Section : **Physics**

Q.1 An electromagnetic wave moves in vacuum. Its speed is c.
Choose the correct options about the characteristics of electromagnetic waves:
(A) $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$
(B) Electromagnetic waves are transverse in nature.
(C) Both the electric field and magnetic field vibrate perpendicular to the direction of propagation of waves
(D) Electromagnetic waves are longitudinal in nature.
Choose the **correct** answer from the options given below:
1. (A), (B) and (C) only
2. (A), (C) and (D) only
3. (C) and (D) only
4. (A) and (B) only

Options 1. 1
2. 2
3. 3
4. 4

Q.2 A cell of emf 2.2 V gives a current of 0.2 A through a resistance of 9 Ω.
The internal resistance of the cell will be:
1. 1 Ω
2. 2 Ω
3. 4 Ω
4. 1.1 Ω

Options 1. 1
2. 2
3. 3
4. 4

Q.3 A chain reaction in fission of uranium is possible because
1. small amount of energy is released
2. more than one neutron is given out
3. large amount of energy is released
4. fragments in fission are radioactive.

Options 1. 1
2. 2
3. 3
4. 4

Q.4 The force between two small charged spheres having charges of 0.2 μC and 0.6 μC placed 0.6 m apart in air will be:
1. 0.018 N
2. 0.18 N
3. 0.03 N
4. 0.003 N

Options 1. 1
2. 2
3. 3
4. 4

Q.5 A small piece of metal wire is dragged in the region of magnetic flux 8×10^{-4} Wb in 0.5 s.
The length of the wire is perpendicular to the magnetic field. The emf induced in the wire would be:
1. 4.0 mV
2. 2.4 mV
3. 1.6 mV
4. 3.2 mV

Options 1. 1
2. 2
3. 3
4. 4

Q.6 The ratio for the speed of the electron in the 3rd orbit of He^+ to the speed of the electron in the 3rd orbit of the hydrogen atom will be

1. 4:1
2. 2:1
3. 1:2
4. 1:4

Options 1. 1
2. 2
3. 3
4. 4

Q.7 On which of the following factors angular fringe width does not depend?

1. wavelength
2. distance between slits
3. ratio of wavelength and distance between slits
4. distance between slits and screen

Options 1. 1
2. 2
3. 3
4. 4

Q.8 Which of the following statements is true about electromotive force (emf) of a cell?

1. It depends on external resistance.
2. emf is the potential difference between positive and negative terminals of a cell in a closed circuit.
3. It has electrostatic origin.
4. emf is the potential difference between positive and negative terminals of a cell in a open circuit.

Options 1. 1
2. 2
3. 3
4. 4

Q.9 A sinusoidal voltage with peak value 220 V and variable frequency is applied to a series LCR circuit in which R = 10 Ω L = 4 mH, and C = 100 mF. Consider the following:

(A) Resonant angular frequency $(w_o) = 50$ rad/s

(B) Resonant frequency $(v_o) = 25/n$ Hz

(C) Resonant frequency $(v_o) = 50/n$ Hz

(D) The rms current at resonance is 15.5 A

Choose the **correct** answer from the options given below:

1. (A) and (C) only
2. (A), (B) and (D) only
3. (A), (C) and (D) only
4. (B) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.10 An aeroplane having a wing span of 40 m flies due north at a speed of 100 m s^{-1} in magnetic field 5×10^{-5} T acting vertically downward. The potential difference between the tips of the wings is

1. 0.2 V
2. 0.5 V
3. 0.8 V
4. 2.0 V

Options 1. 1
2. 2
3. 3
4. 4

Q.11 For a given photosensitive material, the stopping potential V_0 varies with the frequency of incident radiation as

1. inversely proportional to frequency
2. linearly with frequency
3. independent of frequency
4. exponentially with frequency

Options 1. 1
2. 2
3. 3
4. 4

Q.12 Two capacitors of capacitance of 6 μF and 12 μF are connected in series with a battery. The voltage across 6 μF capacitor is 2 V. The total voltage across the combination is
1. 4 V
2. 2 V
3. 0.3 V
4. 3 V

Options 1. 1
2. 2
3. 3
4. 4

Q.13 What type of wavefront will emerge from a (i) distant light source and (ii) point source?
1. (i) Spherical; (i) Plane
2. (i) Plane ; (il) Spherical
3. (i) Spherical ; (i) Spherical
4. (i) plane; (ii) Plane

Options 1. 1
2. 2
3. 3
4. 4

Q.14 In a single slit diffraction experiment, first minima for $\lambda_1 = 600$ nm coincides with first maxima for wavelength λ_2. The value of λ_2 is
1. 400 nm
2. 600 nm
3. 440 nm
4. 300 nm

Options 1. 1
2. 2
3. 3
4. 4

Q.15 To convert a galvanometer into an ammeter
1. a very small resistance is added in series with the galvanometer
2. a high resistance is added in series with the galvanometer
3. a very small resistance is added in parallel with the galvanometer
4. a high resistance is added in parallel with the galvanometer

Options 1. 1
2. 2
3. 3
4. 4

Q.16 A domestic appliance draws 2.5 A from a 220 V, 50 Hz power supply. The amplitude of current is
1. 3.5 A
2. 2.5 A
3. 1.8 A
4. 0 A

Options 1. 1
2. 2
3. 3
4. 4

Q.17 The external diameter of a 5 m long hollow copper tube is 10 cm and the thickness of its wall is 5 mm. If the specific resistance of copper be 1.7×10^{-8} Ω-m, then its resistance would be approximately
1. 4.5×10^{-5} Ω
2. 6.0×10^{-5} Ω
3. 7.0×10^{-5} Ω
4. 8.0×10^{-5} Ω

Options 1. 1
2. 2
3. 3
4. 4

Q.18 The physical quantity which does not change when X-rays of wavelength 10^{-10} m, or visible light of wavelength 400 nm,

or radio waves of 500 m wavelength pass through glass is

1. frequency
2. wavelength
3. speed
4. refractive index

Options 1. 1
2. 2
3. 3
4. 4

Q.19 A 50 W, 100 V bulb is to be used on a 200 V, 50 Hz a.c. supply.
Calculate the inductance of inductor used so that the bulb glows with normal brightness.

1. $\frac{2\sqrt{3}}{\pi}$H
2. $\frac{\sqrt{3}}{\pi}$H
3. $\frac{100\sqrt{3}}{\pi}$H
4. $\frac{200\sqrt{3}}{\pi}$H

Options 1. 1
2. 2
3. 3
4. 4

Q.20 A metal foil of thickness (3/4)d is introduced between two plates of a capacitor of capacitance C. The distance between the plates of the capacitor is d. The new capacitance of the capacitor will be

1. 2 C
2. C/2
3. C
4. 4 C

Options 1. 1
2. 2
3. 3
4. 4

Q.21 Identify the INCORRECT statement(s) in the context of phenomenon of interference.

1. All bright and dark fringes have equal width.
2. All bright fringes have the same intensity.
3. Fringe width depends on the distance of screen from the slits.
4. All dark and bright fringes are not equally spaced.

Choose the *correct* answer from the options given below:

1. (A) only
2. (B) and (C) only
3. (C) and (D) only
4. (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.22 Identify the correct statement(s) among the following.

1. Electrical conductivity in an intrinsic semiconductor is due to electrons excited from the conduction band to valence band.
2. In germanium atom electrical conductivity is due to intrinsic charge carriers.
3. In doped atoms, the size of the dopant atom should be almost the same as that of the intrinsic crystal.
4. In n-type semiconductor, the donor atom becomes negatively charged.

Choose *correct* answer from the options given below:

1. (A) and (B) only
2. (B) and(C) only
3. (B) only
4. (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.23 An ammeter should have very low resistance

1. to show large deflection
2. to generate less heat
3. to protect the galvanometer from damage
4. so that it may not change the value of the actual current in the circuit

Options 1. 1
2. 2
3. 3
4. 4

Q.24 Read the following statements regarding energy levels, and identify the correct statements.
(A) The energy of an atom is least when its electron is revolving in an orbit closest to the nucleus
(B) the energy levels of the excited states come closer and closer together as principal quantum number increases
(C) ionisation energy of the hydrogen atom is the minimum energy required to free the electron from the ground state of the hydrogen atom
(D) as the excitation of hydrogen atom increases, the value of minimum energy required to free the electron from the excited atom decreases.
Choose the *correct* answer from the options given below:
1. (A), (B) and (D) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (B), (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.25 Identify the correct properties of equipotential surfaces among the following.
(A) No work is done in moving a test charge over an equipotential surface.
(B) Electric field is always normal to the equipotential surface at every point.
(C) Equipotential surfaces are closer together in the regions of the strong electric field and farther apart in the regions of the weak electric field.
(D) No two equipotential surfaces can intersect each other.
Choose the *correct* answer from the options given below:
1. (A), (B) and (C) only
2. (A), (B) and (D) only
3. (A), (B), (C) and (D)
4. (B), (C) and (D) only

Options 1. 1
2. 2
3. 3
4. 4

Q.26 The introduction of dielectric slab between the capacitor plates increase its capacitance due to
1. increase in the electric field
2. increase in the electric potential
3. increase in the charge
4. decrease in the electric field

Options 1. 1
2. 2
3. 3
4. 4

Q.27 If light of wavelength 412.5 nm is incident on each of the metals given below, which ones will show photoelectric emission ?

Metal	Work Function (eV)
Na	1.92
K	2.15
Ca	3.20
Mo	4.17

Choose the *correct* answer from the options given below:
1. Na and K only
2. Ca and Mo only
3. Na, Kand Ca only
4. K, Ca and Mo

Options 1. 1
2. 2
3. 3
4. 4

Q.28 For what distance is ray optics a good approximation when the aperture is 3 mm wide and the wavelength is 500 nm?
1. 15 m
2. 16 m
3. 17 m
4. 18 m

Options 1. 1
2. 2
3. 3
4. 4

Q.29 In which of the following cases emf would be induced-
1. When a coil and a magnet move with the same velocity in the same direction.

2. When a magnet is rotated about its own axis.
3. Whenever the magnetic flux linked with a circuit changes even if the circuit is open.
4. When a closed loop moves totally inside a uniform magnetic field.

Options 1. 1
2. 2
3. 3
4. 4

Q.30 Ultraviolet radiations of 6.2 eV are incident on an aluminum surface of work function 4.2 eV. The maximum kinetic energy of the emitted electrons is
1. 10.4 eV
2. 6.2 eV
3. 2.0 eV
4. 4.2 eV

Options 1. 1
2. 2
3. 3
4. 4

Q.31 The overhead horizontal power transmission line carries a current of 75 A from east to west direction. The
magnetic field above it at a vertical distance of 1.2 m will be
1. 1.25×10^{-5} T, towards south
2. 4.4×10^{-5} T, towards west
3. 6.25×10^{-5} T, towards north
4. 1.25×10^{-5} T, towards north

Options 1. 1
2. 2
3. 3
4. 4

Q.32 A telescope has an objective lens of focal length 150 cm and an eyepiece of focal length 5.0 cm. The magnifying power
of the telescope is
1. 30
2. 36
3. 35
4. 42

Options 1. 1
2. 2
3. 3
4. 4

Q.33 For a metre Bridge, Choose the incorrect option from the following
1. The wire of one meter length fixed on the wooden plank is a uniform conducting wire having constant resistance
per unit length.
2. Metre Bridge is not suitable to measure very low resistances.
3. Interchanging the position of the galvanometer and the cell will not change the balance point on the wire X/Y = $\frac{l_1}{l_2}$
4. The internal resistance of the cell affects the balancing position of null point.

Options 1. 1
2. 2
3. 3
4. 4

Q.34 Two long parallel wires separated by a distance of 2.50 cm, repel each other with a force of 4×10^{-5} N/m. The current in one wire is 0.5 A. The current in the second wire will be
1. 5 A
2. 10 A
3. 4 A
4. 0.5 A

Options 1. 1
2. 2
3. 3
4. 4

Q.35 Two particles P_1 and P_2, having equal charges accelerated by the same potential difference enter a region of a uniform

magnetic field and describe circular paths of radii R_1 and R_2, respectively. The ratio of the mass of P_1 to that of P_2 will be

1. $\left(\frac{R_1}{R_2}\right)^2$
2. $\left(\frac{R_1}{R_2}\right)$
3. $\left(\frac{R_1}{R_2}\right)^{0.5}$
4. $\left(\frac{R_2}{R_1}\right)^2$

Options 1. 1
2. 2
3. 3
4. 4

Q.36 One student cuts a magnet of magnetic moment M, into two identical parts perpendicular to its length. The magnetic moment of each part will be

1. M
2. M/2
3. 2M
4. 4M

Options 1. 1
2. 2
3. 3
4. 4

Q.37 A battery of 24 V and internal resistance 2 Ω is connected to a load (external resistance) R. The value of current so that power delivered to the load will be maximum, is

1. 12 A
2. 8 A
3. 6 A
4. 3 A

Options 1. 1
2. 2
3. 3
4. 4

Q.38 A charge 1.2×10^{-8} C is uniformly distributed on the conducting sphere of radius 5 cm. The magnitude of the electric field at the centre of the conducting sphere is

1. 1.6×10^4 N/C
2. 2.16×10^4 N/C
3. zero
4. 4.32×10^4 N/C

Options 1. 1
2. 2
3. 3
4. 4

Q.39 The radius of curvature of the path of a charged particle in a uniform magnetic field is directly proportional to the

1. charge of the particle
2. momentum of the particle
3. kinetic energy of the particle
4. flux density of the field

Options 1. 1
2. 2
3. 3
4. 4

Q.40 On adding a small amount of boron to a silicon crystal

1. boron becomes a donor atom
2. its resistance is increased
3. it becomes a n-type semiconductor
4. it becomes a p-type semiconductor

Options 1. 1
2. 2

3. 3

4. 4

Q.41 **Choose the correct option from the following**

1. **The internal resistance of a cell depends on its distance between electrodes and on the area of the electrodes.**
2. **The emf of a cell is measured when it is used in series in an electrical circuit carrying current *I* .**
3. **If a cell of emf E and of internal resistance r is providing current *I* through a resistance R then the potential difference across the cell is V = I(R +r).**

(D) The emf of a cell is 1 V, if 1 J of work is done by the cell to drive 1 C of charge in the whole circuit.

Choose the *correct* answer from the options given below:

1. **(A) and (B) only**
2. **(B) and (C) only**
3. **(C) and (D) only**
4. **(A) and (D) only**

Options 1. 1

2. 2

3. 3

4. 4

Q.42 A plane electromagnetic wave travels in vacuum along z-direction. What will be the directions of its electric field ($\vec{E}$) and magnetic field ($\vec{B}$) vectors?

1. $\vec{E}$ and $\vec{B}$ in y-z plane and are mutually perpendicular
2. $\vec{E}$ and $\vec{B}$ in z-x plane and are mutually perpendicular
3. $\vec{E}$ and $\vec{B}$ in x-y plane and are mutually perpendicular
4. $\vec{E}$ and $\vec{B}$ in x-z plane and are mutually parallel

Options 1. 1

2. 2

3. 3

4. 4

Q.43 **Identify the correct statements among the following.**

(A) Inside a conductor, electrostatic field is non-zero

(B) Electrostatic potential is constant throughout the volume of the conductor and has the same value (as inside) on its surface

(C) In a conductor with a cavity, with no charges inside the cavity, the electric field inside the cavity is non-zero, whatever be the size and shape of the cavity

(D) At the surface of a charged conductor, electrostatic field must be normal to the surface at every point

Choose correct answer from the options given below:

1. **(A), (B) and (C) only**
2. **(A), (B) and (D) only**
3. **(B) and (D) only**
4. **(B), (C) and (D) only**

Options 1. 1

2. 2

3. 3

4. 4

Q.44 **A positive charge is moving vertically upwards. When it enters a region of magnetic field directed towards north, the direction of force on the charge would be**

1. **East**
2. **West**
3. **North**
4. **South**

Options 1. 1

2. 2

3. 3

4. 4

Q.45 **Two capacitors of capacitances C and 4C at potentials 40 V and 60 V, respectively are connected in parallel. The common potential of the combination is**

1. **48 V**
2. **68 V**
3. **50 V**
4. **56 V**

Options 1. 1

2. 2

3. 3

4. 4

Q.46 **When a semiconductor is doped with a donor impurity**

1. **electron concentration decreases and hole concentration remains the same**

2. hole concentration decreases and electron concentration remains the same
3. electron concentration increases and hole concentration remains the same
4. electron concentration increases and hole concentration decreases

Options 1. 1
2. 2
3. 3
4. 4

Q.47 What percentage of a given mass of a radioactive substance will be left undecayed after five half-life periods?
1. 5.723%
2. 3.125%
3. 1.289%
4. 6.567%

Options 1. 1
2. 2
3. 3
4. 4

Q.48 The critical angle is maximum when light travels from
1. glass to air
2. air to water
3. air to glass
4. water to air

Options 1. 1
2. 2
3. 3
4. 4

Q.49 The resistivity of the material of a wire of length 15 m, area of cross-section $6 \times 10^{-7}\ \mathrm{m}^2$ and resistance $10\ \Omega$ will be
1. $4 \times 10^{-7}\ \Omega\,\mathrm{m}$
2. $2 \times 10^{-7}\ \Omega\,\mathrm{m}$
3. $3 \times 10^{-7}\ \Omega\,\mathrm{m}$
4. $5 \times 10^{-7}\ \Omega\,\mathrm{m}$

Options 1. 1
2. 2
3. 3
4. 4

Q.50 A charged particle enters a uniform magnetic field at an angle of $45°$ with the field. The path along which the particle moves in the field will be
1. linear
2. circular
3. helical with axis along magnetic field
4. helical with axis perpendicular to magnetic field

Options 1. 1
2. 2
3. 3
4. 4