



CBSE -WORKSHOP ON OBJECTIVE TYPE QUESTIONS IN  
PHYSICS DATES 8-9 MAY, 2019

## OBJECTIVE QUESTIONS COMPENDIUM IN PHYSICS (042)

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Resource Person

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(Jayshree Periwal High School, Jaipur)
- (2) Yash Pal Singh  
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VENUE:-  
JAYSHREE PERIWAL HIGH SCHOOL, JAIPUR  
3, Chitrakoot Scheme, Ajmer road, Jaipur (302021)

## BRIEF REPORT

CBSE workshop on objective type questions (OTQs) was successfully conducted at Jayshree Periwal High School, Jaipur on 8<sup>th</sup> -9<sup>th</sup> May, 2019.

Educators were guided to prepare OTQs (Multiple Choice Questions, True – False Type Questions, Completion Type Questions and Matching Type Questions).

The workshop was successful due to active participation of 49 participants from different regions.

Once again we would like to express outer gratitude to Mrs. Anita Karwal, (CBSE Chairman) for bestowing us with the responsibility.

### Resource persons

- (1) Raj Kumar Parashari  
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## ***Chapter -1 Electric Charges And Fields***

<i>1.1 Multiple Choice Questions</i>	<i>(7-10)</i>
<i>1.2 Completion Type Questions</i>	<i>(11-13)</i>
<i>1.3 True/False Type Questions</i>	<i>(14-15)</i>
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## ***Chapter – 3 Current Electricity***

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## ***Chapter – 4 Moving Charges And Magnetism***

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## ***Chapter – 5 Magnetism And Matter***

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## ***Chapter – 6 Electromagnetic Induction***

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## ***Chapter – 7 Alternating Current***

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<i>1.3 True/False Type Questions</i>	<i>(73-73)</i>
<i>1.4 Matching type Questions</i>	<i>(74-74)</i>

## ***Chapter – 8 Electromagnetic Waves***

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<i>1.3 True/False Type Questions</i>	<i>(79-80)</i>
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## ***Chapter – 9 Ray Optics And Optical Instruments***

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## ***Chapter – 10 Wave Optics***

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## ***Chapter – 11 Dual Nature Of Radiation And Matter***

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## ***Chapter – 12 Atoms***

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**ELECTRIC CHARGES AND FIELDS -1**

**(i) Multiple Choice Questions**

1. Two charges  $3 \times 10^{-5} C$  and  $5 \times 10^4 C$  are placed at a distance 10 cm from each other. Find the value of electrostatic force acting between them.
- (a)  $13.5 \times 10^{11} N$  (b)  $40 \times 10^{11} N$   
(c)  $180 \times 10^9 N$  (d)  $13.5 \times 10^{10} N$

**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**

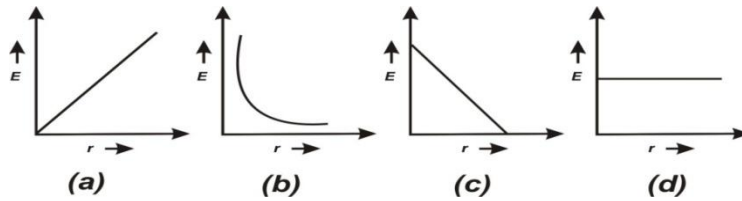
5. If  $\oint E \cdot ds = 0$ , inside a surface, that means :-

- (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  $\rightarrow$  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 ( $q = -1.6 \times 10^{-19} C$ ), then the charge on the glass rod will be \_\_\_\_\_ C.

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

**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.**  $(9 \times 10^9 N)$

**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  $\times$  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  $(2\pi/3)\mu\text{C}$ . Its surface density of charge is \_\_\_\_\_.

**Ans.  $1.67 \times 10^{-7} \text{ C/m}^2$  ( $\sigma = \frac{Q}{4\pi R^2} = \frac{(2\pi/3) \times 10^{-6}}{4\pi \times (1)^2} = 1.67 \times 10^{-7} \text{ C/m}^2$ )**

### 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  $0.2 \times 10^{-6} \text{ C}$  are 15 cm apart, the magnitude and direction of the resultant electric intensity E at a point midway between the charge is \_\_\_\_\_.

**Ans.  $6.4 \times 10^5 \text{ N/C}$ , 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  $1.6 \times 10^{-19} C$ .

**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  $3.0 \times 10^6 V/m$ . Therefore a conducting sphere 10 cm in radius can easily hold a charge of  $4 \times 10^{-6} C$  in air without breakdown.

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

**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  $\frac{Q^2 \sqrt{3}}{4\pi\epsilon_0 a^2}$ .

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

$$\begin{aligned} &= \sqrt{\left(\frac{KQ^2}{a^2}\right)^2 + \left(\frac{KQ^2}{a^2}\right)^2 + 2\left(\frac{KQ^2}{a^2}\right) \times \left(\frac{2KQ^2}{a^2}\right) \times \frac{1}{2}} \\ &= \frac{KQ^2 \sqrt{3}}{a^2} \end{aligned}$$

**Applying**

(iv) Matching type Questions

1. (i) Direction of dipole moment (a) positive charge to negative charge  
(ii) Direction of electric field lines (b) negative charge to positive charge  
Ans. (i) (b), (ii)(a) (c) positive charge to positive charge

**Remembering**

2. (i) As a body acquires positive charge, its mass (a) Increases  
(ii) As a body acquires negative charge, its mass (b) Remain same  
Ans. (i) (c), (ii) (a) (c) Decreases  
(d) First increase then decrease.

**Understanding**

3. (i) S.I. unit of electric flux is (a)  $\frac{N}{C^2}$   
(ii) S.I. unit of electric field is (b)  $\frac{N}{C}$   
Ans. (i) (c), (ii)(b) (c)  $\frac{N}{C} \times m^2$   
(d)  $\frac{N}{m^2} \times C$

**Remembering**

4. (i) Electric field intensity on the surface of charged conducting sphere (a)  $\frac{\sigma}{\epsilon_0}$   
(ii) Electric field intensity due to infinite charged sheet (b)  $\frac{\sigma}{2\epsilon_0}$   
Ans. (i) (a), (ii)(b) (c)  $\frac{\sigma}{4\epsilon_0}$   
(d)  $\frac{\sigma}{6\epsilon_0}$

**Remembering**

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

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

**Understanding**



6. (i) Electric field lines due to a point like positive charge (a) radically inward  
(b) radically outward  
(ii) Electric field lines due to a point like negative charge (c) parallel to charge  
(d) perpendicular to charge

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

**Remembering**

7. (i) Electrostatic force is (a) Always attractive  
(ii) Gravitational force is (b) Always repulsive  
(c) Both attractive and repulsive

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

**Remembering**

8. (a) Electric field (a) Volt × metre  
(b) Electric flux (b) Volt /sec  
(c) Volt / metre

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

**[Remembering]**

9. (a) Charging by friction (a) Both bodies must be charged  
(b) Charging by Induction (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. (a) Along the direction of electric dipole moment  
(ii) Direction of electric field intensity on equatorial point of dipole (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 (a)  $\frac{\sigma}{\epsilon_0}$   
(ii) Electric field intensity on the surface of charged sphericalshell (b)  $\frac{\sigma}{2\epsilon_0}$   
(c)  $\frac{2\sigma}{3\epsilon_0}$

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

**[Remembering]**

12. (i) Electric charge (a) volt/ metre  
(ii) Electric flux (b) Remains Quantised  
**Ans. (i) (b), (ii)(c)** (c) Scalar Quantity

**[Understanding]**

13. (i) Gauss Law (a)  $\oint \vec{E} \cdot d\vec{S} = \frac{\sigma}{\epsilon_0}$   
(ii) Coulombs Law (b)  $\oint \vec{E} \cdot d\vec{S} = \frac{q}{\epsilon_0}$

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

**[Applying]**

14. (i) Net force on a dipole is zero (a) Dipole in non uniform electric field  
(ii) A scale rubbed with hair attracts small pieces of paper. (b) Dipole in uniform electric field  
(c) Charging by conduction.

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

**[Applying]**

15. (i) Two similarly charged bodies (a) Always repel each other  
(ii) Two oppositely charged bodies (b) Always attract each other  
**Ans. (i) (c), (ii)(b)** (c) May attract or repel each other

**[Understanding]**

16. (i) Direction of electric field lines (a) Positive to negative charge  
(ii) Direction of electric dipole moment (b) Negative to positive charge  
**Ans. (i) (a), (ii)(b)** (c) perpendicular to the line joining both charges

**[Remembering]**



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  $1\mu\text{f}$ ,  $2\mu\text{F}$  &  $3\mu\text{F}$  are connected in series and a potential difference of 11V is applied across the combination then the potential difference across the plates of  $1\mu\text{F}$  capacitor is

(a) 2V

(b) 4V

(c) 1V

(d) 6V

Ans. (d)

### Applying

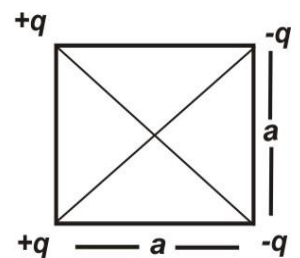
8. The potential at the centre of the square is-

(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 tree during lightning 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.  $U = -\vec{p} \cdot \vec{E}$**

**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  $2\mu\text{F}$  are connected in series. Equivalent capacitance will be .....

Ans. ( $1\mu\text{F}$ )

**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  $\theta = 60^\circ$  will be negative.

Ans. False

Applying

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

Ans. False

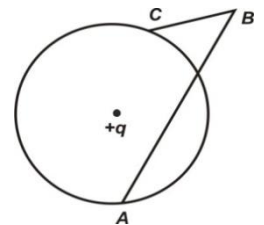
Remembering

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

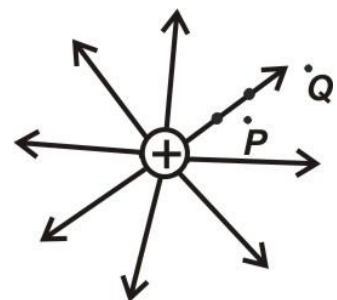
Applying

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  $\oint \vec{E} \cdot d\vec{l} = 0$**

**Understanding**

15. Four capacitor each of capacitance  $16\mu F$  are connected in series. Equivalent capacitance will be  $4\mu F$ .

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

**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 (P)  $\frac{\sigma}{2\epsilon_0}$   
 charged conductor is  
 (b) The value of electric field inside a charged (Q)  $\frac{\sigma}{\epsilon_0}$   
 capacitor is (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

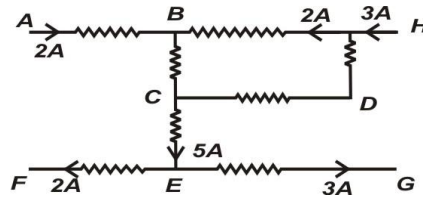
(i) **Multiple Choice Questions**

1. Kirchoff'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:

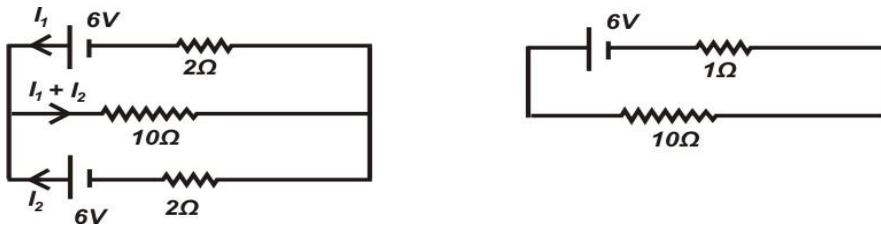


- (a) 4 amp
- (b) 2 amp
- (c) 5 amp
- (d) 10 amp

**Ans. A**

**Apply**

3. Electric current through resistance  $10\ \Omega$ , in the given circuit is:

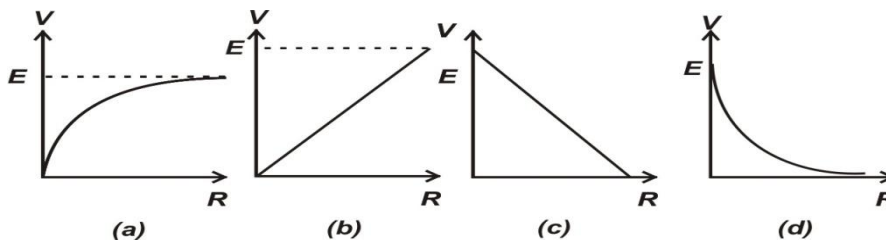


- (a) 0 amp
- (b) 0.5 amp
- (c)  $6/11$  amp
- (d) 2 amp

**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 :

	<b>Temp. coefficient</b>	<b>Resistivity</b>
(a)	Low	Low
(b)	High	High
(c)	High	Low
(d)	Low	High

**Ans. A**

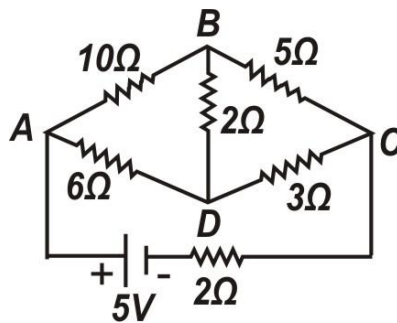
**Remembering**

- (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.  $2\text{ V}$ , a balance is obtained for  $50\text{ cm}$  of the potentiometer wire. If the cell is shunted by a  $2\ \Omega$  resistor and the balance is obtained across  $40\text{ cm}$  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  $40\text{ cm}$ , calculate value of  $S$ .

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

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

### Applying

12. How much work is required to carry a  $6\ \mu\text{C}$  charge from the negative to the positive terminal of a  $9\text{V}$  battery?

- (a)  $54 \times 10^{-3}\text{ J}$  (b)  $54 \times 10^{-6}\text{ J}$   
(c)  $54 \times 10^{-9}\text{ J}$  (d)  $54 \times 10^{-12}\text{ J}$

**Ans. (b)** [ $W = qV = 54\ \mu\text{J}$ ]

### Applying

13. For a cell, the terminal potential difference is  $3.6\text{ V}$ , when the circuit is open. If the potential difference reduces to  $3\text{ V}$ , when cell is connected to a resistance of  $5\ \Omega$ , 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)  $2.0\ \Omega$  (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

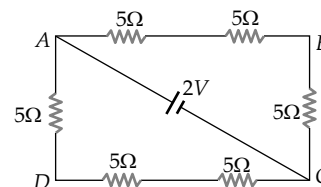
15. Kirchhoff's I law for the electric junction is based on:
- (a) Law of conservation of charge  
(b) Law of conservation of energy  
(c) Law of conservation of angular momentum  
(d) Law of conservation of mass

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

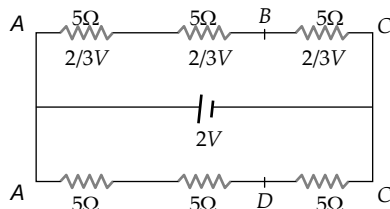
### Remembering

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



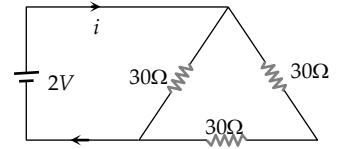
18. The current in the adjoining circuit will be

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

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

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

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



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

**Applying**

19. The temperature coefficient of resistance for a wire is  $0.00125/^{\circ}C$ . At  $27^{\circ}K$  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)**  $R_2 = R_1[1 + \alpha(t_2 - t_1)]$   
 $2 = 1[1 + 0.00125(t_2 - 27)] \Rightarrow t_2 = 827^{\circ}C$  or 1100 K  
 $\Rightarrow t = 854^{\circ}C \Rightarrow T = 1127K$

**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  $v_d = \frac{e}{m} \cdot \frac{El}{l} \tau$  (Since  $V = El$ )  
 $\therefore v_d \propto E$

**Understanding**

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

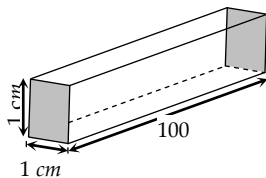
(a)  $3 \times 10^{-9} \text{ ohm}$

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

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

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

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



**Area of cross-section  $A = 1\text{ cm} \times 100\text{ cm}$**   
 $= 100\text{ cm}^2 = 10^{-2}\text{ m}^2$

**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

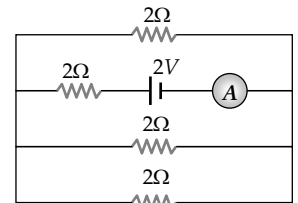
- (a)  $21 \times 10^3 \pm 10\%$  (b)  $23 \times 10^1 \pm 10$   
 (c)  $21 \times 10^3 \pm 5\%$  (d)  $12 \times 10^3 \pm 5\%$

**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)  $2 A$



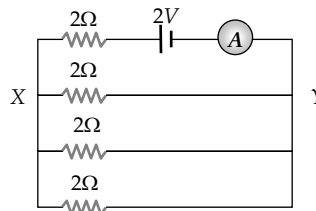
**Ans. (b)** Resistance across  $XY = \frac{2}{3} \Omega$

**Total resistance**

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

**Current through ammeter**

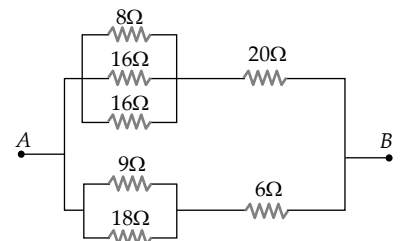
$$= \frac{2}{8/3} = \frac{6}{8} = \frac{3}{4} A$$



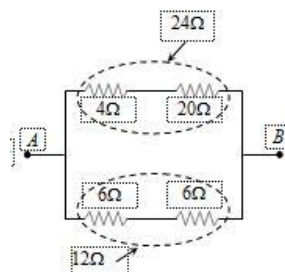
**Applying**

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



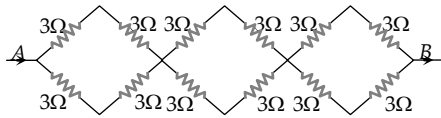
**Ans. (b)** [8Ω, 16Ω, 16Ω are in parallel then equivalent is 4Ω, 9Ω & 18Ω are in parallel their equivalent is 6Ω]



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

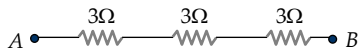
**Applying**

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

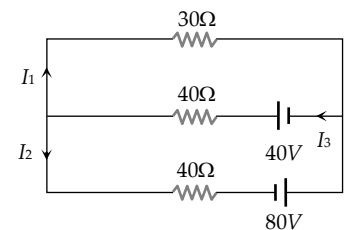


$$\Rightarrow R_{eq} = 9\Omega$$

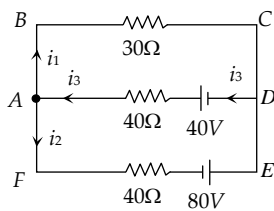
### Applying

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

$$i_3 = i_1 + i_2 \quad \dots(i)$$

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

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

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

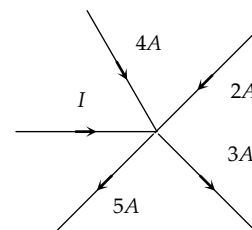
$$\Rightarrow i_1 + 2i_2 = 3 \quad \dots(iii)$$

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

### Applying

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

- (a) 3A (b) 8 A  
 (c) 2A (d) 5A



Ans. (c)

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

### Understanding

28. Two cells when connected in series are balanced on  $8m$  on a potentiometer. If the cells are connected with polarities of one of the cell is reversed, they balance on  $2m$ . 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  $3\text{ ohm}$  and *emf*  $10\text{ volt}$  is connected to a uniform wire of length  $500\text{ cm}$  and resistance  $3\text{ ohm}$ . The potential gradient in the wire is

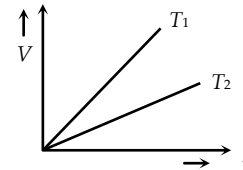
- (a)  $30\text{ mV/cm}$  (b)  $10\text{ mV/cm}$   
 (c)  $20\text{ mV/cm}$  (d)  $4\text{ mV/cm}$

**Ans. (b)** **Potential gradient** =  $\frac{e.R}{(R+r).L} = \frac{10 \times 3}{(3 + 3) \times 5}$   
 $= 1V/m = 10\text{ mV/cm}$ .

**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)  $T_1 < T_2$

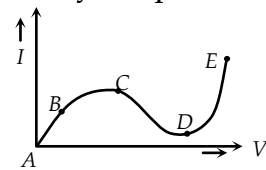


**Ans. (a)**  $T_1 > T_2$

**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 =  $R_{\text{alloy}}$ ; the resistivity of constituent metals  $R_{\text{metal}}$ . Then, usually

- (a)  $R_{\text{alloy}} = R_{\text{metal}}$  (b)  $R_{\text{alloy}} < R_{\text{metal}}$   
 (c) There is no simple relation between  $R_{\text{alloy}}$  and  $R_{\text{metal}}$   
 (d)  $R_{\text{alloy}} > R_{\text{metal}}$

**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

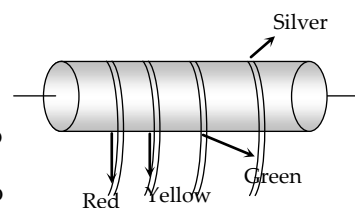
- (a) 1 : 3 : 5 (b) 5 : 3 : 1  
 (c) 1 : 15 : 125 (d) 125 : 15 : 1

**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)  $24 \times 10^6 \Omega \pm 5\%$  (b)  $35 \times 10^6 \Omega \pm 10\%$   
 (c)  $5.6 k \Omega$  (d)  $24 \times 10^6 \Omega \pm 10\%$



**Ans. (d)**  $24 \times 10^6 \Omega \pm 10\%.$

**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

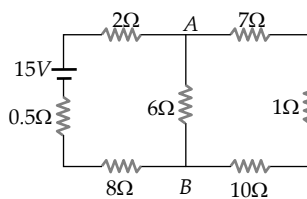
- (a) 1 : 2 (b) 8 : 1  
 (c) 1 : 8 (d) 1 : 1

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

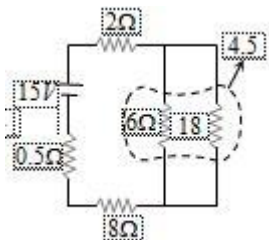
**Understanding**

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  $4R$  resistance.**

**Applying**

**(ii) Completion Type Questions**

1. Kirchoff's I law for electric network is based on \_\_\_\_\_.

**Ans. Conservation of charge)**

**Remembering**

2. Kirchoff'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 Kirchoff'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  $0.1 \Omega$  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 ( $V = E + Ir, = 2 + 5 \times 0.1 = 2.5 \text{ volt}$ )**

**Applying**

11. There is a metal block of dimensions  $20 \times 10 \times 15 \text{ cm}$ . The ratio of the maximum and minimum resistance of the block is \_\_\_\_\_ .

**Ans.**  $4 : 1$  ( $R_{\max} = \rho \frac{20}{10 \times 15}$ ,  $R_{\min} = \rho \frac{10}{20 \times 15}$ ,  $\frac{R_{\max}}{R_{\min}} = \rho \frac{20}{10 \times 15} \times \frac{20 \times 15}{10} = 4 : 1$ )

**Applying**



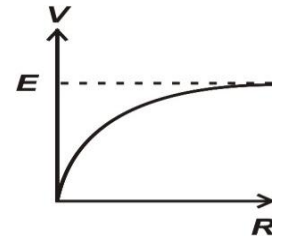
(iii) True/False Type Questions

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 ( $i = \frac{E}{R+r} \Rightarrow i_{\max} = \frac{E}{r}$  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 (a) Joule  
(ii) SI unit of Electric Current (b) Watt  
(c) Ampere

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

Remembering

2. (i) Conductance is reciprocal of (a) Conductivity  
(ii) Resistivity is reciprocal of (b) E. F. Intensity  
(c) Resistance

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

Understanding

3. (i) Kirchoff's I law based upon (a) Law of Conservation of mass  
(ii) Kirchoff's II law based upon (b) Law of Conservation of charge  
(c) Law of Conservation of energy

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

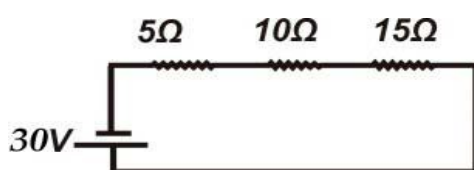
Remembering

4. (i) Ohm's law is applicable for (a) Alloys  
(ii) Ohm's law is not applicable for (b) Carbon resistors  
(c) Diodes

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

Understanding

5. In Given circuit (a) 5 V  
(b) 15 V  
(c) 10 V



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

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)  $\vec{E} \cdot \vec{B}$

Ans. [A]

**Analysing & Evaluating/ Creating**

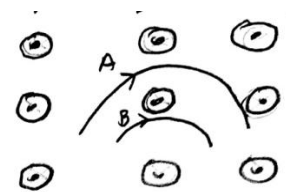
2. A deuteron of kinetic energy 50 keV is describing a circular orbits of radius 0.5 m in a plane perpendicular to the magnetic field  $\vec{B}$ . The kinetic energy of the proton that describes a circular orbit of same radius and inside same  $\vec{B}$  is

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

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

**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



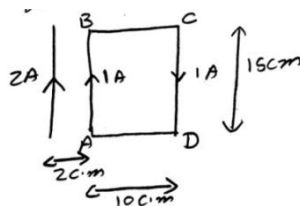
- (a)  $m_A V_A < m_B V_B$                       (b)  $m_A V_A > m_B V_B$   
 (c)  $m_A < m_B$  and  $V_A < V_B$                       (d)  $m_A = m_B$  and  $V_A < V_B$

Ans. [b]  $[r_A > r_B \Rightarrow \frac{m_A V_A}{qB} > \frac{m_B V_B}{qB} \Rightarrow m_A V_A > m_B V_B]$

**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)  $25 \times 10^{-7}$  N towards the wire                      (b)  $25 \times 10^{-7}$  N Away from the wire  
 (c)  $35 \times 10^{-7}$  N, towards the wire                      (d)  $35 \times 10^{-7}$  N away from the wire



Ans. [A]

**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  $r \gg a$  varies

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

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

### 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)**  $[ B = \mu_0 n I = A \pi \times 10^{-7} \times 5 \times 1000 = 2\pi \times 10^{-3} T ]$

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

### 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)**  $\left[ B \propto \frac{1}{r} \right]$

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

**Ans. (a)** **[current in same 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  $\theta$ , 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

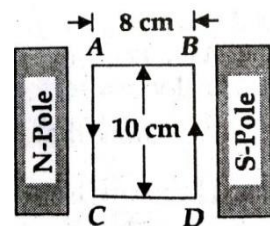
- (a)  $\frac{1}{G}$  (b)  $\frac{1}{G^2}$  (c)  $G$  (d)  $G^2$

**Ans. (a) [ $V_s = \frac{C_s}{G} \Rightarrow \frac{V_s}{C_s} = \frac{1}{G}$ ]**

**Applying**

18. A 100 turns coil shown in the figure carries a current of 2 A in a magnetic field of  $0.2 \text{ Wb} - \text{m}^{-2}$ . 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) [ $\tau = NIAB \sin 90^\circ = 100 \times 2 \times (80 \times 10^{-4}) \times .2 = .32 \text{ N-m}$ ]**

**Applying**

(ii) *Completion Type Questions*

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

**Ans.**  $[C_s = \frac{NBA}{C}]$  **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)  $F = I l B \sin \theta$  and  $\theta = 0^\circ$**

**Understanding**

11. Electric current flows through a thick wire. Magnetic field at a point on its surface is  $(B = \mu_0 I / 2\pi R)$  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  $\sqrt{2}Il / B_0$

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]  $[B = \frac{\mu_0 I}{2\pi r}]$

**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 <sup>2</sup>   |
|                     | (R) Weber/m <sup>2</sup> |

**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)  $3 \times 10^{-5}$  N      (b)  $2.5 \times 10^{-5}$  N      (c)  $1.5 \times 10^{-5}$  N      (d)  $1 \times 10^{-5}$  N

**Ans.- (d)**

### Applying

9. S.I. unit of magnetic pole strength is
- (a) Ampere/meter      (b) Ampere-meter  
(c) volt/meter      (d) Ampere/meter<sup>2</sup>

**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  $\chi$  at  $27^\circ\text{C}$ . At what temperature will its susceptibility be  $0.5 \chi$ .
- (a)  $54^\circ\text{C}$       (b)  $327^\circ\text{C}$   
(c)  $600^\circ\text{C}$       (d)  $237^\circ\text{C}$

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

### 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<sup>2</sup>.

**Ans: True [  $B = \phi / A$  ]**

**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. [  $B = \frac{\mu_0 n I}{2r}$  ]**

**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 radial.

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)  $\mu_r \gg 1$   
(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** 
$$L = \frac{e}{\left(\frac{\Delta I}{\Delta t}\right)} = \frac{200}{\left(\frac{5}{0.1}\right)} = 4$$

**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)  $\pi aB(da/dt)$   
(c)  $\pi a^2(dB/dt)$  (d)  $2\pi aB(da/dt)$

**Answer- d)  $2\pi aB(da/dt)$**

**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  $8 \times 10^{-4}$ Wb, then e.m.f. induced in the wire is
- (a)  $8 \times 10^{-3}$  V (b)  $6 \times 10^{-3}$  V  
(c)  $4 \times 10^{-3}$  V (d)  $2 \times 10^{-3}$  V

**Ans. (d)** 
$$\left[ e = \frac{\Delta\phi}{\Delta t} = \frac{8 \times 10^{-4}}{0.4} = 2 \times 10^{-3} V \right]$$

**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)  $[L = \mu_0 n^2 l A \Rightarrow L \propto n^2]$

**Understanding**

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

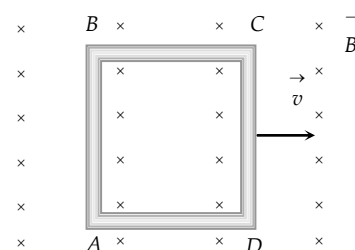
- (a)  $\frac{U}{2}$  (b)  $\frac{U}{4}$   
(c)  $2U$  (d)  $4U$

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

**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

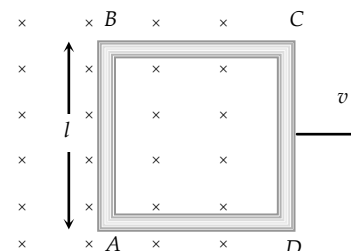
- (a)  $\frac{Blv}{R}$  clockwise  
(b)  $\frac{Blv}{R}$  anticlockwise  
(c)  $\frac{2Blv}{R}$  anticlockwise  
(d) Zero



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  $0.50\text{ m}$  long is rotated with a speed of  $120\text{ rev/min}$  in a plane normal to the earth's magnetic field at the place. If the magnitude of the field is  $0.4\text{ Gauss}$ , the induced e.m.f. between the axle and the rim of the wheel is equal to

- (a)  $1.256 \times 10^{-3}\text{ V}$  (b)  $6.28 \times 10^{-4}\text{ V}$   
 (c)  $1.256 \times 10^{-4}\text{ V}$  (d)  $6.28 \times 10^{-5}\text{ V}$

**Ans. (d)**  $e = Bl^2\pi v = 0.4 \times 10^{-4} \times (0.5)^2 \times (3.14) \times \frac{120}{60}$

**Applying**

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

- (a)  $5.0\text{ coulomb}$  (b)  $4.0\text{ coulomb}$   
 (c)  $1.0\text{ coulomb}$  (d)  $0.8\text{ coulomb}$

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

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

**Applying**

3 Two concentric circular coils one of small radius  $a_1$  and the other of large Radius  $a_2$ , such that  $a_1 \ll a_2$  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  $\mu_r$  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** [ $\phi = BA \cos \theta$  here  $\theta = \angle \vec{B}, \angle \vec{A} = 0^\circ$ ]

**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** [ $L' = \mu_r L$ ]

**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

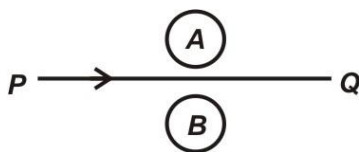


Table A (Coils)

- (a) Coil A
- (b) Coil B

Table B (direction of induced current)

- P) Clock wise
- 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 Hz ac- 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  $\omega$  and fixed amplitude V connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When  $\omega$  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  $\omega$  is applied across an inductance. The instantaneous power developed across it has an angular frequency

(a)  $\omega/4$

(b)  $\omega/2$

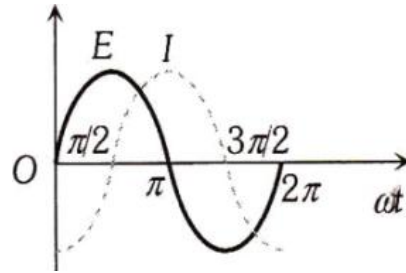
(c)  $\omega$

(d)  $2\omega$

**Ans- (d)**

**Understanding**

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

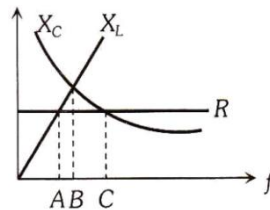


- (a) The voltage lags behind the current by  $\pi/2$   
 (b) The voltage leads the current by  $\pi/2$   
 (c) The voltage and the current are in phase  
 (d) The voltage leads the current by  $\pi$

**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.

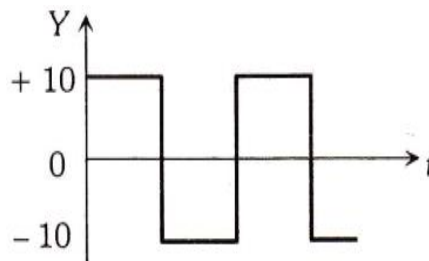


- (a) A  
 (b) B  
 (c) C  
 (d) A and B

**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 series R-C combination, the ac-current may lead ac-voltage by
- (a)  $0^\circ$  (b)  $180^\circ$   
(c)  $30^\circ$  (d)  $90^\circ$

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 low 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**



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)  $0, \frac{\pi}{2}, \frac{2\pi}{2} \dots etc$                       (b)  $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{5\pi}{3} \dots etc$   
(c)  $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4} \dots etc$                       (d)  $0, \frac{\pi}{8}, \frac{\pi}{4} \dots etc$

**Ans. (c)** [at  $t = 0, \frac{T}{2}, T, \frac{3T}{2} \dots$  energy is electrostatic & at  $t = \frac{T}{4}, \frac{3T}{4}, \frac{5T}{4} \dots$  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

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,  $\infty$   
(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

Ans- (a) - (p) , (b) – (s)

**Remembering**

(s) Mho

## 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**  $[\lambda = \frac{c}{\nu} = \frac{3 \times 10^8}{3 \times 10^8} = 1m]$

### 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**  $[ E = h\nu \& p = \frac{h}{\lambda} ]$

**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.  $\gamma$ -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 along x-axis  $E_{\max} = 30 \text{ V/m}$ , the maximum value of magnetic field is \_\_\_\_\_.

**Ans.  $10^{-7} \text{ T}$**

**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**  $[\lambda = \frac{12.42 \times 10^{-7} \text{ eVm}}{11.5 \times 10^3} = 1.08 \text{ \AA}, \text{ so x-rays}]$

**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**  $[\lambda = \frac{c}{\nu} = \frac{3 \times 10^8}{500 \times 10^9} = 6 \times 10^{-4} \text{ m}]$

**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  $\sqrt{\mu\epsilon}$ .

**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  $\omega/k$ .

**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

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

The expression for electric field is

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

**Ans. True**

**Application- solving problems in new situation**



(iv) Matching type Questions

1 Match the following

**EM waves**

- a) Ultraviolet rays
- b) X-rays

Ans- a-P, b-Q

**Remembering**

**Application**

- P) Absorbed by Ozone layer of atmosphere
- Q) To detect fracture of bones
- R) For broadcasting

2 Match the following

**Wavelength (m)**

- a)  $10^{-10}$
- b)  $10^{-3}$

Ans- a-R, b- S

**Remembering**

**Waves**

- P) Radio
- Q) X-Rays
- R) UV Rays
- S) Microwaves

3 Match the following

**Wavelength**

- a)  $10^3$
- b)  $10^{-12}$

Ans- a-P, b-Q

**Application**

**Energy of Photon**

- P)  $1.24 \times 10^{-9} \text{ eV}$
- Q)  $1.24 \times 10^6 \text{ eV}$
- R)  $1.24 \times 10^9 \text{ eV}$

4 Match the following

**EM radiations**

- a) X Rays
- b) Microwaves

Ans-a-Q, b-R

**Remembering**

**Frequency range (Hz)**

- P)  $3 \times 10^{18}$  to  $3 \times 10^{28}$  Hz
- Q)  $10^6$  to  $10^{19}$  Hz
- R)  $1 \times 10^9$  to  $3 \times 10^{11}$  Hz

5 Match the following

**Use**

- a) Water purification
- b) Remote Sensing

Ans-a-Q, b-P

**Remembering**

**Waves**

- P) Microwaves
- Q) UV rays
- R) gamma rays
- S) X-rays



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

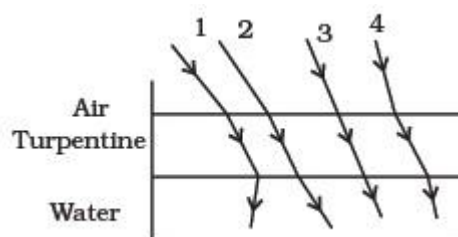
8. An astronomical telescope has a large aperture to:

- (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)  $\gamma$  rays  
(c) radio waves (d) sound waves

Ans-(d)

### Understanding

15. The angle between pass axis of polariser and analyser is  $45^\circ$  ,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)  $30^\circ$  (b)  $45^\circ$   
(c)  $60^\circ$  (d)  $90^\circ$

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  $60^\circ$  is

(a)  $\sqrt{3}$

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

(c)  $\sqrt{2}$

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

Ans- (a)

**Applying**

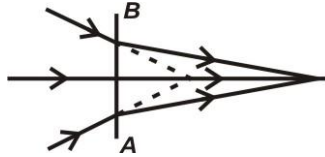
(ii) **Completion Type Questions**

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  $\lambda$  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  $15^\circ$ ,  $25^\circ$  and  $35^\circ$  respectively \_\_\_\_\_ medium will the velocity of light be minimum.

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

**Analysing & Evaluating**

5. One 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  $6000 \text{ \AA}$  falls on plane mirror. The wavelength of reflected light is \_\_\_\_\_.

**Ans.  $6000 \text{ \AA}$**

**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 diopetre 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  $P_1$  and  $P_2$  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  $\delta$  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  $2 \times 10^8 \text{ m/s}$ .

**Ans. True**

**Applying**

8. A thin prism of  $12^\circ$  angle gives a deviation of  $6^\circ$ . 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  $\frac{4}{3}$  and that of glass is  $\frac{3}{2}$ , then refractive index of water w.r.t. glass is  $\frac{9}{8}$ .

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 ( $\lambda$ ) of light, then intensity of scattered light is given by  $I \propto \frac{1}{\lambda^2}$ .

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  $\mu = 1/\sin C$ .

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

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

Ans. (a)-(Q), (b)-(S)

**Remembering**

- 2) (a) The colour scattered most is  
(b) The colour scattered least

- (P) red  
(Q) yellow  
(R) blue  
(S) orange

Ans. (a)-(R), (b)-(P)

**Understanding**

- 3) (a) Intensity of scattered light is directly proportional to  
(b) Total internal reflection occurs when light travel from

- (P) rarer to denser medium  
(Q) denser to rarer medium  
(R)  $\frac{1}{\lambda^4}$   
(S)  $\lambda^4$

Ans. (a)-(R), (b)-(Q)

**Understanding**



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 sources used 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  $\pi$

(b) multiple of  $(2n-1)\pi$

(c) even multiple of  $\pi$

(d) odd multiple of  $\pi$

Ans. (c)

### Remembering

11. The path difference between two waves at the place of destructive interference is given by:

(a) multiple of  $\lambda$

(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)  $D \ll Z_f$

**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  $\lambda$ . 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 Polaroid is a device to produce and detect \_\_\_\_\_ polarised light.

Ans. (Plane)

**[Remembering]**

2 A beam of light is incident normally upon a polariser and the intensity of emergent beam is  $I_0$ . 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  $\pi$ .

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 or 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,  $\lambda$  = wavelength.

**Ans. False**

**[Remembering]**

5. The phase difference between two waves at the place of constructive interference is given as an even multiple of  $\pi$ .

**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  $n\lambda$ . Where  $n = 0,1,2,3$ .

**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 polarised light is allowed to fall upon the analyser. Its angle between analyser and polariser is  $\theta$  then.

**Column I**

- (a)  $\theta = 0^\circ$   
 (b)  $\theta = 45^\circ$

**Answer – (a – i , b – iii)**

**Applying**

**Column II**

- (i) Intensity of final emergent beam =  $I_0 / 2$   
 (ii) Intensity of final emergent beam =  $I_0 / 8$   
 (iii) Intensity of final emergent beam =  $I_0 / 4$

6. Match the following two columns

**Column I**

- (a) Point Source  
 (b) Rectangular Slit kept in front of a distant sources

**Answer – ( a – iii , b – i)**

**Understanding**

**Column II**

- (i) Plane wavefront  
 (ii) Cylindrical wavefront  
 (iii) Spherical wavefront

7. Match the following two columns

**Column I**

- (a) Resolving power of telescope  
 (b) Resolving power of microscope

**Answer – ( a – ii , b – i)**

**Remembering**

**Column II**

- (i)  $2\mu \sin \theta / 1.22\lambda$   
 (ii)  $D / 1.22\lambda$   
 (iii)  $1.22\lambda / 2\mu \sin \theta$

8. Match the following two columns

**Column I**

- (a) Microscope  
 (b) Telescope

**Answer – ( a – ii , b – i)**

**Understanding**

**Column II**

- (i) Resolves  
 (ii) Magnifies  
 (iii) Diverging

9. Match the following two columns

**Column I**

- (a) Intensity at maxima  
 (b) Intensity at minima

**Answer – ( a – ii , b – iii)**

**Remembering**

**Column II**

- (i)  $A_1^2 / A_2^2$   
 (ii)  $(A_1 - A_2)^2$   
 (iii)  $(A_1 + A_2)^2$



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 –

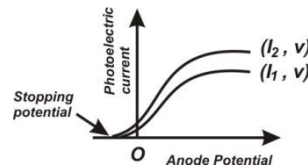
- (a) 1:2 (b) 2:1  
(c) 1:1 (d) 1:3

Ans. (a) [ $I = nh\nu$ ]

**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 [ $KE_{\max} = h\nu - \phi_0 \Rightarrow KE_{\max}$  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 [ $V_0 = \frac{h}{e}\nu - \frac{\phi_0}{e}$ ]

**Analysing & Evaluating**

11. The threshold wavelength for a metal having work function  $\phi_0$  is  $\lambda_0$  , what is the threshold wavelength for a metal whose work function is  $\phi_0 / 2$  .

- (a)  $4 \lambda_0$  (b)  $2 \lambda_0$   
(c)  $\lambda_0/2$  (d)  $\lambda_0 / 4$

Ans. b [ $\phi_0 = \frac{hc}{\lambda_0}$ ]

**Apply**



12. Maximum kinetic energy of emitted electron depends on the frequency of incident photon when frequency of incident photons is
- equal to the threshold frequency
  - half of threshold frequency
  - greater than threshold frequency
  - one third of threshold frequency

**Ans. C**

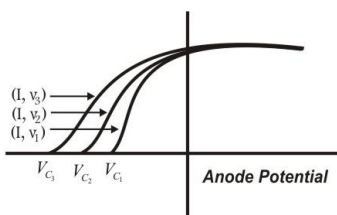
**Understanding**

13. Two particles have equal momentum. What is the ratio of their de-Broglie wavelength?
- 2
  - 1
  - 3
  - 0.5

**Ans. b** [ $\lambda = \frac{h}{p}$ ]

**Analysing & Evaluating**

15. Identify the correct relation for the given diagram for frequency



- $\nu_1 = \nu_2 = \nu_3$
- $\nu_1 > \nu_2 > \nu_3$
- $\nu_1 < \nu_2 < \nu_3$
- $\nu_1 = 2 \nu_2 = 3 \nu_3$

**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**  $[\nu = \frac{c}{\mu}]$

**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.**  $\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$

**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**  $[\lambda = \frac{h}{\sqrt{2mK}} \Rightarrow mK = \text{constant}]$

**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**  $[\phi = h\nu_0]$

**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**  $[eV_0 = h\nu - \phi_0 \quad eV_0' = 2h\nu - \phi_0 = 2eV_0 + \phi_0 \Rightarrow V_0' = 2V_0 + \frac{\phi_0}{e}]$

**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**  $[\nu = \frac{c}{\mu}]$

**Understanding**

13. Emitted photo-electron will possess maximum kinetic energy comparatively if we use light of blue colour rather than red light.

**Ans : True** [ $KE_{\max} = h\nu - \phi_0$  &  $\nu_B > \nu_R$ ]

**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( $\phi$ ) constant. | P. Photocurrent increases.      |
| (b) If Intensity increases keeping $f$ & $\phi$ 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 on heating 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:<br>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<br>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)  $10^{-8}\text{m}$
  - (b)  $10^{-15}\text{m}$
  - (c)  $10^{-12}\text{m}$
  - (d)  $10^{-10}\text{m}$

**Answer : (b)  $10^{-15}\text{m}$**

**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)  $\alpha$  Scattering experiment
  - (d) Thomson's model of atom

**Answer: (c)  $\alpha$  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)  $10^{-3}\text{m}$
  - (b)  $10^{-9}\text{m}$
  - (c)  $10^{-7}\text{m}$
  - (d)  $10^{-5}\text{m}$

**Answer : (c)  $10^{-7}\text{m}$**

**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)  $\frac{Ze^2}{4\pi\epsilon_0 K}$
- b)  $\frac{Ze^2}{2\epsilon_0 K}$
- c)  $\frac{Ze^2}{2\pi\epsilon_0 K}$
- d)  $\frac{Ze^2}{4\epsilon_0 K}$

**Answer: c)  $\frac{Ze^2}{2\pi\epsilon_0 K}$**

**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)  $\frac{e^2}{4\pi\epsilon_0 r}$  (b)  $\frac{e^2}{8\pi\epsilon_0 r}$   
(c)  $\frac{e^3}{8\pi\epsilon_0 r}$  (d)  $\frac{e^2}{3\pi\epsilon_0 r}$

**Ans:- (b)**

**Remembering**

12. What is the order of velocity of electron in a hydrogen atom in ground state.
- (A).  $10^6\text{ms}^{-1}$  (B).  $10^2\text{ms}^{-1}$   
(C).  $10^{10}\text{ms}^{-1}$  (D).  $10^9\text{ms}^{-1}$

**Ans:- (A)  $10^6\text{ms}^{-1}$**

**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-  $E_2 - E_1 = -3.40 - (-13.6) = 10.2\text{eV}$

### 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 3<sup>rd</sup> orbit of an atom?

- (a)  $31.5 \times 10^{-34} \text{ J}\cdot\text{sec}$  (b)  $.315 \times 10^{-34} \text{ J}\cdot\text{sec}$   
(c)  $3.15 \times 10^{-34} \text{ J}\cdot\text{sec}$  (d)  $315 \times 10^{-34} \text{ J}\cdot\text{sec}$

Ans. (c)  $[L_n = \frac{nh}{2\pi} = \frac{3 \times 6.62 \times 10^{-34}}{2 \times 3.14} = 3.15 \times 10^{-34} \text{ J}\cdot\text{S}]$

### 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<sup>-</sup> completely out of the atom is called as

- (a) Kinetic Energy (b) Potential Energy  
(c) Ionisation Energy (d) Excitation energy

Ans. (c)

### Remembering

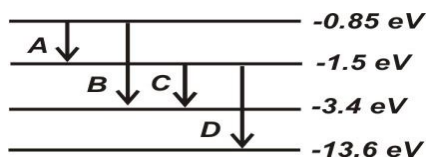
18. The ground state energy of Hydrogen atom is -13.6 eV. What is the KE of an electron in the 3<sup>rd</sup> excited state?

- (a)  $-3.4\text{eV}$  (b)  $-1.51\text{eV}$   
(c)  $-.85\text{eV}$  (d)  $0\text{eV}$

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)  $[\Delta E = \frac{hc}{\lambda} = \frac{12.42 \times 10^{-7} \text{ eVm}}{10.27 \times 10^{-7} \text{ m}} = 12.1 \text{ eV} \text{ \& for transition D, } \Delta E = 12.1 \text{ eV}]$

E & A

20. Bohr's model is most likely to applicable for:

- (a) Spectrum of single  $e^\ominus$  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  $\theta$  for zero value of impact parameter  $b$  is \_\_\_\_\_.

**Answer:  $180^\circ$ .**

**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 decrease with the \_\_\_\_\_ in impact parameter.

**Answer: Increase**

**Understanding**

4. An alpha particle contains \_\_\_\_\_ protons and \_\_\_\_\_ neutrons.

**Answer: Two, two.**

**Remembering**

5. According to 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  $0.5 \text{ \AA}$ , the size of 2<sup>nd</sup> orbit of hydrogen atom would be \_\_\_\_\_.

**Ans.  $2 \text{ \AA}$  {  $r \propto n^2$  }**

**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.  $\nu = \frac{(E_2 - E_1)}{h}$

**Remembering**

12. According to de Broglie a stationary orbit is that which contains an \_\_\_\_\_ number of de -Broglie waves associated with the revolving 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  $(n \rightarrow \infty)$ 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.  $(1.09 \times 10^7 \text{ m}^{-1})$

**Remembering**

19. When an electron jumps from 2<sup>nd</sup> stationary orbit of hydrogen atom to 1<sup>st</sup> stationary orbit, the energy emitted is \_\_\_\_\_.

Ans. 10.2eV

**Applying**

**(iii) True/False Type Questions**

1. Negative sign in expression  $E_n = -\frac{13.6}{n^2} \text{ eV}$  means that the electron is bound with Nucleus.

**Ans. True**

**Understanding**

2. According to Bohr's Postulate electron revolves 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  $\alpha$  - 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

$$\frac{1}{\lambda} = R \left( \frac{1}{4^2} - \frac{1}{n^2} \right), \quad n = 5, 6, 7$$

**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**  $\left[ d = \frac{1}{4\pi\epsilon_0} \frac{(2e)(ze)}{\left(\frac{1}{2}mu^2\right)} \right]$

**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  $180^\circ$ . (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 in the first excited state would be (Q) - 23.8eV

Ans. (a)-(R), (b)-(P)

**Analysing & Evaluating**

2. (a) Kinetic energy in the 1<sup>st</sup> excited state would be (P) 3.4 eV  
(b) Total energy in the first excited state would be (Q) 23.8 eV

Ans. (a)-(P), (b)-(S)

**Analysing & Evaluating**

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)

**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)

**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)

**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  
(S) Gamma region

**Answer: (a) – (P), (b) – (R)**

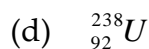
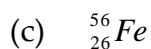
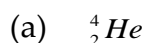
**Remembering**



## NUCLEI - 13

### (i) Multiple Choice Questions

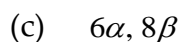
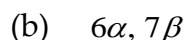
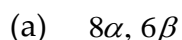
1. The average binding energy per nucleon is maximum for the nucleus.



Ans. (c)

### Remembering

2. In the Uranium radioactive series the initial nucleus is  ${}^{238}_{92}\text{U}$  and that the final nucleus is  ${}^{206}_{82}\text{Pb}$ , when uranium nucleus decays to lead, the number of  $\alpha$ -particle and  $\beta$ -particle emitted are



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. Starting with a sample of pure  $\text{Cu}^{66}$ ,  $\frac{7}{8}$  of it decay into Zn in 15 minutes. The corresponding half life is

(a) 10 minutes

(b) 15 minutes

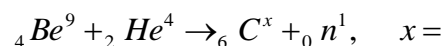
(a) 5 minutes

(d) 7.5 minutes

Ans. (c)

### Applying

5. In reaction:



(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

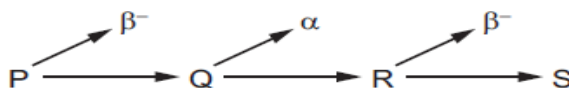
7. Which word equation represents  $\beta^+$  decay?

- (a) proton  $\rightarrow$ neutron + electron + electron antineutrino  
(b) proton  $\rightarrow$ neutron + electron + electron neutrino  
(c) proton  $\rightarrow$ neutron + positron + electron antineutrino  
(d) proton  $\rightarrow$ 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  $\beta^-$  - particle. The second decay results in the emission of an  $\alpha$  -particle. The third decay results in the emission of another  $\beta^-$  - 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  ${}_{92}^{235}\text{U}$  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 of their radii is \_\_\_\_\_.

**Ans. 3 : 5**

**Applying**

5. Complete the equation  ${}^m_n\text{X} \xrightarrow{\alpha \text{ decay}} \text{_____}$ .

**Ans.  ${}^{m-4}_{n-2}\text{Y}$**

**Understanding**

6. The process responsible for energy production in 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  ${}_{6}\text{C}^{12}$ .

**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.  $\beta$ -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  ${}_n X^m$  emits one  $\alpha$  particle and one  $\beta^{-1}$  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  $\alpha$ -ray  $>$   $\beta$ -rays  $>$   $\gamma$ -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  $\beta^-$  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)  $\beta^+$  decay is accompanied with  
(b)  $\beta^-$  decay is accompanied with

Ans. (a-P, b-Q)

Remembering

2. (a) Neutrinos are released in  
(b) atomic number decreases by 2 in

Ans. (a-Q, b-P)

Understanding

3. (a) Weak nuclear forces are involved in  
(b) Lighter nuclei are used

Ans. (a-R, b-Q)

Understanding

5. (a)  $\alpha$  - ray  
(b)  $\gamma$  - ray

Ans. (a-P, b-R)

Remembering

6. (a) Nuclear Fission  
(b) Nuclear Fusion

Ans. (a-P, b-Q)

Understanding

7. (a) Atoms of higher atomic number used  
(b) Atoms of lower atomic number are

Ans. (a-P, b-R)

Understanding

8. (a) Atomic number decreases by 2  
(b) Atomic number increases by 1

Ans. (a-P, b-Q)

Understanding

10. (a) Neutrino emission  
(b) Fast neutrons are slowed to thermal velocities using

Ans. (a-Q, b-(P))

Understanding

- (P) Neutrino  
(Q) Anti neutrino  
(R) X-ray

- (P)  $\alpha$  decay  
(Q)  $\beta$  decay  
(R)  $\gamma$  decay  
(S) electron capture

- (P) Nuclear fission  
(Q) Nuclear fusion  
(R)  $\beta^-$  decay  
(S) Exothermic nuclear reaction

- (P) Low penetrating power  
(Q) Deflected towards positive pole  
(R) High penetrating power

- (P)  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \longrightarrow {}_{56}^{141}\text{Ba} + {}_0^1\text{n} + Q$   
(Q)  ${}^3_1\text{H} + {}^1_1\text{H} \longrightarrow {}^4_2\text{He} + Q$   
(R)  ${}_{90}^{230}\text{Th} \longrightarrow {}_{90}^{226}\text{Ra} + {}^4_2\text{He} + Q$   
(S)  ${}_{55}^{137}\text{Cs} \longrightarrow {}_{56}^{137}\text{Ba} + e^- + \bar{\nu} + Q$

- (P) Nuclear fission  
(Q) Exothermic nuclear reaction  
(R) Nuclear fusion  
(S)  $\beta^-$  - decay

- (P)  $\alpha$ - decay  
(Q)  $\beta^-$  - decay  
(R)  $\gamma$  decay

- (P) Heavy water  
(Q)  $\beta^-$  - decay  
(R)  $\alpha$ - decay



11. (a) Isotopes (P)  ${}_{17}^{37}\text{Cl}$  and  ${}_{19}^{39}\text{K}$   
 (b) Isobars (Q)  ${}_{17}^{37}\text{Cl}$  and  ${}_{16}^{37}\text{S}$   
 (R)  ${}_{1}^1\text{H}$  and  ${}_{1}^2\text{H}$

Ans. (a-R, b-Q)

Applying

12. (a) 1 MeV equals to (P) X = neutron  
 (b)  ${}_{1}^2\text{H} + {}_{1}^2\text{H} \longrightarrow {}_{2}^3\text{He} + X$  (Q) X = electron

Ans. (a-R, b-P) (R)  $1.6 \times 10^{-13} \text{ J}$

Applying

(S)  $1.6 \times 10^{-23} \text{ J}$



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)  $0^{\circ}C$
  - (b)  $-100^{\circ}C$
  - (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  $T_1K$  to  $T_2K$ . 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)**

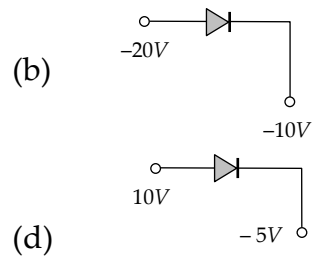
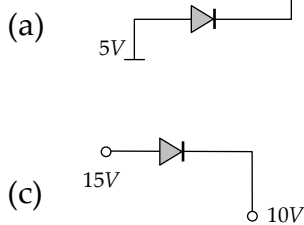
**Remembering**

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



**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 ' $\nu$ '. The output frequency of current is
- (a)  $\nu/2$  (b)  $\nu$   
(c)  $2\nu$  (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 into dc- 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**





<b>Chapter Number</b>	<b>Completion Type</b>	<b>MCQ Type</b>	<b>Matching Type</b>	<b>True False Type</b>	<b>Total Qs.</b>
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