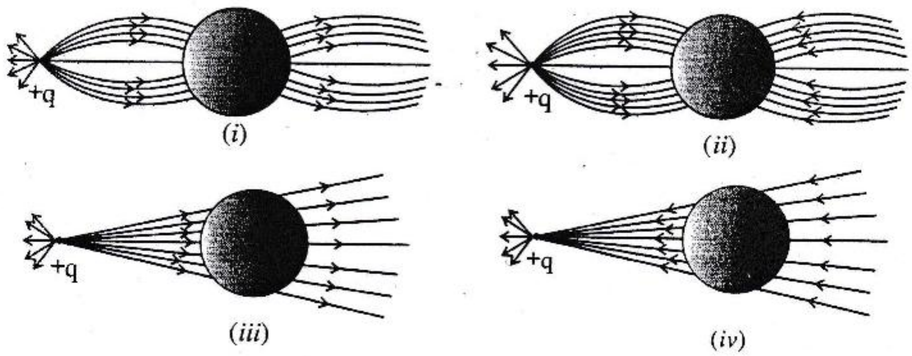
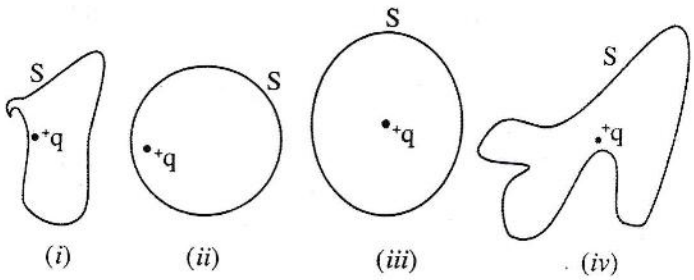
## Multiple Choice Questions **[1 mark]**

***Choose and write the correct option(s) in the following questions.***

1. **A body gets positive charge. It means that**
   (*a*) it has lost electrons
   (*b*) it has gained protons
   (*c*) it has gained positrons
   (*d*) it has gained α-particles.
2. **The minimum value of charge on any charged body may be**
   (*a*) $1.6 \times 10^{-19}$ coulomb
   (*b*) 1 coulomb
   (*c*) $1 \mu C$
   (*d*) $4.8 \times 10^{-12}$ coulomb
3. **When air is replaced by a medium of dielectric constant *K*, the force of attraction between two charges separated by a distance *r***
   (*a*) decreases *K* times
   (*b*) remains unchanged
   (*c*) increases *K* times
   (*d*) increases $K^{-2}$ times
4. **A point positive charge is brought near an isolated conducting sphere (Fig. given below). The electric field is best given by** [*NCERT Exemplar*]




   (*a*) Fig (*i*)
   (*b*) Fig (*ii*)
   (*c*) Fig (*iii*)
   (*d*) Fig (*iv*)
5. **The Electric flux through the surface** [*NCERT Exemplar*]



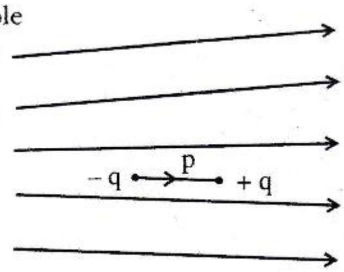

   (*a*) in Fig. (*iv*) is the largest.
   (*b*) in Fig. (*iii*) is the least.
   (*c*) in Fig. (*ii*) is same as Fig. (*iii*) but is smaller than Fig. (*iv*)
   (*d*) is the same for all the figures.

6. **A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed** [*NCERT Exemplar*]
(*a*) perpendicular to the diameter (*b*) parallel to the diameter
(*c*) at an angle tilted towards the diameter (*d*) at an angle tilted away from the diameter

7. **A point charge $+q$, is placed at a distance $d$ from an isolated conducting plane. The field at a point $P$ on the other side of the plane is**
(*a*) directed perpendicular to the plane and away from the plane.
(*b*) directed perpendicular to the plane but towards the plane.
(*c*) directed radially away from the point charge.
(*d*) directed radially towards the point charge.

8. **The conservation of electric charge implies that**
(*a*) total charge of the entire universe remains constant
(*b*) charge cannot be created
(*c*) charge cannot be destroyed
(*d*) simultaneous creation of equal and opposite charge is permissible

9. **Figure shows electric field lines in which an electric dipole $p$ is placed as shown. Which of the following statements is correct?** [*NCERT Exemplar*]




(*a*) the dipole will not experience any force.
(*b*) the dipole will experience a force towards right.
(*c*) the dipole will experience a force towards left.
(*d*) the dipole will experience a force upwards.

10. **A point charge $+q$, is placed at a distance $d$ from an isolated conducting plane. The field at a point $P$ on the other side of the plane is** [*NCERT Exemplar*]
(*a*) directed perpendicular to the plane and away from the plane.
(*b*) directed perpendicular to the plane but towards the plane.
(*c*) directed radially away from the point charge.
(*d*) directed radially towards the point charge.

11. **There are two kinds of charges—positive charge and negative charge. The property which differentiates the two kinds of charges is called**
(*a*) amount of charge (*b*) polarity of charge
(*c*) strength of charge (*d*) field of charge

12. **A method for charging a conductor without bringing a charged object in contact with it is called**
(*a*) electrification (*b*) magnetisation
(*c*) electromagnetic induction (*d*) electrostatic induction

13. **If $\oint E.dS = 0$ over a surface, then**
(*a*) the electric field inside the surface and on it is zero.
(*b*) the electric field inside the surface is necessarily uniform.
(*c*) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.
(*d*) all charges must necessarily be outside the surface.

14. **A cup contains 250 g of water. The number of negative charges present in the cup of water is**
(*a*) $1.34 \times 10^{7}$ C (*b*) $1.34 \times 10^{19}$ C (*c*) $3.34 \times 10^{7}$ C (*d*) $1.34 \times 10^{-19}$ C

15. **When the distance between two charged particles is halved, the Coulomb force between them becomes**
(*a*) one-half (*b*) one-fourth (*c*) double (*d*) four times.

16. **Two charges are at distance $d$ apart in air. Coulomb force between them is $F$. If a dielectric material of dielectric constant $K$ is placed between them, the Coulomb force now becomes**
(*a*) $F/K$ (*b*) $FK$ (*c*) $F/K^2$ (*d*) $K^2F$

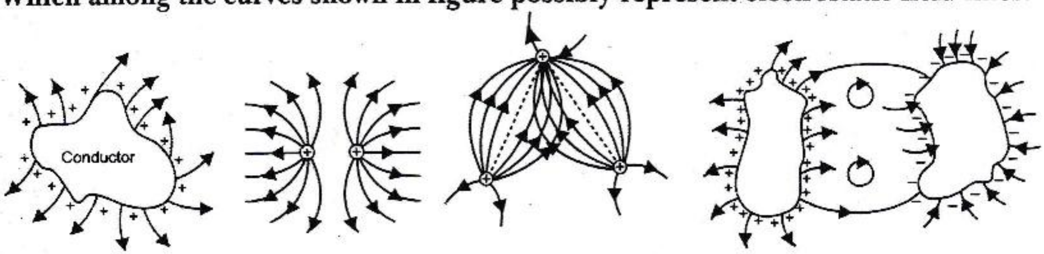
17. **Two point charges $q_1$ and $q_2$ are at separation $r$. The force acting between them is given by $F = K\frac{q_1 q_2}{r^2}$. The constant $K$ depends upon**

(*a*) only on the system of units
(*b*) only on medium between charges
(*c*) both on (*a*) and (*b*)
(*d*) neither on (*a*) nor on (*b*)

18. **Consider a region inside in which there are various types of charges but the total charge is zero. At points outside the region**

(*a*) the electric field is necessarily zero.
(*b*) the electric field is due to the dipole moment of the charge distribution only.
(*c*) the dominant electric field is $\propto \frac{1}{r^3}$, for large $r$, where $r$ is the distance from a origin in this region.
(*d*) the work done to move a charged particle along a closed path, away from the region, will be zero.

19. **Which among the curves shown in figure possibly represent electrostatic field lines?**




(*a*) (*b*) (*c*) (*d*)

20. **A charge '$q$' is placed at the centre of the line joining two equal charges '$Q$'. The system of the three charges will be in equilibrium if '$q$' is equal to:**

(*a*) $-Q/4$
(*b*) $Q/4$
(*c*) $-Q/2$
(*d*) $Q/2$

## Multiple Choice Questions [1 mark]

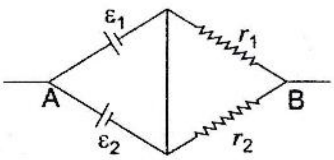
*Choose and write the correct option(s) in the following questions.*

1. **Consider a current carrying wire (current $I$) in the shape of a circle. Note that as the current progresses along the wire, the direction of j (current density) changes in an exact manner, while the current I remain unaffected. The agent that is essentially responsible for is** [*NCERT Exemplar*]

   (*a*) source of emf.
   (*b*) electric field produced by charges accumulated on the surface of wire.
   (*c*) the charges just behind a given segment of wire which push them just the right way by repulsion.
   (*d*) the charges ahead.

2. **Two batteries of emf $\varepsilon_1$ and $\varepsilon_2$ ($\varepsilon_2 > \varepsilon_1$) and internal resistances $r_1$ and $r_2$ respectively are connected in parallel as shown in Figure.** [*NCERT Exemplar*]

   (*a*) The equivalent emf $\varepsilon_{eq}$ of the two cells is between $\varepsilon_1$ and $\varepsilon_2$, *i.e.* $\varepsilon_1 < \varepsilon_{eq} < \varepsilon_2$
   (*b*) The equivalent emf $\varepsilon_{eq}$ is smaller than $\varepsilon_1$.
   (*c*) The $\varepsilon_{eq}$ is given by $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$ always.
   (*d*) $\varepsilon_{eq}$ is independent of internal resistances $r_1$ and $r_2$.




3. **The drift velocity of the free electrons in a conducting wire carrying a current $i$ is $v$. If in a wire of the same metal, but of double the radius, the current be $2i$, then the drift velocity of the electrons will be**

   (*a*) $v/4$ (*b*) $v/2$ (*c*) $v$ (*d*) $4v$

4. **Assume that each atom of copper contributes one free electron. If the current flowing through a copper wire of 1 mm diameter is 1.1 A, the drift velocity of electrons will be (Density of Cu = $9 \times 10^3$ kg/m$^3$, At. wt. of Cu = 63, Avogadro number = $6.02 \times 10^{26}$/kg atom)**

   (*a*) 0.3 mm/s (*b*) 0.5 mm/s (*c*) 0.1 mm/s (*d*) 0.2 mm/s

**5. A resistance $R$ is to be measured using a meter bridge. Student chooses the standard resistance $S$ to be 100Ω. He finds the null point at $l_1$ = 2.9 cm. He is told to attempt to improve the accuracy. Which of the following is a useful way?** *[NCERT Exemplar]*

(*a*) He should measure $l_1$ more accurately.

(*b*) He should change $S$ to 1000Ω and repeat the experiment.

(*c*) He should change $S$ to 3Ω and repeat the experiment.

(*d*) He should give up hope of a more accurate measurement with a meter bridge.

**6. Two cells of emf's approximately 5V and 10V are to be accurately compared using a potentiometer of length 400 cm.** *[NCERT Exemplar]*

(*a*) The battery that runs the potentiometer should have voltage of 8V.

(*b*) The battery of potentiometer can have a voltage of 15V and R adjusted so that the potential drop across the wire slightly exceeds 10V.

(*c*) The first portion of 50 cm of wire itself should have a potential drop of 10V.

(*d*) Potentiometer is usually used for comparing resistances and not voltages.

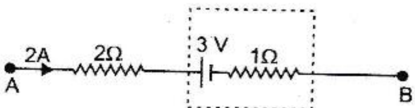
**7. If a copper wire is stretched to make it 0.1 % longer, the percentage increase in resistance will be**

(*a*) 0.2 (*b*) 2 (*c*) 1 (*d*) 0.1

**8. The resistivity of iron is $1 \times 10^{-7}$ ohm-meter. The resistance of the given wire of a particular thickness and length is 1 ohm. If the diameter and length of the wire both are doubled the resistivity will be (in ohm-meter)**

(*a*) $1 \times 10^{-7}$ (*b*) $2 \times 10^{-7}$ (*c*) $4 \times 10^{-7}$ (*d*) $8 \times 10^{-7}$

**9. Figure represents a part of a closed circuit. The potential difference between points $A$ and $B$ $(V_A - V_B)$ is**




(*a*) +9V (*b*) – 9V (*c*) +3V (*d*) + 6V

**10. A student connects 10 dry cells each of emf $E$ and internal resistance $r$ in series, but by mistake the one cell gets wrongly connected. Then net emf and net internal resistance of the combination will be**

(*a*) $8E$, $8r$ (*b*) $8E$, $10r$ (*c*) $10E$, $10r$ (*d*) $8E$, $\frac{r}{10}$

**11. A metal rod of length 10 cm and a rectangular cross-section of 1cm × $\frac{1}{2}$ cm is connected to a battery across opposite faces. The resistance will be** *[NCERT Exemplar]*

(*a*) maximum when the battery is connected across 1 cm × $\frac{1}{2}$ cm faces.

(*b*) maximum when the battery is connected across 10 cm × 1 cm faces.

(*c*) maximum when the battery is connected across 10 cm × $\frac{1}{2}$ cm faces.

(*d*) same irrespective of the three faces.

**12. Which of the following characteristics of electrons determines the current in a conductor?** *[NCERT Exemplar]*

(*a*) Drift velocity alone

(*b*) Thermal velocity alone

(*c*) Both drift velocity and thermal velocity

(*d*) Neither drift nor thermal velocity.

**13. According to Joule's law, if potential difference across a conductor of material of resistivity ρ remains constant, then heat produced in the conductor is directly proportional to**

(*a*) $\frac{1}{\sqrt{\rho}}$ (*b*) $\rho$ (*c*) $\rho^{-1}$ (*d*) $\rho^2$

14. **Two bulbs each marked 100 W, 220 V are connected in series across 220 V supply. The power consumed by them, when lit, is**

(*a*) 220 W (*b*) 100 W (*c*) 50 W (*d*) zero

15. **Two bulbs each marked 100 W, 220 V are connected in parallel across 220 V supply. The power consumed by them, when lit, is**

(*a*) 200 W (*b*) 100 W (*c*) 50 W (*d*) zero

16. **A 100 W, 200 V bulb is being operated at 160 V, the power dissipation is**

(*a*) 32 W (*b*) 64 W (*c*) 100 W (*d*) 160 W

17. **A 5°C rise in temperature is observed in a conductor by passing a current. If the current is doubled, the rise in temperature of the conductor will be nearly**

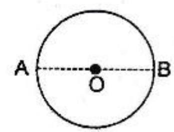
(*a*) 10°C (*b*) 20°C (*c*) 40°C (*d*) 25°C

18. **Temperature dependence of resistivity ρ(T) of semiconductors insulators and metals is significantly based on the following factors.** [*NCERT Exemplar*]

(*a*) number of charge carriers can change with temperature *T*.
(*b*) time interval between two successive collision can depend on *T*.
(*c*) length of material can be a function of *T*.
(*d*) mass of carriers is a function of *T*.

19. **A wire of resistance 12Ω/m is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points *A* and *B* as shown in figure is**

(*a*) 3 Ω (*b*) 6 πΩ (*c*) 6 Ω (*d*) 0.6 πΩ




20. **Kirchhoff's junction rule is a reflection of** [*NCERT Exemplar*]

(*a*) conservation of current density vector.
(*b*) conservation of charge.
(*c*) the fact that the momentum with which a charged particle approaches a junction is unchanged (as a vector) as the charged particle leaves the junction.
(*d*) the fact that there is no accumulation of charged at a junction.

## Multiple Choice Questions [1 mark]

*Choose and write the correct option(s) in the following questions.*

1. **If a conducting wire carries a direct current through it, the magnetic field associated with the current will be ________.**

   (*a*) Both inside and outside the conductor (*b*) Neither inside nor outside the conductor
   (*c*) Only outside the conductor (*d*) Only inside the conductor

2. **A compass needle is placed above a straight conducting wire. If current passes through the conducting wire from South to North. Then the deflection of the compass ________.**

   (*a*) is towards West (*b*) is towards East
   (*c*) keeps oscillating in East-West direction (*d*) No deflection

3. **When a charged particle moving with velocity $\vec{v}$ is subjected to a magnetic field of induction $\vec{B}$, the force on it is non-zero.**
   **This implies that**

   (*a*) angle between is either zero or 180°
   (*b*) angle between is necessarily 90°
   (*c*) angle between can have any value other than 90°
   (*d*) angle between can have any value other than zero and 180°

4. **Consider the following two statements about the Oersted's experiment.**
   **Statement P: The magnetic field due to a straight current carrying conductor is in the form of circular loops around it.**
   **Statement Q: The magnetic field due to a current carrying conductor is weak at near points from the conductor, compared to the far points.**

   (*a*) Both P and Q are true (*b*) Both P and Q are false
   (*c*) P is true, but Q is false (*d*) P is false, but Q is true

5. **Consider the following statements about the representation of the magnetic field**
   **Statement P: The magnetic field emerging out of the plane of the paper is denoted by a dot (⊙).**
   **Statement Q: The magnetic field going into the plane of the paper is denoted by a cross (⊗).**

   (*a*) Both P and Q are true (*b*) P is true, but Q is false
   (*c*) P is false, but Q is true (*d*) Both P and Q are false

6. **In a cyclotron, a charged particle** [*NCERT Exemplar*]

   (*a*) undergoes acceleration all the time
   (*b*) speeds up between the dees because of the magnetic field
   (*c*) speeds up in a dee
   (*d*) slows down within a dee and speeds up between dees

7. **Two charged particles traverse identical helical paths in a completely opposite sense in a uniform magnetic field $B = B_0\hat{k}$.** [*NCERT Exemplar*]

   (*a*) They have equal z-components of momenta
   (*b*) They must have equal charges
   (*c*) They necessarily represent a particle, anti-particle pair
   (*d*) The charge to mass ratio satisfy: $\left(\frac{e}{m}\right)_1 + \left(\frac{e}{m}\right)_2 = 0$

8. **A cyclotron's oscillator frequency is 20 MHz. If the radius of its 'dees' is 40 cm, what is the kinetic energy (in MeV) of the proton beam produced by the accelerator.**

   (*a*) 7 MeV (*b*) 13.25 MeV (*c*) 28 MeV (*d*) 3.5 MeV

9. **Biot-Savart law indicates that the moving electrons (velocity $v$) produce a magnetic field $B$ such that** [*NCERT Exemplar*]

(*a*) $B$ is perpendicular to $v$

(*b*) $B$ is parallel to $v$

(*c*) it obeys inverse cube law

(*d*) it is along the line joining the electron and point of observation

10. **An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?** [*NCERT Exemplar*]

(*a*) The electron will be accelerated along the axis

(*b*) The electron path will be circular about the axis

(*c*) The electron will experience a force at 45° to the axis and hence execute a helical path

(*d*) The electron will continue to move with uniform velocity along the axis of the solenoid

11. **A micro-ammeter has a resistance of 100Ω and a full scale range of 50 μA. It can be used as a higher range ammeter or voltmeter provided resistance is added to it. Pick the correct range and resistance combinations.**

(*a*) 50 V range and 10 kΩ resistance in series

(*b*) 10 V range and 200 kΩ resistance in series

(*c*) 5 mA range with 1 Ω resistance in parallel

(*d*) 10 mA range with 1 Ω resistance in parallel.

12. **A current carrying circular loop of radius $R$ is placed in the $x$-$y$ plane with centre at the origin. Half of the loop with $x > 0$ is now bent so that it now lies in the $y$-$z$ plane.** [*NCERT Exemplar*]

(*a*) The magnitude of magnetic moment now diminishes.

(*b*) The magnetic moment does not change.

(*c*) The magnitude of $B$ at $(0,0,z)$, $z>>R$ increases.

(*d*) The magnitude of $B$ at $(0,0,z)$, $z>>R$ is unchanged.

13. **A circular current loop of magnetic moment $M$ is in an arbitrary orientation in an external magnetic field $B$. The work done to rotate the loop by 30° about an axis perpendicular to its plane is**

(*a*) $MB$ (*b*) $\sqrt{3}\frac{MB}{2}$ (*c*) $\frac{MB}{2}$ (*d*) zero

14. **A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon the**

(*a*) shape of the loop (*b*) area of the loop (*c*) value of current (*d*) magnetic field

15. **A circular coil of 50 turns and radius 7 cm is placed in a uniform magnetic field of 4 T normal to the plane of the coil. If the current in the coil is 6 A then total torque acting on the coil is**

(*a*) 14.78 N (*b*) 0 N (*c*) 7.39 N (*d*) 3.69 N

16. **The gyro-magnetic ratio of an electron in an H-atom, according to Bohr model, is**

(*a*) independent of which orbit it is in. (*b*) negative

(*c*) positive (*d*) increases with the quantum number $n$

17. **The sensitivity of a moving coil galvanometer increases with the decrease in:**

(*a*) number of turns (*b*) area of coil (*c*) magnetic field (*d*) torsional rigidity

18. **A voltmeter of range 2V and resistance 300 Ω cannot be converted to an ammeter of range:**

(*a*) 5 mA (*b*) 8 mA (*c*) 1 A (*d*) 10 A

19. **In an ammeter 4% of the mains current is passing through galvanometer. If the galvanometer is shunted with a 3 Ω resistance.**

(*a*) 116 Ω (*b*) 117 Ω (*c*) 118 Ω (*d*) 120 Ω

**20.** **A rectangular coil of length 0.12 m and width 0.1 m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength 0.2 Weber/$m^2$. The coil carries a current of 2 A. If the plane of the coil is inclined at an angle of 30° with the direction of the field, the torque required to keep the coil in stable equilibrium will be**

(*a*) 0.24 Nm (*b*) 0.12 Nm (*c*) 0.15 Nm (*d*) 0.20 Nm

## Multiple Choice Questions **[1 mark]**

*Choose and write the correct option(s) in the following questions.*

1. **Magnetism in substances is caused by**
   (*a*) orbital motion of electrons only
   (*b*) spin motion of electrons only
   (*c*) due to spin and orbital motions of electrons both
   (*d*) hidden magnets
2. **The major contribution of magnetism in substances is due to**
   (*a*) orbital motion of electrons
   (*b*) spin motion of electrons
   (*c*) equally due to orbital and spin motions of electrons
   (*d*) hidden magnets.

3. **A long solenoid has 1000 turns per metre and carries a current of 1 A. It has a soft iron core of $\mu_r = 1000$. The core is heated beyond the Curie temperature, $T_c$, then** [*NCERT Exemplar*]
(*a*) the *H* field in the solenoid is (nearly) unchanged but the *B* field decreases drastically.
(*b*) the *H* and *B* fields in the solenoid are nearly unchanged.
(*c*) the magnetisation in the core reverses direction.
(*d*) the magnetisation in the core diminishes by a factor of about $10^8$.

4. **A sensitive magnetic instrument can be shielded very effectively from outside fields by placing it inside a box of**
(*a*) teak wood
(*b*) plastic material
(*c*) soft iron of high permeability
(*d*) a metal of high conductivity

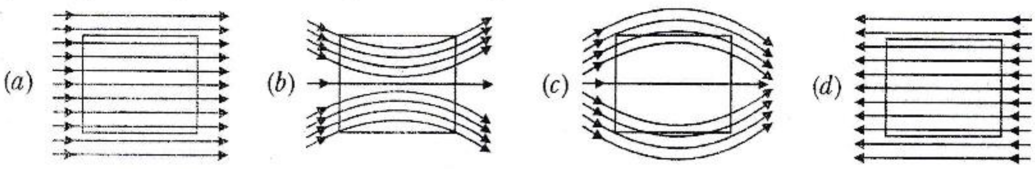
5. **A toroid of *n* turns, mean radius *R* and cross-sectional radius *a* carries current *I*. It is placed on a horizontal table taken as *X-Y* plane. Its magnetic moment $\vec{m}$** [*NCERT Exemplar*]
(*a*) is non-zero and points in the *Z*-direction by symmetry.
(*b*) points along the axis of the toroid ($\vec{m} = m\phi$).
(*c*) is zero, otherwise there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid.
(*d*) is pointing radially outwards.

6. **The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth. The dipole axis makes an angle of 11.3° with the axis of Earth. At Mumbai, declination is nearly zero. Then,** [*NCERT Exemplar*]
(*a*) the declination varies between 11.3° W to 11.3° E.
(*b*) the least declination is 0°.
(*c*) the plane defined by dipole axis and Earth axis passes through Greenwich.
(*d*) declination averaged over Earth must be always negative.

7. **A magnetic needle is kept in a uniform magnetic field. It experiences**
(*a*) a force and a torque
(*b*) a force but not a torque
(*c*) a torque but not a force
(*d*) neither a torque nor a force

8. **A magnetic needle is kept in a non-uniform magnetic field. It experiences**
(*a*) a force and a torque
(*b*) a force but not a torque
(c) a torque but not a force
(*d*) neither a force nor a torque

9. **A uniform magnetic field exists in space in the plane of paper and is initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by**




10. **In a permanent magnet at room temperature** [*NCERT Exemplar*]
(*a*) magnetic moment of each molecule is zero.
(*b*) the individual molecules have non-zero magnetic moment which are all perfectly aligned.
(*c*) domains are partially aligned.
(*d*) domains are all perfectly aligned.

11. **A bar magnet of magnetic moment $\vec{m}$ is placed in a uniform magnetic field of induction $\vec{B}$. The torque exerted on it is**
(*a*) $\vec{m} \cdot \vec{B}$
(*b*) $-\vec{m} \cdot \vec{B}$
(*c*) $\vec{m} \times \vec{B}$
(*d*) $-\vec{m} \times \vec{B}$

12. **Let the magnetic field on earth be modelled by that of a point magnetic dipole at the centre of earth. The angle of dip at a point on the geographical equator**
(*a*) is always zero
(*b*) can be zero at specific points
(*c*) can be positive or negative
(*d*) is bounded

13. **Points A and B are situated perpendicular to the axis of a 2 cm long bar magnet at large distances $x$ and $3x$ from its centre on opposite sides. The ratio of the magnetic fields at A and B will be approximately equal to**
(*a*) 1: 9 (*b*) 2: 9 (*c*) 27: 1 (*d*) 9: 1

14. **Consider the two idealised systems: (*i*) a parallel plate capacitor with large plates and small separation and (*ii*) a long solenoid of length L >> R, radius of cross-section. In (*i*), $E$ is ideally treated as a constant between plates and zero outside. In (*ii*), magnetic field is constant inside the solenoid and zero outside. These idealised assumptions, however, contradict fundamental laws as below:**

(*a*) case (*i*) contradicts Gauss's law for electrostatic fields.

(*b*) case (*ii*) contradicts Gauss's law for magnetic fields.

(*c*) case (*i*) agrees with $\oint E.d1 = 0$

(*d*) case (*ii*) contradicts en $\oint H.d1 = I_{en}$

15. **A paramagnetic sample shows a net magnetisation of 8 $Am^{-1}$ when placed in an external magnetic field of 0.6T at a temperature of 4K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16K, the magnetisation will be** [*NCERT Exemplar*]
(*a*) $\frac{32}{3} Am^{-1}$ (*b*) $\frac{2}{3} Am^{-1}$ (*c*) 6 $Am^{-1}$ (*d*) 2.4 $Am^{-1}$

16. **The ratio of magnetic fields due to a small bar magnet in the end on position to the broad side on position is**
(*a*) 1: 4 (*b*) 1: 2 (*c*) 1: 1 (*d*) 2: 1

17. **How does the magnetic susceptibility $\chi$ of a paramagnetic material change with absolute temperature $T$?**
(*a*) $\chi \propto T$ (*b*) $\chi \propto T^{-1}$ (*c*) $\chi$ = constant (*d*) $\chi \propto e^T$

18. **The meniscus of a liquid contained in one of the limbs of a narrow U-tube is placed between the pole-pieces of an electromagnet with the meniscus in a line with the field. When the electromagnet is switched on, the liquid is seen to rise in the limb. This indicates that the liquid is**
(*a*) ferromagnetic (*b*) paramagnetic
(*c*) diamagnetic (*d*) non-magnetic.

19. **Electro-magnets are made of soft iron because soft iron has**
(*a*) small susceptibility and small retentivity
(*b*) large susceptibility and small retentivity
(*c*) large permeability and large retentivity
(*d*) small permeability and large retentivity.

20. **In a plane perpendicular to the magnetic meridian, the dip needle will be**
(*a*) vertical
(*b*) horizontal
(*c*) inclined equal to the angle of dip at that place
(*d*) pointing in any direction

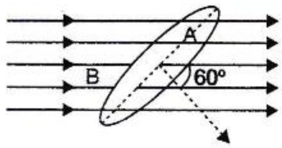
## Multiple Choice Questions **[1 mark]**

*Choose and write the correct option(s) in the following questions.*

1. **Whenever the flux linked with a circuit changes, there is an induced emf in the circuit. This emf in the circuit lasts**
   (a) for a very short duration
   (b) for a long duration
   (c) forever
   (d) as long as the magnetic flux in the circuit changes.

2. **The area of a square shaped coil is $10^{-2}$ m$^2$. Its plane is perpendicular to a magnetic field of strength $10^{-3}$ T. The magnetic flux linked with the coil is**
   (a) 10 Wb (b) $10^{-5}$ Wb (c) $10^5$ Wb (d) 100 Wb

3. **An area $A = 0.5$ m$^2$ shown in the figure is situated in a uniform magnetic field $B = 4.0$ Wb/m$^2$ and its normal makes an angle of 60° with the field. The magnetic flux passing through the area $A$ would be equal to**




   (a) 2.0 weber (b) 1.0 weber (c) $\sqrt{3}$ weber (d) 0.5 weber

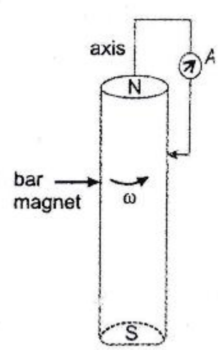
4. **A square of side L meters lies in the *X-Y* plane in a region, where the magnetic field is given by $B = B_o(2\hat{i} + 3\hat{j} + 4\hat{k})\, T$, where $B_o$ is constant. The magnitude of flux passing through the square is** [*NCERT Exemplar*]
   (a) $2\, B_o L^2$ Wb (b) $3\, B_o L^2$ Wb (c) $4\, B_o L^2$ Wb (d) $\sqrt{29}\, B_o L^2$ Wb

5. **A loop, made of straight edges has six corners at $A(0, 0, 0)$, $B(L, O, 0)$, $C(L, L, 0)$, $D(0, L, 0)$ $E(0, L, L)$ and $F(0, 0, L)$. A magnetic field $B = B_o(\hat{i} + \hat{k})\, T$ is present in the region. The flux passing through the loop *ABCDEFA* (in that order) is** [*NCERT Exemplar*]
   (a) $B_o L^2$ Wb (b) $2\, B_o L^2$ Wb (c) $\sqrt{2} B_o L^2$ Wb (d) $4\, B_o L^2$ Wb

6. **An emf is produced in a coil, which is not connected to an external voltage source. This can be due to** [*NCERT Exemplar*]
   (a) the coil being in a time varying magnetic field.
   (b) the coil moving in a time varying magnetic field.
   (c) the coil moving in a constant magnetic field.
   (d) the coil is stationary in external spatially varying magnetic field, which does not change with time.

7. **A magnet is dropped with its north pole towards a closed circular coil placed on a table then**
   (a) looking from above, the induced current in the coil will be anti-clockwise.
   (b) the magnet will fall with uniform acceleration.
   (c) as the magnet falls, its acceleration will be reduced.
   (d) no current will be induced in the coil.

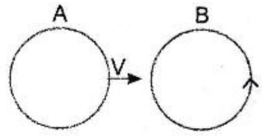
8. **A cylindrical bar magnet is rotated about its axis (Figure given alongside). A wire is connected from the axis and is made to touch the cylindrical surface through a contact. Then** [*NCERT Exemplar*]




   (a) a direct current flows in the ammeter A.
   (b) no current flows through the ammeter A.
   (c) an alternating sinusoidal current flows through the ammeter A with a time period $T = 2\pi/\omega$.
   (d) a time varying non-sinusoidal current flows through the ammeter A.

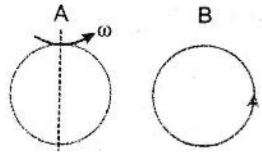
9. **A copper ring is held horizontally and a magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is**
(*a*) equal to that due to gravity
(*b*) less than that due to gravity
(*c*) more than that due to gravity
(*d*) depends on the diameter of the ring and the length of the magnet

10. **There are two coils A and B as shown in the figure. A current starts flowing in B as shown, when A is moved towards B and stops when A stops moving. The current in A is counter clockwise. B is kept stationary when A moves. We can infer that** [*NCERT Exemplar*]




(*a*) there is a constant current in the clockwise direction in A.
(*b*) there is a varying current in A.
(*c*) there is no current in A.
(*d*) there is a constant current in the counterclockwise direction in A.

11. **Same as the above problem except the coil A is made to rotate about a vertical axis refer to the figure. No current flows in B if A is at rest. The current in coil A, when the current in B (at $t = 0$) is counterclockwise and the coil A is as shown at this instant, $t = 0$, is** [*NCERT Exemplar*]



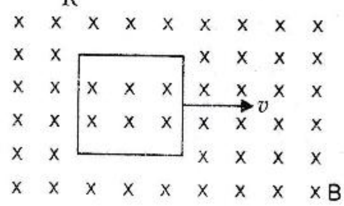

(*a*) constant current clockwise.
(*b*) varying current clockwise.
(*c*) varying current counterclockwise.
(*d*) constant current counterclockwise.

12. **Lenz's law is essential for**
(*a*) conservation of energy
(*b*) conservation of mass
(*c*) conservation of momentum
(*d*) conservation of charge

13. **The self inductance $L$ of a solenoid of length $l$ and area of crosssection $A$, with a fixed number of turns $N$ increases as** [*NCERT Exemplar*]
(*a*) $l$ and $A$ increase.
(*b*) $l$ decreases and $A$ increases.
(*c*) $l$ increases and $A$ decreases.
(*d*) both $l$ and $A$ decrease.

14. **A thin circular ring of area $A$ is held perpendicular to a uniform magnetic field of induction $B$. A small cut is made in the ring and a galvanometer is connected across its ends in such a way that the total resistance of the circuit is $R$. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is**
(*a*) $\frac{BR}{A}$
(*b*) $\frac{AB}{R}$
(*c*) $ABR$
(*d*) $\frac{B^2A}{R^2}$

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




(*a*) $Blv/R$ clockwise
(*b*) $Blv/R$ anticlockwise
(*c*) $2\,Blv/R$ anticlockwise
(*d*) zero.

16. **Inductance plays the role of**
(*a*) inertia
(*b*) friction
(*c*) source of emf
(*d*) force

17. **A circular coil expands radially in a region of magnetic field and no electromotive force is produced in the coil. This can be because** [*NCERT Exemplar*]
(*a*) the magnetic field is constant.
(*b*) the magnetic field is in the same plane as the circular coil and it may or may not vary.

(*c*) the magnetic field has a perpendicular (to the plane of the coil) component whose magnitude is decreasing suitably.

(*d*) there is a constant magnetic field in the perpendicular (to the plane of the coil) direction.

**18. When the current in a coil changes from 8A to 2A in $3 \times 10^{-2}$ second, the emf induced in the coil is 2 volt. The self-inductance of the coil, in millitienry, is**

(*a*) 1 (*b*) 5 (c) 20 (*d*) 10

**19. When the current in a coil is changed from 2A to 4A in 0.05 second, the emf induced in the coil is 8V. The self inductance of coil is**

(*a*) 0.1 H (*b*) 0.2 H (*c*) 0.4 H (*d*) 0.8 H

**20. The mutual inductance of two coils depends upon**

(*a*) medium between coils (*b*) separation between coils

(*c*) both on (*a*) and (*b*) (*d*) none of (*a*) and (*b*)

## Multiple Choice Questions **[1 mark]**

*Choose and write the correct option(s) in the following questions.*

1. **If the *rms* current in a 50 Hz ac circuit is 5A, the value of the current 1/300 seconds after its value becomes zero is** *[NCERT Examplar]*

   (*a*) $5\sqrt{2}$ A (*b*) $5\sqrt{\frac{3}{2}}$ A (*c*) 5/6 A (*d*) $5/\sqrt{2}$ A

2. **An alternating current generator has an internal resistance *Rg* and an internal reactance *Xg*. It is used to supply power to a passive load consisting of a resistance *Rg* and a reactance $X_L$. For maximum power to be delivered from the generator to the load, the value of $X_L$ is equal to** *[NCERT Examplar]*

   (*a*) zero (*b*) $X_g$ (*c*) $-X_g$ (*d*) $R_g$

3. **In an ac circuit, the maximum value of voltage is 423 volts. Its effective voltage is**

   (*a*) 400 volt (*b*) 300 volt (*c*) 323 volt (*d*) 340 volt

4. **The peak voltage of 220 V ac mains is**

   (*a*) 155.6V (*b*) 220.0V (*c*) 311 V (*d*) 440 V

5. **An inductive circuit have zero resistance. When ac voltage is applied across this circuit, then the current lags behind the applied voltage by an angle**

   (*a*) 30° (*b*) 45° (*c*) 90° (*d*) 0°

6. **If an *LCR* circuit contains $L$ = 8 henry; $C$ = 0.5 μF, $R$ = 100 Ω in series. Then the resonant frequency will be:**

   (*a*) 600 rad/s (*b*) 500 rad/s (*c*) 600 Hz (*d*) 500 Hz

7. **When a voltage measuring device is connected to AC mains, the meter shows the steady input voltage of 220V. This means** [*NCERT Examplar*]
   (*a*) input voltage cannot be *AC* voltage, but a *DC* voltage.
   (*b*) maximum input voltage is 220V.
   (*c*) the meter reads not v but $<v^2>$ and is calibrated to read $\sqrt{<v^2>}$.
   (*d*) the pointer of the meter is stuck by some mechanical defect.
8. **To reduce the resonant frequency in an *LCR* series circuit with a generator** [*NCERT Examplar*]
   (*a*) the generator frequency should be reduced.
   (*b*) another capacitor should be added in parallel to the first.
   (*c*) the iron core of the inductor should be removed.
   (*d*) dielectric in the capacitor should be removed.
9. **In a pure capacitive circuit, the current**
   (*a*) lags behind the applied emf by angle $\pi/2$
   (*b*) leads the applied emf by an angle $\pi$
   (*c*) leads the applied emf by angle $\pi/2$
   (*d*) and applied emf are in same phase
10. **In an AC circuit, the emf (ε) and the current (*i*) at any instant are given by**
    $\varepsilon = E_0 \sin \omega t, i = I_0 \sin(\omega t - \phi)$
    **over one complete cycle of *ac* is**
    (*a*) $E_0 I_0$   (*b*) $\frac{1}{2}E_0 I_0$   (*c*) $\frac{1}{2}E_0 I_0 \sin\phi$   (*d*) $\frac{1}{2}E_0 I_0 \cos\phi$
11. **The average power dissipation in pure inductance is**
    (*a*) $\frac{1}{2}LI^2$   (*b*) $\frac{1}{4}LI^2$   (*c*) $2LI^2$   (*d*) zero
12. **Electrical energy is transmitted over large distances at high alternating voltages. Which of the following statements is (are) correct?** [*NCERT Examplar*]
    (*a*) For a given power level, there is a lower current.
    (*b*) Lower current implies less power loss.
    (*c*) Transmission lines can be made thinner.
    (*d*) It is easy to reduce the voltage at the receiving end using step-down transformers.
13. **The reactance of a capacitance at 50 Hz is 5Ω. If the frequency is increased to 100 Hz, the new reactance is**
    (*a*) 5 Ω   (*b*) 10 Ω   (*c*) 2.5 Ω   (*d*) 125 Ω
14. **In a pure inductive circuit, the current**
    (*a*) lags behind the applied emf by an angle $\pi$
    (*b*) lags behind the applied emf by an angle $\pi / 2$
    (*c*) leads the applied emf by an angle $\pi / 2$
    (*d*) and applied emf are in same phase
15. **When an AC voltage of 220 V is applied to the capacitor C** [*NCERT Examplar*]
    (*a*) the maximum voltage between plates is 220 V.
    (*b*) the current is in phase with the applied voltage.
    (*c*) the charge on the plates is in phase with the applied voltage.
    (*d*) power delivered to the capacitor is zero.
16. **In an ac circuit, voltage *V* and current *i* are given by**
    $V = 100 \sin 100\, t$ **volt**
    $i = 100 \sin(100t + \pi/3)$ **mA**

**The power dissipated in the circuit is**

(*a*) $10^4$W (*b*) 10 W (*c*) 2.5 W (*d*) 5 W.

**17. Which of the following combinations should be selected for better tuning of an *LCR* circuit used for communication?** [*NCERT Examplar*]

(*a*) $R = 20\Omega, L = 1.5$ H, $C = 35\mu$F (*b*) $R = 25\Omega, L = 2.5$ H, $C = 45\mu$F

(*c*) $R = 15\Omega, L = 3.5$ H, $C = 30\mu$F (*d*) $R = 25\Omega, L = 1.5$ H, $C = 45\mu$F

**18. An inductor of reactance 1 Ω and a resistor of 2 Ω are connected in series to the terminals of a 6 V (rms) AC source. The power dissipated in the circuit is** [*NCERT Examplar*]

(*a*) 8 W (*b*) 12 W (*c*) 14.4 W (*d*) 18 W

**19. An AC voltage source $E = 200\sqrt{2}\sin 100\,t$, is connected across a circuit containing an AC ammeter and a capacitor of capacitance $1\mu$F. The reading of ammeter is**

(*a*) 10 mA (*b*) 20 mA (*c*) 40 mA (*d*) 80 mA

**20. The output of a step-down transformer is measured to be 24 V when connected to a 12 watt light bulb. The value of the peak current is**

(*a*) $1/\sqrt{2}$ A (*b*) $\sqrt{2}$ A (*c*) 2 A (*d*) $2\sqrt{2}$ A

## Multiple Choice Questions [1 mark]

*Choose and write the correct option(s) in the following questions.*

1. **One requires 11eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in** [*NCERT Exemplar*]

   (*a*) visible region. (*b*) infrared region.

   (*c*) ultraviolet region. (*d*) microwave region.

2. **A plane electromagnetic wave travelling along X-axis has a wavelength 10.0 mm. The electric field points along Y-direction and has peak value of 30 V/m. Then the magnetic field in terms of $x$ in metre and $t$ in second may be expressed as** [*NCERT Exemplar*]

   (*a*) $30 \sin 200\pi (ct - x)$ (*b*) $10^{-7} \sin 200\pi (ct - x)$

   (*c*) $30 \sin \frac{2\pi}{10}(ct - x)$ (*d*) $10^{-7} \sin \frac{2\pi}{10}(ct - x)$

3. **An electromagnetic wave travelling in vacuum is described by $E_x = E_0 \sin(\omega t - kx)$, $B_y = B_0 \sin(\omega t - kx)$**

   (*a*) $E_0 k = B_0 \omega$ (*b*) $E_0 B_0 = \omega k$

   (*c*) $E_0 \omega = B_0 k$ (*d*) $E_0 \omega^2 = B_0 k^2$

4. **A linearly polarised electromagnetic wave given as $E = E_0 \hat{i} \cos(kz - \omega t)$ is incident normally on a perfectly reflecting infinite wall at $z$ = a. Assuming that the material of the wall is optically inactive, the reflected wave will be given as** [*NCERT Exemplar*]

   (*a*) $E_r = -E_0 \hat{i} \cos(kz - \omega t)$ (*b*) $E_r = E_0 \hat{i} \cos(kz + \omega t)$

   (*c*) $E_r = -E_0 \hat{i} \cos(kz + \omega t)$ (*d*) $E_r = E_0 \hat{i} \sin(kz - \omega t)$

5. **Light with an energy flux of 20 W/cm$^2$ falls on a non-reflecting surface at normal incidence. If the surface has an area of 30 cm$^2$, the total momentum delivered (for complete absorption) during 30 minutes is** [*NCERT Exemplar*]

   (*a*) $36 \times 10^{-5}$ kg m/s (*b*) $36 \times 10^{-4}$ kg m/s

   (*c*) $108 \times 10^{4}$ kg m/s (*d*) $1.08 \times 10^{7}$ kg m/s

6. **The part of electromagnetic spectrum belonging to 2.7 K is**

   (*a*) Infrared (*b*) Ultraviolet

   (*c*) X-rays (*d*) Microwaves

7. **An LC circuit contains inductance L = 1μH and capacitance C = 0.01 μF. The wavelength of the electromagnetic wave generated is nearly**

(*a*) 0.5 m (*b*) 5 m

(*c*) 30 m (*d*) 188 m

8. **The radiowaves of wavelength 360 m are transmitted from a transmitter. The inductance of the coil which must be connected with capacitor of capacitance 3.6 μF in a resonant circuit to receive these waves will be nearly**

(*a*) $10^3$ H (*b*) $10^2$ H

(*c*) $10^{-4}$ H (*d*) $10^{-8}$ H

9. **What is the amplitude of electric field produced by radiation coming from a 100 W bulb at a distance of 4 m? The efficiency of bulb is 3.14% and it may be assumed as a point source.**

(*a*) 2.42 V/m (*b*) 3.43 V/m

(*c*) $4.2 \times 10^4$ V/m (*d*) $14 \times 10^4$ V/m

10. **The electric field intensity produced by the radiations coming from 100 W bulb at a 3 m distance is E. The electric field intensity produced by the radiations coming from 50 W bulb at the same distance is** [*NCERT Exemplar*]

(*a*) $\frac{E}{2}$ (*b*) $2E$

(*c*) $\frac{E}{\sqrt{2}}$ (*d*) $\sqrt{2}E$

11. **If E and B represent electric and magnetic field vectors of the electromagnetic wave, the direction of propagation of electromagnetic wave is along** [*NCERT Exemplar*]

(*a*) E (*b*) B

(*c*) B × E (*d*) E × B

12. **An electromagnetic wave travelling along z-axis is given as:**
**$E = E_0 \cos(kz - \omega t)$. Choose the correct options from the following;** [*NCERT Exemplar*]

(*a*) The associated magnetic field is given as $B = \frac{1}{c} k \times E = \frac{1}{\omega}(\hat{k} \times E)$

(*b*) The electromagnetic field can be written in terms of the associated magnetic field as $E = c(B \times \hat{k})$.

(*c*) $\hat{k} . E = 0, \hat{k} . B = 0$

(*d*) $\hat{k} \times E = 0, \hat{k} \times B = 0$

13. **If we want to produce electromagnetic waves of wavelength 500 km by an oscillating charge; then frequency of oscillating charge must be**

(*a*) 600 Hz (*b*) 500 Hz

(*c*) 167 Hz (*d*) 15 Hz

14. **Electromagnetic waves travelling in a medium having relative permeability $\mu_r = 1.3$ and relative permittivity $\varepsilon_r = 2.14$. The speed of electromagnetic waves in medium must be**

(*a*) $1.8 \times 10^8$ m/s (*b*) $1.8 \times 10^4$ m/s

(*c*) $1.8 \times 10^6$ m/s (*d*) $1.8 \times 10^2$ m/s

15. **Electromagnetic waves travelling in a medium has speed $2 \times 10^8$ m/s. If the relative permeability is 1, then the relative permittivity of medium must be**

(*a*) 2 (*b*) 2.25

(*c*) 2.5 (*d*) 1.5

**16. An electromagnetic wave of frequency 3.0 MHz passes from vacuum into a dielectric medium with relative permittivity $\varepsilon_r = 4.0$. Then**

(*a*) wavelength is doubled and frequency remains unchanged

(*b*) wavelength is doubled and frequency becomes half

(*c*) wavelength is halved and frequency remains unchanged

(*d*) wavelength and frequency both remains unchanged

**17. An electromagnetic wave radiates outwards from a dipole antenna, with $E_0$ as the amplitude of its electric field vector. The electric field $E_0$ which transports significant energy from the source falls off as** [*NCERT Exemplar*]

(*a*) $\frac{1}{r^3}$ (*b*) $\frac{1}{r^2}$

(*c*) $\frac{1}{r}$ (*d*) remains constant

**18. A plane electromagnetic wave of energy U is reflected from the surface. Then the momentum transferred by electromagnetic wave to the surface is**

(*a*) 0 (*b*) $\frac{U}{c}$

(*c*) $\frac{2U}{c}$ (*d*) $\frac{U}{2c}$

**19. The rms value of the electric field of light coming from the sun is 720 N/C. The average total energy density of the electromagnetic wave is :**

(*a*) $4.58 \times 10^{-6}$ J/m$^3$ (*b*) $6.37 \times 10^{-9}$ J/m$^3$

(*c*) $1.35 \times 10^{-12}$ J/m$^3$ (*d*) $3.3 \times 10^{-3}$ J/m$^3$

**20. A plane electromagnetic wave propagating along *x* direction can have the following pairs of *E* and *B*** [*NCERT Exemplar*]

(*a*) $E_x, B_y$ (*b*) $E_y, B_z$

(*c*) $B_x, E_y$ (*d*) $E_z, B_y$

## Multiple Choice Questions **[1 mark]**

*Choose and write the correct option(s) in the following questions.*

1. **A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5, the angle of incidence is** [*NCERT Exemplar*]
   (*a*) 7.5° (*b*) 5° (*c*) 15° (*d*) 2.5°

2. **An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be**
   (*a*) 30 cm away from the mirror
   (*b*) 36 cm away from the mirror
   (*c*) 30 cm towards the mirror
   (*d*) 36 cm towards the mirror

3. **A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first colour to emerge is** [*NCERT Exemplar*]
   (*a*) Blue (*b*) Green (*c*) Violet (*d*) Red

4. **A diver in a swimming pool wants to signal his distress to a person lying on the edge of the pool by flashing his waterproof flash light.**
   (*a*) He must direct the beam vertically upward
   (*b*) He has to direct the beam horizontally
   (*c*) He has to direct the beam at an angle to the vertical which is slightly less than the critical angle of incidence for total internal reflection
   (*d*) He has to direct the beam at an angle to the vertical which is slightly more than the critical angle of incidence for total internal reflection.
5. **The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30°. One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace it path (after reflection from the silvered surface) if its angle of incidence of the prism is**
   (*a*) 60° (*b*) 45° (*c*) 30° (*d*) zero
6. **A microscope is focused on a mark. Then a glass slab of refractive index 1.5 and thickness 6 cm is placed on the mark. To get the mark again in focus the microscope should be moved**
   (*a*) 2 cm downward (*b*) 2 cm upward (*c*) 4 cm upward (*d*) 9 cm upward.
7. **An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus. The image** [*NCERT Exemplar*]
   (*a*) Moves away from the lens with an uniform speed 5 m/s.
   (*b*) Moves away from the lens with an uniform accleration.
   (*c*) Moves away from the lens with a non-uniform acceleration.
   (*d*) Moves towards the lens with a non-uniform acceleration.
8. **Transmission of light in optical fibre is due to**
   (*a*) Scattering
   (*b*) Diffraction
   (*c*) Refraction
   (*d*) Multiple total internal reflection.
9. **The wavelength of light in air is 6000 Å and in medium its value is 4000 Å. It means that the refractive index of that medium with respect to air is**
   (*a*) 1.2 (*b*) 2.4 (*c*) 0.66 (*d*) 1.5
10. **You are given four sources of light each one providing a light of a single colour – red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is 90°. Which of the following statements is correct if the source of yellow light is replaced with that of other lights without changing the angle of incidence?** [*NCERT Exemplar*]
   (*a*) The beam of red light would undergo total internal reflection.
   (*b*) The beam of red light would bend towards normal while it gets refracted through the second medium.
   (*c*) The beam of blue light would undergo total internal reflection.
   (*d*) The beam of green light would bend away from the normal as it gets refracted through the second medium.
11. **Refractive index of water is $\frac{5}{3}$. A light source is placed in water at a depth of 4 m. Then what must be the minimum radius of disc placed at water surface so that the light of source can be stopped**
   (*a*) 3 m (*b*) 4 m (*c*) 5 m (*d*) infinite
12. **A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively.**

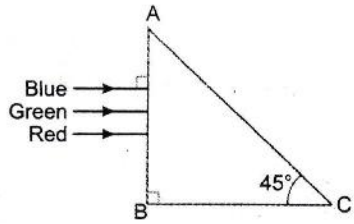
**The prism will**

(a) Not separate the three colours at all

(b) Separate the red colour part from the green and blue colours

(c) Separate the blue colour part from the red and green colours

(d) Separate all the three colours from one another




**13. The radius of curvature of the curved surface of a plano-convex lens is 20 cm. If the refractive index of the material of the lens be 1.5, it will** [*NCERT Exemplar*]

(a) Act as a convex lens only for the objects that lie on its curved side.

(b) Act as a concave lens for the objects that lie on its curved side.

(c) Act as a convex lens irrespective of the side on which the object lies.

(d) Act as a concave lens irrespective of side on which the object lies.

**14. Which of the following is not due to total internal reflection ?**

(a) Working of optical fibre

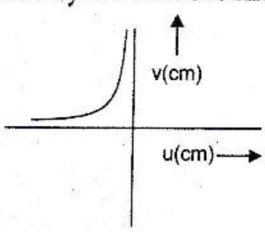
(b) Difference between apparent and real depth of a pond

(c) Mirage on hot summer days

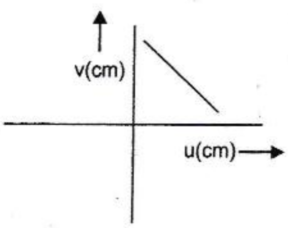
(d) Brilliance of diamond

**15. A student measures the focal length of a convex lens by putting an object pin at a distance '$u$' from the lens and measuring the distance '$v$' of the image pin. The graph between '$u$' and '$v$' plotted by the student should look like**

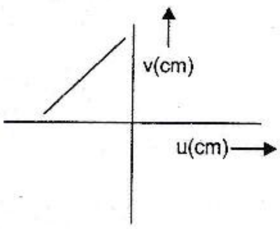
(a)



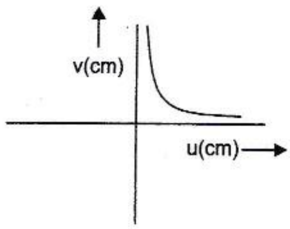

(b)



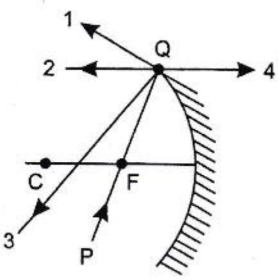

(c)




(d)

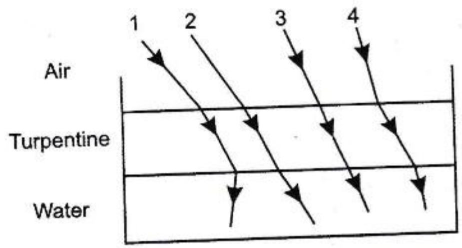



**16. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (Fig. given below). Which of the four rays correctly shows the direction of reflected ray?** [*NCERT Exemplar*]




(a) 1 (b) 2 (c) 3 (d) 4

17. **The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in the figure, the path shown is correct?** [*NCERT Exemplar*]




(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

18. **If the focal length of objective lens is increased then magnifying power of**
   (*a*) Microscope will increase but that of telescope decrease.
   (*b*) Microscope and telescope both will increase.
   (*c*) Microscope and telescope both will decrease.
   (*d*) Microscope will decrease but that of telescope will increase.

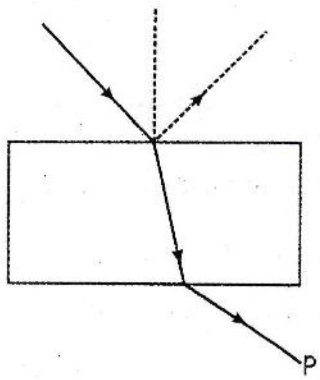
19. **If an object is placed unsymmetrically between two plane mirrors inclined at 70°, then the total number of images formed is**
   (*a*) 5 (*b*) 4 (*c*) 3 (*d*) 1

20. **Between the primary and secondary rainbows, there is a dark band known as Alexandar's dark band. This is because** [*NCERT Exemplar*]
   (*a*) Light scattered into this region interfere destructively.
   (*b*) There is no light scattered into this region.
   (*c*) Light is absorbed in this region.
   (*d*) Angle made at the eye by the scattered rays with respect to the incident light of the sun lies between approximately 42° and 50°.

## Multiple Choice Questions **[1 mark]**

*Choose and write the correct option(s) in the following questions.*

1. **Consider a light beam incident from air to a glass slab at Brewster's angle as shown in figure. A polaroid is placed in the path of the emergent ray at point P and rotated about an axis passing through the centre and perpendicular to the plane of the polaroid.** [*NCERT Exemplar*]




   (*a*) For a particular orientation there shall be darkness as observed through the polaoid.
   (*b*) The intensity of light as seen through the polaroid shall be independent of the rotation.
   (*c*) The intensity of light as seen through the polaroid shall go through a minimum but not zero for two orientations of the polaroid.
   (*d*) The intensity of light as seen through the polaroid shall go through a minimum for four orientations of the polaroid.

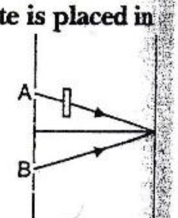
2. **Two waves having the intensities in the ratio of 9 : 1 produce interference. The ratio of maximum to minimum intensity is**
   (*a*) 10 : 8 (*b*) 9 : 1 (*c*) 4 : 1 (*d*) 2 : 1

3. **Four independent waves are expressed as**
   **(*i*)** $y_1 = a_1 \sin \omega t$ **(*ii*)** $y_2 = a_2 \sin 2\omega t$
   **(*iii*)** $y_3 = a_3 \cos \omega t$ **and** **(*iv*)** $y_4 = a_4 \sin(\omega t + \pi/3)$
   **The interference is possible between**
   (*a*) (*i*) and (*iii*) (*b*) (*i*) and (*iv*) (*c*) (*iii*) and (*iv*) (*d*) not possible at all

4. **Consider sunlight incident on a slit of width $10^4$ A. The image seen through the slit shall** [*NCERT Exemplar*]
   (*a*) be a fine sharp slit white in colour at the center.
   (*b*) a bright slit white at the center diffusing to zero intensities at the edges.
   (*c*) a bright slit white at the center diffusing to regions of different colours.
   (*d*) only be a diffused slit white in colour.

5. **In a Young's double-slit experiment the fringe width is found to be 0.4 mm. If the whole apparatus is dipped in water of refractive index 4/3, without disturbing the arrangement, the new fringe width will be**
   (*a*) 0.30 mm (*b*) 0.40 mm (*c*) 0.53 mm (*d*) 0.2 mm

6 **In Young's experiment, monochromatic light is used to illuminate the slits *A* and *B*. Interference fringes are observed on a screen placed in front of the slits. Now if a thin glass plate is placed in the path of the beam coming from A, then**




   (*a*) the fringes will disappear
   (*b*) the fringe width will increase
   (*c*) the fringe width will decrease
   (*d*) there will be no change in the fringe width

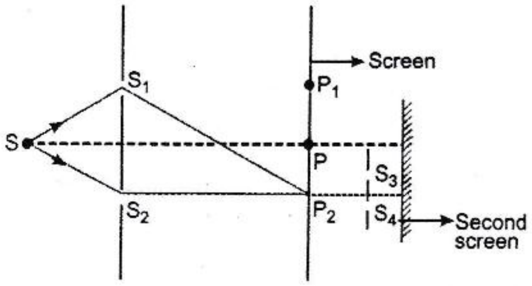
7. **In Young's double slit experiment the separation *d* between the slits is 2 mm, the wavelength $\lambda$ of the light used is 5896 Å and distance *D* between the screen and slits is 100 cm. It is found that the angular width of the fringes is 0.20°. To increase the fringe angular width to 0.21° (with same $\lambda$ and *D*) the separation between the slits needs to be changed to**
   (*a*) 1.8 mm (*b*) 1.9 mm (*c*) 2.1 mm (*d*) 1.7 mm

8. **In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case** *[NCERT Exemplar]*
(a) there shall be alternate interference patterns of red and blue.
(b) there shall be an interference pattern for red distinct from that for blue.
(c) there shall be no interference fringes.
(d) there shall be an interference pattern for red mixing with one for blue.

9. **In a Young's double-slit experiment, the source *S* and two slits *A* and *B* are horizontal, with slit *A* above slit *B*. The fringes are observed on a vertical screen *K*. The optical path length from *S* to *B* is increased very slightly (by introducing a transparent material of higher refractive index) and optical path length from *S* to *A* is not changed. As a result, the fringe system on *K* moves**
(a) vertically downwards slightly
(b) vertically upwards slightly
(c) horizontally slightly to the left
(d) horizontally slightly to the right

10. **In Young's double-slit experiment, the distance between the slit sources and the screen is 1 m. If the distance between the slits is 2 mm and the wavelength of light used is 600 nm, the fringe width is**
(a) 3 mm
(b) 0.3 mm
(c) 6 mm
(d) 0.6 mm

11. **Figure shows a standard two slit arrangement with slits $S_1$, $S_2$. $P_1$, $P_2$ are the two minima points on either side of *P*.** *[NCERT Exemplar]*




**At $P_2$ on the screen, there is a hole and behind $P_2$ is a second 2- slit arrangement with slits $S_3$, $S_4$ and a second screen behind them.**
(a) There would be no interference pattern on the second screen but it would be lighted.
(b) The second screen would be totally dark.
(c) There would be a single bright point on the second screen.
(d) There would be a regular two slit pattern on the second screen.

12. **The Young's double-slit experiment is performed with blue and green lights of wavelengths 4360 Å and 5460 Å respectively. If *x* is the distance of 4th maxima from the central one, then**
(a) $(x)_{blue} = (x)_{green}$
(b) $(x)_{blue} > (x)_{green}$
(c) $(x)_{blue} < (x)_{green}$
(d) $\frac{(x)_{blue}}{(x)_{green}} = \frac{5460}{4360}$

13. **The angular resolution of a 10 cm diameter telescope at a-wavelength 500 nm is of the order of**
(a) $10^{-4}$ rad
(b) $10^{-6}$ rad
(c) $10^{-3}$ rad
(d) $10^{7}$ rad

14. **A telescope has an objective lens of 10 cm diameter and is situated at a distance of 1 km from two objects. The minimum distance between these objects that can be resolved by the telescope, when the mean wavelength of light is 5000 Å is of the order of**
(a) 5 mm
(b) 5 cm
(c) 2.5 m
(d) 5 m

15. **Which of the following phenomenon cannot take place with longitudinal waves (*e.g.*, sound waves)?**
(a) reflection
(b) interference
(c) diffraction
(d) polarisation

**16. Unpolarised light is incident from air on a plane surface of a material of refractive index $\mu$. At a particular angle of incidence $i$, it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation?**

(*a*) Reflected light is polarised with its electric vector parallel to the plane of incidence.

(*b*) Reflected light is polarised with its electric vector perpendicular to the plane of incidence

(*c*) $i = \sin^{-1}\left(\frac{1}{\mu}\right)$ (*d*) $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

**17. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of**

(*a*) small focal length and large diameter (*b*) large focal length and small diameter

(*c*) large focal length and large diameter (*d*) small focal length and small diameter

**18. A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewsters angle $\phi$. If $n$ represents the refractive index of glass with respect to air, then the angle between the reflected and refracted rays is**

(*a*) $90 + \phi$ (*b*) $\sin^{-1}(n \cos\phi)$ (*c*) $90°$ (*d*) $90° - \sin^{-1}\left(\frac{\sin\phi}{n}\right)$

**19. Consider the diffraction pattern for a small pinhole. As the size of the hole is increased**

[*NCERT Exemplar*]

(*a*) the size decreases. (*b*) the intensity increases.

(*c*) the size increases. (*d*) the intensity decreases.

[*NCERT Exemplar*]

**20. For light diverging from a point source**

(*a*) the wavefront is spherical.

(*b*) the intensity decreases in proportion to the distance squared.

(*c*) the wavefront is parabolic.

(*d*) the intensity at the wavefront does not depend on the distance.

## Multiple Choice Questions [1 mark]

*Choose and write the correct option(s) in the following questions.*

1. **A particle is dropped from a height $H$. The de Broglie wavelength of the particle as a function of height is proportional to** [*NCERT Exemplar*]
   (*a*) $H$ (*b*) $H^{1/2}$
   (*c*) $H^0$ (*d*) $H^{-1/2}$

2. **The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1 MeV energy is nearly** [*NCERT Exemplar*]
   (*a*) 1.2 nm (*b*) $1.2 \times 10^{-3}$ nm
   (*c*) $1.2 \times 10^{-6}$ nm (*d*) $1.2 \times 10^{1}$ nm

3. **Consider a beam of electrons (each electron with energy $E_0$) incident on a metal surface kept in an evacuated chamber. Then** [*NCERT Exemplar*]
   (*a*) no electrons will be emitted as only photons can emit electrons.
   (*b*) electrons can be emitted but all with an energy, $E_0$.
   (*c*) electrons can be emitted with any energy, with a maximum of $E_0 - \phi$ ($\phi$ is the work function).
   (*d*) electrons can be emitted with any energy, with a maximum of $E_0$.

4. **The threshold wavelength for photoelectric emission from a material is 5200 Å. Photoelectrons will be emitted when this material is illuminated with monochromatic radiation from a:**
   (*a*) 50 watt infrared lamp (*b*) 1000 watt infrared lamp
   (*c*) 1 watt ultraviolet lamp (*d*) 1 watt infrared lamp

5. **A photoelectric cell is illuminated by a point source of light 1 m away. The plate emits electrons having stopping potential $V$. Then:**
   (*a*) $V$ decreases as distance increase
   (*b*) $V$ increases as distance increase
   (*c*) $V$ is independent of distance ($r$)
   (*d*) $V$ becomes zero when distance increases or decreases.

6. **In a photoelectric experiment, the stopping- potential for the incident light of wavelength 4000 Å is 2 volt. If the wavelength be changed to 3000 Å, the stopping-potential will be:**
   (*a*) 2 volt (*b*) less than 2 volt
   (*c*) zero (*d*) more than 2 volt.

7. **The work-function for a metal is 3 eV. To emit a photoelectron of energy 2 eV from the surface of this metal, the wavelength of the incident light should be:**
   (*a*) 6187 Å (*b*) 4125 Å
   (*c*) 12375 Å (*d*) 2875 Å

8. **In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by**
   (*a*) increasing the potential difference between the anode and filament
   (*b*) increasing the filament current
   (*c*) decreasing the filament current
   (*d*) decreasing the potential difference between the anode and filament

9. **The work-function of a surface of a photosensitive material is 6.2 eV. The wavelength of incident radiation for which the stopping potential is 5 V lies in:**
   (*a*) ultraviolet region (*b*) visible region
   (*c*) infrared region (*d*) X-ray region

10. **A proton, a neutron, an electron and an α-particle have same energy. Then their de Broglie wavelengths compare as** [*NCERT Exemplar*]
   (*a*) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ (*b*) $\lambda_\alpha < \lambda_p = \lambda_n > \lambda_e$
   (*c*) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ (*d*) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

11. **The number of photoelectrons emitted for light of frequency $v$ (higher than the threshold frequency $v_0$) is proportional to:**
   (*a*) threshold frequency (*b*) intensity of light
   (*c*) frequency of light (*d*) $v - v_0$

12. **Relativistic corrections become necessary when the expression for the kinetic energy $\frac{1}{2}mv^2$, becomes comparable with $mc^2$, where $m$ is the mass of the particle. At what de Broglie wavelength will relativistic corrections become important for an electron?** [*NCERT Exemplar*]
   (*a*) $\lambda = 10$ nm (*b*) $\lambda = 10^{-1}$ nm
   (*c*) $\lambda = 10^{-4}$ nm (*d*) $\lambda = 10^{-6}$ nm

13. **Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per second on the average at a target irradiated by this beam is:**
   (*a*) $3 \times 10^{16}$ (*b*) $9 \times 10^{15}$ (*c*) $3 \times 10^{19}$ (*d*) $9 \times 10^{17}$

14. **Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would**
   (*a*) increase by 2 times (*b*) decrease by 2 times
   (*c*) decrease by 4 times (*d*) increase by 4 times

15. **Two particles $A_1$ and $A_2$ of masses $m_1$, $m_2$ ($m_1 > m_2$) have the same de Broglie wavelength. Then** [*NCERT Exemplar*]

(*a*) their momenta are the same.

(*b*) their energies are the same.

(*c*) energy of $A_1$ is less than the energy of $A_2$.

(*d*) energy of $A_1$ is more than the energy of $A_2$.

16. **An electron (mass $m$) with an initial velocity $\vec{v} = v_0\hat{i}$ is in an electric field $\vec{E} = E_0\hat{j}$. If $\lambda_0 = h/mv_0$, it's de Breoglie wavelength at time $t$ is given by** [*NCERT Exemplar*]

(*a*) $\lambda_0$ (*b*) $\lambda_0\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}$ (*c*) $\frac{\lambda_0}{\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}}$ (*d*) $\frac{\lambda_0}{\left(1+\frac{e^2E_0^2t^2}{m^2v_0^2}\right)}$

17. **The de Broglie wavelength of an electron accelerated through a p.d. $V$ is directly proportional to $V^n$. Then $n$ must be equal to ($n$ = )**

(*a*) 1 (*b*) –1 (*c*) 0.5 (*d*) – 0.5

18. **For a given kinetic energy, which of the following has smallest de Broglie wavelength:**

(*a*) electron (*b*) proton (*c*) deuteron (*d*) α-particle

19. **If an electron and a photon propagate in the form of waves having same wavelength, it implies that they have same:**

(*a*) speed (*b*) momentum (*c*) energy (*d*) all the above

20. **A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of $3 \times 10^8$ ms$^{-1}$. The velocity of the particle is (mass of electron = $9.1 \times 10^{-3}$ kg)**

(*a*) $2.7 \times 10^{-18}$ ms$^{-1}$ (*b*) $9 \times 10^{-2}$ ms$^{-1}$ (*c*) $3 \times 10^{-31}$ ms$^{-1}$ (*d*) $2.7 \times 10^{-21}$ ms$^{-1}$

## Multiple Choice Questions [1 mark]

*Choose and write the correct option(s) in the following questions.*

1. **The size of the atom is approximately**
   (*a*) $10^{-6}$ m (*b*) $10^{-8}$ m (*c*) $10^{-10}$ m (*d*) $10^{-14}$ m
2. **The energy required to remove an electron in the $n = 2$ state of hydrogen atom is**
   (*a*) 27.2 eV (*b*) 13.6 eV (*c*) 6.8 eV (*d*) 3.4 eV
3. **Taking the Bohr radius as $a_0 = 53$ pm, the radius of $Li^{++}$ ion in its ground state, on the basis of Bohr's model, will be about** [*NCERT Exemplar*]
   (*a*) 53 pm (*b*) 27 pm (*c*) 18 pm (*d*) 13 pm

4. **The ratio of energies of the hydrogen atom in its first to second excited state is**

(*a*) 1 : 4 (*b*) 4 : 1 (*c*) – 4 : – 9 (*d*) $-\frac{1}{4} : -\frac{1}{9}$

5. **The binding energy of a H-atom, considering an electron moving around a fixed nuclei (proton), is $B = -\frac{me^4}{8n^2\varepsilon_0^2h^2}$ ($m$ = electron mass).**

**If one decides to work in a frame of reference where the electron is at rest, the proton would be moving arround it. By similar arguments, the binding energy would be**

**$B = -\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (M = proton mass)** [*NCERT Exemplar*]

**This last expression is not correct because**

(*a*) *n* would not be integral.

(*b*) Bohr-quantisation applies only to electron

(*c*) the frame in which the electron is at rest is not inertial.

(*d*) the motion of the proton would not be in circular orbits, even approximately.

6. **The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons. This is because** [*NCERT Exemplar*]

(*a*) of the electrons not being subject to a central force.

(*b*) of the electrons colliding with each other

(*c*) of screening effects

(*d*) the force between the nucleus and an electron will no longer be given by Coulomb's law.

7. **The ratio of the speed of the electrons in the ground state of hydrogen to the speed of light in vacuum is**

(*a*) 1/2 (*b*) 2/237 (*c*) 1/137 (*d*) 1/237

8. **For the ground state, the electron in the H-atom has an angular momentum = *h*, according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actuality, this is not true,** [*NCERT Exemplar*]

(*a*) because Bohr model gives incorrect values of angular momentum.

(*b*) because only one of these would have a minimum energy.

(*c*) angular momentum must be in the direction of spin of electron.

(*d*) because electrons go around only in horizontal orbits.

9. **$O_2$ molecule consists of two oxygen atoms. In the molecule, nuclear force between the nuclei of the two atoms** [*NCERT Exemplar*]

(*a*) is not important because nuclear forces are short-ranged.

(*b*) is as important as electrostatic force for binding the two atoms.

(*c*) cancels the repulsive electrostatic force between the nuclei.

(*d*) is not important because oxygen nucleus have equal number of neutrons and protons.

10. **In the following transitions of the hydrogen atom, the one which gives an absorption line of highest frequency is**

(*a*) $n = 1$ to $n = 2$ (*b*) $n = 3$ to $n = 8$ (*c*) $n = 2$ to $n = 1$ (*d*) $n = 8$ to $n = 3$

11. **The wavelength of the first line of Lyman series in hydrogen is 1216 Å. The wavelength of the second line of the same series will be**

(*a*) 912 Å (*b*) 1026 Å (*c*) 3648 Å (*d*) 6566 Å

12. **Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced is** [*NCERT Exemplar*]

(*a*) 10.20 eV (*b*) 20.40 eV (*c*) 13.6 eV (*d*) 27.2 eV

13. **When an electron in an atom goes from a lower to a higher orbit, its**

(*a*) kinetic energy (*KE*) increases, potential energy (*PE*) decreases

(*b*) *KE* increases, *PE* increases

(*c*) *KE* decreases, *PE* increases

(*d*) *KE* decreases, *PE* decreases

14. **According to Bohr's theory, the energy of radiation in the transition from the third excited state to the first excited state for a hydrogen atom is**

(*a*) 0.85 eV (*b*) 13.6 eV (*c*) 2.55 eV (*d*) 3.4 eV

15. **Given the value of Rydberg constant is $10^7\ m^{-1}$, the wave number of the last line of the Balmer series in hydrogen spectrum will be**

(*a*) $0.25 \times 10^7\ m^{-1}$ (*b*) $2.5 \times 10^7\ m^{-1}$ (*c*) $0.025 \times 10^4\ m^{-1}$ (*d*) $0.5 \times 10^7\ m^{-1}$

16. **If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be**

(*a*) $\frac{16}{25}\lambda$ (*b*) $\frac{9}{16}\lambda$ (*c*) $\frac{20}{7}\lambda$ (*d*) $\frac{20}{13}\lambda$

17. **Hydrogen H, deuterium D, singly-ionised helium $He^+$ and doubly-ionised lithium $Li^{++}$ all have one electron around the nucleus. Consider $n = 2$ to $n = 1$ transition. The wavelengths of the emitted radiations are $\lambda_1, \lambda_2, \lambda_3$, and $\lambda_4$ respectively. Then approximately**

(*a*) $\lambda_1 = 2\lambda_2 = 2\sqrt{2}\lambda_3 = 3\sqrt{2}\lambda_4$ (*b*) $\lambda_1 = \lambda_2 = 2\lambda_3 = 3\lambda_4$

(*c*) $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$ (*d*) $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

18. **The Bohr model for the spectra of a H-atom** [*NCERT Exemplar*]

(*a*) will not be applicable to hydrogen in the molecular from.

(*b*) will not be applicable as it is for a He-atom.

(*c*) is valid only at room temperature.

(*d*) predicts continuous as well as discrete spectral lines.

19. **Let $E_n = \frac{1}{8\varepsilon_0^2}\frac{me^4}{n^2h^2}$ be the energy of the *n*th level of H-atom. If all the H-atoms are in the ground state and radiation of frequency $(E_2 - E_1)/h$ falls on it,** [*NCERT Exemplar*]

(*a*) it will not be absorbed at all.

(*b*) some of atoms will move to the first excited state.

(*c*) all atoms will be excited to the $n = 2$ state.

(*d*) no atoms will make a transition to the $n = 3$ state.

20. **A set of atoms in an excited state decays.**

(*a*) in general to any of the states with lower energy.

(*b*) into a lower state only when excited by an external electric field.

(*c*) all together simultaneously into a lower state.

(*d*) to emit photons only when they collide.

## ultiple Choice Questions [1 mark]

*oose and write the correct option(s) in the following questions.*

1. **Suppose we consider a large number of containers each containing initially 10000 atoms of a radioactive material with a half life of 1 year. After 1 year,** *[NCERT Exemplar]*
   (*a*) all the containers will have 5000 atoms of the material.
   (*b*) all the containers will contain the same number of atoms of the material but that number will only be approximately 5000.
   (*c*) the containers will in general have different numbers of the atoms of the material but their average will be close to 5000.
   (*d*) none of the containers can have more than 5000 atoms.

2. **The gravitational force between a H-atom and another particle of mass *m* will be given by Newton's law:** *[NCERT Exemplar]*

   $$F = G\frac{M.m}{r^2}$$, **where *r* is in km and**

   (*a*) $M = m_{proton} + m_{electron}$
   (*b*) $M = m_{proton} + m_{electron} - \frac{B}{c^2}$ $(B = 13.6\text{ eV})$
   (*c*) $M$ is not related to the mass of the hydrogen atom.
   (*d*) $M = m_{proton} + m_{electron} - \frac{|V|}{c^2}$ ($|V|$ = magnitude of the potential energy of electron in the H-atom).

3. **If radius of the $^{27}_{13}$Al nucleus is taken to be $R_{Al}$, then the radius of $^{125}_{53}$Te nucleus is nearly**
   (*a*) $\frac{3}{5}R_{Al}$ (*b*) $\left(\frac{13}{53}\right)^{1/3} R_{Al}$ (*c*) $\left(\frac{53}{13}\right)^{1/3} R_{Al}$ (*d*) $\frac{5}{3}R_{Al}$

4. **The equation $_ZX^A \longrightarrow {}_{Z+1}Y^A + {}_{-1}e^0 + \bar{\upsilon}$ represents**
   (*a*) β-decay (*b*) γ-decay (*c*) fusion (*d*) fission

5. **During a mean life of a radioactive element the fraction that disintegrates is:**
   (*a*) $e$ (*b*) $\frac{1}{e}$ (*c*) $\frac{e-1}{e}$ (*d*) $\frac{e}{e-1}$

6. **How much energy will approximately be released if all the atoms of 1 kg of deuterium could undergo fusion? [Assume energy released per deuterium nucleus is 2 MeV]**
   (*a*) $2 \times 10^7$ kWh (*b*) $9 \times 10^{13}$ J (*c*) $6 \times 10^{27}$ calorie (*d*) $9 \times 10^{13}$ MeV

7. **A nuclear reaction is given below. The masses in amu of reactant and product nuclei are given in brackets:**

   $$\underset{(1.002)}{A} + \underset{(1.004)}{B} \longrightarrow \underset{(1.001)}{C} + \underset{(1.003)}{D} + Q\text{ Mev}$$

   **The value of energy *Q* is**
   (*a*) 1.234 MeV (*b*) 0.91 MeV (*c*) 0.465 MeV (*d*) 1.862 MeV

8. **The binding energies per nucleon of deuteron ($_1H^2$) and helium ($_2He^4$) nuclei are 1.1 MeV and 7 MeV respectively. If two deuterons fuse together to form a helium nucleus, then energy produced is:**
   (*a*) 5.9 MeV (*b*) 23.6 MeV (*c*) 26.9 MeV (*d*) 32.4 MeV

9. **When a nucleus in an atom undergoes a radioactive decay, the electronic energy levels of the atom** *[NCERT Exemplar]*
   (*a*) do not change for any type of radioactivity.
   (*b*) change for α and β radioactivity but not for γ-radioactivity.
   (*c*) change for α-radioactivity but not for others.
   (*d*) change for β-radioactivity but not for others.

10. $M_x$ and $M_y$ denote the atomic masses of the parent and the daughter nuclei respectively in a radioactive decay. The $Q$-value for a $\beta^-$ decay is $Q_1$ and that for a $\beta^+$ decay is $Q_2$. If $m_e$ denotes the mass of an electron, then which of the following statements is correct? [*NCERT Exemplar*]

(*a*) $Q_1 = (M_x - M_y)c^2$ and $Q_2 = (M_x - M_y - 2m_e)c^2$

(*b*) $Q_1 = (M_x - M_y)c^2$ and $Q_2 = (M_x - M_y)c^2$

(*c*) $Q_1 = (M_x - M_y - 2m_e)c^2$ and $Q_2 = (M_x - M_y + 2m_e)c^2$

(*d*) $Q_1 = (M_x - M_y + 2m_e)c^2$ and $Q_2 = (M_x - M_y + 2m_e)c^2$

11. When boron ($^{10}_{5}B$) is bombarded by neutron, alpha-particles is emitted. The resulting nucleus has the mass number

(*a*) 11 (*b*) 7 (*c*) 6 (*d*) 15

12. The half life of $^{215}At$ is 100 μs. The time taken for the activity of the sample of $^{215}At$ to decay to $\frac{1}{16}$ th of its initial value is

(*a*) 400 μs (*b*) 300 μs (*c*) 40 μs (*d*) 6.3 μs

13. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is

(*a*) 20 (*b*) 10 (*c*) 30 (*d*) 15

14. When an α-particle of mass $m$ moving with velocity $v$ bombards on a heavy nucleus of charge Ze, its distance of closest approach from the nucleus depends on $m$ as

(*a*) $\frac{1}{m^2}$ (*b*) $m$ (*c*) $\frac{1}{m}$ (*d*) $\frac{1}{\sqrt{m}}$

15. Tritium is an isotope of hydrogen whose nucleus Triton contains 2 neutrons and 1 proton. Free neutrons decay into $p + \bar{e} + \bar{v}$. If one of the neutrons in Triton decays, it would transform into $He^3$ nucleus. This does not happen. This is because [*NCERT Exemplar*]

(*a*) Triton energy is less than that of a $He^3$ nucleus.

(*b*) the electron created in the beta decay process cannot remain in the nucleus.

(*c*) both the neutrons in triton have to decay simultaneously resulting in a nucleus with 3 protons, which is not a $He^3$ nucleus.

(*d*) because free neutrons decay due to external perturbations which is absent in a triton nucleus.

16. Heavy stable nuclei have more neutrons than protons. This is because of the fact that [*NCERT Exemplar*]

(*a*) neutrons are heavier than protons.

(*b*) electrostatic force between protons are repulsive.

(*c*) neutrons decay into protons through beta decay.

(*d*) nuclear forces between neutrons are weaker than that between protons.

17. In a nuclear reactor, moderators slow down the neutrons which come out in a fission process. The moderator used have light nuclei. Heavy nuclei will not serve the purpose because [*NCERT Exemplar*]

(*a*) they will break up.

(*b*) elastic collision of neutrons with heavy nuclei will not slow them down.

(*c*) the net weight of the reactor would be unbearably high.

(*d*) substances with heavy nuclei do not occur in liquid or gaseous state at room temperature.

18. Samples of two radioactive nuclides $A$ and $B$ are taken. $\lambda_A$ and $\lambda_B$ are the disintegration constants of $A$ and $B$ respectively. In which of the following cases, the two samples can simultaneously have the same decay rate at any time? [*NCERT Exemplar*]

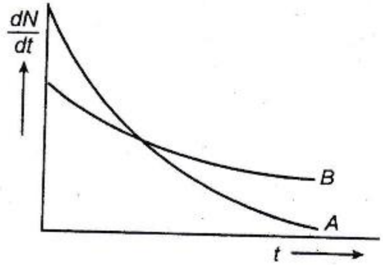
(*a*) Initial rate of decay of $A$ is twice the initial rate of decay of $B$ and $\lambda_A = \lambda_B$.

(*b*) Initial rate of decay of $A$ is twice the initial rate of decay of $B$ and $\lambda_A > \lambda_B$.

(c) Initial rate of decay of $B$ is twice the initial rate of decay of $A$ and $\lambda_A > \lambda_B$.

(d) Initial rate of decay of $B$ is same as the rate of decay of $A$ at $t = 2h$ and $\lambda_B < \lambda_A$.

**19. The variation of decay rate of two radioactive samples $A$ and $B$ with time is shown in figure. Which of the following statements are true?** [*NCERT Exemplar*]




(a) Decay constant of $A$ is greater than that of $B$, hence $A$ always decays faster than $B$.

(b) Decay constant of $B$ is greater than that of $A$ but its decay rate is always smaller than that of $A$.

(c) Decay constant of $A$ is greater than that of $B$ but it does not always decay faster than $B$.

(d) Decay constant of $B$ is smaller than that of $A$ but still its decay rate becomes equal to that of $A$ at a later instant.

**20. The binding energy per nucleon in $^{7}_{3}Li$ and $^{4}_{2}He$ are 7.06 MeV and 5.60 MeV respectively, then in the reaction: $p + ^{7}_{3}Li \rightarrow 2\left(^{4}_{2}He\right)$ the energy of proton must be:** [*NCERT Exemplar*]

(a) 28.24 MeV (b) 17.28 MeV (c) 1.46 MeV (d) 39.2 MeV

## Multiple Choice Questions [1 mark]

*Choose and write the correct option(s) in the following questions.*

1. **The usual semiconductors are:**
   (*a*) germanium and silicon
   (*b*) germanium and copper
   (*c*) silicon and glass
   (*d*) glass and carbon
2. **The energy gap between the valence and conduction bands of a substance is 6 eV. The substance is a:**
   (*a*) conductor
   (*b*) semiconductor
   (*c*) insulator
   (*d*) superconductor
3. **In a *n*-type semiconductor, which of the following statements is true?**
   (*a*) Electrons are majority carriers and trivalent atoms are the dopants.
   (*b*) Electrons are minority carriers and pentavalent atoms are dopants.
   (*c*) Holes are minority carriers and pentavalent atoms are dopants.
   (*d*) Holes are majority carriers and trivalent atoms are dopants.

4. **The conductivity of a semiconductor increases with increase in temperature because** [*NCERT Exemplar*]

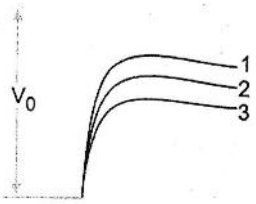
(*a*) number density of free current carriers increases.

(*b*) relaxation time increases.

(*c*) both number density of carriers and relaxation time increase.

(*d*) number density of current carriers increases, relaxation time decreases but effect of decrease in relaxation time is much less than increase in number density.

5. **In given figure, $V_0$ is the potential barrier across a *p-n* junction, when no battery is connected across the junction** [*NCERT Exemplar*]



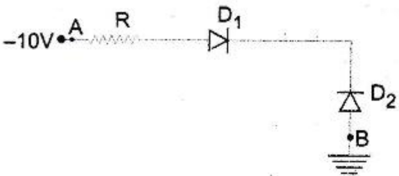

(*a*) 1 and 3 both correspond to forward bias of junction

(*b*) 3 corresponds to forward bias of junction and 1 corresponds to reverse bias of junction

(*c*) 1 corresponds to forward bias and 3 corresponds to reverse bias of junction.

(*d*) 3 and 1 both correspond to reverse bias of junction.

6. **In given figure, assuming the diodes to be ideal,** [*NCERT Exemplar*]




(*a*) $D_1$ is forward biased and $D_2$ is reverse biased and hence currentflows from A to B.

(*b*) $D_2$ is forward biased and $D_1$ is reverse biased and hence no current flows from B to A and vice versa.

(*c*) $D_1$ and $D_2$ are both forward biased and hence current flows from A to B.

(*d*) $D_1$ and $D_2$ are both reverse biased and hence no current flows from A to B and vice versa.

7. **In a good conductor, the energy gap between the valence and conduction bands is**

(*a*) 1 eV (*b*) 6 eV (*c*) infinite (*d*) zero

8. **Electrical conduction in a semiconductor occurs due to**

(*a*) electrons only (*b*) holes only

(*c*) electrons and holes both (*d*) neither electrons nor holes.

9. **If $n_e$ and $n_h$ are the number of electrons and holes in pure germanium, then**

(*a*) $n_e > n_h$ (*b*) $n_e < n_h$ (*c*) $n_e = n_h$ (*d*) $n_e$ = finite and $n_h = 0$

10. **When an electric field is applied across a semiconductor** [*NCERT Exemplar*]

(*a*) electrons move from lower energy level to higher energy level in the conduction band.

(*b*) electrons move from higher energy level to lower energy level in the conduction band.

(*c*) holes in the valence band move from higher energy level to lower energy level.

(*d*) holes in the valence band move from lower energy level to higher energy level.

11. **When trivalent impurity is mixed in a pure semiconductor, the conduction is mainly due to**

(*a*) electrons (*b*) holes

(*c*) protons (*d*) positive ions

12. **The example of *p*-type semiconductor is**

(*a*) pure germanium (*b*) pure silicon

(*c*) germanium doped with arsenic (*d*) germanium doped with boron

13. **The impurity atoms to be mixed in pure silicon to form *p*-type semiconductor are, of**

(*a*) phosphorus (*b*) germanium

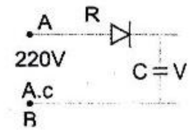
(*c*) antimony (*d*) aluminium

14. **Holes are charge carriers in**

(a) intrinsic semiconductor only (*b*) *p*-type semiconductor only

(c) intrinsic and *p*-type semiconductors (*d*) *n*-type semiconductor

15. **A 220 V A.C. supply is connected between points *A* and *B* (shown in figure). What will be the potential difference *V* across the capacitor?**[*NCERT Exemplar*]



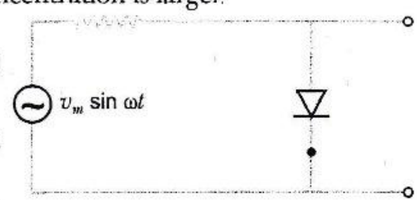

(*a*) 220 V
(*b*) 110 V
(*c*) 0 V
(*d*) $220\sqrt{2}$ V

16. **Hole is** [*NCERT Exemplar*]
(*a*) an anti-particle of electron.
(*b*) a vacancy created when an electron leaves a covalent bond.
(*c*) absence of free electrons.
(*d*) an artificially created particle.

17. **In the depletion region of a diode** [*NCERT Exemplar*]
(*a*) there are no mobile charges
(*b*) equal number of holes and electrons exist, making the region neutral.
(*c*) recombination of holes and electrons has taken place.
(*d*) immobile charged ions exist.

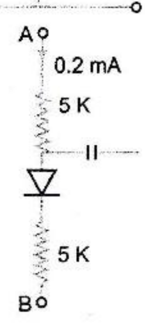
18 **The breakdown in a reverse biased *p-n* junction diode is more likely to occur due to** [*NCERT Exemplar*]
(*a*) large velocity of the minority charge carriers if the doping concentration is small.
(*b*) large velocity of the minority charge carriers if the doping concentration is large.
(*c*) strong electric field in a depletion region if the doping concentration is small.
(*d*) strong electric field in the depletion region if the doping concentration is large.

19. **The output of the given circuit shown in figure.** [*NCERT Exemplar*]




(*a*) would be zero at all times.
(*b*) would be like a half wave rectifier with positive cycles in output.
(*c*) would be like a half wave rectifier with negative cycles in output.
(*d*) would be like that of a full wave rectifier.

20. **In the circuit shown in figure, if the diode forward voltage drop is 0.3 V, the voltage difference between *A* and *B* is** [*NCERT Exemplar*]




(*a*) 1.3 V
(*b*) 2.3 V
(*c*) 0
(*d*) 0.5 V

## Answers