Name:________________

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

Electric Charges and Fields

Harish Shastry -9480198001

1. **Two kinds of charges were identified and named as positive and negative by**
(A) Coulomb (B) Benjamin Franklin (C) Faraday (D) Millikan

2. **The instrument used to detect charges is**
(A) Periscope (B) Endoscope (C) Electroscope (D) Telescope

3. **One of the following methods may be used to charge insulators**
(A) Conduction (B) Induction (C) Friction (D) Radiation

4. **Which of the following material will allow the flow of charges on its surface?**
(A) glass (B) Cotton (C) Dry wood (D) Copper

5. **Two glass rods rubbed with silk are brought nearer. They will**
(A) Repel (B) Attract
(C) Neither attract nor repel (D) Both A and B

6. **The minimum amount of charge that can be added or removed from a body is**
(A) charge of electron (B) Charge of alpha particle
(C) 3.2×10^{-19}C (D) 16×10^{-19}C

7. **As the distance between two charges increases, force between them**
(A) decreases (B) increases
(C) remains the same (D) none of these

8. **Force between two charges depends on**
(A) Distance between charges (B) Magnitude of charges
(C) Medium between charges (D) All the above

9. **A charged body attracts**
(A) opposite kind of charges (B) light uncharged bodies
(C) similar kind of charges (D) both A and B

10. **Property of quantisation of charges was proposed by**
(A) Coulomb (B) Benjamin Franklin (C) Faraday (D) Millikan

11. **Property of quantisation of charges was experimentally proved by**
(A) Coulomb (B) Benjamin Franklin (C) Faraday (D) Millikan

12. **Select the vector quantity among the following**
(A) Electric Charge (B) Electric potential
(C) Electric field (D) Electric current

13. **Electrons are removed from a body. The body is now**
(A) Negatively charged (B) positively charged
(C) Neutral (D) Can't be concluded

14. **Electrons are added to a body. The body is now**
(B) Negatively charged (B) positively charged
(C) Neutral (D) Can't be concluded

15. **A body is negatively charged. After charging, the mass of the body**

(B) decreases
(B) increases
(C) remains the same
(D) none of these

16. **A body is positively charged. After charging, the mass of the body**

(C) decreases
(B) increases
(C) remains the same
(D) none of these

17. **SI unit of electric field is**

(A) NC^{-1}
(B) Vm^{-1}
(C) Neither A nor B
(D) Both A and B

18. **Net charge of a dipole is**

(A) zero
(B) +q
(C) -q
(D) 2q

19. **Direction of dipole moment is**

(A) from negative to positive charge
(B) from positive to negative charge
(C) perpendicular to the line joining the charges
(D) at an angle of 45^o to dipole axis

20. **SI unit of dipole moment is**

(A) Cm
(B) Cm^{-1}
(C) $C^{-1}m$
(D) $C^{-1}m^{-1}$

21. **Intrinsic dipole moment of a polar molecule is (q is net positive charge of dipole and 2a is distance between charges)**

(A) 2aq
(B) aq
(C) aq/2
(D) zero

22. **Intrinsic dipole moment of a non-polar molecule is (q is net positive charge of dipole and 2a is distance between charges)**

(A) 2aq
(B) aq
(C) aq/2
(D) zero

23. **Torque acting on a dipole placed at an angle θ with an electric field is (θ≠0, θ≠180)**

(A) directly proportional to strength of electric field
(B) directly proportional to dipole moment of dipole.
(C) inversely proportional to strength of electric field
(D) Both A and B

24. **In a uniform electric field, a dipole inclined at an angle θ experiences (θ≠0, θ≠180)**

(A) Both torque and force
(B) Only force
(C) Only torque
(D) neither force nor torque

25. **A dipole experiences maximum torque when the angle between electric field and dipole moment is equal to**

(A) 0^o
(B) 180^o
(C) 45^o
(D) 90^o

26. **A dipole experiences minimum torque when the angle between electric field and dipole moment is equal to**

(A) 0^o
(B) 180^o
(C) 90^o
(D) Both A and B

27. **Electric field lines**
(A) Originate from negative charge and terminate in positive charge.
(B) Cross each other
(C) <u>never cross each other</u>
(D) Only A and B are correct

28. **Electric field lines are parallel. This indicates that the electric field**
(A) is Non uniform (B) <u>is uniform</u>
(C) varies with time (D) varies with distance.

29. **SI unit of electric flux is**
(A) <u>$NC^{-1}m^2$</u> (B) $NC^{-1}m^2$ rad (C) NCm^2 (D) NCm^2rad

30. **Flux through a closed surface enclosing dipole is**
(A) <u>zero</u> (B) $1/\varepsilon_o$ (C) $2/\varepsilon_o$ (D) $1/2\varepsilon_o$

31. **Two spheres of radius R and 2R enclose the same charge. Flux through them are in the ratio**
(A) 1:2 (B) 2:1 (C) 1:4 (D) <u>1:1</u>

32. **A sphere and a cube enclose the same charge. If the surface area of cube and sphere are in the ratio 1:2, flux through them are in the ratio**
(B) 1:2 (B) 2:1 (C) 1:4 (D) <u>1:1</u>

33. **A cylindrical gaussian surface lies in a uniform electric field. Flux through it is**
(A) <u>zero</u> (B) $1/\varepsilon_o$ (C) $2/\varepsilon_o$ (D) $1/2\varepsilon_o$

34. **Electric field inside a spherical charged conducting shell**
(A) is same as on the surface (B) varies inversely as the distance
(B) <u>is zero</u> (D) varies inversely as square of the distance

35. **Electric field due to an infinitely large charged plane sheet is**
(A) maximum at infinity
(B) zero at a point close to the sheet
(C) <u>independent of the perpendicular distance from the sheet</u>
(D) varies inversely as the perpendicular distance from the sheet

36. **Electric field due to an infinitely long charged wire varies**
(A) directly as the perpendicular distance from the wire
(B) directly as the square of the perpendicular distance from the wire
(C) <u>inversely as the perpendicular distance from the wire</u>
(D) inversely as the square of the perpendicular distance from the wire

37. **Electric field near an infinitely large charged plane sheet is ($\sigma \rightarrow$surface charge density, $\varepsilon_o \rightarrow$permittivity of free space)**
(A) σ/ε_o. (B) <u>$\sigma/2\varepsilon_o$.</u> (C) $2\sigma/\varepsilon_o$. (D) $\sigma.\varepsilon_o$

38. **Electric field at a distance r from an infinitely long charged wire is ($\lambda \rightarrow$linear charge density, $\varepsilon_o \rightarrow$permittivity of free space)**
(A) <u>$\lambda/2\pi\varepsilon_o r$</u> (B)) $\lambda/\pi\varepsilon_o r$. (C)) $\lambda/2\varepsilon_o r$. (D)) $2\lambda/\pi\varepsilon_o r$.

2. Electrostatic Potential and Capacitors

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1. SI unit of electric potential is

(A) Volt (B) JC^{-1} (C) NC^{-1} (D) Both A and B

2. Due to a point charge electric potential varies

(A) inversely as distance
(B) inversely as square of the distance
(C) directly as the distance
(D) directly as square of the distance

3. Which of the following is not a scalar quantity?

(A) Electric field
(B) Electric potential
(C) Electric flux
(D) Electrostatic potential energy

4. Electric potential due to a dipole

(A) varies inversely as the distance
(B) varies inversely as square of the distance
(C) depends on the sine of the angle between position vector and dipole moment.
(D) only B and C are correct.

5. Equipotential surfaces around a point charge are

(A) Parallel planes
(B) concentric cylinders with axis along the charge.
(C) Concentric spheres with point charge at the centre
(D) none of these

6. What is the potential difference between any two points over the equipotential surface?

(A) 1V
(B) zero
(C) any potential difference is possible
(D) infinity

7. Component of electric field (E) along the equipotential surface is

(A) E cos 45^o (B) E Sin45^o (C) E (D) zero

8. Two positive charges separated by certain distance are kept in free space. As soon as they are allowed

(A) potential energy between them increases and kinetic energy decreases.
(B) potential energy between them decreases and kinetic energy increases.
(C) Both potential energy and kinetic energy decreases.
(D)) Both potential energy and kinetic energy increases.

9. Electric potential on equatorial plane of an electric dipole is

(A) 2V (B) 1V (C) zero (D) infinity

10. On the equatorial plane of an electric dipole,

(A) $V=0$ and $E\neq 0$
(B) $V\neq 0$ and $E=0$
(C) $V=0$, $E=0$
(D) $V\neq 0$ and $E\neq 0$

11. Inside a charged conducting spherical shell

(A) $V=0$ and $E\neq 0$
(B) $V\neq 0$ and $E=0$
(C) $V=0$, $E=0$
(D) $V\neq 0$ and $E\neq 0$

12. **Potential energy between 2-point charges Q_1 and Q_2, separated by a distance r in vacuum is given by**

(A) $\frac{1}{4\pi\varepsilon_o}\frac{Q_1Q_2}{r^2}$ (B) $\frac{1}{4\pi\varepsilon_o}\frac{Q_1Q_2}{r}$ √ (C) $\frac{1}{4\pi\varepsilon_o}\frac{Q_1Q_2}{r^3}$ (D) $\frac{1}{4\pi\varepsilon_o}\frac{Q_1Q_2}{2r}$

13. **An electron is accelerated through a potential difference of 1V. Energy gained by the electron is**

(A) 1eV (B) $1.6\text{x}10^{-19}$J (C) $1.6\text{x}10^{-19}$eV (D) Both A and B

14. **Potential energy of a dipole placed in an electric field is given by (p→dipole moment, E→strength of electric field, θ→angle between electric field and dipole moment)**

(A) -pESinθ (B) -pE tanθ (C) -pECosθ (D) -pECosecθ

15. **Potential energy of a dipole is zero when its dipole moment is aligned**

(A) parallel to the electric field
(B) antiparallel to the electric field
(C) perpendicular to the electric field
(D) at an angle of 45^o to the electric field.

16. **Electric field at a point very close to the surface of a charged conductor is given by (σ→surface charge density, ε_o→permittivity of free space)**

(A) σ/ε_o. (B) $\sigma/2\varepsilon_o$. (C) $2\sigma/\varepsilon_o$. (D) $\sigma.\varepsilon_o$.

17. **Sensitive instruments may be protected from outside electric influence by keeping them inside the cavity of a conductor because**

(A) Electric field is zero inside the cavity of a conductor.
(B) Electric potential is zero inside the cavity of a conductor.
(C) Electric field is maximum inside the cavity of a conductor
(D) electric potential varies by large amount inside the cavity of a conductor.

18. **Polar molecules**

(A) have intrinsic dipole moment (B) do not have intrinsic dipole moment.
(C) do not have dipole length (D) have net charge greater than zero.

19. **Non-Polar molecules**

(A) have intrinsic dipole moment (B) do not have intrinsic dipole moment.
(C) Have dipole length (D) have net charge greater than zero.

20. **Which is the polar molecule among the examples given below?**

(A) H_2 (B) N_2 (C) O_2 (D) NH_3

21. **Which is the non-polar molecule among the examples given below?**

(A) H_2O (B) N_2 (C) SO_2 (D) HCl

22. **The electric field above which dipoles in an insulator break and charges separate is called**

(A) dielectric polarisation (B) dielectric breakdown
(C) dielectric strength (D) dielectric constant

23. **Dielectric strength of a material is measured using SI unit**

(A) Vm^{-1} (B) V (C) JC^{-1} (D) Cm^{-2}

24. **Capacity of a conductor to store charges depends on**

(A) size of the conductor (B) dielectric constant of surrounding medium
(C) neighbouring conductors (D) All the above

25. As the neighbouring conductor is brought nearer to a conductor, its capacity

(A) increases
(B) decrease
(C) does not change
(D) may increase or decrease depending on the medium between them

26. A spherical conductor is charged to Q. Potential on its surface is V. Capacity of the conductor to store charges

(A) depends on charge Q stored on its surface
(B) depends on potential V on the surface.
(C) does not depend on charge Q and potential V on the surface
(D) None of the above are true.

27. Capacitance of a parallel plate capacitor can be increased by

(A) increasing the area of plates
(B) decreasing the distance between the plates.
(C) using a medium of higher dielectric constant between the plates
(D) any of the above methods will increase the capacitance.

28. SI unit of capacitance is

(A) coulomb (B) volt (C) farad (D) electron volt

29. If C_o is the capacitance of a capacitor with air as dielectric and C is the capacitance with medium as dielectric, then dielectric constant (K) of the medium between the plates is

(A) $K=C.C_o$ (B) $K=C/C_o$ (C) $K=C_o/C$ (D) $K=C+C_o$

30. Electric field between the plates of a parallel plate capacitor is ($\sigma\rightarrow$surface charge density, $\varepsilon_o\rightarrow$permittivity of free space)

(B) σ/ε_o. (B) $\sigma/2\varepsilon_o$. (C) $2\sigma/\varepsilon_o$. (D) $\sigma.\varepsilon_o$.

31. Permittivity of a medium ε, dielectric constant K and permittivity of free space ε_o are related as

(A) $\varepsilon=K\varepsilon_o$ (B) $\varepsilon=K/\varepsilon_o$ (C) $\varepsilon\varepsilon_o=K$ (D) $\varepsilon_o/\varepsilon=K$

32. When two capacitors of different value are connected in series, equivalent capacitance value

(A) will be lesser than both the values (B) will be more than both the values
(C) will be in between the two values (D) is independent of the two values

33. When two capacitors of different value are connected in parallel, equivalent capacitance value

(A) will be lesser than both the values (B) will be more than both the values
(C) will be in between the two values (D) is independent of the two values

34. When two capacitors of different value are connected in series,

(A) Only Charge stored in each capacitor is same
(B) Only potential difference across each capacitor is same
(C) Both charge stored and potential difference each capacitor are same
(D) Charge stored in each capacitor are different.

35. When two capacitors of different value are connected in parallel,

(A) Only Charge stored in each capacitor is same
(B) Only potential difference across each capacitor is same
(C) Both charge stored and potential difference each capacitor is same
(D) Energy stored in each capacitor is same.

36. Energy stored in a capacitor of capacitance C charged to potential V is given by

(A) $U=\frac{1}{2}CV^2$ (B) $U=\frac{1}{2}QV$
(C) $U=\frac{Q2}{2C}$ (D) All formulas are correct

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

Current Electricity

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1. SI unit of electric current is

(A) Coulomb (B) <u>Ampere</u> (C) Volt (D) Ohm

2. In metals current is due to the flow of

<u>(A) free electrons</u> (B) protons (C) positive ions (D)negative ions

3. According to Ohm's law current through a conductor is

(A) directly proportional to its resistance

(B) directly proportional to square of its resistance

(C) <u>directly proportional to potential difference between the ends of the conductor</u>

(D) inversely proportional to potential difference between the ends of the conductor

4. Identify the one which does not obey Ohm's law

(A) Copper (B) Gold <u>(C) Diode</u> (D) Iron

5. SI unit of resistance is

(A) Coulomb (B) Ampere (C) Volt <u>(D) Ohm</u>

6. Equation which represents Ohm's law mathematically is

(V$\rightarrow$potential difference across the conductor, I$\rightarrow$current through the conductor, R$\rightarrow$resistance of the conductor)

(A) I=V+R (B) R=VI <u>(C) V=IR</u> (D) V=I/R

7. Equation which represents equivalent form of Ohm's law mathematically is

(j$\rightarrow$current density, σ$\rightarrow$conductivity, E$\rightarrow$electric field strength)

(A) $j = \sigma/E$ (B) $\sigma = j/E$ (C) $j = \sigma + E$ <u>(D) $j = \sigma E$</u>

8. Resistance of a conductor depends on

(A) potential difference across its ends (B) current through the conductor

<u>(C) length of the conductor</u> (D) direction of current flowing through it

9. Which of the following quantities will decide the resistance of a metal?

(A) length of the metal (B) area of cross section

(C) temperature <u>(D) all the above</u>

10. Which of the following quantities will vary the resistivity of a metal?

(A) length of the metal is increased

(B) area of cross section is decreased

<u>(C) temperature is decreased</u>

(D) all the above

11. Select the vector quantity among the following

(A) electric current (B) potential difference

<u>(C) current density</u> (D) electric charge

12. Reciprocal of resistance is

(A) resistivity (B) conductivity (C) permittivity <u>(D) conductance</u>

13. **Reciprocal of resistivity is**
(A) resistance (B) conductivity (C) permittivity (D) conductance

14. **SI unit of conductance is**
(A) mho (B) ohm (C) ohm meter (D) ohm meter^{-1}

15. **SI unit of resistivity is**
(A) Ωm^{-1} (B) Ω^{-1} m (C) Ω^{-1} m^{-1} (D) Ω m

16. **SI unit of conductivity is**
(A) mho (B) mho meter^{-1} (C) ohm meter (D) ohm meter^{-1}

17. **Current flowing through a conductor per unit cross sectional area normal to the flow called**
(A) current density (B) potential difference
(C) drift velocity (D) resistivity

18. **Average velocity of electrons moving under the influence of electric field in a metal is called**
(A) drift velocity (B) terminal velocity
(C) critical velocity (D) rms velocity

19. **Drift velocity acquired by electrons in a conductor per unit electric field is called**
(A) terminal velocity (B) critical velocity
(C) mobility (D) resistivity

20. **For metals as temperature increases, their resistivity**
(A) increases (B) decreases
(C) remains the same (D) first decreases and then increases.

21. **For metals as temperature increases, their conductivity**
(A) increases (B) decreases
(C) remains the same (D) first decreases and then increases.

22. **Materials used for the preparation of standard resistances must have**
(A) low temperature coefficient of resistance.
(B) high temperature coefficient of resistance.
(C) temperature coefficient of resistance equal to infinity.
(D) any value of temperature coefficient of resistance.

23. **Manganin and constantan are used for constructing standard resistance because their …**
(A) temperature coefficient of resistance is large
(B) temperature coefficient of resistance is infinity
(C) temperature coefficient of resistance is very low
(D) temperature coefficient of resistance is negative

24. **Metal strips are used as connecting leads in metre bridge because**
(A) metal strips with less thickness have more resistance. Hence, they can be used to control current flow.
(B) metals strips don't contribute any additional resistance since they have large cross-sectional area and less resistance.

(C) metals strips have high resistance and hence power loss is minimum.
(D) It is easy to fix metal strips in metre bridge board.

25. **SI unit of temperature coefficient of resistance is**
(A) $^{o}C\ ohm^{-1}$ (B) $^{o}C^{-1}\ ohm$ (C) $^{o}C\ ohm$ (D) $^{o}C^{-1}$

26. **Average time interval between two successive collisions of electrons inside a conductor is called**
(A) relaxation time (B) mean life (C) half-life (D) Excitation time

27. **The tolerance value represented by the colour band silver is**
(A) ±10% (B) ±5% (C) ±20% (D) ± 1%

28. **Colour codes in the sequence used to represent the resistance $39x10^{2}\Omega$ are**
(A) Orange, White, Yellow (B) Orange, White, Red
(C) Orange, White, Orange (D) Orange white, Brown

29. **In order to minimise power loss during transmission, electrical power is transmitted at**
(A) high current and low voltages. (B) low current and low voltage
(C) gigh current and high voltage (D) low current and high voltage

30. **Two different resistances are connected in series across a battery. Select the correct sentence**
(A) voltage across both are same (B) power dissipated in both are same
(C) current through both are same (D) All the sentences are correct

31. **Two different resistances are connected in parallel across a battery. Select the correct sentence**
(A) voltage across both are same (B) power dissipated in both are same
(C) current through both are same (D) All the sentences are correct

32. **Two resistances are connected in series. Equivalent resistance of the combination will be**
(A) Lesser than the lowest value of resistance among them
(B) Higher than the highest resistance among them
(C) in between highest and lowest resistances of the combination.
(D) depending on the direction of current flow.

33. **Two resistances are connected in parallel. Equivalent resistance of the combination will be**
(A) Lesser than the lowest value of resistance among them
(B) Higher than the highest resistance among them
(C) in between highest and lowest resistances of the combination.
(D) depending on the direction of current flow.

34. **Equivalent resistance when two resistances R_1 and R_2 are connected in series is given by**
(A) $R_{eq}= R_1+R_2$ (B) $R_{eq}= R_1 \div R_2$
(C) $R_{eq}= (R_1+R_2)/R_1R_2$ (D) $R_{eq}= (R_1R_2)/R_1+R_2$

35. Equivalent resistance when two resistances R_1 and R_2 are connected in parallel is given by

(A) $R_{eq}= R_1+R_2$ (B) $R_{eq}= R_1 \div R_2$
(C) $R_{eq}= (R_1+R_2) /R_1R_2$ (D) $R_{eq}= (R_1R_2) /R_1+R_2$

36. Terminals of a cell are open. Now the potential difference across its terminals is

(A) less than emf of the cell
(B) more than emf of the cell
(C) equal to emf of the cell
(D) equal to potential drop across internal resistance

37. Terminals of a cell are connected by a wire of resistance R. Now the potential difference across its terminals is

(A) less than emf of the cell
(B) more than emf of the cell
(C) equal to emf of the cell
(D) equal to potential drop across internal resistance

38. Opposition offered by a cell to the flow of current through itself is called

(A) External resistance of the cell (B) internal resistance of the cell
(C) Reverse resistance of the cell (D) Forward resistance of the cell

39. Internal resistance of a cell can be measured using

(A) potentiometer (B) electroscope
(C) metre bridge (D) sonometer

40. Two cells of emfs ε_1 and ε_2 are connected in series so as to send the current in the same direction through an external resistance. Now, the equivalent emf of the two cells is

(A) $\varepsilon_1 + \varepsilon_2$ (B) $\varepsilon_1/ \varepsilon_2$ (C) $\varepsilon_2/\varepsilon_1$ (D) $(\varepsilon_1 \varepsilon_2) /(\varepsilon_1 + \varepsilon_2)$

41. Two cells of internal resistances r_1 and r_2 are connected in series. Now, the internal resistance of equivalent cells is

(A) $r_1 r_2$ (B) $r_1+ r_2$ (C) r_2/r_1 (D) $(r_1 r_2) /(r_1+r_2)$

42. Two cells of emfs ε_1 and ε_2 , internal resistances r_1 and r_2 are connected in parallel so as to send the current in the same direction through an external resistance. Now, the equivalent emf of the two cells is

(A) $\varepsilon_1 + \varepsilon_2$ (B) $\varepsilon_1/ \varepsilon_2$ (C) $\frac{\varepsilon_1 r_2+\varepsilon_2 r_1}{r_1+r_2}$ (D) $(\varepsilon_1 \varepsilon_2) /(\varepsilon_1 + \varepsilon_2)$

43. The basic principle behind Kirchhoff's first law is

(A) conservation of energy (B) conservation of momentum
(C) conservation of charge (D) conservation of mass

44. The basic principle behind Kirchhoff's second law is

(A) conservation of energy (B) conservation of momentum
(C) conservation of charge (D) conservation of mass

45. Metre bridge is built on the principle of

(A) Half wave rectifier circuit (B) Wheatstone's Network
(C) Full wave rectifier circuit (D) Resonance network

46. To measure the emf of a cell one may use

(A) metre bridge (B) Ammeter (C) Potentiometer (D) Galvanometer

47. To measure the resistance of a wire, one may use

(A) metre bridge (B) Ammeter (C) Galvanometer (D) Sonometer

48. For measuring emf of a cell, potentiometer is preferred to voltmeter because

(A) potentiometer is an easy device to handle

(B) potentiometer draws more current from the cell.

(C) potentiometer draws no current from the cell.

(D) potentiometer uses a high resistance long wire

49. Wheatstone bridge is the better method to measure resistance of a wire because

(A) No current flows through the wire whose resistance is measured

(B) It is a null method

(C) It uses a one meter long wire

(D) It needs very less current to operate.

50. In a potentiometer circuit, emf of the experimental cell is

(A) inversely proportional to square of balancing length

(B) directly proportional to square of balancing length

(C) inversely proportional to balancing length

(D) directly proportional to balancing length

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

Moving Charges and Magnetism

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1. The concept that moving charges or currents produce a magnetic field was discovered by

(A) Laplace (B) Biot-Savart (C) Flehming <u>(D) Oersted</u>

2. Magnetic field is a

(A) scalar quantity <u>(B) vector quantity</u>
(C) dimensionless quantity (D) a quantity without unit

3. Lorentz force is the force experienced by a charged particle moving in

(A) electric and gravitational field (B) magnetic and gravitational field
<u>(C) electric and magnetic field</u> (D) gravitational field only

4. Force experienced by a positive charged particle moving in a magnetic field is given by

(A) Right hand thumb rule (B) left hand thumb rule
<u>(C) Flehming's right hand rule</u> (D) Kirchhoff's rule

5. Force acting on a charged particle moving in a magnetic field is maximum when

(A) the charged particle moves parallel to the magnetic field
<u>(B) the charged particle moves perpendicular to the magnetic field.</u>
(C) the charged particle moves antiparallel to the magnetic field.
(D) the charged particle moves at an angle of 45^o to the magnetic field

6. Force acting on a charged particle moving in a magnetic field is zero when

<u>(A) the charged particle moves parallel or antiparallel to the magnetic field</u>
(B) the charged particle moves perpendicular to the magnetic field.
(C) the charged particle moves at an angle of 60^o to the magnetic field.
(D) the charged particle moves at an angle of 45^o to the magnetic field

7. Under which condition a particle will experience a force in a magnetic field?

(A) It should be an electrically charged particle.
(B) It should move with certain speed
(C) Direction velocity of the charged particle must make an angle with the magnetic field other than zero or 180^o.
<u>(D) All the above conditions must be satisfied.</u>

8. A neutron moves with a uniform velocity at an angle of 90^o to a uniform magnetic field. Its path will be

(A) a circle (B) a parabola
(C) ellipse <u>(D) a straight line</u>

9. A proton is kept in a uniform magnetic field. The proton will

(A) move in a circle (B) move in a straight line
(C) move in an elliptical path <u>(D) not move</u>

10. A charged particle moves parallel to a magnetic field. Its path is

(A) a circle (B) a parabola
(C) ellipse <u>(D) a straight line</u>

11. **A charged particle moves anti parallel to a magnetic field. Its path is**

(A) a circle
(B) a parabola
(C) ellipse
(D) a straight line

12. **A charged particle moves perpendicular to a magnetic field. Its path is**

(A) a circle
(B) a parabola
(C) ellipse
(D) a straight line

13. **A charged particle moves at an angle θ to a magnetic field. If θ ≠ 0, θ ≠ 180 and θ ≠ 90. Then its path is**

(A) a circle
(B) a helix
(C) ellipse
(D) a straight line

14. **A charged particle moving with a certain speed enters a uniform magnetic field aligned in some other direction to its motion. Now,**

(A) its speed charges
(B) Kinetic energy changes
(C) direction of motion changes
(D) All the above mentioned quantities will change

15. **A charged particle moving with a certain speed enters a uniform electric field aligned in some other direction to its motion. Now,**

(A) its speed charges
(B) Kinetic energy changes
(C) direction of motion changes
(D) All the above mentioned quantities will change.

16. **SI unit of magnetic field strength is**

(A) gauss (B) tesla (C) oersted (D) weber

17. **1 gauss is equal to**

(A) 10^{-4}T (B) 3.6×10^{-4}T (C) 10^{-5}T (D) 3.6×10^{-5}T

18. **Unit of magnetic field in terms of base units is**

(A) $NsC^{-1}m^{-1}$ (B) $Ns^{-1}Cm^{-1}$ (C) $N^{-1}sCm^{-1}$ (D) $N^{-1}s^{-1}Cm^{-1}$

19. **One tesla is equal to**

(A) 1 $NsC^{-1}m^{-1}$ (B) 1 $Ns^{-1}Cm^{-1}$ (C) 1 $N^{-1}sCm^{-1}$ (D) 1 $N^{-1}s^{-1}Cm^{-1}$

20. **Magnitude of force (F) acting on a positively charged particle (q) moving with a speed (v) at an angle of θ to a magnetic field (B) is given by**

(A) $F=q^2vB\sin\theta$ (B) $F=qv^2B\tan\theta$ (C) $F=q^2vB\tan\theta$ (D) $F=qvB\sin\theta$

21. **Magnitude of force (F) acting on a conductor of length L carrying current I at an angle of θ to a magnetic field (B) is given by**

(A) $F=B^2IL\sin\theta$ (B) $F=BI^2L\tan\theta$ (C) $F=B^2IL\tan\theta$ (D) $F=BIL\sin\theta$

22. **Force acting on a conductor carrying current placed in a uniform magnetic field will be maximum if**

(A) It is placed parallel to the magnetic field
(B) It is placed perpendicular the magnetic field
(C) It is placed at an angle of 45° to the magnetic field.
(D) It is placed at an angle of 60° to the magnetic field.

23. **Force acting on a conductor carrying current placed in a uniform magnetic field will be minimum if**

(E) <u>It is placed parallel to the magnetic field</u>
(F) It is placed perpendicular the magnetic field
(G) It is placed at an angle of 45^o to the magnetic field.
(H) It is placed at an angle of 60^o to the magnetic field.

24. **When a charged particle is describing helix in a magnetic field, distance moved by it along the magnetic field during one rotation is called**

(A) mean free path   <u>(B) pitch</u>
(C) range   (D) circumference

25. **Value of pitch for a charged particle moving perpendicular to the magnetic field is equal to**

<u>(A) zero</u>   (B) radius of the circular path
(C) diameter of the circular path   (D) circumference of the circular path

26. **Lorentz equation is** (F-force, q-charge, E-Electric field, B-Magnetic field, V-velocity of the particle)

(A)) $\vec{F} = q\vec{E} + q(\vec{V} \bullet \vec{B})$ (B) $\vec{F} = q\vec{E} + (\vec{V} \times \vec{B})$
(C) $\vec{F} = \vec{E} + (\vec{V} \times \vec{B})$ <u>(D) $\vec{F} = q\vec{E} + q(\vec{V} \times \vec{B})$</u>

27. **Dimension of** $q\vec{E} + q(\vec{V} \times \vec{B})$ **is**

(A) $[M\,LT^{-1}]$ <u>(B) $[M\,LT^{-2}]$</u>   (C) $[M\,L^{-1}T^{-2}]$ (D) $[M\,L^{-2}T^{-1}]$

28. **A positively charged particle is moving perpendicular to both electric and magnetic fields with a uniform speed. Magnetic and electric fields are mutually perpendicular to each other. The ratio of magnitude of electric field and magnetic field is equal to the speed of the particle. Path traced by the particle is**

(A) a circle   (B) a helix
(C) ellipse   <u>(D) a straight line</u>

29. **A positively charged particle (q) is moving perpendicular to both electric and magnetic fields with a uniform speed. Magnetic and electric fields are mutually perpendicular to each other. The ratio of magnitude of electric field (E) and magnetic field (B) is equal to the speed (v) of the particle. Now, the net force acting on the charged particle is**

(A) qvB   (B) Eq   <u>(C) zero</u>   (D) q(E-vB)

30. **Charge to mass of ratio of electron was first determined by**

(A) Oersted   (B) Tesla   <u>(C) J.J.Thomson</u>   (D) Lorentz

31. **The method employed by J J Thomson while determining the charge to mass ratio of electron is**

(A) magnetic field produced by a current carrying conductor
(B) emf induced in a coil due to varying magnetic field
<u>(C) velocity selector</u>
(D) force on a current element in a magnetic field

32. Mass spectrograph employs the principle of

(A) magnetic field produced by a current carrying conductor
(B) emf induced in a coil due to varying magnetic field
(C) velocity selector
(D) force on a current element in a magnetic field

33. Device used to accelerate charged particles to high energies is

(A) Cyclotron (B) electroscope
(C) mass spectrograph (D) Oscillator

34. In a cyclotron direction of charged particle is changed by applying

(A) electric field (B) magnetic field
(C) Both electric and magnetic field (D) Gravitational field

35. A charged particle of negligible mass can be accelerated in

(A) electric field (B) magnetic field
(C) Gravitational field (D) Both gravitational and magnetic fields

36. Period of rotation of a charged particle in a cyclotron is independent of

(A) radius of circular path (B) charge of the particle
(C) strength of magnetic field (D) mass of the particle

37. Frequency of rotation of a charged particle in a cyclotron is independent of

(A) radius of circular path (B) charge of the particle
(C) strength of magnetic field (D) mass of the particle

38. Cyclotron was invented by

(A) Nicola Tesla (B) Christian Oersted
(C) E.O. Lawrence and M.S. Livingston (D) Laplace

39. Relation between current and magnetic field produced by a current element is given by

(A) Ampere's law (B) Coulomb's law
(C) Biot-Savart's law (D) Maxwell's law

40. Relation between the permittivity of free space ε_0, and the permeability of free space μ_0 then the product $\varepsilon_0\mu_0$ is (take c as speed of light in vacuum

(A) c (B) 1/c (C) $1/c^2$ (D) c^2

41. If permittivity of free space is ε_0 and the permeability of free space is μ_0 then the speed of light in vacuum is given by

(A) $\frac{1}{\sqrt{\mu_o \varepsilon_o}}$ (B) $\sqrt{\mu_o \varepsilon_o}$ (C) $\frac{\sqrt{\mu_o}}{\sqrt{\varepsilon_o}}$ (D) $\frac{\sqrt{\varepsilon_o}}{\sqrt{\mu_o}}$

42. Magnetic field produced by a circular coil carrying current is maximum

(A) at the centre of the coil
(B) near the circumference of the coil
(C) at infinite distance from the centre of the coil along the axis of the coil.
(D) at a distance √2 times the radius from the centre of the coil

43. **Magnetic field due to an infinitely long straight current carrying wire at a distance r outside is**

(A) directly proportional to r
<u>(B) inversely proportional to r</u>
(C) directly proportional to r^2
(D) inversely proportional to r^2

44. **Magnetic field due to an infinitely long straight current carrying wire at a distance r from its axis within the wire is**

<u>(A) directly proportional to r</u>
(B) inversely proportional to r
(C) directly proportional to r^2
(D) inversely proportional to r^2

45. **The line integral $\oint \vec{B}.\vec{dL}$ in a closed curve is equal to (with usual symbols)**

(A) μ_o times the net magnetic field within the area bounded by the loop
(B) net current through the area bounded by the loop
<u>(C) μ_o times the net current through the area bounded by the curve</u>
(D) the magnetic field within the area bounded by the loop

46. **Magnetic field due to an infinitely long solenoid is**

<u>(A) uniform along the axis inside.</u>
(B) uniform outside the solenoid
(C) uniform at the edges
(D) maximum at the edges

47. **Magnetic field due to an infinitely long solenoid is**

(A) <u>directly proportional to current through it</u>
(B) inversely proportional to the current through it
(C) directly proportional to square of current through it
(D) inversely proportional to square of the current through it.

48. **Magnetic field inside a solenoid is given by (μ_o- permeability of vacuum, n-number of turns per unit length, I- current through solenoid)**

(A) μ_o /nI
<u>(B) μ_onI</u>
(C) nI/μ_o
(D) μ_on/I

49. **Magnetic field inside a toroid is given by (μ_o- permeability of vacuum, n-number of turns per unit length, I- current through solenoid)**

(A) μ_o /nI
<u>(B) μ_onI</u>
(C) nI/μ_o
(D) μ_on/I

50. **Which one of the following device can be used to produce very strong uniform magnetic field?**

<u>(A) solenoid</u>
(B) cyclotron
(C) Galvanometer
(D) spectrograph

51. **Like currents**

(A) repel each other
<u>(B) attract each other</u>
(C) do produce magnetic fields
(D) are the sources of gravitational field.

52. **Unlike currents**

<u>(A) repel each other</u>
(B) attract each other
(C) do produce magnetic fields
(D) are the sources of gravitational field.

53. **Two infinitely long straight parallel conductors each carrying current of 1A in the same direction kept separated by a distance of 1m in air**

<u>(A) attract each with a force of $2x10^{-7}$ Nm^{-1}.</u>
(B) repel each with a force of $2x10^{-7}$ Nm^{-1}.
(C) attract each with a force of $1x10^{-7}$ Nm^{-1}.
(D) repel each with a force of $1x10^{-7}$ Nm^{-1}.

54. A current loop placed in a uniform magnetic field

(A) experiences only force
(B) experiences only torque
(C) experiences both torque and force
(D) does not experience both torque and force

55. Torque acting on a current loop is maximum when

(A) plane of the coil is parallel to the uniform magnetic field
(B) plane of the coil is perpendicular to the uniform magnetic field
(C) plane of the coil is at angle of 45^0 with the uniform magnetic field.
(D) plane of the coil is at angle of 60^0 with the uniform magnetic field

56. SI unit of magnetic moment is

(A) Am (B) Am^2 (C) A^2m (D) Am^{-2}

57. A rectangular coil carrying current is placed with its plane making an angle of 90º with the direction of magnetic field. Now, the torque acting on it is

(A) zero (B) maximum
(C) will depend on the current through it (D) BIM / √2

58. Net force acting on a circular current loop placed in a uniform magnetic field is

(A) BIL/2 (B) BIL (C) 2BIL (D) zero

59. Expression for Bohr magneton is

(A) $\mu = \frac{h}{4\pi m_e}$ (B) $\mu = \frac{eh}{4\pi m_e}$ (C) $\mu = \frac{e}{4\pi h m_e}$ (D) $\mu = \frac{\pi h}{4 e m_e}$

60. The value of Bohr magneton is s

(A) $9.27\text{x}10^{-25}$ Am^2 (B) $9.27\text{x}10^{-26}$ Am^2
(C) $9.27\text{x}10^{-24}$ Am^2 (D) $9.27\text{x}10^{-23}$ Am^2

61. Current flowing through a circuit can be detected using

(A) cyclotron (B) galvanometer
(C) mass spectrograph (D) electroscope

62. For a galvanometer, deflection per unit current is

(A) range (B) current sensitivity
(C) cut off current (D) power

63. Sensitivity of a galvanometer can be increased by

(A) increasing number of turns in the coil
(B) decreasing the area of the coil
(C) decreasing the strength of the magnetic field between the pole pieces
(D) increasing the torsional constant of the spring

64. Current flowing through a circuit can be measured using

(A) voltmeter (B) galvanometer (C) meter bridge (D) ammeter

65. A galvanometer is converted into ammeter by

(A) Connecting a high resistance in series with its coil
(B) Connecting a low resistance in series with its coil
(C) Connecting a high resistance in parallel with its coil
(D) Connecting a low resistance in parallel with its coil

66. Range of an ammeter can be increased by

(A) Increasing the value of shunt resistance

(B) Decreasing the value of shunt resistance

(C) Connecting another low resistance in series with the shunt resistance.

(D) Decreasing the strength of the magnetic field between the pole pieces.

67. Potential difference across any component in a circuit can be measured using

(B) voltmeter (B) galvanometer (C) meter bridge (D) electroscope

68. A galvanometer is converted into voltmeter ammeter by

(A) Connecting a high resistance in series with its coil

(B) Connecting a low resistance in series with its coil

(C) Connecting a high resistance in parallel with its coil

(D) Connecting a low resistance in parallel with its coil

69. Range of a voltmeter can be increased by

(E) Increasing the value of series resistance .

(F) Decreasing the value of series resistance

(G) Connecting another high resistance in parallel with the already connected high resistance.

(H) Decreasing the strength of the magnetic field between the pole pieces.

70. Dimension of magnetic moment is

(A) $[M^2A^1L^2]$ (B) $[M^oA^1L^2]$ (C) $[M^oA^{-1}L^2]$ (D) $[M^oA^1L^{-2}]$

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

5. Magnetism and Matter

Harish Shastry -9480198001

1. **Which is true regarding a bar magnet?**
(A) Magnetic field lines are directed from north to south outside the magnet.
(B) Magnetic field lines do not exist inside a bar magnet.
(C) Magnetic field lines are crowded near the midpoint of the magnet.
(D) Many neutral points exist outside a single bar magnet.

2. **Which is not true regarding magnetic field lines?**
(A) Magnetic field lines do not intersect
(B) magnetic field lines form closed lines
(C) normal to the magnetic field lines gives the direction of magnetic field.
(D) Magnetic field lines are directed from south to north inside a magnet.

3. **Product of area and current through a current loop is called**
(A) magnetic induction (B) magnetic moment
(C) magnetic permeability (D) Bohr magneton

4. **Magnetic field at a distance r on the axial line of a magnetic dipole is**
(A) directly proportional to r^2. (B) inversely proportional to r^2.
(C) directly proportional to r^3. (D) inversely proportional to r^3.

5. **Magnetic field at a distance r on the equatorial line of a magnetic dipole is**
(A) directly proportional to r^2. (B) inversely proportional to r^2.
(C) directly proportional to r^3. (D) inversely proportional to r^3.

6. **Magnetic field at a distance r on the axial line of a magnetic dipole of dipole moment m is given by**
(A) $B = \frac{\mu_o}{4\pi}\frac{2m}{r}$ (B) $B = \frac{\mu_o}{4\pi}\frac{2m}{r^2}$ (C) $B = \frac{\mu_o}{4\pi}\frac{m}{r^3}$ (D) $B = \frac{\mu_o}{4\pi}\frac{2m}{r^3}$

7. **Magnetic field at a distance r on the equatorial line of a magnetic dipole of dipole moment m is given by**
(A) $B = \frac{\mu_o}{4\pi}\frac{2m}{r}$ (B) $B = \frac{\mu_o}{4\pi}\frac{2m}{r^2}$ (C) $B = \frac{\mu_o}{4\pi}\frac{m}{r^3}$ (D) $B = \frac{\mu_o}{4\pi}\frac{2m}{r^3}$

8. **Product of pole strength and length of a magnetic dipole is called**
(A) magnetic induction (B) magnetic moment
(C) magnetic permeability (D) Bohr magneton

9. **Ratio of magnetic moment to the length of magnetic dipole is called**
(A) magnetic induction (B) magnetic permeability
(C)Bohr magneton (D) pole strength

10. **SI unit of magnetic pole strength is**
(A) Am (B) Am^2 (C) Am^{-1} (D) Am^{-2}

11. **Period of oscillation of a magnetic needle in a magnetic field depend on**
(A) directly proportional to the square root of moment of inertia of the needle
(B) inversely proportional to the square root of magnetic moment
(C) inversely proportional to the square root of strength of the magnetic field
(D) all the quantities mentioned above

12. **Torque acting on a magnetic needle placed in a magnetic field is maximum**
(A) when the magnetic moment and magnetic fields are parallel.
(B) when the magnetic moment and magnetic fields are anti parallel.
(C) <u>when the magnetic moment and magnetic fields are perpendicular.</u>
(D) when magnetic moment and magnetic fields are inclined at 45^o.

13. **Magnetic needle placed in a magnetic field will be in stable equilibrium**
(A) <u>when the magnetic moment and magnetic fields are parallel.</u>
(B) when the magnetic moment and magnetic fields are anti parallel.
(C) when the magnetic moment and magnetic fields are perpendicular.
(D) when magnetic moment and magnetic fields are inclined at 45^o.

14. **Magnetic needle placed in a magnetic field will be in unstable equilibrium**
(A) when the magnetic moment and magnetic fields are parallel.
(B) <u>when the magnetic moment and magnetic fields are anti parallel.</u>
(C) when the magnetic moment and magnetic fields are perpendicular.
(D) when magnetic moment and magnetic fields are inclined at 45^o.

15. **Potential energy of a magnetic dipole with its magnetic moment aligned at an angle θ to the external magnetic field is zero when**
(A) $\theta=0^o$ <u>(B) $\theta=90^o$</u>   (C) $\theta=180^o$ (D) $\theta=45^o$

16. **Potential energy stored in a magnetic dipole placed with its magnetic moment (m) inclined at an angle θ to the external magnetic field (B) is given by**
(A) $U = -BM \cot\theta$ (B) $U = -BM \sin\theta$
(C) $U = -BM \tan\theta$ <u>(D) $U = -BM \cos\theta$</u>

17. **The net magnetic flux through any closed surface is (A-area of closed surface)**
(A) unity   (B) μ_o A   (C)) μ_o 2A   <u>(D) zero</u>

18. **Gauss' law in magnetism is**
(A) The net magnetic flux through any closed surface is μ_o times the current
(B) <u>The net magnetic flux through any closed surface is zero</u>
(C) The net magnetic flux through any closed surface is unity
(D) The net magnetic flux through any closed surface is μ_o times magnetic moment

19. **A gaussian surface is enclosing a magnetic dipole. Select the wrong statement**
(A) net magnetic flux through the surface is zero since magnetic field lines form a closed surface.
(B) number of magnetic field lines entering the surface is equal to number of magnetic field lines leaving the surface.
(C) magnetic field lines of the dipole form a closed loop.
<u>(D) net magnetic flux through the surface is unity.</u>

20. **Magnetic inclination (dip angle) is the angle between**
(A) Earth's magnetic field and geographic meridian
(B) Earth's magnetic field and axis of rotation of earth
(C) <u>Earth's magnetic field and its horizontal component.</u>
(D) Earth's magnetic field and its vertical component.

21. **Magnetic declination is the angle between**
(A) Earth's magnetic field and its horizontal component.
(B) Earth's magnetic field and its vertical component.
(C) Geographic meridian and magnetic meridian.
(D) Geographic meridian and axis of rotation of earth.

22. **Inclination is**
(A) maximum at the poles
(B) maximum at the equator
(C) maximum in the region between the pole and equator
(D) uniform at all places of earth

23. **Inclination is**
(A) minimum at the poles
(B) minimum at the equator
(C) minimum in the region between the pole and equator
(D) uniform at all places of earth

24. **What is the value of horizontal component of earth's magnetic field at the place where inclination is 90^o?**
(A) zero (B) 3.5×10^{-5}T (C) 7.0×10^{-5}T (D) 1.75×10^{-5}T

25. **What is the value of vertical component of earth's magnetic field at the place where inclination is 0^o?**
(A) zero (B) 3.5×10^{-5}T (C) 7.0×10^{-5}T (D) 1.75×10^{-5}T

26. **Horizontal component of earth's magnetic at a place is zero. Angle of dip (or inclination) at the place is**
(A) 0^o (B) 90^o (C) 45^o (D) 60^o

27. **Vertical component of earth's magnetic at a place is zero. Angle of dip (or inclination) at the place is**
(A) 0^o (B) 90^o (C) 45^o (D) 60^o

28. **If Z_E is the vertical component and H_E is the horizontal component of earth's magnetic field at a place, then the earth's magnetic field at the place is**
(A) $(Z_E+H_E)^{1/2}$ (B) $(Z_E^2+H_E^2)$
(C) $(Z_E^2+H_E^2)^{1/2}$ (D) (Z_E+H_E)

29. **If Z_E is the vertical component and H_E is the horizontal component of earth's magnetic field at a place, then the tangent of inclination is equal to**
(A) Z_E+H_E (B) $Z_E\ H_E$
(C) $Z_E \div H_E$ (D) $H_E \div H_E$

30. **If Z_E is the vertical component of earth's magnetic field and B_E is the earth's total magnetic field at a place, then**
(A) $Z_E = B_E \sin\theta$ (B) $Z_E = B_E \cos\theta$
(C) $B_E = Z_E \sin\theta$ (D) $B_E = Z_E \cos\theta$

31. **If H_E is the horizontal component of earth's magnetic field and B_E is the earth's total magnetic field at a place, then**
(A) $H_E = B_E \sin\theta$ (B) $H_E = B_E \cos\theta$

(C) $B_E = H_E \sin\theta$ (D) $B_E = H_E \cos\theta$

32. Net magnetic moment per unit volume of a magnetic material is called

(A) magnetisation (B) magnetic intensity
(C) magnetic permeability (D) magnetic susceptibility

33. SI unit of magnetisation is

(A) Am (B) Am^{-2} (C) Am^{-3} (D) Am^{-1}

34. Magnetic intensity is the

(A) ratio of magnetic induction to magnetic susceptibility
(B) ratio of magnetic induction to electric permittivity
(C) ratio of magnetic induction to permeability
(D) ratio of magnetic induction to magnetisation

35. SI unit of magnetic intensity is

(A) Am (B) Am^{-2} (C) Am^{-3} (D) Am^{-1}

36. Magnetic permeability is defined as

(A) ratio of magnetic induction to magnetic susceptibility
(B) ratio of magnetic induction to electric permittivity
(C) ratio of magnetic induction to permeability
(D) ratio of magnetic induction to magnetic intensity

37. SI unit of magnetic permeability is

(A) TAm (B) TAm^{-2} (C) TAm^{-3} (D) $TA^{-1}m$

38. The ratio of magnetisation to magnetic intensity is called

(A) relative permeability (B) absolute permeability
(C) magnetic susceptibility (D) retentivity

39. Relative permeability (μ_r) and susceptibility (χ) of a magnetic material are related as

(A) $\mu_r = 1 - \chi$ (B) $\mu_r = 1 + \chi$ (C) $\chi = \mu_r + 1$ (D) $\mu_r = 1 \div \chi$

40. Dimension of susceptibility is

(A) $[MLT^{-2}]$ (B) $[ML^{-1}T^{-2}]$ (C) $[M^0L^0T^0]$ (D) $[ML^{-2}T^{-1}]$

41. Dimension of relative permeability is

(A) $[MLT^{-2}]$ (B) $[ML^{-1}T^{-2}]$ (C) $[M^0L^0T^0]$ (D) $[ML^{-2}T^{-1}]$

42. Relative permeability (μ_r), absolute permeability (μ) and permeability of free space (μ_o) are related as

(A) $\mu_r = \mu \mu_o$ (B) $\mu = \mu_r \mu_o$ (C) $\mu_o = \mu_r \mu$ (D) $\mu = \mu_r + \mu_o$

43. Absolute permeability (μ), susceptibility (χ) and permeability of free space (μ_o) are related as

(A) $\mu = \chi \mu_o$ (B) $\chi = \mu \mu_o$ (C) $\mu = \mu_o (1+\chi)$ (D) $\mu = \mu_o + \chi$

44. **Identify the property exhibited by diamagnetic substances:**

(A) They are repelled by a magnet.
(B) Their susceptibility value is positive.
(C) Their susceptibility varies inversely as absolute temperature.
(D) They have very high value of susceptibility.

45. **Magnetic materials whose susceptivity is very low and positive are**

(A) diamagnetic (B) paramagnetic
(C) ferromagnetic (D) superconductors

46. **Magnetic materials whose susceptivity is high and positive are**

(A) diamagnetic (B) paramagnetic
(C) ferromagnetic (D) superconductors

47. **Magnetic materials which show hysteresis property are**

(A) diamagnetic (B) paramagnetic
(C) ferromagnetic (D) superconductors

48. **Magnetic materials whose susceptivity is inversely proportional to absolute temperature are**

(A) diamagnetic and paramagnetic (B) paramagnetic and ferromagnetic
(C) ferromagnetic and paramagnetic (D) superconductors and diamagnetic

49. **The property exhibited by diamagnetic substances is**

(A) Meisner effect (B) curie law
(C) hysteresis (D) Retentivity

50. **Meissner effect is the phenomenon of**

(A) susceptibility varying inversely as absolute temperature.
(B) of retaining magnetism even after the removal of external magnetic field.
(C) magnetisation lagging behind the magnetic intensity.
(D) perfect diamagnetism in superconductors.

51. **Which is the diamagnetic material among the following?**

(A) Iron (B) cobalt (C) nickel (D) copper

52. **Which is the paramagnetic material among the following?**

(A) Iron (B) cobalt (C) nickel (D) Aluminium

53. **Which is the ferromagnetic material among the following?**

(A) Iron (B) copper (C) Bismuth (D) Aluminium

54. **Super conductors are**

(A) diamagnetic materials (B) paramagnetic materials
(C) ferromagnetic materials (D) non magnetic materials

55. **Curie law for paramagnetic substances states that**

(A) susceptibility of a paramagnetic material is directly proportional to absolute temperature.
(B) susceptibility of a paramagnetic material is directly proportional to square root of absolute temperature.
(C) susceptibility of a paramagnetic material is inversely proportional to square root of absolute temperature.
(D) susceptibility of a paramagnetic material is inversely proportional to absolute temperature.

56. **Soft magnetic materials are those**

(A) which do not exhibit hysteresis property
(B) magnetic materials whose susceptibility id independent of temperature
(C) ferromagnetic materials which lose magnetisation on the removal of external magnetic field.
(D) ferromagnetic materials which retain magnetisation on the removal of external magnetic field.

57. **Hard magnetic materials are those**

(A) which do not exhibit hysteresis property
(B) magnetic materials whose susceptibility id independent of temperature
(C) ferromagnetic materials which lose magnetisation on the removal of external magnetic field.
(D) ferromagnetic materials which retain magnetisation on the removal of external magnetic field.

58. **Curie temperature in magnetism is the temperature**

(A) above which a ferromagnetic material shows the property of paramagnetic material.
(B) below which a ferromagnetic material shows the property of paramagnetic material.
(C) above which a ferromagnetic material shows the property of diamagnetic material.
(D) below which a ferromagnetic material shows the property of diamagnetic material.

59. **Retentivity of a ferromagnetic substance is the**

(A) property of losing magnetisation when external magnetising field is removed.
(B) property of retaining magnetisation when external magnetising field is removed.
(C) property of showing paramagnetic property above curie temperature
(D) property of losing magnetisation when coercive field is applied.

60. **Coercivity of a ferromagnetic substance is the**

(A) property of losing magnetisation when external magnetising field is removed.
(B) property of retaining magnetisation when external magnetising field is removed.
(C) property of showing paramagnetic property above curie temperature
(D) property of losing magnetisation when external magnetic field is reversed.

61. **For a ferromagnetic material, magnetic induction lags behind the strength of magnetic intensity. This is called**

(A) coercivity (B) retentivity
(C) Meissner effect (D) Hysteresis

62. **Substances which at room temperature retain their ferromagnetic property for a long period of time are called**
(A) Temporary magnets (B) permanent magnets.
(C) non magnetic substances (D) electromagnets

63. **Materials used for constructing electromagnets must have**
(A) low permeability and high retentivity
(B) high permeability and low retentivity
(C) high permeability and high retentivity
(D) low permeability and low retentivity

64. **Materials used for constructing permanent magnets must have**
(A) low permeability and high retentivity
(B) high permeability and low retentivity
(C) high permeability and high retentivity
(D) low permeability and low retentivity

65. **Core of a transformer must be a material of**
(A) high permeability, low retentivity and low hysteresis loss
(B) high permeability, high retentivity and low hysteresis loss
(C) low permeability, low retentivity and low hysteresis loss
(D) high permeability, low retentivity and high hysteresis loss

66. **Intrinsic magnetic dipole moment of atoms of diamagnetic materials is**
(A) zero (B) small (C) large (D) infinity

67. **Intrinsic magnetic dipole moment of atoms of paramagnetic materials is**
(A) zero (B) small (C) large (D) infinity

68. **Intrinsic magnetic dipole moment of atoms of ferromagnetic materials is**
(A) zero (B) small (C) large (D) infinity

69. **Core of electromagnets and solenoid are made of**
(A) Soft iron (B) Aluminium
(D) Copper (D) bismuth

70. **Area inside the hysteresis curve represents**
(A) energy dissipated per unit volume
(B) magnetic moment per unit volume
(C) susceptibility of the material
(D) permeability of the specimen

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

6. Electromagnetic induction

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1. Electromagnetic induction is

(A) the magnetic field developed due to displacement current.
(B) The magnetic field developed due to conduction current
(C) induction of emf in a coil when the magnetic lux through it varies with time.
(D) The magnetic field developed due to timely varying electric flux.

2. An emf will be induced in a coil when

(A) a magnet is moved towards and away from the coil.
(B) magnetic is rotated near a coil
(C) Area of cross section of coil is varied.
(D) any oof the above method is followed.

3. Electromagnetic induction was discovered by

(A) Michael Faraday (B) Lenz
(C) Gauss (D) Tesla

4. A magnet and a coil are moved in the same direction with the same speed. Now,

(A) a constant emf is induced in the coil
(B) emf is not induced in the coil
(C) induced current flows through the coil when its ends are connected
(D) emf induced in the coil varies with time.

5. According to Faraday, magnitude emf induced in a coil is

(A) maximum when rate of change of electric flux is lowest
(B) minimum when rate of change of electric flux is highest
(C) maximum when rate of change of electric flux is highest
(D) zero when rate of change of electric flux is highest.

6. SI unit of magnetic flux is

(A) weber (B) weber m^{-2} (C) weber m^{2} (D) weber m^{-1}

7. SI unit of magnetic flux is

(A) T m^{2} (B) weber m^{-2} (C) weber m^{2} (D) weber m^{-1}

8. SI unit of magnetic field is

(A) T m^{2} (B) weber m^{-2} (C) weber m^{2} (D) weber m^{-1}

9. Magnetic flux per unit area is called

(A) magnetic induction (B) magntisation
(C) magnetic susceptibility (D) magnetic permeability

10. Scalar quantity among the following is

(A) Magnetic moment (B) magnetic intensity
(C) magnetic flux (D) magnetisation

11. The magnitude of induced emf in a circuit is equal to time rate of change of magnetic flux through the circuit is

(A) Faraday's law (B) Lenz's law
(C) Gauss' law (D) Kirchoff's law

12. **The law which gives polarity of induced emf in a circuit due to rate of change of magnetic flux is**
(A) Faraday’s law
<u>(B) Lenz’s law</u>
(C) Gauss’ law
(D) Kirchhoff’s law

13. **Lenz’s law is based on**
(A) the law of conservation of charge
<u>(B) the law of conservation of energy</u>
(C) the law of conservation of momentum
(D) the law of conservation of angular momentum

14. **In a closed circuit, electric currents are induced when there is a change in magnetic flux linked with it. This is to**
(A) support the change in magnetic flux
<u>(B) oppose the change in magnetic flux</u>
(C) increase the total energy involved in the process
(D) decrease the total energy involved in the process

15. **North pole of a magnet is moved along the axis towards a circular coil. Direction of current flowing in the side of the coil phasing the magnet is**
<u>(A) anticlockwise</u>
(B) clock wise
(C) normal to the plane of the coil towards the coil
(D) normal to the plane of the coil away from the coil

16. **North pole of a magnet is moved away from a circular coil along the axis of the coil. Direction of current flowing in the side of the coil phasing the magnet is**
(A) anticlockwise
<u>(B) clock wise</u>
(C) normal to the plane of the coil towards the coil
(D) normal to the plane of the coil away from the coil

17. **South pole of a magnet is moved away from the circular coil along the axis of the coil. Direction of current flowing in the side of the coil phasing the magnet is**
<u>(A) anticlockwise</u>
(B) clock wise
(C) normal to the plane of the coil towards the coil
(D) normal to the plane of the coil away from the coil

18. **South pole of a magnet is moved towards a circular coil along the axis of the coil. Direction of current flowing in the side of the coil phasing the magnet is**
(A) anticlockwise
<u>(B) clock wise</u>
(C) normal to the plane of the coil towards the coil
(D) normal to the plane of the coil away from the coil

19. **South pole of a magnet is moved towards a circular coil along the axis of the coil. The side of the coil phasing the magnet**
(A) would act like north pole
<u>(B) would act like south pole</u>
(C) will develop magnetic field lines emerging normally out of the plane of the coil
(D) will develop magnetic field lines emerging parallel to the plane of the coil

20. **South pole of a magnet is moved away from a circular coil along the axis of the coil. The side of the coil phasing the magnet**

(A) would act like north pole
(B) would act like south pole
(C) will develop magnetic field lines normally entering into the plane of the coil
(D) will develop magnetic field lines emerging parallel to the plane of the coil

21. **North pole of a magnet is moved towards a circular coil along the axis of the coil. The side of the coil phasing the magnet**

(A) would act like north pole
(B) would act like south pole
(C) will develop magnetic field lines normally entering into the plane of the coil
(D) will develop magnetic field lines emerging parallel to the plane of the coil

22. **North pole of a magnet is moved away from a circular coil along the axis of the coil. The side of the coil phasing the magnet**

(A) would act like north pole
(B) would act like south pole
(C) will develop magnetic field lines emerging normally out of the plane of the coil
(D) will develop magnetic field lines emerging parallel to the plane of the coil

23. **Which among the following factors does not affect the magnitude emf induced in a metallic rod moving in a magnetic field?**

(A) velocity of the metallic rod (B) length of the metallic rod
(C) strength of the magnetic field (D) Resistance of the metallic rod.

24. **Emf induced in a metallic rod of length L moving perpendicular to a uniform magnetic field B with a speed v is**

(A) $BL \div v$ (B) $B \div Lv$ (C) $Bv \div L$ (D) BvL

25. **Currents induced when bulk pieces of metal are subjected to varying magnetic field are called**

(A) displacement currents (B) conduction currents
(C) wattless currents (D) eddy currents

26. **Eddy currents were discovered by**

(A) Foucault (B) Faraday (C) Lenz (D) Gauss

27. **Eddy currents are reduced in the core of a transformer by**

(A) winding the coil over the core (B) using thick copper wires
(C) using a thick block of insulator (D) laminated iron core

28. **Principle employed in magnetic breaking of trains is**

(A) displacement currents (B) conduction currents
(C) wattless currents (D) eddy currents

29. **Amplitude of oscillations of a metal plate oscillating in a magnetic field damp due to**

(A) displacement currents (B) conduction currents
(C) wattless currents (D) eddy currents

30. Instrument which doesn't employ eddy current principle is

(A) Electric power meter (B) Induction furnace
(C) Magnetic break in trains (D) Cyclotron

31. SI unit of self-inductance is:

(A) henry (H) (B) farad (F)
(C) coulomb (C) (D) ohm (Ω)

32. SI unit of mutual -inductance is:

(A) henry (H) (B) farad (F)
(C) coulomb (C) (D) ohm (Ω)

33. Dimension of self-inductance is

(A) $[ML^{-2}T^{-2}A^{2}]$ (B) $[ML^{2}T^{-2}A^{-2}]$ (C) $[ML^{3}T^{-2}A^{-2}]$ (D) $[M^{2}L^{2}T^{-2}A^{-2}]$

34. Vector quantity among the following is

(A) Magnetic induction (B) magnetic flux
(C) inductance (D) potential difference

35. Two solenoids of different radii are kept inside one another coaxially. Mutual inductance of inner coil with respect to outer coil is M_{12} and mutual inductance of outer coil with respect to inner coil is M_{21}. Now,

(A) $M_{12} > M_{21}$ (B) $M_{12} < M_{21}$
(C) $M_{12} = M_{21}$ (D) M_{12} is always =0

36. Mutual inductance between a pair of coils is

(A) directly proportional to the product of number of turns in each coil.
(B) inversely proportional to the product of number of turns in each coil.
(C) directly proportional to the square root of product of number of turns in each coil.
(D) inversely proportional to the square root of product of number of turns in each coil.

37. Mutual induction principle is used in

(A) Choke coil (B) Transformer (C) rectifier (D) Cyclotron

38. Self-induction principle is used in

(A) Choke coil (B) Transformer (C) rectifier (D) Cyclotron

39. Mutual inductance between a pair of coils depends on

(A) number of turns in both the coils
(B) permeability of medium inside the coils
(C) relative orientation of the coils
(D) all the above mentioned factors

40. An iron rod is introduced into to a solenoid. Now its self-inductance

(A) increases (B) decreases
(C) remains the same (D) may increase or decrease depending on size of the rod

41. Self induced emf is also called

(A) back emf (B) motional emf (C) terminal emf (D) breakdown emf

42. **Energy stored in an inductor of self-inductance L when current increases from zero to I is**
(A) $U = \frac{1}{2} LI$ (B) $U = I/2L$ (C) $U = \frac{1}{2} LI^2$ (D) $U = \frac{1}{2} L^2 I$

43. **AC generator works on the principle of**
(A) Force on a current carrying conductor placed in magnetic field
(B) electromagnetic induction
(C) production of displacement current due to varying electric flux
(D) magnetic effect of electric current.

44. **Ac generator converts**
(A) Mechanical energy to chemical energy
(B) mechanical energy to electrical energy
(C) electrical energy to mechanical energy
(D) chemical energy to mechanical energy

45. **Peak value of emf generated in an ac generator having coil of N turns , area-A, turning in a magnetic field B at an angular velocity ω is given by**
(A) $E_m = NA^2B\omega$ (B) $E_m = NAB^2\omega$ (C) $E_m = N^2AB\omega$ (D) $E_m = NAB\omega$

46. **Number of cycles of ac generated per second is called**
(A) frequency of ac (B) period of ac
(C) amplitude of ac (D) instantaneous emf

47. **Time taken by ac to complete one full cycle is called**
(A) frequency of ac (B) period of ac
(C) amplitude of ac (D) instantaneous emf

48. **Equation for instantaneous value of emf induced in a generator coil is given by**
(A) $E=E_m\sin(\omega/t)$ (B) $E=E_m\omega \sin\omega t$ (C) $E=EmT \sin\omega t$ (D) $E=E_m\sin\omega t$

49. **In which type of generators potential energy of water stored at height is used as mechanical energy?**
(A) nuclear power generators (B) thermal power generators
(C) hydro electric generators (D) Solar power generators

50. **Maximum emf generated in an ac generator is independent of**
(A) number of turns in the generator coil
(B) area of the coil
(C) frequency of rotation of the coil
(D) resistance of the coil.

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

7. Alternating Current

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1. Relation between peak value of emf (V_m) and rms value of emf (V_{rms}) is

(A) $V_{rms} = V_m \sqrt{2}$ (B) $V_m = V_{rms} \sqrt{2}$
(C) $V_{rms} = V_m - \sqrt{2}$ (D) $V_{rms} = V_m + \sqrt{2}$

2. Relation between peak value of emf (I_m) and rms value of emf (I_{rms}) is

(A) $I_m = I_{rms} \sqrt{2}$ (B) $I_m = I_{rms} \div \sqrt{2}$
(C) $I_{rms} = I_m - \sqrt{2}$ (D) $I_{rms} = I_m + \sqrt{2}$

3. An alternating voltage ,$V=V_m \sin\omega t$ is applied across a resistor. Current through the resistor is

(A) $I=I_m \sin\omega t$ (B) $I=I_m \sin(\omega t+[\pi/2])$
(C) $I=I_m \sin(\omega t - [\pi/2])$ (D) $I=I_m \sin(\omega t+\pi)$

4. In the case of alternating voltage applied to a resistor:

(A) the current leads the voltage by a phase angle of $\pi/2$
(B) the current lags behind the voltage by a phase angle of $\pi/2$
(C) the current and the voltage are in phase
(D) the current leads the voltage by a phase angle of $\pi/4$

5. Average power dissipated in a purely resistive ac circuit is

(A) $P=V_m I_m$ (B) $P=V_{rms} I_{rms}$
(C) $P= V_m\sqrt{2}\ \ I_m\sqrt{2}$ (D) P= zero

6. Power factor in a purely resistive ac circuit is

(A) one (B) infinity (C) zero (D) $1/\sqrt{2}$

7. Phase difference between voltage and current in a purely resistive circuit is

(A) zero (B) π (C) $\pi/2$ (D) $\pi/4$

8. As the frequency of ac increases, resistance of resistor

(A) decreases (B) increases
(C) does not change (D) first increases and then decreases

9. An ac of rms value 10A is passed through a resistor for a certain time. Then a direct current of 10A is passed through the same resistor for the same time. Now,

(A)power developed in both the cases are same
(B) Power developed by dc source is more
(C) Power developed by ac source is more
(D) Power developed in the two cases depends on frequency of ac.

10. The equivalent dc value for an ac which produces the same heat loss in a resistor in a given time is called

(A) Mean value of ac (B) average vale of ac
(C) peak value of ac (D) rms value of ac

11. Average value of an ac for one full cycle is

(A) unity (B) peak value (C) zero (D) rms value

12. **An alternating voltage ,$V=V_m \sin\omega t$ is applied across a capacitor. Current through the capacitor is**
(A) $I=I_m \sin\omega t$ (B) $I=I_m \sin[\omega t+(\pi/2)]$
(C) $I=I_m \sin[\omega t-(\pi/2)]$ (D) $I=I_m \sin(\omega t+\pi)$

13. **In the case of alternating voltage applied to a capacitor:**
(A) the current leads the voltage by a phase angle of $\pi/2$
(B) the current lags behind the voltage by a phase angle of $\pi/2$
(C) the current and the voltage are in phase
(D) the current leads the voltage by a phase angle of $\pi/4$

14. **Average power dissipated in a purely capacitive ac circuit is**
(A) $P=V_mI_m$ (B) $P=V_{rms}\,I_{rms}$
(C) $P= V_m\sqrt{2}\;\; I_m\sqrt{2}$ (D) P= zero

15. **Power factor in a purely capacitive ac circuit is**
(A) one (B) infinity (C) zero (D) $1/\sqrt{2}$

16. **Phase difference between voltage and current in a purely resistive circuit is**
(A) zero (B) π (C) $\pi/2$ (D) $\pi/4$

17. **As the frequency of ac increases, capacitive reactance**
(A) decreases (B) increases
(C) does not change (D) first increases and then decreases

18. **Capacitive reactance is**
(A) inversely proportional to the frequency of ac source.
(B) directly proportional to the capacitance of the capacitor.
(C) independent of the frequency of ac source.
(D) independent of capacitance of the capacitor.

19. **Capacitor offers infinite reactance to**
(A) direct current (B) high frequency ac
(C) resonance frequency (D) ac source of any frequency value

20. **Reactance offered by a capacitor of capacitance C when connected across an ac source of frequency ω is**
(A) $X_c = \omega C$ (B) $X_c = \omega/C$ (C) $X_c = 1/\omega C$ (D) $X_c = C/\omega$

21. **Si unit of capacitive reactance is**
(A) ohm (B) mho (C) farad (D) ohm metre

22. **An alternating voltage, $V=V_m \sin\omega t$ is applied across an inductor. Current through the inductor is**
(A) $I=I_m \sin\omega t$ (B) $I=I_m \sin[\omega t+(\pi/2)]$
(C) $I=I_m \sin[\omega t-(\pi/2)]$ (D) $I=I_m \sin(\omega t+\pi)$

23. **In the case of alternating voltage applied to an inductor:**
(A) the current leads the voltage by a phase angle of $\pi/2$
(B) the current lags behind the voltage by a phase angle of $\pi/2$
(C) the current and the voltage are in phase
(D) the current leads the voltage by a phase angle of $\pi/4$

24. Average power dissipated in a purely inductive ac circuit is

(A) $P=V_mI_m$ (B) $P=V_{rms}\,I_{rms}$
(C) $P= V_m\sqrt{2}\ \ I_m\sqrt{2}$ (D) P= zero

25. Power factor in a purely inductive ac circuit is

(A) one (B) infinity (C) zero (D) $1/\sqrt{2}$

26. Phase difference between voltage and current in a purely inductive circuit is

(A) zero (B) π (C) $\pi/2$ (D) $\pi/4$

27. As the frequency of ac increases, inductive reactance

(A) decreases (B) increases
(C) does not change (D) first increases and then decreases

28. Inductive reactance is

(A) inversely proportional to the frequency of ac source.
(B) directly proportional to the self-inductance of the inductor.
(C) independent of the frequency of ac source.
(D) independent of self-inductance of inductor.

29. An Inductor offers very large reactance to

(A) direct current (B) very high frequency ac
(C) resonance frequency (D) ac source of any frequency value

30. Reactance offered by an inductor to direct current is

(A) almost zero (B) very high
(C) unity (D) depends on the current drawn from dc source

31. Reactance offered by an inductor of self-inductance L when connected across an ac source of frequency ω is

(A) $X_L = \omega L$ (B) $X_L = \omega/L$ (C) $X_L = 1/\omega L$ (D) $X_L = L/\omega$

32. SI unit of inductive reactance is

(A) ohm (B) mho (C) henry (D) ohm metre

33. An inductor stores energy in

(A) gravitational field (B) magnetic field
(C) electric field (D) luminous field

34. A capacitor stores energy in

(A) gravitational field (B) magnetic field
(C) electric field (D) luminous field

35. In a series RLC circuit at resonance

(A) net reactance is equal to resistance
(B) net reactance is equal to the reactance of the capacitor.
(C)net reactance is equal to the reactance of the inductor.
(D) net reactance is zero

36. **In a series RLC circuit, at resonance**

(A) net impedance is equal to the reactance of the capacitor.
(B) net impedance is equal to resistance
(C) net impedance is equal to the reactance of the inductor.
(D) net impedance is zero

37. **In a series RLC circuit, at resonance**

(A) inductive reactance is equal to resistance of resistor.
(B) capacitive reactance is equal to resistance of resistor.
(C) inductive reactance is equal to capacitive reactance.
(D) net impedance is zero

38. **In a series RLC circuit, at resonance**

(A) Potential difference across inductor is equal to potential difference across resistor.
(B) Potential difference across capacitor is equal to potential difference across resistor.
(C) Potential difference across inductor is equal to potential difference across capacitor.
(D) net voltage across resistor and inductor is zero.

39. **In a series RLC circuit, at resonance**

(A) power factor is unity.
(B) current and voltages are in phase.
(C) impedance of the circuit is equal to resistance
(D) All the above statements are correct.

40. **In a series resonance circuit, below the resonance frequency**

(A) Capacitive reactance is greater than the inductive reactance.
(B) Inductive reactance is greater than capacitive reactance.
(C) Inductive and capacitive reactances are equal.
(D) Voltage leads the current

41. **In a series resonance circuit, above the resonance frequency**

(A) Capacitive reactance is greater than the inductive reactance.
(B) Inductive reactance is greater than capacitive reactance.
(C) Inductive and capacitive reactances are equal.
(D) Current leads the voltage.

42. **In a series RLC circuit, current and power dissipated is found to be maximum. Now the frequency ω of ac is**

(A) greater than $\frac{1}{\sqrt{LC}}$ (B) lesser than $\frac{1}{\sqrt{LC}}$
(C) equal to $\frac{1}{\sqrt{LC}}$ (D) equal to $\sqrt{\frac{L}{C}}$

43. **If R is resistance, X_C is capacitive reactance, X_L is inductive reactance then impedance Z is**

(A) $Z = \sqrt{R^2 + (X_C - X_L)^2}$ (B) $Z = \sqrt{R + (X_C - X_L)}$
(C) $Z = R^2 + (X_C - X_L)^2$ (D) $Z = \sqrt{R^2 + (X_C + X_L)^2}$

44. **Current will be wattless in an ac circuit containing**

(A) inductor, capacitor and resistor   (B) inductor and resistor
(C) capacitor and resistor   (4) Inductor and capacitor

45. If R is resistance, X_C is capacitive reactance, X_L is inductive reactance and Z is impedance of series resonance circuit, then power factor, cosϕ is

(A) $\cos\phi = \frac{R}{Z}$ (B) $\cos\phi = \frac{Z}{R}$

(C) $\cos\phi = RZ$ (D) $\cos\phi = R - Z$

46. Dimension of $\sqrt{LC}$ is

(A) $[M^1L^oT^1]$ (B) $[M^oL^1T^1]$

(C) $[M^oL^oT^{-1}]$ (D) $[M^oL^oT^1]$

47. Dimension of $\frac{1}{\sqrt{LC}}$ is

(A) $[M^1L^oT^1]$ (B) $[M^oL^1T^1]$

(C) $[M^oL^oT^{-1}]$ (D) $[M^oL^oT^1]$

48. Frequency of electrical oscillations of a LC circuit is given by

(A) $\omega_o = \frac{1}{2\sqrt{LC}}$ (B) $\omega_o = \frac{1}{\sqrt{L+C}}$

(C) $\omega_o = \frac{1}{\sqrt{LC}}$ (D) $\omega_o = \sqrt{\frac{L}{C}}$

49. As the frequency of ac in a series RLC circuit is increased, the total impedance of the circuit,

(A) increases

(B) decreases

(C) decreases up to resonance and then increases.

(D) remains the same

50. The circuit used for tuning mechanism in radio and TV sets is

(A) Metre bridge circuit (B) Series RLC resonance circuit

(C) Half wave rectifier circuit (D) Full wave rectifier circuit

51. Electrical components needed for electrical resonance circuit are

(A) Resistor and capacitor (B) Resistor and Inductor

(C) Inductor and capacitor (D) Resistor and diode

52. In a series resonance circuit, frequencies at which current will be $\frac{1}{\sqrt{2}}$ times the current at resonance are called

(A) Half power frequencies (B) half resonance frequencies

(C) rms frequencies (D) resonance frequencies

53. Range of frequencies over which current in a series resonance circuit is equal to or more than $\frac{1}{\sqrt{2}}$ times the current at resonance is called

(A) Band width (B) quality factor

(C) half power frequencies (D) resonance frequency

54. In a series resonance circuit, half power frequencies are the frequencies at which

(A) Power is $\frac{1}{\sqrt{2}}$ times the power at resonance and current is half that at resonance

(B) Current is $\frac{1}{\sqrt{2}}$ times the current at resonance and power is half that at resonance

(C) Power is 2 times the power at resonance and current is half of that at resonance

(D) Power is half of that at resonance and current is 2 times that at resonance

55. Ratio of resonance frequency to bandwidth is called

(A) Quality factor (B) half power frequency
(C) resonance frequency (D) power factor

56. Quality factor of a series resonance circuit is given by

(A) $Q=\frac{1}{R}\sqrt{\frac{L}{C}}$ (B) $Q=R\sqrt{\frac{L}{C}}$ (C) $Q=\frac{1}{R}\sqrt{\frac{C}{L}}$ (D) $Q=R\sqrt{\frac{C}{L}}$

57. If X_L and X_C are the inductive and capacitive reactances of a series RLC circuit at resonance, then quality factor is

(A) $Q=\frac{X_L}{R}$ (B) $Q=\frac{X_C}{R}$
(C) $Q=\frac{1}{R}\sqrt{\frac{L}{C}}$ (D) all the equations are correct

58. SI unit of quality factor of a series resonance circuit is

(a) hertz (B) seconds (C) metre (D) no unit

59. As the bandwidth of a series resonance circuit increases, quality factor

(A) increases (B) decreases
(C) first increases and then decreases (D) remains the same

60. Principle of working of a transformer is

(A) Self-induction (B) Ampere-maxwell rule
(C) Mutual induction (D) Wheatstone's bridge

61. Transformer is a device

(A) which converts ac to dc
(B) which converts dc to ac
(C) which increases or decreases the amplitude of ac.
(D) used measure emf of a cell

62. In a step-up transformer

(A) secondary voltage is less than primary and secondary current is more than primary
(B) secondary voltage is more than primary and secondary current is less than primary
(C) both voltage and current at the secondary are more than that at the primary
(D) both current and voltages at the secondary are less than that at the primary

63. In a step-down transformer

(A) secondary voltage is less than primary and secondary current is more than primary
(B) secondary voltage is more than primary and secondary current is less than primary
(C) both voltage and current at the secondary are more than that at the primary
(D) both current and voltages at the secondary are less than that at the primary

64. In a step-up transformer

(A) number of turns in the secondary are more than the number turns at the primary
(B) number of turns in the secondary are less than the number turns at the primary
(C) number of turns in the primary and secondary are equal.
(D) Primary and secondary are connected together by to facilitate current flow.

65. In a step-down transformer

(A) number of turns in the secondary are more than the number turns at the primary
(B) number of turns in the secondary are less than the number turns at the primary
(C) number of turns in the primary and secondary are equal.
(D) Primary and secondary are connected together by to facilitate current flow.

66. A DC battery is applied to the primary of a step-up transformer.

(A) Voltage at the secondary will be more than the DC battery voltage
(B) Voltage at the secondary will be less than the DC battery voltage
(C) Voltage at the secondary will be equal to the DC battery voltage
(D) Voltage at the secondary will be zero

67. In a transformer, primary and secondary are wound over a iron core. This is to

(A) reduce eddy current loss
(B) reduce flux leakage loss
(C) reduce heat loss due to resistance
(D) increase the mass of the transformer.

68. In a transformer, eddy currents losses are minimised by

(A) using thin copper wires
(B) winding more turns of coil
(C) laminated core
(D) using heavy large single iron core.

69. In a transformer, heat loss due to resistance of wires are minimised by

(A) using thin copper wires
(B) winding more turns of coil
(C) using thick copper wires
(D) laminated core.

70. Heat loss due to repeated magnetisation and de magnetisation of the core of a transformer energy is called

(A) Joule heating
(B) eddy current loss
(C) flux leakage loss
(D) hysteresis loss

71. Heat loss due to hysteresis in the core of a transformer can be reduced by

(A) using a material as a core for which area of hysteresis curve is least
(B) using a material as a core for which area of hysteresis curve is maximum
(C) using a material as a core which does not exhibit hysteresis
(D) using diamagnetic materials

72. In order to reduce I^2R power loss during transmission, power is transmitted through cables

(A) at high voltage and low current
(B) low voltage and high current
(C) low voltage and low current
(D) high voltage and high current

73. Ratio of output power to the input power of a transformer is called

(A) quality factor
(B) energy factor
(C) energy loss
(D) efficiency

74. In an ideal transformer

(A) Efficiency is equal to 100%
(B) Electrical energy will be lost in the form of heat
(C) Efficiency is less than 100%
(D) Efficiency will be more than 100%

75. The quantity that doesn't change from input to output of a practical transformer is

(A) Power
(B) voltage
(C) frequency of ac
(D) current

76. In practical transformers

(A) Efficiency is equal to 100%
(B) output electrical energy will be less than the input electrical energy
(C) output electrical energy will be more than input electrical energy
(D) Efficiency will be more than 100%

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

8. Electromagnetic waves

Harish Shastry B-9480198001

1. Inconsistency in Ampere's circuital law was identified by

(A) J.C. Maxwell (B) Gauss
(C) Michael Faraday (D) Heinrich Hertz

2. Electromagnetic wave theory was proposed by

(A) J.C. Maxwell (B) Gauss
(C) Michael Faraday (D) Heinrich Hertz

3. Electromagnetic wave theory was experimentally proved by

(A) J.C. Maxwell (B) Gauss
(C) Michael Faraday (D) Heinrich Hertz

4. Current produced due to timely varying electric field is called

(A) conduction current (B) displacement current
(C) drift current (D) induced current

5. Current produced by flow of electrons due to potential difference is called

(A) conduction current (B) displacement current
(C) drift current (D) induced current

6. By using symbols having usual meaning, displacement current can be expressed as

(A) $\mathrm{i_D} = \in_o \frac{d\phi_E}{\mathrm{dt}}$ (B) $\mathrm{i_D} = \mu_o \frac{d\phi_E}{\mathrm{dt}}$
(C)) $\mathrm{i_D} = \in \frac{dI}{\mathrm{dt}}$ (D) $\mathrm{i_D} = \mu_o \frac{\mathrm{dI}}{\mathrm{dt}}$

7. Mathematically, Ampere-Maxwell law can be written as

(A) $\oint \vec{B} \cdot \overrightarrow{dL} = \mu_o \mathrm{i_c} + \mu_o \frac{d\phi_E}{\mathrm{dt}}$ (B) $\oint \vec{B} \cdot \overrightarrow{dL} = \mu_o \mathrm{i_c} + \mu_o \in_o \frac{d\phi_E}{\mathrm{dt}}$
(C) $\oint \vec{E} \cdot \overrightarrow{dL} = \mu_o \mathrm{i_c} + \mu_o \in_o \frac{d\phi_E}{\mathrm{dt}}$ (D) $\oint \vec{B} \cdot \overrightarrow{dL} = \mu_o \mathrm{i_c} + \in_o \frac{d\phi_E}{\mathrm{dt}}$

8. Electromagnetic waves are produced

(A) by an oscillating charge
(B) by an accelerated charge
(C) when electrons undergo transition from higher energy level to lower energy level
(D) by all the above methods

9. Electromagnetic waves are

(A) transverse waves (B) longitudinal waves
(C) mechanical waves (D) one dimensional waves

10. Angle between electric and magnetic field directions in a electromagnetic wave are

(A) 0^o (B) 90^o (C) 180^o (D) 45^o

11. Angle between magnetic field direction and direction of motion of an electromagnetic wave is

(A) 0^o (B) 90^o (C) 180^o (D) 45^o

12. **Velocity of a electromagnetic wave (c) in terms of permeability (μ_o) and permittivity ($\in_o$) of free space is**

(A) $c = \frac{1}{\mu_o \epsilon_o}$ (B) $c = \sqrt{\mu_o \epsilon_o}$ (C) $c = \frac{1}{\sqrt{\mu_o \epsilon_o}}$ (D) $c = \sqrt{\frac{\mu_o}{\epsilon_o}}$

13. **Dimension of $\sqrt{\mu_o \epsilon_o}$ is**

(A) $[M^oL^1T^{-1}]$ (B) $[M^{-1}L^1T^{-1}]$
(C) $[M^oL^{-1}T^1]$ (D) $[M^oL^2T^{-1}]$

14. **Dimension of $\frac{1}{\sqrt{\mu_o \epsilon_o}}$ is**

(A) $[M^oL^1T^{-1}]$ (B) $[M^{-1}L^1T^{-1}]$
(C) $[M^oL^{-1}T^1]$ (D) $[M^oL^2T^{-1}]$

15. **Velocity of an electromagnetic wave in vacuum in terms of propagation constant (k) and angular frequency (ω) is**

(A) $c=\omega k$ (B) $c= \omega/k$ (C) $c=k/\omega$ (D) $c=\omega+k$

16. **Velocity of an electromagnetic wave in vacuum in terms of peak values of electric (E_o) and magnetic (B_o) fields is**

(A) $c = E_o/B_o$ (B) $c= E_o B_o$ (C) $c= B_o/E_o$ (D) $c= B_o +E_o$

17. **Velocity of light in a material medium depends on**

(A) electrical properties of the medium (B) magnetic properties of the medium
(C) refractive index of the medium (D) All the above factors

18. **Distance travelled by light in air in a time interval of $\frac{1}{2.9979246x10^8}$ seconds is**

(A) 1km (B) 1mm (C) 1μm (D) 1m

19. **Momentum (p) of an electromagnetic wave of energy U is**

(A) $p=U/c$ (B) $p=Uc$ (C) $p=c/U$ (D) $p=c+U$

20. **Energy density of an electromagnetic wave in terms of peak value of electric field E is**

(A) $U = \frac{1}{2}\epsilon_o E^2$ (B) $U = \frac{1}{2}\frac{\epsilon_o}{E^2}$
(C) $U = \frac{1}{2}\frac{E^2}{\epsilon_o}$ (D) $U = 2E^2\epsilon_o$

21. **Energy density of an electromagnetic wave in terms of peak value of magnetic field B is**

(A) $U = \frac{1}{2}\mu_o B^2$ (B) $U = \frac{1}{2}\frac{\mu_o}{B^2}$
(C) $U = \frac{1}{2}\frac{B^2}{\mu_o}$ (D) $U = 2B^2\mu_o$

22. **Electromagnetic waves of lowest wavelength among the following are**

(A) radio waves (B) ultraviolet waves
(C) infrared waves (D) gamma rays

23. **Radio waves may be used**

(A) To ionise atoms (B) in the treatment of cancer
(B) in communication (D) sterilize water

24. **Microwaves waves may be used**

(C) To ionise atoms (B) in the treatment of cancer
(D) ovens (D) sterilize water

25. **Which electromagnetic wave is used in radar communication?**
(A) Micro waves (B) X-rays (C) Gamma rays (D) UV rays

26. **Which electromagnetic waves are referred as heat waves?**
(A) Micro waves (B) radio waves
(C) ultraviolet waves (D) Infra red waves

27. **A hot object can produce**
(A) IR rays (B) X-rays (C) Gamma rays (D) UV rays

28. **Radiations which keep earth warm are**
(A) IR rays (B) X-rays (C) Gamma rays (D) UV rays

29. **When high energy electrons are bombarded bombarded with metal target, electromagnetic waves produced are**
(A) IR rays (B) X-rays (C) Gamma rays (D) UV rays

30. **The electromagnetic radiation used to diagnose the fracture in bones is**
(A) IR rays (B) X-rays (C) Gamma rays (D) UV rays

31. **Which statement among the following is wrong regarding ultra violet rays?**
(A) UV rays are used to sterilize water since they can kill microorganisms.
(B) UV rays are absorbed by glass
(C) Ozone can absorb all radiations except UV rays.
(D) Sun is a source of UV radiation.

32. **Electromagnetic waves used in LASIK eye surgery is**
(A) IR rays (B) X-rays (C) Gamma rays (D) UV rays

33. **Electro magnetic radiation which can kill cells and hence used in the treatment of cancer is**
(A) IR rays (B) X-rays (C) Gamma rays (D) Microwaves

34. **Radioactive sources can produce**
(A) Radio waves rays (B) Laser
(C) Gamma rays. (D) Microwaves

35. **Welders use goggle to protect their eyes from**
(A) IR rays (B) UV-rays
(C) Gamma rays (D) Microwaves

36. **Wavelength range of visible light is**
(A) 700 Å to 400 Å (B) 700nm to 400nm
(C) 400nm to 1nm (D) 400 Å to 1Å

37. **Wavelength range of X-ryas is**
(B) 700 Å to 400 Å (B) 700nm to 400nm
(C) 10nm to 10^{-4}nm (D) 400 Å to 1Å

38. **Radiation which can produvce more melanin and cause skin burn is**
(A) IR rays (B) UV-rays
(C) Gamma rays (D) Microwaves

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

9. Ray optics and optical instruments

Harish Shastry -9480198001

1. When a ray of light falls on a transparent medium, angle of incidence is always equal to

(A) angle of refraction (B) angle of deviation
(C) angle of polarisation <u>(D) angle of reflection</u>

2. Geometric centre of a spherical mirror is called

(A) aperture <u>(B) pole</u> (C) vertex (D) focus

3. Geometric centre of a spherical refracting lens is called

(A) aperture (B) pole <u>(C) optic centre</u> (D) focus

4. The line joining the pole and the centre of curvature of the spherical mirror is known as

<u>(A) the principal axis.</u> (B) the major axis
(C) the minor axis (D) axial line

5. The point on the principal focus at which paraxial rays converge or appear to diverge is called

(A) aperture (B) pole (C) vertex <u>(D) principal focus</u>

6. Distance from principal focus to the pole of a lens or curved mirror is called

(A) mean free path (B) diameter
(C) radius of curvature (D) focal length

7. If f is the focal length of a curved mirror of radius of curvature R, then

<u>(A) f=R/2</u> (B) f=2R (C) f=2/R (D) f=R

8. Which mirror can produce both real and virtual images of a real object?

<u>(A) Concave mirror</u> (B) convex mirror
(C) plane mirror (D) All the above mirror

9. A concave mirror is producing same sized real image. The object distance is

(A) f (B) 4f <u>(C) 2f</u> (D) 3f

10. A mirror is always producing virtual diminished image irrespective of object distance. The mirror is

(A) Concave mirror <u>(B) convex mirror</u>
(C) plane mirror (D) All the above mirror

11. Concave mirror is used by dentists because

(A) it always produces virtual diminished image
(B) it can produce both real and virtual images
<u>(C) it can produce enlarged virtual image</u>
(D) it cannot produce virtual image

12. Convex mirror is used as rear-view mirror because

<u>(A) it can produce virtual diminished image for any object distance</u>
(B) it can produce both real and virtual images
(C) it can produce enlarged virtual image
(D) it cannot produce virtual image

13. **An object is placed at a distance 2f from a concave mirror. The magnification of image is**

(A) m=-2 (B) m = +1 (C) m=+2 (D) m= -1

14. **For a mirror, object distance (u), image distance (v) and focal length (f) are related as**

(A) $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ (B) $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$

(C) $\frac{1}{u}=\frac{1}{v}+\frac{1}{f}$ (D) $\frac{1}{v}=-\frac{1}{f}+\frac{1}{u}$

15. **For an object kept in front of a convex mirror, the magnification is**

(A) is always less than one and positive.
(B) is always less than one and negative
(C) is always greater than one and positive
(D) is always greater than one and negative

16. **When a ray of light travels from one medium to another, the quantity that doesn't change is**

(A) speed of light (B) wavelength of light
(C) colour of light (D) frequency of light

17. **When a ray of light travels from medium 1 to medium 2, the ratio of sine of the angle incidence to sine of the angle of refraction is**

(A) refractive index of medium 2 with respect to medium 1.
(B) refractive index of medium 1 with respect to medium 2.
(C) refractive index of medium 1 with respect to medium 1.
(D) refractive index of medium 2 with respect to medium 2.

18. **Dimension of refractive index is**

(A) $[MLT^{-2}]$ (B) $[M^{-1}LT^{-2}]$ (C) $[M^0LT^{-2}]$ (D) $[M^0L^0T^0]$

19. **The colour of light which travels with highest speed in a medium (other than air) is**

(A) Red (B) Blue (C) violet (D) yellow

20. **The colour of light which travels with least speed in a medium (other than air) is**

(A) Red (B) Blue (C) violet (D) yellow

21. **Refractive index of a medium is highest with respect to the light of colour**

(A) Red (B) Blue (C) violet (D) yellow

22. **Refractive index of a medium is lowest with respect to light of colour**

(A) Red (B) Blue (C) violet (D) yellow

23. **Which coloured light travels with highest speed in vacuum?**

(A) Red (B) Blue
(C) violet (D) all colours travel with equal speeds

24. **Select the phenomenon which does not occur due to refraction**

(A) normal shift (B) lateral shift
(C) mirage (D) bending of light at narrow edges

25. **If an object lying at a real depth (RD) inside a liquid appears to be nearer at a depth AD from the surface, then the refractive index of the liquid is**
(A) n = AD/RD (B) n = RD/AD
(C) n = RD x AD (D) n=RD - AD

26. **Brilliance of diamond is due to**
(A) Interference of light (B) polarisation of light
(C) diffraction of light (D) total internal reflection of light

27. **Critical angle for a pair of media depends on**
(A) Refractive indices of both media (B) colour of light
(C) speed of light in both media (D) all the above quantities

28. **Refractive index of a denser medium kept in air is**
(A) Inversely proportional to the critical angle i_c
(B) Directly proportional to the critical angle i_c
(C) Inversely proportional to the sine of the critical angle ($\sin i_c$)
(D) Directly proportion to the sine of the critical angle ($\sin i_c$)

29. **Optic fibres work on the principle of**
(A) total internal reflection (B) refraction
(C) interference (D) diffraction

30. **Optic fibres are used**
(A) to transmit optical signals
(B) in decorative lamps
(C) to facilitate visual examination of internal organs like stomach and intestines
(D) in all the above applications

31. **Critical angle for the material of the total reflecting prisms used to bend a ray of light by 90^o and 180^o must be**
(A) greater than 90^o (B) 90^o
(C) less than 45^o (D) between 90^o and 180^o

32. **Total reflecting prisms are used**
(A) To turn a ray of light by 90^o. (B) To turn a ray of light by 180^o.
(C) To produce upright image (D) in all the above applications

33. **Which one of the following does not employ the principle of total internal reflection?**
(A) optic fibres (B) total reflecting prisms
(C) diamonds (D) Rear view mirror

34. **Which natural phenomenon among the following is due to total internal reflection of light?**
(A) Spider web appearing coloured (B) Compact disc appearing coloured during day
(C) mirage (D) Normal shift

35. **Focal length of a lens does not depend on**
(A) refractive index of lens and refractive index of surrounding medium.
(B) wavelength of light
(C) radii of curvature of the two surfaces of the lens.
(D) distance of the object from the lens

36. A convex lens of glass and focal f in air is immersed in water. Now its focal length will be

(A) f/2 (B) f/4 (C) f/3 (D) greater than f

37. Reciprocal of focal length of a lens is called

(A) power (B) critical angle
(C) refractive index (D) magnification

38. SI unit of power of lens is

(A) watt (W) (B) dioptre (D)
(C) horse power (hp) (D) joules/second (Js^{-1})

39. Focal length of a lens of power one dioptre is

(A) 10m (B) 1cm (C) 100cm (D) 100m

40. As the focal length of a lens increases, its power

(A) decreases (B) increases
(C) remains the same (D) initially increase and then decreases

41. Power of a lens is

(A) directly proportional to focal length
(B) inversely proportional to the focal length
(C) directly proportional to square root of focal length
(D) inversely proportional to square root of focal length

42. Which lens can produce both real and virtual images of a real object?

(A) Concave lens (B) convex lens
(C) Plano concave lens (D) glass slab

43. A convex lens is producing same sized real image. The object distance is

(A) f (B) 4f (C) 2f (D) 3f

44. A lens is always producing virtual diminished image irrespective of object distance. The lens is

(A) Concave lens (B) convex lens
(C) Plano concave lens (D) Glass sphere

45. An object is placed at a distance 2f from a convex. The magnification of image is

(A) m=-2 (B) m = +1 (C) m=+2 (D) m= -1

46. For an object kept in front of a concave lens, the magnification is

(A) is always less than one and positive.
(B) is always less than one and negative
(C) is always greater than one and positive
(D) is always greater than one and negative

47. A concave mirror is producing real, inverted and magnified image at finite distance. Then the object is

(A) at the principal focus of the mirror
(B) beyond the centre of curvature of the mirror
(C) within the principal focus of the mirror
(D) in between principal focus and centre of curvature of the mirror

48. For a lens object distance (u), image distance (v) and focal length (f) are related as

(A) $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ (B) $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$

(C) $\frac{1}{u}=\frac{1}{v}+\frac{1}{f}$ (D) $\frac{1}{v}=\frac{1}{f}-\frac{1}{u}$

49. When two thin convex lenses of different focal length are kept in contact, the effective focal length of the combination

(A) will be less than the focal length of each lens.
(B) will be more than the focal length of each lens
(C) will be in between the focal length of two lenses
(D) will be equal to focal length of one of the lenses

50. When two thin convex lenses of different power are kept in contact, the effective power of the combination

(A) will be less than the power of each lens
(B) will be more than the power of each lens
(C) will be in between the powers of two lenses
(D) will be equal to power of one of the lenses.

51. A thin concave lens and a thin convex lens, having equal focal lengths are kept in contact. Focal length of the combination is equal to

(A) zero
(B) infinity
(C) double the focal length of each lens
(D) half of the focal length of each lens

52. A thin concave lens and a thin convex lens, having equal focal lengths are kept in contact. Power of the combination is equal to

(A) zero (B) infinity
(C) double the focal length of each lens (D) half of the focal length of each lens

53. Ina prism, as the angle of incidence is increased, angle of deviation

(A) decreases continuously
(B) increases continuously
(C) first decreases, reaches a minimum value and then increases
(D) does not change

54. At the minimum angle of deviation

(A) Angle of incidence and angle of emergence are equal
(B) angle refractions are equal
(C) Angle of the prism is equal to double the angle of retraction
(D) All the statements are correct.

55. In a prism, except at the minimum deviation position, single angle of deviation can be obtained for

(A) two angles of incidence
(B) only one angle of incidence
(C) many angles of incidence
(D) the angle of incidence which is equal to angle of deviation

56. **In a prism the most deviated colour is**
(A) Red (B) Blue <u>(C) violet</u> (D) yellow

57. **In a prism the least deviated colour is**
<u>(A) Red</u> (B) Blue (C) violet (D) yellow

58. **Inside a prism, the colour of light which travels with least speed is**
(A) Red (B) Blue <u>(C) violet</u> (D) yellow

59. **A thin prism is one whose refracting angle is**
(A) equal to 60^o (B) equal to 45^o
(C) equal to 90^o <u>(D) less than 10^o</u>

60. **The phenomenon of splitting of light into its component colours is known as**
(A) Diffraction (B) scattering
(C) total internal reflection <u>(D) dispersion</u>

61. **In vacuum (or air), the speed of light is**
(A) directly proportional to wavelength of light
(B) inversely proportional to wavelength of light
<u>(C) independent of wavelength of light</u>.
(D) inversely proportional to square root of wavelength of light.

62. **Non dispersive among the following is**
(A) glass (B) water <u>(C) vacuum</u> (D) diamond

63. **Sunlight reaches earth in the form of white light and not as its components. This is because**
(A) air and vacuum are non-dispersive
(B) all wavelengths travel with equal speeds in air and vacuum
(C) Both A and B are wrong
<u>(D) Both A and B are correct</u>

64. **During the formation of a rainbow light undergoes**
(A) internal reflection and diffraction (B) refraction and diffraction
(C) interreference and diffraction <u>(D) internal reflection and refraction</u>

65. **We will see a rain bow only when**
<u>(A) our back is towards shining sun and it is raining in our front side</u>
(B) our back is towards raining side and sun is shining in our front side
(C) Both shining sun and raining region is in our back side
(D) Both shining sun and raining region is in our front side

66. **The outermost colour of primary rain bow is**
<u>(A) Red</u> (B) Blue (C) violet (D) green

67. **The inner most colour of primary rain bow is**
(A) Red (B) Blue <u>(C) violet</u> (D) green

68. **As sunlight travels through the earth's atmosphere, its direction is changed by the atmospheric particles. This is called**
(A) <u>scattering</u> (B) dispersion (C) reflection (D) interference

69. According to Rayleigh's scattering, the amount of scattering of light is

(A) inversely proportional to the wavelength
(B) directly proportional to the wavelength
(C) inversely proportional to the fourth power of the wavelength
(D) directly proportional to the fourth power of the wavelength

70. The amount of scattering of light is inversely proportional to the fourth power of the wavelength. This is known as

(A) Rayleigh's law (B) Snell's law
(C) Huygens's principle (D) Newton's law

71. Sky appears blue due to

(A) dispersion of light (B) Rayleigh's scattering
(C) Interference of light (D) Polarisation of light

72. Rayleigh's scattering is found only when

(A) size of the scattering particle is much more than the wavelength of light
(B) size of the scattering particle is much less than the wavelength of light
(C) size of the scattering particle is equal to the wavelength of light
(D) size of the scattering particle is independent of the wavelength of light

73. White colour of clouds is due to

(A) Rayleigh's scattering
(B) clouds containing water droplets scatter all wavelengths equally
(C) cloud reflects sun light completely
(D) All colours are equally absorbed by cloud

74. During sun rise and sun set, sun appears reddish. This sis due to

(A) Rayleigh's law (B) Snell's law
(C) Huygens's principle (D) Newton's law

75. The apparent flattening (oval shape) of the sun at sunset and sunrise is due to

(A) scattering
(B) refraction of light as it passes through different layers of atmosphere.
(C) total internal reflection
(D) dispersion

76. **The closest distance for which the eye lens can focus light on the retina is called**

(A) least distance of distinct vision (B) focal length
(C) far point (D) path length

77. The standard value of near point for normal vision is

(A) 25cm (B) 100cm (C) infinity (D) 25m

78. The highest distance up to which an object can be seen clearly by a normal human being is called

(A) near point (B) far point
(C) critical length (D) visible length

79. Far point for a normal human being is

(A) 25cm (B) 100cm (C) infinity (D) 25m

80. A convex lens is will act like a simple microscope

(A) when the object is beyond 2f distance
(B) when the object is between 2F and 2F
(C) when the object is at 2F
(D) when the object is within the focus.

81. Image formed by a simple microscope is

(A) enlarged, real and erect
(B) diminished, virtual and erect
(C) enlarged, virtual and erect
(D) enlarged, real and erect

82. If D is least distance of distinct vision, magnification of a simple microscope containing a lens of focal length f is

(A) $m = 1 + \frac{f}{D}$
(B) $m = 1 - \frac{D}{f}$
(C) $m = 1 - \frac{f}{D}$
(D) $m = 1 + \frac{D}{f}$

83. Magnification of a simple microscope when the image is formed at infinity is D-least distance of distinct vision, f- focal length of lens

(A) $m = 1 + \frac{f}{D}$
(B) $m = \frac{D}{f}$
(C) $m = \frac{f}{D}$
(D) $m = f + \frac{D}{f}$

84. If D is least distance of distinct vision, f_o is focal length of objective lens, f_e is the focal length of eyepiece and L is tube length then the magnification of compound microscope for image at least distance of distinct vision is

(A) $m = \frac{L}{f_o}\left(1 + \frac{D}{f_e}\right)$
(B) $m = \frac{f_o}{L}\left(1 + \frac{D}{f_e}\right)$
(C) $m = \frac{L}{f_o}\left(1 - \frac{D}{f_e}\right)$
(D) $m = \frac{f_o}{L}\left(1 - \frac{D}{f_e}\right)$

85. If D is least distance of distinct vision, f_o is focal length of objective lens, f_e is the focal length of eyepiece and L is tube length then the magnification of compound microscope for image at infinity is

(A) $m = \frac{L}{f_o}\left(1 + \frac{D}{f_e}\right)$
(B) $m = \frac{f_o}{L}\left(\frac{D}{f_e}\right)$
(C) $m = \frac{L}{f_o}\left(\frac{D}{f_e}\right)$
(D) $m = \frac{D}{L}\left(\frac{f_o}{f_e}\right)$

86. If f_o is focal length of objective lens, f_e is the focal length of eyepiece then the magnification of telescope is

(A) $m = \frac{f_e}{f_o}$
(B) $m = \frac{f_o}{f_e}$
(C) $m = f_o f_e$
(D) $m = f_o + f_e$

87. If f_o is focal length of objective lens, f_e is the focal length of eyepiece then the tube length of a telescope is

(A) $L = \frac{f_e}{f_o}$
(B) $L = \frac{f_o}{f_e}$
(C) $L = f_o f_e$
(D) $L = f_o + f_e$

88. To increase the magnifying power of telescope

(A) focal length of eyepiece must be increased.
(B) focal length of eyepiece must be decreased
(C) focal length of objective must be decreased
(D) eye piece of smaller size must be used.

89. Advantages reflecting telescopes over refracting telescopes is

(A) Reflecting telescopes use concave mirrors which are lighter compared to lenses
(B) reflecting telescopes use concave mirrors which are free from chromatic aberration
(C) It is easy to mount concave mirrors as compared to lenses in refracting telescopes
(D) All the above mentioned factors are correct

90. Cassegrain telescope is a

(A) Refracting telescope
(B) telescope which uses only lenses
(C) telescope which has maximum chromatic aberration
(D) reflecting telescope

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

10. Wave optics

Harish Shastry -9480198001

1. The book OPTICKS was written by

(A) Christiaan Huygens (B) Isaac Newton
(C) J C Maxwell (D) Snell

2. Corpuscular theory was initially proposed by

(A) Descartes (B) Christian Huygens
(C) J C Maxwell (D) Snell

3. Wave theory of light was proposed by

(A) Descartes (B) Christian Huygens
(C) Max Planck (D) Snell

4. Wave theory of light failed to explain

(A) Reflection of light (B) Refraction of light
(C) Propagation of light in vacuum (D) Snell's law

5. Electromagnetic theory of light was proposed by

(A) Descartes (B) Christian Huygens
(C) J C Maxwell (D) Newton

6. Electromagnetic theory of light was experimentally confirmed by

(A) Heinrich hertz (B) Christian Huygens
(C) J C Maxwell (D) Newton

7. Quantum theory of light was proposed by

(A) Heinrich hertz (B) Christian Huygens
(C) J C Maxwell (D) Max Planck

8. Which phenomenon associated with light could only be explained using quantum theory light?

(A) Reflection (B) Refraction
(C) Polarisation (D) Photoelectric effect

9. Corpuscular theory predicted that if a ray of light bends towards normal after refraction, then

(A) speed of light would be greater in the second medium
(B) speed of light would be less in the second medium
(C) speed of light in the second medium will be same as in the first medium
(D) light will not travel to second medium

10. Christiaan Huygens wave theory predicted that if a ray of light bends towards normal after refraction, then

(A) speed of light would be greater in the second medium
(B) speed of light would be less in the second medium
(C) speed of light in the second medium will be same as in the first medium
(D) light will not travel to second medium

11. **Name the scientist who experimentally verified that the speed of light in water is less than the speed in air?**
(A) Descartes
(B) Christian Huygens
(C) J C Maxwell
(D) Foucault

12. **Which experiment confirms the wave nature of light?**
(A) Rutherford's alpha particle scattering experiment
(B) Hallwach and Lenard's experiment of photoelectric effect
(C) Thomas Young's double slit experiment
(D) Davisson Germer experiment

13. **Which theory could satisfactorily explain reflection and refraction of light?**
(A) Quantum theory
(B) Corpuscular theory
(C) Wave theory
(C) All the above theories

14. **The theory of light which could explain propagation of light through vacuum is**
(A) Electromagnetic theory
(B) Corpuscular theory
(C) Wave theory
(C) All the above theories

15. **Interference and diffraction of light were explained only by**
(A) Maxwell's electromagnetic theory
(B) Corpuscular theory
(C) Huygens Wave theory
(C) Maxwell's Quantum theory

16. **According to J.C. Maxwell, if permeability of free space is μ_o and permittivity is $\in_o$ velocity of electromagnetic wave (c) is**
(A) $c = \frac{1}{\mu_o \epsilon_o}$
(B) $c = \sqrt{\mu_o \epsilon_o}$
(C) $c = \frac{1}{\sqrt{\mu_o \epsilon_o}}$
(D) $c = \sqrt{\frac{\mu_o}{\epsilon_o}}$

17. **Dimension of $\sqrt{\mu_o \epsilon_o}$ is**
(A) $[M^oL^1T^{-1}]$
(B) $[M^{-1}L^1T^{-1}]$
(C) $[M^oL^{-1}T^{1}]$
(D) $[M^oL^2T^{-1}]$

18. **Dimension of $\frac{1}{\sqrt{\mu_o \epsilon_o}}$ is**
(A) $[M^oL^1T^{-1}]$
(B) $[M^{-1}L^1T^{-1}]$
(C) $[M^oL^{-1}T^{1}]$
(D) $[M^oL^2T^{-1}]$

19. **According to Huygens principle, wavefront is**
(A) locus of points, which oscillate in phase
(B) surface of constant phase.
(C) Both A and B are wrong
(D) Both A and B are correct

20. **According to Huygens principle, wavefront emitted from a point source of light is**
(A) cylindrical wavefront
(B) spherical wavefront
(C) plane wavefront
(4) parallel rays

21. **According to Huygens principle, wavefront emitted from a linear source of light is**
(A) cylindrical wavefront
(B) spherical wavefront
(C) plane wavefront
(4) parallel rays

22. **According to Huygens principle, wavefront emitted from a source of light at infinity is**

(A) cylindrical wavefront
(B) spherical wavefront
(C) plane wavefront
(4) convergent rays

23. **According to Huygens principle, the energy of the wave travels in a direction**

(A) perpendicular to the wavefront
(B) parallel to the wavefront
(C) at 45^o to the wavefront.
(D) at 90^o to the wavefront.

24. **According to Huygens principle, a ray of light is in a direction**

(A) perpendicular to the wavefront
(B) parallel to the wavefront
(C) at 45^o to the wavefront.
(D) at 90^o to the wavefront.

25. **A plane wavefront is incident on a convex lens, the refracted wavefront is**

(A) spherical wavefront converging towards 2F
(B) spherical wavefront converging towards F
(C) plane wavefront moving towards infinity
(D) spherical wavefront converging at 4f

26. **A plane wavefront is incident on a plane mirror. The reflected wavefront is**

(A) plane wavefront
(B) spherical wavefront diverging to infinity
(C) cylindrical wavefront
(D) spherical converging wavefront

27. **Apparent change in the frequency of a wave when there is a relative motion between source and observer is called**

(A) Normal Shift
(B) Lateral shift
(C) doppler effect
(D) dispersion

28. **When a source emitting light of frequency ν is moving with a speed V along the line joining the observer and source, apparent change in frequency Δν is given by (c-speed of light in vacuum)**

(A) $\frac{\Delta\nu}{\nu} = \frac{-V}{c}$
(B) $\frac{\Delta\nu}{\nu} = \frac{-c}{V}$
(C) $\frac{\Delta\nu}{\nu} = Vc$
(D) $\frac{\Delta\nu}{\nu} = -V + C$

29. **Modification in the distribution of light energy due to the superposition of two or more light waves from the coherent sources is known as**

(A) Polarisation
(B) refraction
(C) Interference
(D) Diffraction

30. **Two sources emitting light waves having same frequency or wavelength, having equal or nearly equal amplitude with zero or constant phase difference are called**

(A) monochromatic source
(B) coherent sources
(C) Incoherent sources
(D) composite sources

31. **During interreference**

(A) there is a loss of energy
(B) there is a redistribution of energy but there is no loss.
(C) there is an increment in energy by a factor 4
(D) there is an increment in energy by a factor 2

32. **If Io is the intensity of each coherent source of same amplitude, the intensities at the maxima and minima of interreference pattern are respectively**

(A) Io and zero (B) zero and Io

(C) 4Io and zero (D) zero and 4Io

33. **If Io is the intensity of each coherent source of same amplitude, then the average intensity of distributed light energy on the screen due to interreference is**

(A) Io (B) 2Io (C) zero (D) 4Io

34. **Path difference between the two coherent waves forming interference maxima on the young's interference screen is (λ-wavelength of coherent sources and n=0,1,2,3….)**

(A) $n\lambda$ (B) $(n+1)\lambda$ (C) $(n+1)\lambda/2$ (D) $(2n+1)\lambda/2$

35. **Phase difference between the two coherent waves forming interference maxima on the interference screen is and n=0,1,2,3….)**

(A) $2n\pi$ (B) $(n+1)\pi$ (C) $(n+1)\pi/2$ (D) $(2n+1)\pi/2$

36. **Path difference between the two coherent waves forming interference minima on the young's interference screen is (λ-wavelength of coherent sources and n=0,1,2,3….)**

(A) $n\lambda$ (B) $(n + 1)\lambda$ (C) $(n+1)\lambda/2$ (D) $(2n+1)\lambda/2$

37. **Phase difference between the two coherent waves forming interference minima on the interference screen is and n=0,1,2,3….)**

(A) $2n\pi$ (B) $(2n+1)\pi$ (C) $(n+1)\pi/2$ (D) $(2n+1)\pi/2$

38. **If a is the amplitude of coherent sources, amplitude of the resultant wave at the maxima is**

(A) a (B) 2a (C) zero (D) 4a

39. **If a is the amplitude of coherent sources, amplitude of the resultant wave at the minima is**

(A) a (B) 2a (C) zero (D) 4a

40. **Between the two coherent sources, conditions required for the constructive interreference is (n=0,1,2,3,4,5….)**

(A) path difference = $n\lambda$ and phase difference = $2n\pi$

(B) path difference = $(2n+1)\lambda/2$ and phase difference = $(2n+1)\pi$

(C) path difference = $(n+ ½)\lambda/2$ and phase difference = $(2n+1)\pi/2$

(D) path difference = $n\lambda/2$ and phase difference = $n\pi/2$

41. **Between the two coherent sources, conditions required for the destructive interreference is (n=0,1,2,3,4,5….)**

(A) path difference = $n\lambda$ and phase difference = $2n\pi$

(B) path difference = $(2n+1)\lambda/2$ and phase difference = $(2n+1)\pi$

(C) path difference = $(n+ ½)\lambda/2$ and phase difference = $(2n+1)\pi/2$

(D) path difference = $n\lambda/2$ and phase difference = $n\pi/2$

42. **Which phenomenon of light is involved in the colourful appearance of soap bubble?**

(A) photoelectric effect (B) diffraction

(C) interference (D) polarisation

43. Which phenomenon of light is involved in the colourful appearance thin film of oil on the surface of water?

(A) photoelectric effect (B) diffraction
(C) interference (D) polarisation

44. The fringes formed due to superposition of coherent sources in Young's double slit experiment when the screen is kept at very large distances from the sources are in the form of

(A) circles (B) parabola
(C) ellipse (D) straight lines

45. Distance between two successive bright fringes is called

(A) Lateral Shift (B) Normal Shift
(C) Fringe width (D) slit width

46. Distance between two successive dark fringes is called

(A) Lateral Shift (B) Normal Shift
(C) Fringe width (D) slit width

47. Distance between dark fringe and very next bright fringe is equal to

(A) fringe width (B) half of fringe width
(C) double the fringe width (D) one third of fringe width

48. Fringe width in Young's double slit experiment is

(A) directly proportional to wavelength of light
(B) inversely proportional to wavelength of light
(C) directly proportional to square of the wavelength of light
(D) inversely proportional to square of the wavelength of light

49. Fringe width in Young's double slit experiment is

(A) directly proportional to the distance between the coherent sources.
(B) inversely proportional to the distance between the coherent sources
(C) directly proportional to square of the distance between the coherent sources
(D) inversely proportional to square of the distance between the coherent sources

50. Fringe width in Young's double slit experiment is

(A) directly proportional to the perpendicular distance from coherent sources to screen.
(B) inversely proportional to the perpendicular distance from coherent sources to screen.
(C) directly proportional to square of the perpendicular distance from coherent sources to screen.
(D) inversely proportional to square of perpendicular distance from coherent sources to screen.

51. As the distance between the coherent sources in young's double slit experiment is increased, fringe width

(A) increases (B) decreases
(C) remains the same (D) first increases and then decreases.

52. As the distance between from the screen to the slits is in young's double slit experiment is increased, fringe width

(A) increases (B) decreases
(C) remains the same (D) first increases and then decreases.

53. **Fringe width in Young's double slit experiment is not be affected when**
(A) wavelength of light is changed
(B) Brightness of sources is changed
(C) distance from coherent sources (slits) to the screen is changed
(D) distance between the coherent sources (slits) is changed

54. **Which is not true regarding Interference fringes obtained in Young's double slit experiment?**
(A) All bright fringes are equally bright
(B) All dark fringes are equally dark
(C) Brightness of fringes will be uniform and then suddenly decreases to zero.
(D) Distance between any two consecutive fringes is same

55. **Bending of light around narrow edges is called**
(A) refraction (B) polarisation
(C) interference (D) diffraction

56. **Compact Disks appeared coloured against sunlight. It is due to**
(A) refraction of light (B) polarisation of light
(C) interference of light (D) diffraction of light

57. **Spider web appeared coloured against sunlight. It is due to**
(A) refraction of light (B) polarisation of light
(C) interference of light (D) diffraction of light

58. **When a light of wavelength λ diffracts at an angle θ at a single slit of width 'a', the condition for the formation of minima is (n=1,2,3,4,5…..)**
(A) $a \sin\theta = n\lambda$ (B) $a \sin\theta = (2n+1)\lambda$
(C) $a \sin\theta = (2n+1)\lambda/2$ (D) $a \sin\theta = (n + ½)\lambda/2$

59. **When a light of wavelength λ diffracts at an angle θ at a single slit of width 'a', the condition for the formation of maxima is (n=1,2,3,4,5…..)**
(A) $a \sin\theta = n\lambda$ (B) $a \sin\theta = (2n+1)\lambda$
(C) $a \sin\theta = (2n+1)\lambda/2$ (D) $a \sin\theta = (n + ½)\lambda/2$

60. **For diffraction of light of wavelength λ at a single slit of width a, angular width of central maxima is**
(A) $\theta=\lambda/a$ (B) $\theta=2\lambda/a$ (C) $\theta=\lambda/2a$ (D) $\theta=a\lambda$

61. **If 'D' is the distance between single slit of width 'a' and screen, λ is the wavelength of of light, then, width (x) of central maxima of diffraction pattern is**
(A) $x=\lambda D/a$ (B) $x=2\lambda D/a$ (C) $x=\lambda D/2a$ (D) $x=Da\lambda$

62. **As the slit width is increased, angular width of central maximum of diffraction pattern**
(A) increases (B) decreases
(C) remains the same (D) first increases and then decreases

63. **In a single slit diffraction patter,**
(A) All fringes are equally bright
(B) All fringes are of equal width
(C) only central maximum is brightest and widest
(D) All fringes are of equal width but not of equal brightness.

64. **The limit of the ability of microscopes and telescopes to distinguish very close objects is called**

(A) limit of resolution (B) least distance of distinct vision
(C) far point (D) threshold of vision

65. **Reciprocal of limit of resolution is called**

(A) magnifying power (B) focal length
(C) optical power (D) Resolving power

66. **Limit of resolution ($\Delta\theta$) of a telescope is given by (λ-wavelength of light and a-radius of the objective lens)**

(A) $\Delta\theta = \frac{1.22\lambda}{a}$ (B) $\Delta\theta = \frac{0.61\lambda}{a}$

(C) $\Delta\theta = \frac{0.61a}{\lambda}$ (D) $\Delta\theta = \frac{1.22\,a}{\lambda}$

67. **Resolving power (RP) of a telescope is given by (λ-wavelength of light and a-radius of the objective lens)**

(A) $RP = \frac{1.22\lambda}{a}$ (B) $RP = \frac{0.61\lambda}{a}$

(C) $RP = \frac{a}{0.61\,\lambda}$ (D) $RP = \frac{a}{1.22\lambda}$

68. **Resolving power of a telescope can be increased by**

(A) increasing the focal length of objective
(B) increasing the focal length of eye piece
(C) increasing the diameter of objective
(D) increasing the diameter of eye piece

69. **Very good telescopes and microscopes will have**

(A) high resolving power and high limit of resolution
(B) less resolving power and less limit of resolution
(C) less resolving power and high limit of resolution
(D) high resolving power and less limit of resolution

70. **The reciprocal of the minimum separation of two points seen as distinct through a microscope is called**

(A) Resolving power of the microscope
(B) Limit of resolution of microscope
(C) Magnifying power of microscope
(D) Optical power of microscope

71. **As the diameter of objective of a telescope is increased.**

(A) resolving power and limit of resolution will decrease
(B) resolving power and limit of resolution will increase.
(C) resolving power will increase and limit of resolution will decrease
(D) resolving power will decrease and limit of resolution will increase

72. **Limit of resolution ($\Delta\theta$) of a microscope is given by (λ-wavelength of light, θ-semi vertical angle of cone of rays entering to objective lens, n-refractive index of the medium between object and objective lens)**

(A) $\Delta\theta = \frac{1.22\lambda}{n\sin\theta}$ (B) $\Delta\theta = \frac{0.61\lambda}{n\sin\theta}$

(C) $\Delta\theta = \frac{0.61\,n}{\lambda\sin\theta}$ (D) $\Delta\theta = \frac{0.61\,n}{2\,\lambda\sin\theta}$

73. Resolving power (RP) of a microscope is given by (λ-wavelength of light, θ-semi vertical angle of cone of rays entering to objective lens, n-refractive index of the medium between object and objective lens)

(A) $RP = \frac{1.22\lambda}{n \sin\theta}$ (B) $RP = \frac{0.61\lambda}{n \sin\theta}$

(C) $RP = \frac{n \sin\theta}{0.61\,\lambda}$ (D) $RP == \frac{2\,n \sin\theta}{0.61\,\lambda}$

74. Resolving power of a microscope can be increased by

(A) illuminating the object with light of higher wavelength
(B) illuminating the object with light of lower wavelength
(C) decreasing the refractive index of the medium between object and objective lens.
(D) increasing the size of the eye piece.

75. Filling an oil of higher refractive index between object and objective lens of a microscope will

(A) increase resolving power and limit of resolution
(B) decrease resolving power and limit of resolution
(C) increase resolving power and decrease limit of resolution
(D) decrease resolving power and increase limit of resolution

76. "Oil immersion objective microscopes" are

(A) the microscopes immersed in oil of lower refractive index
(B) the microscopes immersed in oil of higher refractive index
(C) the microscopes in which oil of higher refractive index fills the gap between object and objective
(D) the microscopes in which oil of lower refractive index fills the gap between object and objective

77. The distance between the screen and the slit at which the spreading of light due to diffraction from the centre of the screen is exactly equal to the size of the slit is called

(A) least distance of distinct vision (B) Normal shift
(C) Lateral shift (D) Fresnel distance

78. Fresnel distance (z) for light of wavelength λ diffracted through a slit of width 'a' is

(A) $z = \frac{a}{\lambda}$ (B) $z = \frac{a^2}{\lambda}$ (C) $z = \frac{\lambda^2}{a}$ (D) $z = \frac{\lambda}{a}$

79. z (x,t) = a sin (kx – ωt) equation represents a wave polarised in

(A) xy-plane (B) yz-plane (C) xz-plane (D) any plane

80. Electromagnetic waves are

(A) longitudinal waves (B) transverse waves
(C) mechanical waves (D) one dimensional waves

81. If $\vec{E}$ is the electric field vector and $\vec{B}$ is magnetic field vector at an instant in an electromagnetic wave, then the direction of propagation of wave will be

(A) Along $\vec{E}$ (B) along $\vec{B}$
(B) Along $\vec{E} \times \vec{B}$ (D) perpendicular to $\vec{E} \times \vec{B}$

82. **The phenomenon exhibited by light which confirms its transverse nature is**
(A) diffraction
(B) interference
(C) photoelectric effect
(D) polarisation

83. **Polarisation property is shown only by**
(A) transverse waves
(B) longitudinal waves
(C) Sound waves
(D) Ultrasonic waves

84. **Waves in which displacement is always perpendicular to the direction of motion of the wave and vibrations are found in more than one plane are called**
(A) unpolarised transverse waves
(B) polarised transverse waves
(C) unpolarised longitudinal waves
(D) polarised longitudinal waves

85. **Waves in which displacement is always perpendicular to the direction of motion of the wave and vibrations are confined to a single plane are called**
(A) unpolarised transverse waves
(B) polarised transverse waves
(C) unpolarised longitudinal waves
(D) polarised longitudinal waves

86. **Which wave among the following will show polarisation?**
(A) Sound waves
(B) Ultrasonics
(C) Infrasonic
(D) Electromagnetic waves

87. **When a unpolarised light is passed through a polaroid sheet**
(A) The electric field vectors along the direction of the aligned molecules get absorbed
(B) The electric field vectors along the direction of the aligned molecules are allowed to pass through
(C) The electric field vectors perpendicular to the direction of the aligned molecules are allowed to pass through
(D) No electric field is absorbed.

88. **When two polaroid sheets are kept on each other with their pass axes perpendicular, the intensity of outcoming light from the second when unpolarised light is incident on the first is**
(A) Half the incident intensity
(B) one fourth of incident intensity
(C) zero
(D) one third of incident intensity

89. **When two polaroid sheets are kept on each other with their pass axes parallel, the intensity of outcoming light from the second when unpolarised is incident on the first is**
(B) Half the incident intensity
(B) one fourth of incident intensity
(C) zero
(D) one third of incident intensity

90. **Two polaroid sheets are kept over each other. Light is incident on the first and the second one is turned with incident light as axis. Intensity of outcoming light from the second becomes minimum and maximum twice during one full rotation. Now, the incident light is**
(A) an unpolarised transverse wave
(B) a polarised transverse wave
(C) an unpolarised longitudinal wave
(D) a polarised longitudinal wave

91. **Two polaroid sheets are kept over each other. Light is incident on the first and the second one is turned with incident light as axis. It is found that intensity of outcoming light is uniform throughout the rotation. Now, the incident light is**
(A) an unpolarised transverse wave
(B) a polarised transverse wave
(C) an unpolarised longitudinal wave
(D) a polarised longitudinal wave

92. **If I_o is the intensity of unpolarised light incident on a polaroid sheet whose pass axis makes an angle of θ with the plane of vibrations of incident light, then according Malu's law intensity of emerging light is**

(A) $I=I_o + \cos^2\theta$ (B) $I=I_o - \cos^2\theta$

<u>(C) $I=I_o \cos^2\theta$</u> (D) $I=I_o \cos\theta$

93. **Which one of the following does not use polaroid?**

(A) Sunglasses to reduce the intensity of light
(B) window panes to reduce intensity of light
(C) 3D movie cameras
<u>(D) Thin coating on reading lenses</u>

94. **Polarised light will not be produced by**

(A) scattering (B) reflection

(C) multiple refraction <u>(D) interference of coherent sources</u>

95. **When the angle of incidence is equal to angle of polarisation,**

<u>(A) reflected light is completely polarised</u>
(B) reflected light is partially polarised
(C) refracted light is completely polarised.
(D) reflected and refracted rays are parallel to each other

96. **Reflected light is completely polarised when the angle of incidence is**

(A) equal to angle of refraction <u>(B) equal to Brewster's angle</u>.

(C) equal to angle of deviation (D) equal to 90^o.

97. **At the polarising angle of incidence**

<u>(A) reflected and refracted rays are perpendicular to each other.</u>
(B) reflected and refracted rays are parallel to each other
(C) refracted light is completely polarised.
(D) reflected light is partially polarised

98. **If i_B is Brewster's angle and μ is the refractive index of reflecting medium, then, according to Brewster's law,**

<u>(A) $\tan i_B = \mu$</u> (B) $\tan \mu = i_B$

(C) $\tan \mu = 1/i_B$ (D) $\tan i_B = 1/\mu$

99. **At the Brewster's angle of incidence, plane of vibration of reflected ray and plane in which ray of light is incident are**

<u>(A) perpendicular to each other</u> (B) parallel to each other

(C) aligned at 45^o to each other (D) aligned at 60^o to each other

100. **Tangent of the polarising angle is equal to the refractive index of medium which reflects light. This is called**

(A) Snell's law (B) Malu's law

(C) Huygens principle <u>(D) Brewster's law</u>

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

11. Dual Nature of radiation and Matter

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1. Specific charge is defined as
(A) Charge to velocity ratio
(B) Velocity to charge ratio
(C) Charge to mass ratio
(D) Mass to charge ratio

2. Specific charge of electron is
(A) 1.602×10^{-19} C kg^{-1}
(B) 1.76×10^{11} C kg^{-1}
(C) 1.76×10^{-19} C kg^{-1}
(D) 17.6×10^{11} C kg^{-1}

3. Specific charge of electron was experimentally determined by
(A) J.J. Thomson
(B) Rutherford
(C) Heinrich Hertz
(D) Roentgen

4. Photo electric effect was discovered by
(A) J.J. Thomson
(B) Rutherford
(C) Heinrich Hertz
(D) Roentgen

5. Experimental observations of photo electric effect were explained by
(A) J.J. Thomson
(B) Rutherford
(C) Heinrich Hertz
(D) Albert Einstein

6. Quantum theory of radiation was proposed by
(A) J.J. Thomson
(B) Max Planck
(C) Heinrich Hertz
(D) Albert Einstein

7. Minimum energy required to remove an electron from metal surface is called
(A) excitation energy
(B) ionization energy
(C) work function
(D) Chemical energy

8. An electron is accelerated through a potential difference of one volt. The kinetic energy gained by it is equal to
(A) 1.6×10^{-19} eV
(B) 1J
(C) 1 eV
(D) 10eV

9. 1eV is equal to
(A) 1.6×10^{-19} J
(B) 1J
(C) 10J
(D) 100J

10. Emission of electrons from the surface of a metal by supplying energy in the form of heat is called
(A) Photo electric emission
(B) field emission
(C) secondary emission
(D) thermionic emission

11. Emission of electrons from the surface of a metal by supplying energy in the form of light is called
(A) Photo electric emission
(B) field emission
(C) secondary emission
(D) thermionic emission

12. Emission of electrons from the surface of a metal by subjecting it to high magnetic or electric field is called
(A) Photo electric emission
(B) field emission
(C) secondary emission
(D) thermionic emission

13. Work function of metal depends on
(A) frequency of incident radiation (B) wavelength of incident radiation
(B) type of photosensitive surface (D) all the factors mentioned here

14. Name the phenomenon associated with light which can be explained only by quantum theory of radiation.
(A) Interreference (B) Diffraction (C) Polarization (D) Photoelectric effect

15. Threshold frequency is defined as
(A) the maximum frequency of incident radiation below which photoelectrons are emitted from the surface of a photosensitive material.
(B) the minimum frequency of incident radiation above which photoelectrons are emitted from the surface of a photosensitive material.
(C) the frequency of incident radiation at which photoelectrons are emitted from the surface of a photosensitive material with maximum kinetic energy.
(D) the frequency of incident radiation at which photoelectrons are not emitted from the surface of a photosensitive material.

16. Above threshold frequency maximum kinetic energy of emitted photo electrons during photo electric emission depends on
(A) frequency of incident radiation (B) intensity of incident radiation
(C) Speed of incident radiation (D) none of these

17. Photoelectric current during photo electric emission depends on
(A) frequency of incident radiation (B) intensity of incident radiation
(C) Speed of incident radiation (D) none of these

18. The number of photoelectrons emitted per second from a metal surface increases when
(A) the energy of incident photons increases
(B) the frequency of incident light increases
(C) wavelength of incident light increases
(D) the intensity of incident light increases

19. With reference to photoelectric emission, stopping potential is
(A) the minimum positive potential of anode for which photo electric current becomes zero.
(B) the minimum negative potential of anode for which photo electric current becomes zero.
(C) the minimum positive potential of anode for which photo electric current becomes maximum.
(D) the minimum negative potential of anode for which photo electric current becomes maximum

20. Stopping potential in photoelectric emission depends on
(A) frequency of incident radiation (B) intensity of incident radiation
(C) Speed of incident radiation (D) none of these

21. Above threshold frequency, kinetic energy of photoelectrons is independent of
(A) frequency of incident radiation (B) wavelength of incident radiation
(C) Energy of incident radiation (D) intensity of incident radiation

22. Einstein's photoelectric equation is
$K_{max} \rightarrow$ maximum kinetic energy of photoelectrons, $h \rightarrow$ Planck's constant,
$\nu \rightarrow$ frequency of incident radiation, $\phi_o \rightarrow$ work function
(A) $K_{max} = h\nu - \phi_o$ (B) $K_{max} = h\nu + \phi_o$
(C) $h\nu = K_{max} \div \phi_o$ (C) $\phi_o = K_{max} + h\nu$

23. Einstein's photoelectric equation was experimentally verified by
(A) Heinrich Hertz (B) Max Planck
(C) J J Thomson (D) Millikan

24. Einstein's photoelectric equation is based on
(A) law of conservation of momentum
(B) law of conservation of charge
(C) Law of conservation of energy
(D) Law of conservation of angular momentum

25. Rest mass of photon is
(A) one (B) zero (C) infinite (D) 9.1×10^{-31} kg

26. Charge of photon is
(A) positive (B) negative (C) neutral (D) 1.6×10^{-19} C

27. Photons can be deflected by
(A) Electric field (B) Magnetic field
(C) Earth's gravitational field (D) None of these

28. Speed of photon in vacuum is
(A) zero (B) unity
(C) $3 \times 10^8 ms^{-1}$ (D) maximum for minimum frequency.

29. Energy possessed by a photon is
(A) Directly proportional to its frequency
(B) Inversely proportional to its frequency
(C) Independent of wavelength
(D) Directly proportional to wavelength

30. Energy possessed by a photon is
(A) Directly proportional to its wavelength
(B) Inversely proportional to its frequency
(C) Independent of wavelength
(D) Inversely proportional to wavelength

31. Name the experiment which proved de Broglie's matter wave principle
(A) Davisson-Germer experiment (B) Rutherford alpha particle experiment
(C) Hallwach and Lenard's experiment (D) Faraday's coil and magnet experiment

32. Scientists who experimentally confirmed the wave nature of moving particle are
(A) Heinrich hertz, Davisson and Germer (B) Davisson, Germer and de-Broglie
(C) Davission, Germer and G.P.Thomson (D) Davisson, Germer and J.J.Thomson

33. The de-Broglie wavelength of a moving particle is
(A) inversely proportional to the momentum of the particle
(B) inversely proportional to the velocity of the particle
(C) inversely proportional to the mass of the particle
(D) All the statements are correct.

34. If E is the kinetic energy of a moving particle, its de-Broglie wavelength is
(A) inversely proportional to E
(B) directly proportional to E
(C) directly proportional to square root of E
(D) inversely proportional to square root of E

35. Energy of photon having frequency ν is given by (h is Planck's constant)
(A) $E=h/\nu$ (B) $E=h\nu$ (C) $E=\nu/h$ (D) $E=h+\nu$

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

12. Atoms

Harish Shastry -9480198001

1. Who proposed plum pudding model of an atom?
(A) J.J Thomson (B) Rutherford (C) Neil Bohr (D) Pauli

2. Planetary model of the atom was proposed by
(A) J.J Thomson (B) Rutherford (C) Neil Bohr (D) Pauli

3. Thomson's plum pudding model of atom was discarded because
(A) the model couldn't explain neutral charge of an atom.
(B) the model failed explain the results of Rutherford's α-particle scattering experiment
(C) the model was not built on the basis quantum theory.
(D) there was no explanation for the reason for the distribution of positive charge in a sphere.

4. In α-particle scattering experiment, it is found that
(A) Most of the α-particles are scattered at small angles and very few deflected backwards.
(B) Most of the α-particles deflected backwards and very few scattered at small angles.
(C) Equal number of α-particles scattered at small angles and reflected back.
(D) All the α-particles were absorbed by gold foil.

5. In Rutherford's α-particle scattering experiment, alpha particles were bombarded towards gold foil because
(A) gold nucleus is much heavier than α-particle.
(B) Gold is highly malleable and can be drawn into very thin sheet.
(C) None of the above reasons are correct.
(D) Both A and B are correct.

6. In Rutherford's α-particle scattering experiment, distance of closest approach is
(A) 10^{-14}m (B) 10^{-10}m (C) 10^{-6}m (D) 10^{-3}m

7. Inside the nucleus of an atom,
(A) Almost all the mass of an atom is concentrated.
(B) Entire positive charge is distributed.
(C) Nuclear force exists
(D) All are correct

8. Perpendicular distance between the initial velocity direction of alpha particle and center of the nucleus is called
(A) nuclear radius (B) Energy gap
(C) impact parameter (D) mean free path

9. In Rutherford's α-particle scattering experiment, when impact parameter is zero
(A) Angle of scattering is zero (B) Angle of scattering is 180^o
(B) Angle of scattering is equal to 90^o (C) alpha particle enters the gold nucleus.

10. According to classical electro magnetic theory, path of an electron orbit around the nucleus will be
(A) circular (B) elliptical (C) spiral (D) straight line

11. According to Rutherford's model, nucleus of an atom is
(A) positively charged
(B) negatively charged
(C) electrically neutral
(D) positively or negatively charged depending on atomic number

12. According to Rutherford's model, centripetal force for the electron moving round the nucleus is provided by
(A) nuclear force of attraction between electron and nucleus
(B) electrostatic force of attraction between positively charged nucleus and negatively charged electron
(C) gravitational force between heavy nucleus and lighter electron
(D) magnetic force between nuclear magnetic moment and electron magnetic moment.

13. When an electron revolves round the nucleus,
(A) Its electrostatic potential energy is zero and kinetic energy is positive
(B) Its electrostatic potential energy is negative and kinetic energy is positive.
(C) Its electrostatic potential energy is negative and kinetic energy is zero.
(D) Its electrostatic potential energy and kinetic energy, both are zero.

14. Rutherford's nuclear atom model failed to explain
(A) the distribution of positive and negative charge inside the nucleus.
(B) Size of the nucleus
(C) Size of the atom
(D) Stability of the atom

15. According to Bohr's postulates, angular momentum of an electron in its orbit around a nucleus is equal to
(A) equal to an integral multiple of $h/2\pi$
(B) equal to an integral multiple of $2\pi/h$
(C) equal to an integral multiple of $h2\pi$
(D) equal to an integral multiple of $2h/\pi$

16. According to Bohr's hydrogen atom model, the radius of the n^{th} stationary orbit of electron is proportional to
(A) $\frac{1}{n}$ (B) n (C) $\frac{1}{n^2}$ (D) n^2

17. According to Bohr's hydrogen atom model, the radius of first, second and third electron orbits are in the ratio
(A) 1:2:3 (B) 1:4:9 (C) 3:2:1 (D) 9:4:1

18. According to Bohr's hydrogen atom model, as long as electron moves in a stationary orbit,
(A) Its radius will shrink (B) Electron loses energy
(B) It emits radiation of certain frequency. (C) Electron does not lose energy

19. According to Bohr's hydrogen atom model, as the electrons move to outer orbits
(A) speed of electrons increases (B) speed of electrons decreases
(C) their speed does not change (D) electrons may increase or decrease.

20. Orbital velocity of electron in a stationary n^{th} orbit is given by
(A) $v = \frac{e^2}{2\epsilon_0 nh}$ (B) $v = \frac{2\epsilon_0 nh}{e^2}$ (C) $v = \frac{\pi me^2}{n^2h^2\epsilon_0^2}$ (D) $\frac{n^2h^2\epsilon_0^2}{\pi me^2}$

21. Radius of the first orbit of hydrogen atom is (in angstroms)
(A) 0.529 (B) 5.29 (C) 52.9 (D) 0.0529

22. Total energy of an electron revolving round in a stationary orbit around hydrogen nucleus is
(A) always positive (B) always negative
(C) independent of quantum number n (D) independent of velocity

23. Energy of an electron in the ground state of hydrogen atom is
(A) -13.6eV (B) -3.4eV (C) +13.6eV (D) 13.6J

24. Minimum energy required to remove an electron from the ground state of an atom is called
(A) ionization energy (B) Excitation energy
(C) work function (D) Binding energy

25. The ionization potential of hydrogen atom is
(A)13.6V (B)8.24V (C)10.36V (D)14.24V

26. According to Bohr's hydrogen atom model, as the electrons move to outer orbits, its total energy
(A) decreases (B) increases
(C) remains the same (D) will become more negative.

27. According to Bohr's hydrogen atom model, the total energy of electron in n^{th} stationary orbit is proportional to
(A) $\frac{1}{n}$ (B) n (C) $\frac{1}{n^2}$ (D) n^2

28. The series of hydrogen spectrum lying in visible region is
(A) Lyman series (B) Balmer series
(C) Paschen series (D) Bracket series

29. Lyman series of hydrogen spectrum lies in
(A) visible region (B) Infrared region
(C) ultraviolet region (D) Partly in visible and partly in infra-red region

30. Energy required to excite an electron from lower energy state to higher energy state is called
(A) ionization energy (B) Excitation energy
(C) work function (D) Binding energy

31. Value of Rydberg constant for hydrogen is
(A) 1.097×10^{10} m^{-1} (B) 10.97×10^{10} m^{-1}
(C) 1.097×10^{7} m^{-1} (D) 1.097×10^{-7} m^{-1}

32. SI unit of wave number is
(A) m^{-1} (B) m (C) Hz (D) seconds

33. If n_1 and n_2 represent the quantum numbers of lower and higher energy states respectively, then for the first line of Lyman series,
(A) $n_1=1$ and $n_2=3$ (B) $n_1=1$ and $n_2=2$
(C) $n_1=1$ and $n_2=4$ (D) $n_1=1$ and $n_2=5$

34. If n_1 and n_2 represent the quantum numbers of lower and higher energy states respectively, then for the second line of Balmer series,

(A) $n_1=2$ and $n_2=3$ (B) $n_1=2$ and $n_2=\infty$

<u>(C) $n_1=2$ and $n_2=4$</u> (D) $n_1=2$ and $n_2=5$

35. If n_1 and n_2 represent the quantum numbers of lower and higher energy states respectively, then for the last line of Paschen series,

(A) $n_1=3$ and $n_2=5$ <u>(B) $n_1=3$ and $n_2=\infty$</u>

(C) $n_1=3$ and $n_2=4$ (D) $n_1=3$ and $n_2=6$

36. If n_1 and n_2 represent the quantum numbers of lower and higher energy states respectively, then for the first line of Brackett series,

<u>(A) $n_1=4$ and $n_2=5$</u> (B) $n_1=4$ and $n_2=\infty$

(C) $n_1=4$ and $n_2=6$ (D) $n_1=4$ and $n_2=7$

37. Different lines of Pfund series of hydrogen spectrum will be obtained when electron from higher orbits undergo transition to the lower orbit of quantum number,

<u>(A) $n_1= 5$</u> (B) $n_1=7$

(C) $n_1= 6$ (D) $n_1=8$

38. The formula for wave number for Paschen series is ($\lambda \rightarrow$wavelength, R-Rydberg constant for hydrogen, n=6,7,8,9……..)

(A) $\frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$ <u>(B)</u> $\frac{1}{\lambda} = R\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

(C) $\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (D) $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$

39. Bohr's hydrogen atom model fails in explaining

(A) stability of the atom

(B) different series in hydrogen spectrum

(C) ionization energy of hydrogen atom

<u>(D) intensity of different spectral lines of hydrogen atom</u>

40. Bohr's hydrogen atom model successfully explained

(A) the intensity of different spectral lines

(B) fine structure of spectral lines.

(C) The spectrum of atoms having more number of electrons

(D) <u>wavelength of different series of hydrogen spectrum</u>

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

13. Nuclei and Radioactivity

Harish Shastry -9480198001

1. Strongest force in nature is

(a) Electromagnetic force (b) weak nuclear force
(c) <u>strong nuclear force</u> (d) gravitational force

2. Atomic number of a nucleus represents

<u>(a) number of protons</u> (b) number of protons and neutrons
(c) number of neutrons (d) number of nucleons

3. Mass number of a nucleus represents

(a) number of protons (b) number of protons and electrons
(c) number of neutrons <u>(d) number of nucleons</u>

4. Difference between mass number and atomic number of a nucleus represents

(a) number of protons (b) number of protons and neutrons
<u>(c) number of neutrons</u> (d) number of nucleons

5. If Z represents atomic number and A represents mass number of a nucleus, then charge of the nucleus is (e=magnitude of charge of electron)

(a) +Ae (b) +(A-Z)e (c) +(A+Z)e <u>(d) +Ze</u>

6. Volume of a nucleus is directly proportional to

(a) Atomic number (b) <u>atomic mass</u>
(c) radius of nucleus (d) density of nucleus

7. If A is the mass number, radius of a nucleus is

(a) <u>directly proportional to $A^{1/3}$</u> (b) directly proportional to A^3
(a) inversely proportional to $A^{1/3}$ (b) inversely proportional to A^3

8. Radius of a nucleus of mass number A is given by (R_o is a constant)

<u>(a) $R=R_oA^{1/3}$</u> (ab) $R=R_oA^{1/2}$ (a) $R=R_o + A^{1/3}$ (a) $R=Ro - A^{1/3}$

9. If Z is atomic number, A is mass number, m_p is mass of proton, m_n is mass of a neutron, then mass defect (Δm) is

(a) $\Delta m= Zm_n + (A-Z)m_p$ (b) $\Delta m= Zm_p + (A+Z)m_n$
<u>(c) $\Delta m= Zm_p + (A-Z)m_n$</u> (d) $\Delta m= Zm_n + (A+Z)m_p$

10. Density of a nucleus is

(a) directly proportional to mass number
(b) inversely proportional to mass number
(c) <u>independent of mass number</u>
(d) directly proportional to atomic number

11. Mass defect is

(a) Uncertainty in determining the mass of a nucleus
(b) <u>The difference in mass of a nucleus and its constituents.</u>
(c) Sum of the mass of constituents and mass of nucleus
(d) Difference between mass of nucleus and mass of electrons

12. **Density of a nucleus is about**
(a) 2.29×10^{17} kgm^{-3} (b) 2.29×10^{10} kgm^{-3}
(c) 2.29×10^{7} kgm^{-3} (d) 2.29×10^{3} kgm^{-3}

13. **Atoms of nuclei having same number of protons but different mass number are called**
(a) isotones (b) isotopes (c) isobars (d) mirror nuclei

14. **Atoms of two nuclei having same number of neutrons are called**
(a) isotones (b) isotopes (c) isobars (d) mirror nuclei

15. **Atoms of two nuclei having same atomic mass but proton and neutron number interchanged are called**
(a) isotones (b) isotopes (c) isobars (d) mirror nuclei

16. **Atoms of two nuclei having same atomic mass but different atomic number are called**
(a) isotones (b) isotopes (c) isobars (d) mirror nuclei

17. **Among the following atoms, select the isotopes.**
(a) $^{35}_{17}$Cl and $^{37}_{17}$Cl (b) $^{76}_{32}$Ge and $^{76}_{34}$Se
(c) $^{7}_{4}$Be and $^{8}_{3}$Li (d) $^{14}_{6}$C and $^{14}_{7}$N

18. **Among the following atoms, select the isotones.**
(a) $^{39}_{19}$K and $^{37}_{17}$Cl (b) $^{76}_{32}$Ge and $^{76}_{34}$Se
(c) $^{7}_{4}$Be and $^{8}_{3}$Li (d) $^{14}_{6}$C and $^{14}_{7}$N

19. **Among the following atoms, select the mirror nuclei.**
(a) $^{39}_{19}$K and $^{37}_{17}$Cl (b) $^{76}_{32}$Ge and $^{76}_{34}$Se
(c) $^{7}_{4}$Be and $^{7}_{3}$Li (d) $^{14}_{6}$C and $^{14}_{7}$N

20. **Among the following atoms, select the isobars.**
(a) $^{35}_{17}$Cl and $^{37}_{17}$Cl (b) $^{35}_{17}$Cl and $^{39}_{17}$Cl (c) $^{7}_{4}$Be and $^{8}_{3}$Li (d) $^{14}_{6}$C and $^{14}_{7}$N

21. **Charge of a nucleus**
(a) is positive (b) is negative
(c) is neutral (d) depends on atomic number

22. **1 atomic mass unit is equal to**
(a) 9.1×10^{-31} kg (b) 1.66×10^{-27}kg (c) 9.1×10^{-27}kg (d) 1.66×10^{-31}kg

23. **1 atomic mass unit is equal to**
(a) $\frac{1}{12}$th of the mass of one C^{12} atom. (b) $\frac{1}{14}$th of the mass of one C^{14} atom.
(c) $\frac{1}{12}$th of the mass of one C^{16} atom. (d) $\frac{1}{16}$th of the mass of one C^{16} atom.

24. **Nuclear binding energy is the**
(a) energy equivalent of mass defect
(b) energy required to form a nucleus starting from individual nucleons
(c) energy required to break a nucleus into constituent nucleons
<u>(d) all the above answers are correct</u>

25. **Energy equivalent of 1 atomic mass unit is**
(a) 931.5 eV (b) 1MeV (c) <u>931.5 MeV</u> (d) 1 eV

26. **Atomic mass can be determined using**
(a) Beam balance (b) Spring balance
<u>(c) Mass spectrograph</u> (d) Spectrometer

27. **Neutron was discovered by**
<u>(a) James Chadwick</u> (b) J J Thomson
(c) Rutherford (d) Niels Bohr

28. **Select the wrong statement regarding to neutrons**
(a) neutrons are electrically neutral
(b) two neutrons inside the nucleus experience nuclear force.
<u>(c) two neutrons inside the nucleus experience electrostatic force of repulsion</u>
(d) Neutron is stable inside the nucleus and a free neutron outside the nucleus is unstable.

29. **According to Einstein, energy equivalent of mass m is (c is speed of light in vacuum)**
(a) E=mc/2 (b) E=2mc <u>(c) $E=mc^2$</u> (d) $E=m^2c$

30. **Energy equivalent of 1kg mass is**
(a) 931.5 eV <u>(b) 9×10^{16}J</u> (c) 931.5 MeV (d) 9J

31. **The energy equivalent of mass defect of a nucleus is**
(a) Kinetic energy (b) potential energy (c) <u>binding energy</u> (d) Pressure energy

32. **According to binding energy curve, which one of the following elements is less stable?**
(a) <u>elements with less mass number</u>
(b) elements with highest binding per nucleon
(c) elements with mass number between 30 and 170
(d) all elements

33. **Binding energy per nucleon is the**
<u>(a) the ratio of the binding energy of a nucleus to the number of the nucleons.</u>
(b) the ratio of the binding energy of a nucleus to the atomic number
(c) the ratio of the binding energy of a nucleus to the number of the neutrons
(d) the ratio of the binding energy of a nucleus to the number of the electrons

34. **Select the true statement**
(a) Nuclei having highest binding energy are most stable
(b) Nuclei having least binding energy are most stable
(c) <u>Nuclei having highest binding energy per nucleon are most stable</u>
(d) Nuclei having least binding energy per nucleon are most stable.

35. Which of the following pair of particles cannot experience nuclear force between them?

(a) Neutron and proton (b) Proton and proton

(c) electron and proton (d) neutron and neutron

36. Select the statement which is not true.

(a) nuclear force is short range and saturated.

(b) nuclear force can exist between electrically neutral neutrons.

(c) nuclear force is charge independent, strongest force.

(d) nuclear force varies as the square of the distance between nucleons.

37. The force that acts like centripetal force for the electron revolving round the nucleus is

(a) Nuclear force (b) Electrostatic force

(c) gravitational force (d) electromagnetic force

38. Radioactivity was discovered by

(a) Marie Curie (b) Henry Becquerel

(c) James Chadwick (d) J J Thomson

39. Which is not found during radioactive decay?

(a) emission of alpha particles (b) emission of β^- particles

(c) emission of X-ray (d) emission of γ-rays

40. Alpha-particles found during radioactive decay process

(a) are positively charged (b) are neutral particles

(c) are negatively charged (d) contain 2 protons and one neutron

41. Alpha-particles found during radioactive decay process

(a) contain 2 protons and one neutron (b) are neutral particles

(c) are negatively charged (d) contain 2 protons and 2 neutrons

42. β^- particles found during radioactive decay process

(a) are positively charged (b) are neutral particles

(c) are negatively charged (d) are similar to He nuclei

43. β^+ particles found during radioactive decay process

(a) are positively charged (b) are neutral particles

(c) are negatively charged (d) are similar to He nuclei

44. γ-decay of radioactivity involves

(a) positively charged particles (b) negatively charged particles

(c) electromagnetic radiations (d) particles similar to He nuclei

45. After alpha decay of radioactivity, (as compared to parent nucleus)

(a) Mass number of daughter nucleus decreases by 2 and atomic number decreases by 4

(b) Mass number of daughter nucleus decreases by 4 and atomic number decreases by 2

(c) Both mass number and atomic number of daughter nucleus decrease by 2

(d) Both mass number and atomic number of daughter nucleus decrease by 4

46. **After β^- decay of radioactivity, (as compared to parent nucleus)**

(a) Atomic number of daughter nucleus increases by 1 and mass number remains the same.
(b) mass number of daughter nucleus decreases by 1 and atomic number remains the same.
(c) Both mass number and atomic number of daughter nucleus increases by 1
(d) Both mass number and atomic number of daughter nucleus decreases by 1

47. **After β^+ decay of radioactivity, (as compared to parent nucleus)**

(a) Atomic number of daughter nucleus increases by 1 and mass number remains the same.
(b) Atomic number of daughter nucleus decreases by 1 and mass number remains the same.
(c) Both mass number and atomic number of daughter nucleus increases by 1
(d) Both mass number and atomic number of daughter nucleus decreases by 1

48. **During γ-decay of radioactivity, (as compared to parent nucleus)**

(a) Mass number of daughter nucleus decreases by 2 and atomic number decreases by 4
(b) Mass number of daughter nucleus decreases by 4 and atomic number decreases by 2
(c) Both mass number and atomic number of daughter nucleus decrease by 2
(d) There will be no change in the mass number and atomic number of daughter nuclei

49. **In beta-minus decay of radioactivity,**

(a) a neutron transforms into a proton within the nucleus
(b) a proton transforms into neutron inside the nucleus
(c) electrons outside the nucleus are emitted
(d) neutron is emitted from the nucleus

50. **In β^+ decay of radioactivity,**

(a) a neutron transforms into a proton within the nucleus
(b) a proton transforms into neutron inside the nucleus
(c) electrons outside the nucleus are emitted
(d) neutron is emitted from the nucleus

51. **Name the particle X in the reaction, $n \rightarrow p + e^- + X$**

(a) neutrino (b) positron (c) electron (d) antineutrino

52. **Name the particle X in the reaction, $p \rightarrow n + e^+ + X$**

(a) neutrino (b) positron (c) electron (d) antineutrino

53. **Which one of the following particles is emitted along with electron during β^- decay?**

(a) antineutrino ($\bar{\nu}$) (b) neutrino (ν)
(c) positron (d) Helium nucleus

54. **The charge of neutrino is**

(a) $+1.6\text{x}10^{-19}$C (b) $-1.6\text{x}10^{-19}$C (c) zero (d) $+3.2\text{x}10^{-19}$C

55. **The charge of antineutrino is**

(a) $+1.6\text{x}10^{-19}$C (b) $-1.6\text{x}10^{-19}$C (c) zero (d) $+3.2\text{x}10^{-19}$C

56. Rate of disintegration of a radioactive sample is

(a) inversely proportional to the number of atoms in the sample at the instant
<u>(b) directly proportional to the number of atoms in the sample at the instant</u>
(c) independent of the number of atoms in the sample at the instant
(d) directly proportional to the square of number of atoms in the sample at the instant

57. The time in which number of radioactive nuclei disintegrate to half of original value is called

(a) Mean life | <u>(b) Half life</u>
(c) Active life | (d) Quarter life

58. The time in which number of radioactive nuclei disintegrate to e^{-1} times the original value is called

<u>(a) Mean life</u> | (b) Half life
(c) Active life | (d) Quarter life

59. With reference to radioactivity, select the correct relation

(a) Mean life = Half-life | (b) Mean life < Half life
<u>(c) Mean life > Half-life</u> | (d) Half-life = (Mean life)/2

60. Relation between mean life (τ) and half-life (T) is

(a) $T=0.693/\tau$ | (b) $\tau = 0.693\,T$
(c) <u>$\tau = T/0.693$</u> | (d) $\tau = 0.693 + T$

61. **Relation between Half-life (T) and decay constant λ is**

<u>(a) $T=0.693/\lambda$</u> | (b) $\tau = 0.693\,\lambda$
(c) $\tau = \lambda/0.693$ | (d) $\tau = 0.693 + \lambda$

62. **Relation between mean life (τ) and decay constant λ is**

(a) $\tau=0.693/\lambda$ | (b) $\tau = 0.693\,\lambda$
(c) <u>$\tau = 1 / \lambda$</u> | (d) $\tau = 0.693 + \lambda$

63. Reciprocal of decay constant is called

<u>(a) Mean life</u> | (b) Half life
(c) Active life | (d) Quarter life

64. SI unit of activity of a radioactive sample is

(a) <u>becquerel</u> | (b) curie
(c) electron volt | (d) joules/ second

65. 1 Ci is equal to ………. decays per second

(a) 3.7×10^{7} Bq | (b) 3.7×10^{8} Bq | (c) 3.7×10^{9} Bq | (d) <u>3.7×10^{10} Bq</u>

66. The process in which two lighter nuclei combine together to form a heavier nucleus is called

(a) Nuclear fission | (b) <u>nuclear fusion</u>
(c) Radioactivity | (d) photoelectric effect

67. During nuclear fission process

(a) Energy is converted into mass | (b) <u>mass is converted into energy</u>
(c) Energy is not released. | (d) Weak nucleus splits into heavy nuclei

68. In nuclear power reactors

(a) Controlled fusion chain reaction is undertaken
(b) controlled fission chain reaction is undertaken
(c) uncontrolled fission chain reaction is undertaken
(d) uncontrolled fusion chain reaction is undertaken

69. In nuclear bomb

(a) Controlled fusion chain reaction is carried out
(b) controlled fission chain reaction is carried out
(c) uncontrolled fission chain reaction is carried out
(d) uncontrolled fusion chain reaction is carried out

70. Nuclear reaction occurring stars is

(a) Fission reaction (b) fusion reaction
(c) Chemical reaction (d) Combustion

71. For the nuclear reaction occurring in a nuclear reactor, multiplication factor 'K' is

(a) greater than one (b) less than one
(c) equal to one (d) negative

72. Which one of the following is also called thermonuclear reaction?

(a) Fission reaction (b) fusion reaction
(c) Radioactivity (d) β^{-} decay

73. In a nuclear reactor, moderators are used to

(a) stop the leakage of neutron (b) slow down the fast neutrons
(c) absorb the neutrons (d) increase the kinetic energy of neutrons

74. In a nuclear reactor, control rods are used to

(a) stop the leakage of neutron (b) slow down the fast neutrons
(c) absorb the neutrons (d) increase the kinetic energy of neutrons

MULTIPLE CHOICE QUESTIONS WITH ANSWERS

14. Semiconductors

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1. Which one of the following is an example for a semiconductor?
(a) Cu (b) Au (c) Ge (d) Al

2. The energy band above the valence band is called
(a) Conduction band (b) Forbidden Band
(c) Semiconductor band (d) Insulator band

3. Pentavalent dopants have a valency of
(a) 3 (b) 4 (c) 5 (d) 6

4. The diode used as a voltage regulator is
(a) Zener diode (b) Light Emitting Diode
(c) Photo diode (d) Solar cell

5. Tetravalent among the following is
(a) Silicon (b) boron (c) Indium (d) Aluminium

6. In an intrinsic semiconductor, number of free electrons is
(a) greater than number of holes (b) lesser than number of holes
(c) equal to number of holes (d) more than number of atoms

7. In a material conduction band and valence band overlap. Material is a
(a) semi-conductor (b) insulator
(c) metal (d) doped semiconductor

8. A p-type semiconductor is
(b) Positively charged (b) negatively charged
(c) electrically neutral (d) an intrinsic semiconductor

9. A n-type semiconductor is
(c) Positively charged (b) negatively charged
(c) electrically neutral (d) an intrinsic semiconductor

10. The vacancy with effective positive electronic charge created in the valence band when an electron in a semiconductor jumps to conduction band is called
(a) Positron (b) electron (c) hole (d) proton

11. Trivalent dopant atom is also called
(a) Donor impurity atom (b) acceptor impurity atom
(c) intrinsic atom (d) extrinsic atom

12. An intrinsic semiconductor is doped with boron impurity atoms. Resulting extrinsic semiconductor is
(a) n-type semiconductor (b) p-type semiconductor
(c) p-n junction (d) Depletion region

13. Semiconductor doped with pentavalent impurity is a………. semiconductor
(a) n- type (b) p- type (c) intrinsic (d) p-n junction

14. **As soon as p-n junction is formed, migration of electrons from n to p side and holes from p to n side produces**

(a) diffusion current (b) conduction current
(c) drift current (d) displacement current

15. **Diffusion current is produced by the diffusion of**

(a) majority carriers across the junction
(b) minority carriers across the junction
(c) protons across the junction
(d) ions across the junction

16. **Drift current is produced by the motion of**

(a) majority carriers across the junction
(b) minority carriers across the junction
(c) protons across the junction
(d) ions across the junction

17. **During forward bias of a p-n junction diode**

(a) p-side of the diode is connected to positive and n-side of the diode is connected to negative of the battery
(b) n-side of the diode is connected to positive and p-side of the diode is connected to negative of the battery
(c) both p and n sides of the diode are connected to positive of the battery.
(d) both p and sides of the diode are connected to negative of the battery

18. **During forward bias of a p-n junction diode, width of the depletion region**

(a) decreases (b) increases
(c) remains the same (d) may increase or decrease depending on type of dopant

19. **During reverse bias of a p-n junction diode, width of the depletion region**

(a) decreases (b) increases
(c) remains the same (d) may increase or decrease depending on type of dopant

20. **During reverse bias very small current flowing through a diode is due to the flow of**

(a) majority carriers (b) minority charge carriers
(c) protons (d) ions

21. **During forward bias, resistance offered by a p-n junction**

(a) is very less
(b) is very high
(c) will be increasing as forward bias voltage increases
(d) is infinity

22. **During reverse bias, resistance offered by a p-n junction**

(a) is very less
(b) is very high
(c) will be decreasing as reverse bias voltage increases
(d) is zero

23. **The forward voltage of the diode after which forward current increases sharply is called**
(a) reverse voltage (b) break down voltage
(c) cut in voltage (d) applied voltage

24. **Rectifier is a circuit which**
(a) converts alternating current to direct current
(b) converts direct current to alternating current
(c) increases or decrease the amplitude of ac
(d) which changes the frequency of ac

25. **The device which can convert ac to dc is**
(a) Transformer (b) p-n junction diode
(c) capacitor (d) resistor

26. **The diode which can provide a constant output voltage irrespective of changes in the current at reverse bias is**
(a) Photo diode (b) Light emitting diode
(c) Zener diode (d) Solar cell

27. **The diode which can convert optical signal into electrical signal during reverse bias is**
(a) Photo diode (b) Light emitting diode
(c) Zener diode (d) Solar cell

28. **The diode which can emit light during forward bis is**
(a) Photo diode (b) Light emitting diode
(c) Zener diode (d) Solar cell

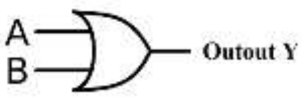
29. **A p-n junction which can generate emf when solar radiation falls on it is called**
(a) Photo diode (b) Light emitting diode
(c) Zener diode (d) Solar cell

30. **The principle of a solar cell is**
(a) Thermionic effect (b) Photo voltaic effect
(c) Field effect (d) Chemical effect

31. **When a solar cell is in open circuit, potential difference across it is called**
(a) break down voltage (b) cut in voltage
(c) open circuit voltage (d) short circuit current

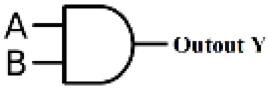
32. **When the terminals of a solar cell are connected, current flowing through it is called**
(a) break down voltage (b) cut in voltage
(c) open circuit voltage (d) short circuit current

33. **Following symbol represents**



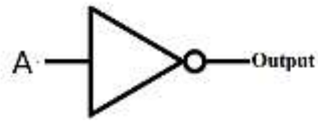
(a) AND gate (b) OR gate
(c) NOR gate (d) NAND gate

34. **Following symbol represents**



(a) AND gate
(b) OR gate
(c) NOR gate
(d) NAND gate

35. **Following symbol represents**



(a) AND gate
(b) OR gate
(c) NOR gate
(d) NOT gate

36. If A and B are inputs to a NAND gate which one of the following combinations of A and B represent correct output Y?

(a) A=0, B=1 and Y=0
(b) A=1, B=0 and Y=0
(c) A=1, B=1 and Y=1
(d) A=0, B=0 and Y=1

37. If A and B are the two inputs of the OR gate, then it output is represented as

(a) Y= A+B (b) Y= AB (c) Y = $\overline{A+B}$ (d) Y= $\overline{AB}$

38. When both the inputs (A and B) of AND gate is 1, the output is

(a) 0 (b) 1 (c) 2 (d) 3

39. Universal gate among the following is

(a) AND (b) NOT (c) OR (d) NAND

40. The basic gate with one output which is complement of one input is

(a) NOT gate (b) AND gate (c) OR gate (d) NOR gate

41. The diode used as a voltage regulator is

(b) Zener diode
(b) Light Emitting Diode
(c) Photo diode
(d) Solar cell

42. Two inputs of a AND gate are 1 and 0. What is the output?

(a) 0 (b) 1 (c) 2 (d) 3

43. Diode whose reverse bias current increases with amount of light falling on its junction is

(a) Zener diode
(b) Light Emitting Diode
(c) Photo diode
(d) Solar cell

44. p-n junction which develops emf when solar light falls on it is called

(a) Zener diode
(b) Light Emitting Diode
(c) Photo diode
(d) Solar cell

45. For an OR Gate, which set of inputs A and B give output Y=0?

(a) A=1, B=1. (b) A=0, B=1. (c) A=1, B= 0. (d) A=0, B =0