^{7} t) T$

The expression for electric field is

$Ez = 150\sin(0.8x10^{4} x + 2.5 x 10^{7} t) Vm/s$

Ans. True

Application- solving problems in new situation

(iv) Matching type Questions

1 Match the following

EM waves	**Application**
a) Ultraviolet rays	P) Absorbed by Ozone layer of atmosphere
b) X-rays	Q) To detect fracture of bones
Ans- a-P, b-Q	R) For broadcasting

Remembering

2 Match the following

Wavelength (m)	**Waves**
a) 10^{-10}	P) Radio
b) 10^{-3}	Q) X-Rays
Ans- a-R, b- S	R) UV Rays
Remembering	S) Microwaves

3 Match the following

Wavelength	**Energy of Photon**
a) 10^{3}	P) 1.24×10^{-9}ev
b) 10^{-12}	Q) 1.24×10^{6}ev
Ans- a-P, b-Q	R) 1.24×10^{9}ev

Application

4 Match the following

EM radiations	**Frequency range (Hz)**
a) X Rays	P) 3×10^{18} to 3×10^{28} Hz
b) Microwaves	Q) 10^{6} to 10^{19} Hz
Ans-a-Q, b-R	R) 1×10^{9} to 3×10^{11} Hz

Remembering

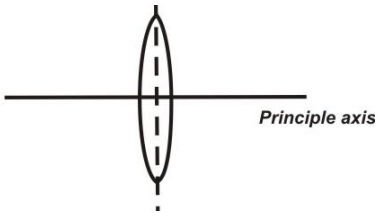
5 Match the following

Use	**Waves**
a) Water purification	P) Microwaves
b) Remote Sensing	Q) UV rays
Ans-a-Q, b-P	R) gamma rays
Remembering	S) X-rays

RAY OPTICS AND OPTICAL INSTRUMENTS - 9

(i) Multiple Choice Questions

1. An equiconvex lens of focal length 15 cm is cut into two halves as shown in figure. Find the focal length of each part?



(a) -30cm (b) -20cm

(c) 30cm (d) -15cm

Ans. (c)

Analysing & Evaluating

2. How does the focal length of a convex lens changes if mono chromatic red light is used instead of violet light?

(a) Focal length is increased when red light is used

(b) Focal length is decreased when red light is used

(c) Focal length is remain same when red light is used

(d) Not depends on color of light.

Ans. (a)

Understanding

3. A glass lens is immersed in water. What will be the effect on the power of lens?

(a) increase (b) decrease

(c) constant (d) not depends

Ans. (b)

Understanding

5. How does the magnifying power of a telescope change on increasing the linear diameter of its objective?

(a) Power increases on increases diameter

(b) Power decreases on decreases diameter

(c) Power remain constant on increases diameter

(d) Power doesn't depends on diameter

Ans. (d)

Understanding

6. What is the magnification and focal length of a plane mirror.

(a) $+1, \infty$ (b) $+1, 0$

(c) $-1, \infty$ (d) $-1, 0$

Ans. (a)

Remembering

7. An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus. The image

(a) moves away from the lens with an uniform speed 5 m/s.

(b) moves away from the lens with an uniform acceleration.

(c) moves away from the lens with a non-uniform acceleration.

(d) moves towards the lens with a non-uniform acceleration.

Ans- c

Understanding

8. An astronomical telescope has a large aperture to:

(a) increase span of observation

(b) have low dispersion

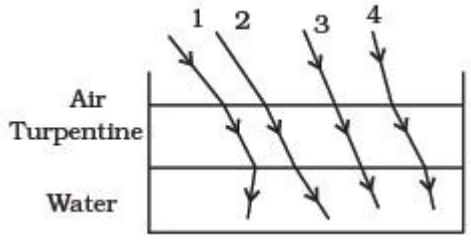
(c) reduce spherical aberration

(d) have high resolution

Ans-d

Remembering

9. The optical density of turpentine is higher than that of water while its mass density is lower shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in the path shown is correct?



(a) 1 (b) 2

(c) 3 (d) 4

Ans- b

Analysing & Evaluating

10. When diameter of objective of an astronomical telescope is doubled ,its limit of resolution is

(a) doubled (b) one fourth

(c) halved (d) unaffected

Ans-(c)

Application

14. Which one of the following cannot be polarised

(a) X rays (b) γ rays

(c) radio waves (d) sound waves

Ans-(d)

Understanding

15. The angle between pass axis of polariser and analyser is 45^0 ,the percentage of polarised light passing through analyser is (relative to light incident on the polariser)

(a) 25% (b) 50%

(c) 75% (d) 100%

Ans-(a)

Applying

16. A short pulse of white light incident from air to glass slab at normal incidence. After travelling through the slab the first colour to emerge is

(a) violet (b) blue

(c) green (d) red

Ans-(d)

Understanding

17. Two lenses of focal lengths 20 cm and - 40cm are held in contact. If an object lies at infinity, image formed by the lens combination will be at

(a) infinity (b) 20cm

(c) 40cm (d) 60cm

Ans-(c)

Application

18. An unpolarized light is incident onto a medium of refractive index $\sqrt{3}$ at the polarising angle of the medium then The angle of refraction is

(a) 30^0 (b) 45^0

(c) 60^0 (d) 90^0

Ans- (a)

Applying

19. Resolving power of compound microscope is

(a) $d=\frac{\lambda}{2\mu sin\theta}$ (b) $\frac{1}{d}=\frac{2\mu sin\theta}{\lambda}$

(c) $d\theta=\frac{1.22\lambda}{D}$ (d) $\frac{1}{d\theta}=\frac{D}{1.22\lambda}$

Ans- (b)

Remembering

20. Optical fibres are based on the phenomenon of

(a) reflection (b) refraction

(c) dispersion (d) total internal reflection

Ans- (d)

Understanding

21. The characteristic feature of light which remains unaffected on refraction is

(a) speed (b) frequency

(c) wavelength (d) velocity of light

Ans- (b)

Remembering

22. The value of refractive index of medium of polarising angle 60^0 is

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$

(c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

Ans- (a)

Applying

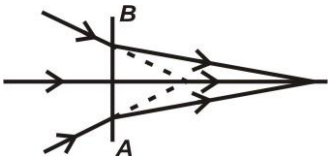
(ii) Completion Type Questions

1. An air bubble in a jar of water shines brightly is an example of _____.

Ans. Total Internal Reflection

Understanding

2. The line A & B in the ray diagram of figure represent a _____ lens.



Ans. Diverging/Concave

Understanding

3. The expression _____ gives the intensity I of scattered light varying with the wavelength λ of the incident ray of light.

Ans. $I \propto \frac{1}{\lambda^4}$

Remembering

4. For the same angle of incidence, the angles of refraction in three different medium A, B and C are 15°, 25°and 35°respectively _____ medium will the velocity of light be minimum.

Ans. A medium **[** $\mu = \frac{\sin i}{\sin r} = \frac{c}{\upsilon} \Rightarrow \upsilon \propto \sin r$ **]**

Analysing & Evaluating

5. On dioptre is _____of lens of focal length _____ meter.

Ans. Power, 1m

Remembering

6. In the minimum deviation position, the refracted ray in the prism is _____to the base of prism.

Ans. Parallel

Analysing & Evaluating

7. In cassegrainian telescope, a large aperture_____ mirror & a small apertures _____ mirror is used.

Ans. Concave, convex

Understanding

8. The deviation through a prism is minimum when angle of incidence is equal to angle of _____.

Ans. Emergence

Remembering

9. The image formed by the convex mirror is always _____ and _____.

Ans. Virtual, erect

Understanding

10. A _____ mirror is used as rear view mirror because it has a wider field of view.

Ans. Convex mirror

Understanding

11. Light of wavelength 6000 Å falls on plane mirror. The wavelength of reflected light is _____.

Ans. 6000 Å

Understanding

12. Total internal reflection must occur when angle of incidence is more than the _____.

Ans. Critical angle

Remembering

13. A ray of light undergoes _____ twice on passing through a prism

Ans. Refraction

Understanding

14. In minimum deviation position, the refracted ray is _____ to the base of the prism.

Ans. Parallel

Analysis

15. Total internal reflection will occur when ray of light travel from _____ medium to _____ medium.

Ans. Denser, rarer

Remembering

16. The basic cause of refraction is change in _____ of light in going from one medium to another

Ans. Velocity

Understanding

17. One dioptre is the power of a lens of focal length _____.

Ans. 1 m

Applying

18. Due to refraction, the depth of an optically denser medium appears to be _____ than its real depth.

Ans- Less

Remembering

19. When light undergoes refraction, its frequency _____

Ans- Remains same

Remembering

20. If two thin lenses of power P1 and P2 are held in contact then the power of the combination will be _____

Ans- $P_1 + P_2$

Applying

21. A convergent lens made of crown glass (refractive index 1.5) has focal length 20cm in air. If it is immersed in a liquid of refractive index 1.60, its focal length will be _____

Ans- -160 cm

Applying

(iii) True/False Type Questions

1. The frequency changes when light passes from a rarer to a denser medium?

Ans. False

Understanding

2. A ray of light passes through a glass slab, shift produced in path of emergent ray depends on refractive index.

Ans. True

Applying

3. When a convex lens placed inside a transparent medium of refracting index greater than that of its own material, it behave as concave lens.

Ans. True

Analyzing and evaluating

4. The deviation δ of a ray on passing through a prism of small angle A is $(\mu - 1)A$.

Ans. True

Remembering

5. The correct formula for magnifying power of a simple microscope is in normal adjustment $m = \left(1 + \frac{d}{f}\right)$

Ans. False

Remembering

7. Light ray passes through a medium $\mu = \frac{3}{2}$. The speed of light in this medium is $2 \times 10^8 \, m/s$.

Ans. True

Applying

8. A thin prism of 12° angle gives a deviation of 6°. The refracting index of a material of the prism 1.5.

Ans. True

Applying

9. The use of optical fibre is based on the phenomenon total internal reflection.

Ans. (True)

Remembering

10. If refractive index of water is 4/3 and that of glass is 3/2 ,then refractive index of water w.r.t. glass is 9/8.

Ans. (false) $\mu_{wg} = \frac{\mu_w}{\mu_g} = \frac{8}{9}$

Applying

11. In reflecting type telescope, image is brighter as compared to that in refracting type telescope.

Ans. (True)

Analysis

12. When size of atmospheric particles is very small compared to the wavelength (λ) of light, then intensity of scattered light is given by $I \alpha \frac{1}{\lambda^2}$.

Ans. (False)

Understanding

13. The basic cause of dispersion is difference in deviation produced for wavelength of different colours.

Ans. (True)

Understanding

14. Formula for magnifying power of simple microscope in adjustment for least distance of distinct given is m=$(1+\frac{D}{f})$.

Ans. (True)

Remembering

15. A telescope uses on objective lens of focal length f_o and an eye lens of focal length f_e. In normal adjustment the separation between the two lenses is f_o-f_e.

Ans. (False)

Analysis

16. Smaller the limit of resolution of an optical instrument, greater is its resolving power.

Ans True

Understanding

17. The relation between critical angle and refractive index is μ = 1/sinC.

Ans. True

Remembering

18. Dispersion is the phenomena that takes place inside an optical fiber.

Ans. False

Remembering

19. In a concave mirror when the object is located beyond C the magnification is equal to 1.

Ans. False

Understanding

20. Total internal reflection occurs when Angle of incidence is greater than critical angle

Ans. True

Understanding

21. An air bubble inside a glass slab ($\mu = 1.5$) appears at 6 cm when viewed from the opposite side. The thickness of the slab is 10 cm.

Ans. False

Analysing & Evaluating

22. When light undergoes refraction, the wavelength decreases in denser medium

Ans. True

Understanding

(iv) Matching type Questions

1) (a) Resolving power of microscope
(b) Resolving power of astronomical telescope

Ans. (a)-(Q),(b)-(S)

Remembering

(P) $d=\frac{\lambda}{2\mu sin\theta}$
(Q) $\frac{1}{d}=\frac{2\mu sin\theta}{\lambda}$
(R) $d\theta=\frac{1.22\lambda}{D}$
(S) $\frac{1}{d\theta}=\frac{D}{1.22\lambda}$

2) (a) The colour scattered most is
(b) The colour scattered least

Ans. (a)-(R),(b)-(P)

Understanding

(P) red
(Q) yellow
(R) blue
(S) orange

3) (a) Intensity of scattered light is directly proportional to
(b) Total internal reflection occurs when light travel from

Ans. (a)-(R),(b)-(Q)

Understanding

(P) rarer to denser medium
(Q) denser to rarer medium
(R) $\frac{1}{\lambda^4}$
(S) λ^4

WAVE OPTICS -10

(i) Multiple Choice Questions

1. The phenomenon of polarization is exhibited by

(a) Longitudinal Wave (b) Matter Wave

(c) Transverse Wave (d) Mechanical Wave

Ans. (c)

Understanding

2. Unpolarised light incident on a plane glass surface at an angle of incidence *i*. It angle of refraction be *r*, what should be the angle of incidence so that the reflected and refracted rays are perpendicular to each other?

(a) $i + r = 90^o$ (b) $i + r = 180^o$

(c) $i + r = 0$ (d) $i + r = i_c$

Ans. (a)

Understanding

3. Which of the following is correct for "Malus Law"

(a) $I = I_0^2 \cos^2 \theta$ (b) $I = I_0 \cos^2 \theta$

(c) $I = I_0^2 \sin^2 \theta$ (d) $I = I_0 \tan^{-1} \theta$

Ans. (b)

Understanding

4. Unpolarised beam of light of intensity I_o is incident on a polariser P_1. Another polariser P_2 is held parallel to it such that its pass axis is oriented at an angle 60^0, then what percentage of light will emerge from the system:

(a) 30% (b) 100%

(c) 12.5% (d) 37.5%

Ans. (c)

Analysing & Evaluating

5. In a Young's double slit experiment, the separation between the slits is 0.1 mm, the wavelength of light used is 600nm and the interference pattern is observed on a screen 1m away. Find the separation between bright fringes.

(a) 6.6 mm (b) 6.0 mm

(c) 6 m (d) 60 cm

Ans. (b)

Application

6. In YDSE, The distance between two consecutive bright and dark fringes are given by:

(a) $\beta = \frac{\lambda D}{d}$ (b) $\beta = \frac{Dd}{\lambda}$

(c) $\beta = \frac{\lambda}{Dd}$ (d) $\beta = \frac{\lambda d}{D}$

Ans. (a)

Remembering

7. In the Young double slit experiment, the fringe pattern as seen on the screen is:

(a) parabola (b) Hyperbola

(c) Ellipse (d) Spiral

Ans. (b)

Understanding

8. The light sourcesused in Young's double slit experiment are

(a) Incoherent (b) Coherent

(c) White light (d) Blue-green-red Light.

Ans. (b)

Remembering

9. What is the effect on the angular width of interference fringes in a Young's double slit experiment when the screen moved near to the plane of slits.

(a) increases (b) decreases

(c) constant (d) not defined

Ans. (c)

Analysing & Evaluating

10. The phase difference between two waves at the place of constructive interference is given as a multiple of:

(a) multiple of π (b) multiple of(2n-1) π

(c) even multiple of π (d) odd multiple of π

Ans. (c)

Remembering

11. The path difference between two waves at the place of destructive interference is given by:

(a) multiple of λ (b) multiple of $\lambda/2$

(c) even multiple of $\lambda/2$ (d) odd multiple of $\lambda/2$

Ans. (d)

Remembering

12. Resolving Power of Microscope depends upon

(a) Focal Length (b) Wavelength

(c) Diameter (d) Wavelength, Diameter of lens

Ans. (d)

Remembering

13. Diffraction effects show that light does not travel straight lines. Under what condition the concepts of ray optics are valid. (D = distance of screen from the slit).

(a) $D < Z_f$ (b) $D = Z_f$

(c) $D > Z_f$ (d) $D << Z_f$

Ans.–(d)

Applying

14. Bending of Light phenomena is shown by

(a) Polarization (b) Diffraction

(c) Interference (d) Dispersion

Ans. (b)

Understanding

15. Angular width of interference fringe depends on

(a) Distance Between Slit and Screen (b) Wavelength of light

(c) Ratio of the wavelength and Slit width (d) Width of Slit

Ans. (b)

Analysing and Evaluating

16. Resolving Power of the telescope depends upon the

(a) Diameter of circular aperture (b) Focal Length

(c) Magnification Power (d) Refractive index

Ans. (a)

Remembering

17. In the phenomena of Diffraction of light when the violet light is used in the experiment is used instead of red light then,

(a) Fringe width increases (b) No change in fridge width

(c) Fringe width decreases (d) Colour pattern is formed

Ans. (c)

Understanding

18. Diffraction aspect is easier to notice in case of the sound waves then in case of the light waves because sound waves

(a) Have longer wavelength (b) Shorter wavelength

(c) Longitudinal wave (d) Transverse waves

Ans. (a)

Understanding

19. The wave-front due to source situated at the infinity is

(a) Spherical (b) Plane

(c) Cylindrical (d) Rectangular

Ans. (b)

Understanding

20. Colours appears on a thin film of a soap and a soap bubble is due to

(a) Diffraction (b) Refraction

(c) Dispersion (d) Interference

Ans. (d)

Understanding

21. For an aperture of size (d) illuminated by a parallel beam of light having wavelength ʎ. The Fresnel's distance

(a) $Z = d^2 / \lambda$ (b) $Z = d / \lambda$

(c) $Z = d / \lambda^2$ (d) $Z = d\lambda$

Ans. (a)

Understanding

(ii) Completion Type Questions

1 Poloroid is a device to produce and detect _____ polorised light.

Ans. (Plane)

[Remembering]

2 A beam of light is incident normally upon a polariser and the intensity of emergent beam is I_o. The intensity of the emergent beam is found to be unchanged when the polariser is rotated about an axis perpendicular to the pass axis. Incident beam is …….. in nature.

Ans. Unpolarised

[Understanding]

3 Polarization phenomenon are exhibit by the _____waves only.

Ans. (Transverse Wave)

[Remembering]

4 The value of Brewster Angle depends on the nature of the transparent refracting medium and the _____ of light used.

Ans. (Wavelength)

[Understanding]

5. In Young's double slit experiment, the fringe width is given by _____.

Ans. ($\beta = D\lambda / d$)

[Remembering]

6. The phase difference between two waves in _____ interference is given as an even multiple of π.

Ans. (Constructive)

[Understanding]

7. Fringe width is different as the separation between two consecutive_____ or _____.

Ans. (Maxima , minima)

[Remembering]

8. The phenomena of polarization demonstrate light has _____ nature.

Ans. (Transverse)

[Understanding]

9. _____ of light occurs when size of the obstacle of aperture is comparable of wavelength of light.

Ans. (Diffraction)

[Understanding]

10. During reflection or refraction of light, _____ remains unchanged.

Ans. (Frequency)

[Applying]

11. Continuous locus of oscillation with constant phase is called as _____.

Ans. (Wave-front)

[Remembering]

12. In interference and _____, the light energy is redistributed increases in one region and decreases in other.

Ans. (Diffraction)

[Understanding]

13. At polarising angle the refracted and reflected are _____ to each other.

Ans. (perpendicular)

[Understanding]

14. The intensity in sunglasses and window panes can be controlled by _____.

Ans. (polaroid)

[Remembering]

15. Intensity of light is determine by _____ of the amplitude of oscillating $\vec{E}$.

Ans. (Square)

[Remembering]

16. The tangent of angle polarization as light ray travels from air to glass is equal to the refractive index. This law is called as _____

Ans. (Brewster's law)

[Remembering]

(iii) True/False Type Questions

1. Sustained Interference is caused due to superposition of two waves coming from two coherent source.

Ans. True

[Understanding]

2. Fringe width is defined as the separation between two consecutive maxima or minima.

Ans. True

[Remembering]

3. When white light is used to illuminate the slit we obtain an interference pattern consisting of a central white fringe having few coloured fringes on two sides and uniform illumination.

Ans. True

[Understanding]

4. Fringe width is given by, $\beta = D/d\lambda$ where d = separation of coherent sources, D = distance of screen from source, λ = wavelength.

Ans. False

[Remembering]

5. The phase difference between two waves at the place of constructive interference is given as an even multiple of π.

Ans. True

[Understanding]

6. Light is a longitudinal wave.

Ans. False

[Remembering]

7. "The angle of polarization for any transparent medium also depend on the wavelength of the incident light."

Ans. True

[Remembering]

8. In single slit experiment the slit width is doubled than original width intensity increases 4 times the initial intensity

Ans. True

[Understanding]

9. Bending of light phenomena from corners of obstacle or aperture is related with interference.

Ans. False

[Understanding]

10. Diffraction of light occurs when size of the aperture is comparable to the wavelength of light.

Ans. True

[Understanding]

11. Diffraction is interference due to wavelength from different parts of same wave front.

Ans. True

[Understanding]

12. Resolving power of the telescope decrease when the aperture of the objective is increased.

Ans. False

[Analysing and evaluating]

13. Resolving power of the Microscope increases on decreasing the wavelength of light.

Ans. True

[Analysing and evaluating]

14. Resolving power of microscope can be increased by choosing a higher refractive medium of objective glass.

Ans. False

[Understanding]

15. The Fresnel's distance for an aperture of 1mm of wavelength 1000 nm is 1m.

Ans. True

[Applying]

16. Intensity of light is maximum on either side of central maxima is same in case of the diffraction.

Ans. False

[Understanding]

17. Path difference between two waves originating from two coherent sources for constructive interference at a point should be n. Where m = 0,1,2,3.

Ans. True

[Applying]

(iv) Matching type Questions

1. According to young's double slit experiment, match the following columns.

Column I	Column II
a. In YDSE, when width of one slit is slightly increased	(i) maximum intensity will increase
b. In YDSE, When one slit is closed	(ii) Maximum intensity will decrease
	(iii) interference pattern will disappear

Ans- (a-i, b-iii)

Understanding

2 In normal Young's double slit experiment match the following two columns

Column I	Column II
a) In YDSE apparatus is immersed in a liquid	(i) Fringe width will increase
b) When wavelength of light used is increased	(ii) Fringe width will decrease
	(iii) Fringe width will remain constant

Ans.- (a-ii, b-i)

Understanding

3. Match the following two columns

Column I	Column II
(a) Single Slit experiment	(i) Diffraction
(b) Double slit Experiment	(ii) Polarization
	(iii) Interference

Answer – (a- i , b-iii)

Remembering

4. Match the following two columns

Column I	Column II
(a) Malus law	(i) $\mu = \tan I\ p$
(b) Brewster's law	(ii) $I = I_0 \cos^2 \theta$
	(iii) $I = I_0^2 \cos^2\ \theta$

Answer – (a-iii , b – i)

Remembering

5. Unpolarised light of intensity I_0 is incident upon a polariser. Now the polaried is allowed to fall upon the analyser. It angle between analyser and polariser is θ then.

Column I	Column II
(a) $\theta = 0°$	(i) Intensity of final emergent beam $= I_0/2$
(b) $\theta = 45°$	(ii) Intensity of final emergent beam $= I_0/8$
	(iii) Intensity of final emergent beam $= I_0/4$

Answer – (a – i , b – iii)

Applying

6. Match the following two columns

Column I	Column II
(a) Point Source	(i) Plane wavefront
(b) Rectangular Slit kept in front of a distant sources	(ii) Cylindrical wavefront
	(iii) Spherical wavefromnt

Answer – (a – iii , b – i)

Understanding

7. Match the following two columns

Column I	Column II
(a) Resolving power of telescope	(i) $2\mu \sin\theta / 1.22\lambda$
(b) Resolving power of microscope	(ii) $D/1.22\lambda$
	(iii) $1.22\lambda / 2\mu \sin\theta$

Answer – (a – ii , b – i)

Remembering

8. Match the following two columns

Column I	Column II
(a) Microscope	(i) Resolves
(b) Telescope	(ii) Magnifies
	(iii) Diverging

Answer – (a – ii , b – i)

Understanding

9. Match the following two columns

Column I	Column II
(a) Intensity at maxima	(i) A_1^2 / A_2^2
(b) Intensity at minima	(ii) $(A_1 - A_2)^2$
	(iii) $(A_1 + A_2)^2$

Answer – (a – ii , b – iii)

Remembering

DUAL NATURE OF RADIATION AND MATTER - 11

(i) Multiple Choice Questions

1. The theory, on the basis of Photoelectric effect can be explained:

   (a) Corpuscular theory (b) Wave theory

   (c) Electromagnetic theory (d) Quantum theory

Ans. (d)

Remembering

2. The photoelectric work function for a metal surface is 4.14 ev. The cutoff wavelength for this is :

   (a) 4125 Å (b) 2062.5 Å

   (c) 3000 Å (d) 6000 Å

Ans. (c) **[** $\lambda = \frac{hc}{E} = \frac{12.42 \times 10^{-7}\ evm}{4.14\,eV} = 3000\ \overset{o}{A}$ **]**

Applying

3. If E_1, E_2, E_3, E_4 are the respective kinetic energies of electron, deuteron, proton and neutron having same De- Broglie wavelength. Select the correct order in which those values would increase :

   (a) E_1, E_3, E_4, E_2 (b) E_2, E_4, E_1, E_3

   (c) E_2, E_4, E_3, E_1 (d) E_3, E_1, E_2, E_4

Ans. (C) **[** $\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow mk =$ **constant]**

Analysing & Evaluating

5. When radiation of given frequency is incident upon different metals, the maximum kinetic energy of electrons emitted –

   (a) decrease with increase of work function

   (b) increase with increase of work function

   (c) remains same with the increase of work function

   (d) does not depend upon work function

Ans. (a) **[KE_{max} =** $h\upsilon - \phi_o$ **]**

Remembering

6. A proton, a neutron, an electron and alpha particle have same kinetic energy, then their De-Broglie wavelengths compare as

   (a) $\lambda_e = \lambda_p = \lambda_n = \lambda a$ (b) $\lambda_e > \lambda_p > \lambda_n > \lambda_a$

   (c) $\lambda_a < \lambda_p < \lambda_n < \lambda_e$ (d) $\lambda_p = \lambda_n \& \lambda_e > \lambda_a$

Ans. (b) $\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow \lambda \propto \frac{1}{\sqrt{m}}$

Applying

7. The monochromatic beams A and B of equal intensities I, hit a screen. The number of photons hitting the screen by beam A is twice that by beam B. The ratio of their frequencies will be –

(a) 1:2 (b) 2:1

(c) 1:1 (d) 1:3

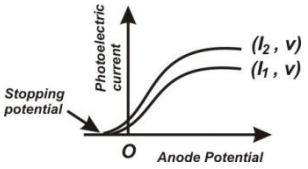
Ans. (a) [I = $nh\upsilon$]

Applying

8. Following graph shows the variation of photoelectric current with anode potential for two light beam of same wavelength but different intensity. Find the correct relation :

(a) $I_1 > I_2$ (b) $I_1 = I_2$

(c) $I_1 < I_2$ (d) $I_1 \leq I_2$



Ans. (c)

Understanding

9. Which of the following has maximum stopping potential when metal is illuminated by visible light?

(a) Blue (b) Yellow

(c) Violet (d) Red

Ans. c [$KE_{max} = h\upsilon - \phi_o \Rightarrow KE_{max}$ is max or violet]

Analysing & Evaluating

10. The slop of frequency of incident ray and stopping potential for a given surface will be

(a) h (b) h/e

(c) eh (d) e

Ans. b [$V_o = \frac{h}{e}\upsilon - \frac{\phi_o}{e}$]

Analysing & Evaluating

11. The threshold wavelength for a metal having work function φ_0 is λ_0 , what is the threshold wavelength for a metal whose work function is $\varphi_0/2$.

(a) $4\lambda_0$ (b) $2\lambda_0$

(c) $\lambda_0/2$ (d) $\lambda_0/4$

Ans. b [$\phi_o = \frac{hc}{\lambda_o}$]

Apply

12. Maximum kinetic energy of emitted electron depends on the frequency of incident photon when frequency of incident photons is

(a) equal to the threshold frequency

(b) half of threshold frequency

(c) greater then threshold frequency

(d) one third of threshold frequency

Ans. C

Understanding

13. Two particles have equal momentum. What is the ratio of their de-Broglie wavelength?

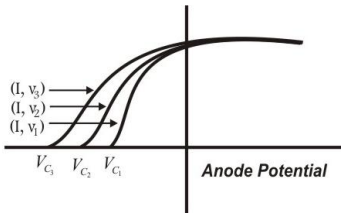
(a) 2 (b) 1

(c) 3 (d) 0.5

Ans. b [$\lambda = \frac{h}{p}$

Analysing & Evaluating

15. Identify the correct relation for the given diagram for frequency



(a) $\upsilon_1 = \upsilon_2 = \upsilon_3$ (b) $\upsilon_1 > \upsilon_2 > \upsilon_3$

(c) $\upsilon_1 < \upsilon_2 < \upsilon_3$ (d) $\upsilon_1 = 2\,\upsilon_2 = 3\,\upsilon_3$

Ans. c

Understanding

(ii) Completion Type Questions

1. The minimum energy required by a free electron to just escape from the metal surface is called as ---------.

Ans. Work function

Remembering

2. The maximum kinetic energy of emitted photoelectrons depends on the -------- of incident radiation and the nature of material.

Ans. Frequency

Understanding

3. The maximum kinetic energy of emitted photoelectrons is independent of --------- of incident radiation.

Ans. Intensity of incident radiation

Understanding

4. The velocity of photon in different media is --------

Ans. Different [$\upsilon = \frac{c}{\mu}$ **]**

Understanding

5. The main aim of Davison- Germer experiment is to verify the ---------- nature of moving electrons.

Ans. Wave

Remembering

6. The expression for De-Broglie wavelength of an electron moving under a potential difference of V Volts is --------

Ans. $\lambda = \frac{12.27}{\sqrt{v}} \overset{o}{A}$

Remembering

7. The minimum frequency required to eject an electron from the surface of a metal surface is called--------- Frequency.

Ans. Threshold

Remembering

8. In photoelectric effect, saturation current is not affected on decreasing the ……of incident radiation provided its intensity remains unchanged.

Ans : wavelength/frequency

Understanding

9. The minimum energy required to just escape electron from metal surface is …….

Ans : work function

Remembering

10. Photon is not a material particle but it is a packet of ……..

Ans : energy

Remembering

11. The intensity of radiation also depends upon the number of ……. present in it.

Ans : photons

Remembering

12. Momentum of photon in different media is……..

Ans : Different

Understanding

13. Davisson and germer experiment established the…….of slow moving electrons.

Ans : wave nature

Remembering

14. Matter wave are associated with ……..particle.

Ans : Moving

Remembering

(iii) True/False Type Questions

1. An electron and proton have the same De-Broglie wavelength, the K.E. of electron is greater than K.E. of proton.

   This statement true / false

Ans. True **[** $\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow mK = cons\tan t$ **]**

Understanding

2. The electron emission can be obtained from photoelectric emission only.

Ans. False **[Thermo ionic emission, field emission etc]**

Remembering

3. Photoelectric current varies linearly with the intensity of the incident radiation.

Ans. True **[As one electron cause emission of one electron]**

Remembering

4. The higher is the work function for a photosensitive material, the greater is the value of threshold frequency.

Ans. True **[** $\phi = h\upsilon_0$ **]**

Understanding

5. The maximum K.E. of the ejected photoelectrons is dependent of the intensity of the incident light.

Ans. **False[KE_{max} depends upon frequency of incident radiation]**

Applying

6. "Photoelectric effect can be explained by wave nature of light".

Ans : False **[Explained by Einstein using quantum theory]**

Understanding

7. "Photoelectron are ejected with kinetic energy which ranges from 0 to KE_{max} when frequency of incident photon is greater than threshold frequency of metal "

Ans : **True**

Remembering

8. "Stopping potential depends on intensity of incident light "

Ans: False **[Stopping potential depends upon frequency of incident radiation]**

Understanding

9. "If we double the frequency of incident photon than stopping potential also doubled"

Ans : False **[eV$_0$= h** $h\upsilon - \phi_0$ **eV** $eV_0^{'} = 2h\upsilon - \phi_0 = 2eV_0 + \phi_0 \Rightarrow V_0^{'} = 2V_0 + \frac{\phi_0}{e}$ **]**

Analysing & Evaluating

10. De broglie wave length of proton and deuteron are equal when accelerated by same potential.

Ans : False $\lambda = \frac{h}{\sqrt{2mqV}} \Rightarrow \lambda \propto \frac{1}{\sqrt{m}}$ **]**

Analysing & Evaluating

11. In photoelectric emission the emitted photoelectrons have different kinetic energies.

Ans : True [has a range from 0 to KE_{max}]

Understanding

12. Velocity of photons in different media is different ?

Ans : True [$\upsilon = \frac{c}{\mu}$ **]**

Understanding

13. Emitted photo-electron will possess maximum kinetic energy comparatively if we use light of blue colour rather than red light.

Ans : True [$KE_{max} = h\upsilon - \phi_0 \& \upsilon_B > \upsilon_R$**]**

Analysing & Evaluating

(iv) Matching type Questions

1. Match column –I statement with the right option of column - II

Column – I	Column - II
(a) If frequency (*f*) is increased keeping intensity (*I*) and work function(φ) constant.	P. Photocurrent increases.
(b) If Intensity increases keeping f & φ constant	Q. Stopping potential increases
	R. Photocurrent decreases

Ans. a-Q ,b- P

Analysing & Evaluating

2. Match column –I statement with the right option of column - II

Column – I	Column - II
(a) Target material changes.	P. Maximum kinetic energy of the photo electron changes.
(b) Intensity of incident photon changes.	Q. Photocurrent changes.
	R. Maximum kinetic energy of photo electron remains same

Ans. a- P, b- R

Understanding

3. Match column –I statement with the right option of column - II

Column – I	Column - II
(a) The phenomenon of emission of electron from the metal surface onheating is called.	P. Photoelectric emission.
(b) The phenomenon of emission of electron from the metal when radiation of suitable frequency fall on it.	Q. Secondary emission.
	R. Thermionic emission.

Ans. a- R ,b- P,

Remembering

4. Match column –I statement with the right option of column - II

Column – I	Column – II
a) If the frequency (f) is increased keeping same intensity on a given metal	Statements:
	P. Stopping potential remains same
b) If the frequency (f) is kept same and the intensity of radiation is increased on a given metal	Q. Stopping potential decreases
	R. Maximum K.E. of electrons increases

Ans. a-R , b-P

Understanding

ATOMS - 12

(i) Multiple Choice Questions

1. When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because
   (a) Alpha particles are positively charged
   (b) Mass of alpha particle is more than mass of electron
   (c) Most of the part of an atom is empty space
   (d) Alpha particles moves with high velocity

Answer : (c) Most of the part of an atom is empty space

Understanding

2. The radius of an atomic nucleus have an order of,

(a) 10^{-8}m (b) 10^{-15}m (c) 10^{-12}m (d) 10^{-10}m

Answer : (b) 10^{-15}m

Remembering

3. In an experiment of scattering of alpha particle showed for the first time that the atom has,

(a) Electron (b) Proton (c) Neutron (d) Nucleus

Answer : (d) Nucleus

Remembering

4. The existence of positively charged nucleus was established by,

(a) Bohr's model of H-atom (b) Positive ray analysis
(c) α Scattering experiment (d) Thomson's model of atom

Answer: (c) α Scattering experiment

Remembering

5. What was the order of thickness of gold foil on which beam of alpha particles allowed to fall in Geiger-Marsden Experiment?

(a) 10^{-3}m (b) 10^{-9}m (c) 10^{-7}m (d) 10^{-5}m

Answer : (c) 10^{-7}m

Remembering

6. In Geiger Marsden experiment, the expression of distance of closest approach to the nucleus of a alpha particle before it comes to momentarily at rest and reverse its direction is,

a) $\frac{Ze^2}{4\pi\varepsilon_0 K}$ b) $\frac{Ze^2}{2\varepsilon_0 K}$

c) $\frac{Ze^2}{2\pi\varepsilon_0 K}$ d) $\frac{Ze^2}{4\varepsilon_0 K}$

Answer: c) $\frac{Ze^2}{2\pi\varepsilon_0 K}$

Remembering

7. According to Bohr's postulates, an electrons revolve around the nucleus in _____ orbits.

(a) Dynamic (b) Stationary

(c) Lower (d) First

Ans:- (b) Stable or stationary

Remembering

8. The angular momentum of the electron in the nth allowed orbit is;

(a) $\frac{ph}{2\pi}$ (b) $\frac{h}{2\pi}$

(c) $\frac{2h}{\pi}$ (d) $\frac{nh}{2\pi}$

Ans:- (d) $\frac{nh}{2\pi}$

Remembering

9. Which spectral series of hydrogen lie in UV region.

(a) Paschen (b) Lyman

(c) Brackett (d) Balmer

Ans:- (b) Lyman Series

Remembering

10. In equation $E_n=-\frac{13.6}{n^2}$, what does this negative sign indicates.

(a) Electrons are free to move

(b) Electron is bound with nucleus.

(c) Kinetic energy is equal to potential energy

(d) Atom is radiating energy

Ans:- (b)

Understanding

11. Kinetic energy of electron in hydrogen atom is

(a) $\frac{e^2}{4\pi\varepsilon_0 r}$ (b) $\frac{e^2}{8\pi\varepsilon_0 r}$

(c) $\frac{e^3}{8\pi\varepsilon_0 r}$ (d) $\frac{e^2}{3\pi\varepsilon_0 r}$

Ans:- (b)

Remembering

12. What is the order of velocity of electron in a hydrogen atom in ground state.

(A). $10^6 ms^{-1}$ (B). $10^2 ms^{-1}$

(C) $10^{10} ms^{-1}$ (D). $10^9 ms^{-1}$

Ans:- (A) $10^6 ms^{-1}$

Remembering

13. Energy required to excite an electron in hydrogen atom to its ground state to its first excited state is .

(A). 6.2eV (B). 3.40eV

(C). 10.2eV (D). -13.6eV

Ans:- (C) 10.2eV Hint- E_2-E_1=-3.40-(-13.6)= 10.2eV

Applying

14. The Bohr's model is applicable to which kind of atoms

(A). Having one electron only (B). Having two electrons

(C). Having eight electrons (D). Having more than eight electrons.

Ans:- (A) Having one electron

Understanding

15. What is the angular momentum of an electron revolving in the 3rd orbit of an atom?

(a) $31.5\times10^{-34}J.\sec$ (b) $.315\times10^{-34}J.\sec$

(c) $3.15\times10^{-34}J.\sec$ (d) $315\times10^{-34}J.\sec$

Ans. (c) [$l_n=\frac{nh}{zx}=\frac{3\times6.62\times10^{-34}}{2\times3.14}=3.15\times10^{-34}J-S$]

Applying

16. Which one of these is the famous Bohers' quantisation condition for angular momentum

(a) $l=\frac{h}{2\pi}$ (b) $l=\frac{h}{9\pi}$

(c) $l=\frac{nh}{2\pi}$ (d) $l=\frac{nm_p}{2\pi}$

Ans. (c)

Remembering

17. The minimum energy required to knock an e^- completely out of the atom is called as

(a) Kinetic Energy (b) Potential Energy

(c) IonisationEnergy (d) Excitation energy

Ans. (c)

Remembering

18. The ground state energy of Hydrogen atom is -13.6 eV. What is the KE of an electron in the 3rd excited state?

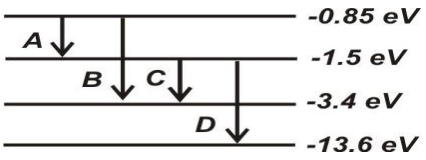
(a) $-3.4eV$ (b) $-1.51\,eV$

(c) $-.85eV$ (d) $0eV$

Ans. (b)

Apply

19. The energy level diagram of an element is given:- , which transition corresponds to the emission of a spectral line of wave length 102.7 nm



(a) A (b) B

(c) C (d) D

Ans. (d) **[** $\Delta E = \frac{hc}{\lambda} = \frac{12.42\times10^{-7}\, evm}{10.27\times10^{-7}\, m} = 12.1\, eV$ & *for transition D,* $\Delta E = 12.1\, eV$ **]**

E & A

20. Bohr's model is most likely to applicable for:

(a) Spectrum of single e^{Θ} atom (b) spectrum of Helium atom

(c) intensity variations is spectral lines (d) frequencies emitted by hydrogenic atoms.

Ans. (a)

Understanding

21. For the shortest wavelength present in the paschen series of spectral lines $\frac{1}{\lambda} = R\left[\frac{1}{n_2^2} - \frac{1}{n_1^2}\right]$

(a) $n_2 = 3,\ n_1 = \infty$ (b) $n_2 = \infty,\ n_1 = 3$

(c) $n_2 = 3,\ n_1 = 1$ (d) $n_2 = \infty,\ n_1 = 1$

Ans. (a)

Applying

22. The radius of the innermost electron orbit of a hydrogen atom is r_1. What is the ratio of radii of the $n = 2$ and $n = 3$ orbits?

(a) $\frac{4}{9}$ (b) $\frac{9}{4}$

(c) $\frac{10}{15}$ (d) $\frac{2}{5}$

Ans. (a)

Apply

(ii) Completion Type Questions

1. The angle of scattering θ for zero value of impact parameter b is _____.

Answer: 180^0.

Applying and Evaluating

2. The frequency spectrum of radiation emitted as per Rutherford's model of atom is _____.

Answer: Continuous.

Remembering

3. The scattering angle will decreases with the _____ in impact parameter.

Answer: Increase

Understanding

4. An alpha particle contains _____ protons and _____neutrons.

Answer: Two, two.

Remembering

5. According the Rutherford's model of an atom, the most of space in atom is _____.

Answer: Empty.

Understanding

6. The radius of an atom is about _____m and that of nucleus is _____m.

Answer: 10^{-10} m and 10^{-15} m.

Remembering

7. The Rutherford's model of an atom cannot explain the characteristics _____ spectrum emitted by H-atom.

Answer: Line

Understanding

8. The force responsible for scattering of alpha particle with target nucleus is _____.

Answer: Electrostatic force

Remembering

9. The SI unit of impact parameter is _____.

Answer: Meter.

Remembering

10. If the size of first orbit of hydrogen atom is 0.5 Å, the size of 2^{nd} orbit of hydrogen atom would be _____.

Ans. 2 $\overset{o}{A}$ { $r \propto n^2$ }

Applying and Evaluating

11. When an electron jumps from an outer stationary orbit of energy E_2 to an inner stationary orbit of energy E_1, the frequency of radiation emitted = _____.

Ans. $\upsilon = \frac{(E_2 - E_1)}{h}$

Remembering

12. According to de Broglie a stationary orbit is that which contains an _____ number of de –Broglie waves associated with the revolting electron

Ans. Integral

Remembering

13. _____ is a physical quantity whose dimensions are the same as that of Planck's constant.

Ans. Angular momentum

Applying

14. Energy possessed by an electron for ($n \to \infty$)th orbit is _____.

Ans. Zero

Understanding

15. _____series of hydrogen spectrum which lies in the visible region electromagnetic spectrum.

Ans. Balmer

Understanding

16. _____ volt is the ionisation potential of hydrogen atom.

Ans. 13.6

Applying

17. Total energy of electron in a stationary orbit is _____, which means the electron is bound to the nucleus and is not free to leave it.

Ans. Negative

Remembering

18. The value of Rydberg constant is _____.

Ans. ($1.09 \times 10^7 m^{-1}$**)**

Remembering

19. When an electron jumps from 2nd stationary orbit of hydrogen atom to 1st stationary orbit, the energy emitted is _____.

Ans. 10.2eV

Applying

(iii) True/False Type Questions

1. Negative sign in expression $E_n = -\frac{13.6}{n^2}$ eV means that the electron is bound with Nucleus.

Ans. True

Understanding

2. According to Bohr's Postulate electron resolves around the nucleus only in the orbits for which angular momentum is $\frac{nh}{2\pi}$., where n= principal quantum no of the orbit.

Ans. False

Understanding

3. Paschen series of hydrogen atom lie in UV region.

Ans. False

Remembering

4. Electron will revolve in stationary orbit.

Ans. True

Remembering

5. At room temperature most of the hydrogen atoms are in ground state.

Ans. True

Remembering

6. In hydrogen atom Kinetic energy(K.E) of revolving orbit in an orbit is E then total energy of electron will be –E.

Ans. True

Applying

7. Shortest wavelength in balmer series is 364.6 nm.

Ans. True

Applying

8. We use a very thin gold foil in Rutherford's α - particle scattering experiment.

Ans. True

Remembering

9. In the Rutherford atomic model, the electrostatic force of attraction between revolving electrons and nucleus provides the necessary centripetal force.

Ans. True

Understanding

10. Empirical formula for p-fund series of hydrogen spectra is given by $\frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{n^2}\right),\ n = 5,6,7$

Ans. False

Remembering

11. When an electron transit from one of its orbit to another of lower energy it emits a photon of energy equal to $h\nu = E_f - E_i$

Ans. True

Remembering

12. To ionize a hydrogen atom an electron from the ground state, $-13.6\,\text{eV}$ of energy must be supplied.

Ans. False

Understanding

13. Most of the mass and entire positive charge are concentrated in a very small volume of the atom. (True/false)

Answer: True

Remembering

14. The distance of closest approach between alpha particle and a nucleus is directly proportional to kinetic energy of alpha particle, when it is far apart from nucleus. (True/false)

Ans. False[d= $\frac{1}{4\pi\varepsilon_0}\frac{(2e)(ze)}{(\frac{1}{2}mu^2)}$**]**

Understanding

15. The existence of positively charged nucleus in atom was established by alpha particle scattering experiment. (True/false)

Ans. True

Understanding

16. The electrostatic force between the alpha particle and target nucleus is responsible for the scattering. (True/false)

Ans. True

Remembering

17. Atom should emit discrete frequency of radiation, according to Rutherford's model. (True/false)

Ans. False

Understanding

18. When the impact parameter of alpha particle is minimum, the angle of scattering is 180^0. (True/false)

Ans. True

Understanding

(iv) Matching type Questions

1.	(a)	Potential energy in the first excited state would be	(P) - 3.4eV
	(b)	Total energy is the first excited state would be	(Q) - 23.8eV
Ans.	**(a)-(R), (b)-(P)**		(R) - 6.8eV
Analysing & Evaluating			(S) - 13.6eV
2.	(a)	Kinetic energy in the 1st excited state would be	(P) 3.4 eV
	(b)	Total energy is the first excited state would be	(Q) 23.8 eV
Ans.	**(a)-(P), (b)-(S)**		(R) 20.4 eV
Analysing & Evaluating			(S) -3.4 eV
3.	An electron in hydrogen atom moves from $n=1$ to $n=2$.		(P) One –fourth times
	(a)	Angular momentum	(Q) Two –times
	(b)	Kinetic radius	(R) Four times
Ans.	**(a)-(Q), (b)-(P)**		(S) Half times
Analysing & Evaluating			
4.	For hydrogen atom		(P) Infrared region
	(a)	Lyman series	(Q) Ultraviolet region
	(b)	Balmer series	(R) Visible region
Ans.	**(a)-(Q), (b)-(R)**		(c) Invisible region
Remembering			
5	For hydrogen atom spectrum		(P) $n=6 \rightarrow n=3$
	(a)	Ultraviolet light	(Q) $n=3 \rightarrow n=1$
	(b)	Visible light	(R) $n=4 \rightarrow n=2$
Ans.	**(a)-(Q), (b)-(R)**		(S) $n=7 \rightarrow n=6$
Analysing & Evaluating			
6	(a) Bohr's model of atom		(P) Continuous spectrum
	(b) Rutherford's model of atom		(Q) Band spectrum
			(R) Line spectrum
Answer: (a) – (R) , (b) – (P)			
Remembering			

7	(a) Kinetic energy of electron revolving around nucleus	(P) Always positive
	(b) Total energy of electron revolving around nucleus	(Q) Always negative (R) May be positive or negative
Answer: (a) – (P), (b) – (Q)		
Remembering		
8	(a) P fund series	(P) IR region
	(b) Balmer series	(Q) U-V region (R) Visible region
Answer: (a) – (P), (b) – (R)		**(S) Gamma region**
Remembering		

NUCLEI - 13

(i) Multiple Choice Questions

1. The average binding energy per nucleon is maximum for the nucleus.

(a) ${}^{4}_{2}He$ (b) ${}^{16}_{8}O$

(c) ${}^{56}_{26}Fe$ (d) ${}^{238}_{92}U$

Ans. (c)

Remembering

2. In the Uranium radioactive series the initial nucleus is ${}^{238}_{92}U$ and that the final nucleus is ${}^{206}_{82}Pb$, when uranium nucleus decays to lead, the number of α- particle and β-particle emitted are

(a) $8\alpha, 6\beta$ (b) $6\alpha, 7\beta$

(c) $6\alpha, 8\beta$ (d) $4\alpha, 3\beta$

Ans. (a)

Analysing & Evaluating

3. In gamma rays emission from a nucleus

(a) only the proton number changes

(b) both the proton no and neutron no changes

(c) there is no change in the proton number and neutron number

(d) only the neutron no changes

Ans. (c)

Understanding

4. Stating with a sample of pure Cu^{66}, $\frac{7}{8}$ of it decay into Zn in 15 minutes. The corresponding half life is

(a) 10 minutes (b) 15 minutes

(a) 5 minutes (d) 7.5 minutes

Ans. (c)

Applying

5. In reaction:

${}_{4}Be^{9} + {}_{2}He^{4} \rightarrow {}_{6}C^{x} + {}_{0}n^{1}, \quad x =$

(a) 16 (b) 12

(c) 10 (d) 14

Ans. (b)

Understanding

6. Activity of a radioactive sample decrease to $\left(\frac{1}{3}\right)$ of its original value in 3 days. then in 9 days its activity with becomes

(a) $\frac{1}{27}$ of the original value (b) $\frac{1}{9}$ of the original value

(c) $\frac{1}{18}$ of the original value (d) $\frac{1}{3}$ of the original value

Ans. (a)

Applying

7. Which word equation represents β+ decay?

(a) proton →neutron + electron + electron antineutrino

(b) proton →neutron + electron + electron neutrino

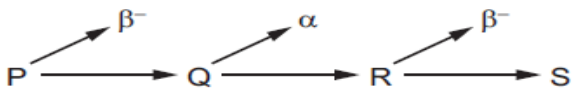
(c) proton →neutron + positron + electron antineutrino

(d) proton →neutron + positron + electron neutrino

Ans. (d)

Understanding

8. In a radioactive decay series, three successive decays each result in a particle being emitted. The first decay results in the emission of a ß- – particle. The second decay results in the emission of an α -particle. The third decay results in the emission of another ß- – particle.



Nuclides P and S are compared.

Which statement is correct?

(a) P and S are identical in all respects.

(b) P and S are isotopes of the same element.

(c) S is a different element of lower atomic number.

(d) S is a different element of reduced mass.

Ans. (b)

Analysing & Evaluating

9. What is the ratio of nuclear radii if the mass numbers of two nuclei are 4 and 32

(a) 1 : 2 (b) 1 : 3

(c) 1; 4 (d) 1 : 5

Ans. (a)

Applying

10. Which statement about alpha, beta and gamma radiation is correct?

(a) Alpha radiation has the greatest ionizing power.

(b) Beta radiation has the greatest ionizing power.

(c) Gamma radiation has the greatest ionizing power.

(d) Alpha, beta and gamma radiation have nearly equal ionizing powers.

Ans. (a)

Remembering

11. The nuclei of the isotopes of an element all contain the same number of a certain particle. What is this particle?

(a) electron (b) neutron

(c) nucleon (d) proton

Ans. (d)

Remembering

(ii) Completion Type Questions

1. The rest mass of a nucleus is _____than the sum of the rest masses of its constituent nucleons.

Ans. Less [Mass defect]

Remembering

2. Heavy water is a _____, which slows down fast moving neutrons to thermal velocities so that they can cause fission of ${}^{235}_{92}U$ nuclei.

Ans. Moderator

Understanding

3. The _____force holds the nucleons together inside a nucleus.

Ans. Strong nuclear force

Remembering

4. Two nuclei have mass numbers in the ratio 27 : 125. Then the ratio & their radii is _____ .

Ans. 3 : 5

Applying

5. Complete the equation ${}^{m}_{n}X \xrightarrow[\alpha\ decay]{}$ _____.

Ans. ${}^{m-4}_{n-2}Y$

Understanding

6. The process responsible for energy production is the Sun is _____ .

Ans. Nuclear fusion

Remembering

7. A radioactive isotope of silver has half life of 20 minutes. The fraction of the original activity that remain after one hour is _____.

Ans. $\frac{1}{8}$

Analysing & Evaluating

8. One atomic mass unit is defined as _____ of mass of an atom of ${}_{6}C^{12}$.

Ans. (1/12th)

Remembering

9. 1eV is the energy acquired by an electron when accelerated through …..…… potential difference.

Ans. (1V)

Remembering

10. Isotopes of an element are the atoms of an element which have _____. But different atomic weights.

Ans. (same atomic number)

Remembering

11. Isobars are the atoms of different element which have same _____ but different atomic number.

Ans. (atomic weights)

Remembering

12. Isotones are the nuclides which contain_____.

Ans. (same no of neutrons)

Remembering

13. Nuclear forces are the _____ force, which hold together the nucleons in the tiny nucleus.

Ans. (strongest)

Remembering

(iii) True/False Type Questions

1. The radius R of a nucleus is proportional to cube root of its mass number.

Ans. True [$r = r_0 A^{\frac{1}{3}}$ **]**

Remembering

2. Solar energy is mainly caused due to burning of Hydrogen in the oxygen.

Ans. False [nuclear fusion]

Understanding

3. β -particles have a high ionizing power.

Ans. False [$\alpha -$ **particles have high ionizing power]**

Applying

4. Heavy water is used as a moderator in a nuclear reactor.

Ans. True

Remembering

5. If a nucleus ${}_nX^m$ emits one α particle and one β^{-1} particle then mass number is *m-4* and atomic number is *n-2* of the product.

Ans. False [mass number = m-4 atomic number = n-1]

Understanding

6. Correct order of increasing penetrating power is α- ray > β -rays > γ -rays.

Ans. False [Penetration power $\gamma - rays > \beta - rays > \alpha - rays$ **]**

Remembering

8. $N = N_0 e^{-\lambda t}$ represents solution to the radioactive decay law.

Ans. True

Remembering

10. Nuclear forces are charge independent and non-central forces.

Ans. True

Remembering

11. The density of nuclear matter is independent of the size of the nucleus.

Ans. (True)

Remembering

12. Isotopes of an element are the atoms of an element which have different atomic no. but same mass number.

Ans. (False same atomic no. and different mass no.)

Understanding

13. Neutron is a charge less particle having mass slightly greater than that of proton.

Ans. (True)

Remembering

14. In β^- decay neutron converts to a proton according to $n \rightarrow p + e^- + \bar{\nu}$

Ans. (True)

Remembering

15. The nuclear force is charge independent i.e. it acts equally among all nucleons.

Ans. (True)

Remembering

16. All nuclides with same mass no. are called isotones.

Ans. (False)

Remembering

(iv) Matching type Questions

1. (a) ß$^{+}$ decay is accompanied with
   (b) ß$^{-}$ decay is accompanied with

(P) Neutrino
(Q)Anti neutrino
(R) X-ray

Ans. (a-P, b-Q)
Remembering

2. (a) Neutrinos are released in
   (b) atomic number decreases by 2 in

(P) α decay
(Q) ß decay
(R) γ decay
(S) electron capture

Ans. (a-Q, b-P)
Understanding

3. (a) Weak nuclear forces are involved in
   (b) Lighter nuclei are used

(P) Nuclear fission
(Q) Nuclear fusion
(R) ß$^{-}$ decay
(S) Exothermic nuclear reaction

Ans. (a-R, b-Q)
Understanding

5. (a) $\alpha - ray$
   (b) $\gamma - ray$

(P) Low perpetrating power
(Q) Deflected towards positive pole
(R) High perpetrating power

Ans. (a-P, b-R)
Remembering

6. (a) Nuclear Fission
   (b) Nuclear Fusion

(P) ${}^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{141}_{56}Ba + {}^{1}_{0}n + Q$
(Q) ${}^{3}_{1}H + {}^{1}_{1}H \longrightarrow {}^{4}_{2}He + Q$
(R) ${}^{230}_{90}Th \longrightarrow {}^{226}_{90}Ra + {}^{4}_{2}He + Q$
(S) ${}^{137}_{55}C_S \longrightarrow {}^{137}_{56}Ba + e^{-} + \bar{\nu} + Q$

Ans. (a-P, b-Q)
Understanding

7. (a) Atoms of higher atomic number used
   (b) Atoms of lower atomic number are

(P) Nuclear fission
(Q) Exothermic nuclear reaction
(R) Nuclear fusion
(S) β – decay

Ans. (a-P, b-R)
Understanding

8. (a) Atomic number decreases by 2
   (b) Atomic number increases by 1

(P) α- decay
(Q) β^{-} – decay
(R) γ decay

Ans. (a-P, b-Q)
Understanding

10. (a) Neutrino emission
    (b) Fast neutrons are slowed to thermal velocities using

(P) Heavy water
(Q) β – decay
(R) α- decay

Ans. (a-Q, b-(P)
Understanding

11.	(a)	Isotopes	(P) ${}^{37}_{17}Cl$ *and* ${}^{39}_{19}K$
	(b)	Isobars	(Q) ${}^{37}_{17}Cl$ *and* ${}^{37}_{16}S$
			(R) ${}^{1}_{1}H$ *and* ${}^{2}_{1}H$

Ans. (a-R, b-Q)

Applying

12.	(a)	1 MeV equals to	(P) X = neutron
	(b)	${}_1H^2 + {}_1H^2 \longrightarrow {}_2He^3 + X$	(Q) X = electron
			(R) $1.6\times10^{-13}J$
			(S) $1.6\times10^{-23}J$

Ans. (a-R, b-P)

Applying

SEMICONDUCTOR - 14

(i) Multiple Choice Questions

1. In Conductor, Semiconductor and Insulator, the forbidden energy gap are E_1 ,E_2 and E_3 respectively. Which one is correct

   a) $E_1 < E_2 < E_3$ b) $E_1 > E_2 = E_3$

   c) $E_1 = E_2 < E_3$ d) $E_1 > E_2 > E_3$

Ans. a)

Remembering

2. Silicon is doped with which of the following to obtain P type semiconductor

   a) Phosphorus b) Gallium

   c) Germanium d) Bismuth

Ans. b)

Understanding

3. What happens to resistance of an intrinsic semiconductor when heated

   a) increases b) remains constant

   c) decreases d) decreases linearly

Ans. c) **[$R \propto \frac{1}{n\tau}$]**

Understanding

4. A semiconductor has an electron concentration of 6×10^{22} per $m^3$and hole concentration of 8.5×10^9 per m^3 .Then it is

   a) N type semiconductor b) P type semi conductor

   c) intrinsic semiconductor d) conductor

Ans. a)

Understanding

5. What type of doping is used in Zener diode

   a) light b) moderate

   c) heavy d) no doping

Ans. c) **[Depletion layer becomes thinner and electric field with in intensifies]**

Remembering

6. 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 carries and pentavalent atoms are the dopants.

(d) Holes are majority carries and trivalent atoms are the dopants.

Ans. (c)

Remembering

7. Carbon, silicon and germanium have four valence electrons each. These are characterized by valence and conduction bands separated by energy band gap respectively equal to $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$. Which of the following statements is true?

(a) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_C$

(b) $(E_g)_C < (E_g)_{Ge} < (E_g)_{Si}$

(c) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$

(d) $(E_g)_C = (E_g)_{Si} = (E_g)_{Ge}$

Ans. (c)

Remembering

8. In an unbiased p-n junction, holes diffuse from the p-region to n-region because

(a) free electrons in the n-region attract them.

(b) they move across the junction by the potential difference.

(c) hole concentration in p-region is more as compared to n-region.

(d) All the above.

Ans. (c)

Understanding

9. 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.

Ans. (c)

Understanding

10. In a p-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 carries and pentavalent atoms are the dopants.

(d) Holes are majority carries and trivalent atoms are the dopants.

Ans. (d)

Remembering

11. The intrinsic semiconductor becomes an insulator at

(a) $0°C$ (b) $-100°C$

(c) $300\ K$ (d) $0\ K$

Ans. (d) At $0K$ temperature semiconductor behaves as an insulator, because at very low temperature electrons cannot jump from the valence band to conduction band.

Remembering

12. In the forward bias arrangement of a *PN*-junction diode

(a) The *N*-end is connected to the positive terminal of the battery

(b) The *P*-end is connected to the positive terminal of the battery

(c) The direction of current is from *N*-end to *P*-end in the diode

(d) The *P*-end is connected to the negative terminal of battery

Ans. (b) The *P*-end is connected to the positive terminal of the battery

Remembering

13. In a PN-junction diode

(a) The current in the reverse biased condition is generally very small $\sim \mu A$

(b) The current in the reverse biased condition is small but the forward biased current is independent of the bias voltage

(c) The reverse biased current is strongly dependent on the applied bias voltage

(d) The forward biased current is very small in comparison to reverse biased current

Ans. (a) In forward biased *PN*-junction, external voltage decreases the potential barrier, so current is maximum. While in reversed biased *PN*-junction, external voltage increases the potential barrier, so the current is very small.

Understanding

14. A *P*-type semiconductor can be obtained by adding

(a) Arsenic to pure silicon (b) Gallium to pure silicon

(c) Antimony to pure germanium (d) Phosphorous to pure germanium

Ans. (b) *Ga* has a valancy of 3.

Remembering

15. Electrical conductivity of a semiconductor

(a) Decreases with the rise in its temperature

(b) Increases with the rise in its temperature

(c) Does not change with the rise in its temperature

(d) First increases and then decreases with the rise in its temperature

Ans. (b) With temperature rise conductivity of semiconductors increases. ($\rho \propto \frac{1}{n\tau}$)

Understanding

16. A semiconductor is cooled from $T_1 K$ to $T_2 K$. Its resistance

(a) Will decrease (b) Will increase

(c) Will first decrease and then increase (d) Will not change

Ans. (b) Resistance of semiconductor $R \propto \frac{1}{n\tau}$

Understanding

17. The cut-in voltage for silicon diode is approximately

(a) 0.2 V (b) 0.6 V

(c) 1.1 V (d) 1.4 V

Ans. (b)

Remembering

18. The depletion layer in the *P-N* junction region is caused by

(a) Drift of holes

(b) Diffusion of charge carriers

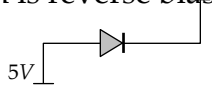
(c) Migration of impurity ions

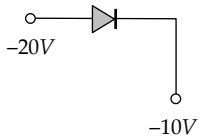
(d) Drift of electrons

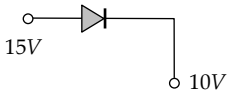
Ans. (b) Due to the large concentration of electrons in *N*-side and holes in *P*-side, they diffuses from their own side to other side. Hence depletion region produces.

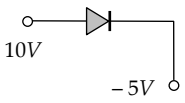
Understanding

19. Which is reverse biased diode

(a) 

(b) 

(c) 

(d) 

Ans. (b) Because *P*-side is more negative as compared to *N*-side.

Understanding

20. If a full wave rectifier circuit is operating from 50 *Hz* mains, the fundamental frequency in the ripple will be

(a) 50 *Hz* (b) 70.7 *Hz*

(c) 100 *Hz* (d) 25 *Hz*

Ans. (c) In full wave rectifier, the fundamental frequency in ripple is twice that of input frequency.

Remembering

21. In a full wave rectifiers, input *ac* current has a frequency 'ν'. The output frequency of current is

(a) $\nu/2$ (b) ν

(c) 2ν (d) None of these

Ans. (c)

Remembering

(ii) Completion Type Questions

1. A pure semiconductor which is free of every impurity is called _____semiconductor.

Ans. Intrinsic

Remembering

2. Mobility of hole is _____ than that of electrons.

Ans. Less

Understanding

3. LED works under _____ bias.

Ans. Forward

Remembering

4. In p-n junction diode there is a _____ of majority carriers across the junction in forward bias.

Ans. Diffusion

Remembering

5. The resistance of p-n junction is _____ when reverse biased.

Ans. High

Understanding

6. Hole density is _____ compared to electron density in a p type semiconductor.

Ans. Greater

Remembering

7. Metals have _____ conductivity and _____ resistivity.

Ans. High, low

Remembering

8. In half-wave rectification, if the input frequency is 50 Hz then the output frequency of the signal will be _____ Hz.

Ans. 50 Hz

Understanding

9. In full -wave rectification, if the input frequency is 50 Hz then the output frequency of the signal will be _____ Hz.

Ans. 100 Hz

Understanding

(iii) True/False Type Questions

1. Charge carriers in n type semiconductor are both electrons and holes.

Ans. True [Electrons – majority holes – minority]

Understanding

2. Current increases linearly with applied potential difference in a p-n diode.

Ans. False [Semiconductors are non-ohmic]

Remembering

3. Resistance of p-n junction is low when forward biased & high when reverse biased.

Ans. True

Understanding

4. LED works under reverse bias condition

Ans. False [Forward Bias]

Remembering

5. Rectifier converts alternating supply voltage intodc- voltage.

Ans. True [p-n junction diode allows current under forward bias and blocks in reverse bias]

Understanding

6. Electrons have higher mobility as compared to holes.

Ans. True [Electron needs less energy to move]

Remembering

7. When a forward bias is applied to a pn junction, depletion layer increases

Ans. False [It decreases]

Understanding

8. Ideal junction diode acts as a closed switch when forward biased and open switch when reverse biased.

Ans. True [It conducts only when forward biased]

Understanding

9. Capacitor is used as a filter in a rectifier.

Ans. True [Capacitor first charges and then discharge current to ensure constant supply of current /voltage]

Understanding

(iv) Matching type Questions

1	i)	$E_g > 3$ eV	a)	Metals
	ii)	$E_g < 3$ eV	b)	Semiconductor
			c)	Insulator
Ans.	**i) --- c**			
	ii) --- b			
	Remembering			
2	i)	$n_e >> n_h$	a)	Intrinsic Semiconductor
	ii)	$n_e = n_h$	b)	p type Semiconductor
			c)	n Type Semiconductor
Ans.	**i) --- c**			
	ii) --- a			
	Remembering			
3	i)	High Conductivity ,Low resistivity	a)	Semiconductor
	ii)	Low conductivity ,High Resistivity	b)	Metals
			c)	Insulator
Ans.	**i) --- b**			
	ii) --- c			
	Remembering			
4	With the rise in temperature			
	i)	Resistance of metallic conductor	a)	Remains same
	ii)	Resistance of semiconductor	b)	increases
			c)	Decreases
Ans.	**i) --- b**			
	ii) --- c			
	Understanding			

Chapter Number	Completion Type	MCQ Type	Matching Type	True False Type	Total Qs.
1	22	19	16	17	74
2	14	18	9	17	58
3	11	37	5	11	64
4	12	18	2	15	47
5	11	12	11	23	57
6	5	19	1	7	32
7	4	22	5	6	37
8	12	8	5	13	38
9	21	22	3	21	67
10	16	21	9	17	63
11	14	15	4	13	46
12	19	22	8	18	67
13	13	11	12	16	52
14	9	21	4	9	43
	183	265	94	203	745