

## CUET Physics Mock Test - Part 1 (Most Expected)

**Q1. The electric field inside a uniformly charged spherical shell is:**

- A) Infinite
- B) Zero
- C) Uniform but non-zero
- D) Directly proportional to the distance from the center

**Correct Answer:** B) Zero

**Explanation:** According to Gauss's Law, the charge on a conducting spherical shell resides entirely on its outer surface. Since there is no enclosed charge inside, the electric field is zero.

**Q2. Two charges  $q_1$  and  $q_2$  are placed in a vacuum at a distance  $r$ . If a dielectric slab of dielectric constant  $K$  is introduced between them, the electrostatic force between them will:**

- A) Increase
- B) Decrease
- C) Remain the same
- D) Become zero

**Correct Answer:** B) Decrease

**Explanation:** The force between two charges in a medium is given by  $F' = \frac{F}{K}$ , where  $F$  is the force in a vacuum. Since  $K > 1$  for any dielectric, the force decreases.

**Q3. A parallel plate capacitor is charged by a battery. If the battery is disconnected and the distance between the plates is increased, the potential difference between the plates will:**

- A) Increase
- B) Decrease
- C) Remain the same
- D) Become zero

**Correct Answer:** A) Increase

**Explanation:** When the battery is disconnected, the charge ( $Q$ ) remains constant. Capacitance  $C = \frac{\epsilon_0 A}{d}$ . If distance  $d$  increases,  $C$  decreases. Since  $V = \frac{Q}{C}$ , a decrease in  $C$  leads to an increase in  $V$ .

**Q4. Drift velocity ( $v_d$ ) of electrons in a conductor is related to the applied electric field ( $E$ ) as:**

- A)  $v_d \propto E^2$
- B)  $v_d \propto \sqrt{E}$
- C)  $v_d \propto E$
- D)  $v_d$  is independent of  $E$

**Correct Answer:** C)  $v_d \propto E$

**Explanation:** Drift velocity is given by  $v_d = \left(\frac{e \tau}{m}\right) E$ , where  $e$  is charge,  $\tau$  is relaxation time, and  $m$  is mass. Therefore, drift velocity is directly proportional to the electric field.

**Q5. Kirchhoff's First Law (Junction Rule) and Second Law (Loop Rule) are respectively based on the conservation of:**

- A) Energy and Charge
- B) Momentum and Energy
- C) Charge and Energy
- D) Mass and Charge

**Correct Answer:** C) Charge and Energy

**Explanation:** The Junction Rule is based on the conservation of charge (charge entering = charge leaving). The Loop Rule is based on the conservation of energy (total potential drop = total potential gain).

**Q6. With an increase in temperature, the resistivity of a semiconductor:**

- A) Increases
- B) Decreases
- C) Remains constant

D) First increases then decreases

**Correct Answer:** B) Decreases

**Explanation:** In semiconductors, as temperature increases, more covalent bonds break, creating more electron-hole pairs. This increases conductivity, thereby decreasing resistivity.

**Q7. The magnetic field ( $B$ ) at the center of a circular current-carrying coil of radius  $r$  is:**

A) Directly proportional to  $r$

B) Inversely proportional to  $r$

C) Directly proportional to  $r^2$

D) Inversely proportional to  $r^2$

**Correct Answer:** B) Inversely proportional to  $r$

**Explanation:** The formula for the magnetic field at the center of a circular loop is  $B = \frac{\mu_0 I}{2r}$ . Thus,  $B \propto \frac{1}{r}$ .

**Q8. A charged particle moving with velocity  $v$  in a uniform magnetic field  $B$  experiences maximum magnetic force when the angle between  $v$  and  $B$  is:**

A)  $0^\circ$

B)  $45^\circ$

C)  $90^\circ$

D)  $180^\circ$

**Correct Answer:** C)  $90^\circ$

**Explanation:** Magnetic force is given by  $F = qvB \sin(\theta)$ . The force is maximum when  $\sin(\theta) = 1$ , which occurs at  $\theta = 90^\circ$ .

**Q9. The angle of dip at the Earth's magnetic equator is:**

A)  $0^\circ$

B)  $45^\circ$

C)  $90^\circ$

D)  $180^\circ$

**Correct Answer:** A)  $0^\circ$

**Explanation:** At the magnetic equator, the Earth's magnetic field lines are completely horizontal, so the angle of dip (inclination) is  $0^\circ$ . At the poles, it is  $90^\circ$ .

**Q10. Lenz's Law is a consequence of the law of conservation of:**

A) Charge

B) Momentum

C) Mass

D) Energy

**Correct Answer:** D) Energy

**Explanation:** The mechanical work done in moving a magnet against the induced repulsive/attractive force is converted into electrical energy (induced current).

**Q11. In a purely inductive AC circuit, the alternating current:**

A) Leads the voltage by  $90^\circ$

B) Lags the voltage by  $90^\circ$

C) Is in phase with the voltage

D) Lags the voltage by  $45^\circ$

**Correct Answer:** B) Lags the voltage by  $90^\circ$

**Explanation:** In a pure inductor, the current lags behind the applied emf by a phase angle of  $\frac{\pi}{2}$  or  $90^\circ$ . (Remember the acronym CIVIL: in an Inductor (L), Voltage (V) leads Current (I)).

**Q12. The power factor of an LCR series circuit at resonance is:**

A) 0

B) 0.5

C) 1

D) Infinity

**Correct Answer:** C) 1

**Explanation:** At resonance, the inductive reactance equals capacitive reactance ( $X_L = X_C$ ), making the circuit purely resistive. Phase angle  $\phi = 0^\circ$ , and power factor  $\cos(\phi) = \cos(0^\circ) = 1$ .

**Q13. Which of the following electromagnetic waves has the minimum wavelength?**

- A) X-rays
- B) Microwaves
- C) Gamma rays
- D) Ultraviolet rays

**Correct Answer:** C) Gamma rays

**Explanation:** In the electromagnetic spectrum, Gamma rays have the highest frequency and therefore the shortest (minimum) wavelength.

**Q14. The phenomenon of a mirage in a desert is primarily due to:**

- A) Interference of light
- B) Diffraction of light
- C) Total internal reflection of light
- D) Scattering of light

**Correct Answer:** C) Total internal reflection of light

**Explanation:** Hot air near the ground is less dense than cooler air above it. Light from the sky bends away from the normal until it hits the critical angle and undergoes total internal reflection, creating an illusion of water.

**Q15. In Young's Double Slit Experiment, if the distance between the two slits is halved, the fringe width will:**

- A) Be halved
- B) Double
- C) Become four times
- D) Remain the same

**Correct Answer:** B) Double

**Explanation:** Fringe width is given by  $\beta = \frac{\lambda D}{d}$ . Since  $\beta$  is inversely proportional to the slit distance  $d$ , halving  $d$  will double the fringe width.

**Q16. The photoelectric work function of a metal is  $W$ . If light of energy  $E$  ( $E > W$ ) falls on it, the maximum kinetic energy of the emitted photoelectrons is:**

- A)  $E + W$
- B)  $E - W$
- C)  $\frac{E}{W}$
- D)  $W - E$

**Correct Answer:** B)  $E - W$

**Explanation:** According to Einstein's photoelectric equation, the energy of the incident photon is used to overcome the work function, and the rest becomes kinetic energy:  $K_{\max} = E - W$ .

**Q17. The de Broglie wavelength ( $\lambda$ ) associated with a particle of momentum  $p$  is:**

- A)  $\lambda = \frac{h}{p}$
- B)  $\lambda = hp$
- C)  $\lambda = \frac{p}{h}$
- D)  $\lambda = \frac{h^2}{p}$

**Correct Answer:** A)  $\lambda = \frac{h}{p}$

**Explanation:** Louis de Broglie proposed that matter has a wave nature, and the wavelength is inversely proportional to momentum:  $\lambda = \frac{h}{p}$ , where  $h$  is Planck's constant.

**Q18. According to Bohr's atomic model, the angular momentum of an electron in a stationary orbit is an integral multiple of:**

- A)  $\frac{h}{\pi}$
- B)  $\frac{h}{2\pi}$
- C)  $h$

D)  $2\pi h$

**Correct Answer:** B)  $\frac{h}{2\pi}$

**Explanation:** Bohr's quantization condition states that an electron can only revolve in certain orbits where its angular momentum ( $mvr$ ) is an integral multiple of  $\frac{h}{2\pi}$ .

**Q19. The nuclear density of a nucleus is:**

- A) Directly proportional to its mass number  $A$
- B) Inversely proportional to its mass number  $A$
- C) Directly proportional to  $A^{1/3}$
- D) Independent of its mass number  $A$

**Correct Answer:** D) Independent of its mass number  $A$

**Explanation:** Nuclear volume is proportional to the mass number  $A$  ( $V \propto R^3 \propto A$ ). Since mass is also proportional to  $A$ , the density (Mass/Volume) becomes constant ( $\approx 2.3 \times 10^{17} \text{ kg/m}^3$ ) for all nuclei.

**Q20. In an n-type semiconductor, the majority charge carriers are:**

- A) Holes
- B) Electrons
- C) Protons
- D) Neutrons

**Correct Answer:** B) Electrons

**Explanation:** An n-type semiconductor is doped with pentavalent impurities (like Phosphorus), which donate extra electrons. Thus, electrons are the majority charge carriers.

**Q21. The depletion layer in a p-n junction diode is formed due to:**

- A) Drift of electrons
- B) Diffusion of charge carriers
- C) Migration of impurity ions

D) Application of external voltage

**Correct Answer:** B) Diffusion of charge carriers

**Explanation:** Due to the concentration gradient, electrons diffuse from the n-side to the p-side, and holes diffuse from the p-side to the n-side, leaving behind immobile ions that form the depletion region.

**Q22. A logic gate that produces a HIGH output (1) only when all its inputs are HIGH (1) is an:**

A) OR Gate

B) AND Gate

C) NOR Gate

D) NAND Gate

**Correct Answer:** B) AND Gate

**Explanation:** The Boolean expression for an AND gate is  $Y = A \cdot B$ . It only outputs 1 when both  $A$  and  $B$  are 1.

**Q23. The ratio of the radii of two nuclei with mass numbers 8 and 64 is:**

A) 1:2

B) 1:4

C) 1:8

D) 2:1

**Correct Answer:** A) 1:2

**Explanation:** The radius of a nucleus is given by  $R = R_0 A^{1/3}$ .

$$\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{8}{64}\right)^{1/3} = \left(\frac{1}{8}\right)^{1/3} = \frac{1}{2}$$

**Q24. A convex lens of focal length  $f$  is immersed in water. Its focal length will:**

A) Decrease

B) Increase

C) Remain unchanged

D) Become negative

**Correct Answer:** B) Increase

**Explanation:** According to the Lens Maker's Formula, when a lens is immersed in a medium with a higher refractive index than air (like water), the relative refractive index of the glass decreases, which causes the focal length to increase.

**Q25. Which phenomenon confirms the transverse nature of light waves?**

A) Interference

B) Diffraction

C) Polarization

D) Dispersion

**Correct Answer:** C) Polarization

**Explanation:** Only transverse waves can be polarized. Longitudinal waves (like sound) cannot be polarized because their vibrations are in the same direction as wave propagation.

**Q26. According to Gauss's Law, the total electric flux through any closed surface is equal to:**

A)  $1/\epsilon_0$  times the total charge enclosed

B)  $\epsilon_0$  times the total charge enclosed

C) Zero, regardless of the charge enclosed

D) The square of the charge enclosed

**Correct Answer:** A)  $1/\epsilon_0$  times the total charge enclosed

**Explanation:** Gauss's law states that the net electric flux ( $\Phi$ ) through any closed surface is equal to the net charge ( $q$ ) inside the surface divided by the permittivity of free space ( $\epsilon_0$ ). So,  $\Phi = q/\epsilon_0$ .

**Q27. The energy stored in a capacitor of capacitance  $C$  charged to a potential difference  $V$  is:**

A)  $CV$

B)  $\frac{1}{2} CV^2$

C)  $CV^2$

D)  $\frac{1}{2} CV^2$

**Correct Answer:** B)  $\frac{1}{2} CV^2$

**Explanation:** The work done in charging a capacitor is stored as electrostatic potential energy, given by the formula  $U = \frac{1}{2} CV^2$  (or  $Q^2/2C$ ).

**Q28. A Wheatstone bridge is most sensitive when:**

A) The galvanometer resistance is zero

B) The battery has no internal resistance

C) The resistances of all four arms are approximately equal

D) The resistances of the arms are infinitely large

**Correct Answer:** C) The resistances of all four arms are approximately equal

**Explanation:** The sensitivity of a Wheatstone bridge is maximum when the ratio arms have equal resistances, ensuring maximum deflection in the galvanometer for a small change in unknown resistance.

**Q29. The magnetic field  $B$  inside a long current-carrying solenoid is:**

A) Uniform and parallel to the axis

B) Non-uniform and perpendicular to the axis

C) Zero

D) Maximum at the ends and minimum at the center

**Correct Answer:** A) Uniform and parallel to the axis

**Explanation:** Deep inside a long solenoid, the magnetic field lines are straight, parallel, and closely spaced, indicating a strong, uniform magnetic field given by  $B = \mu_0 n I$ .

**Q30. The magnetic susceptibility of a ferromagnetic material is:**

A) Small and negative

B) Small and positive

C) Large and negative

D) Large and positive

**Correct Answer:** D) Large and positive

**Explanation:** Ferromagnetic materials (like iron, nickel, cobalt) are strongly attracted by magnetic fields. They have a very large and positive magnetic susceptibility ( $\chi \gg 1$ ).

**Q31. The SI unit of Mutual Inductance is:**

A) Weber

B) Tesla

C) Henry

D) Faraday

**Correct Answer:** C) Henry

**Explanation:** The SI unit for both self-inductance and mutual inductance is Henry (H). Weber is for magnetic flux, Tesla for magnetic field, and Faraday is related to charge (Farad is for capacitance).

**Q32. The core of a transformer is laminated to reduce energy losses due to:**

A) Flux leakage

B) Copper loss

C) Hysteresis loss

D) Eddy currents

**Correct Answer:** D) Eddy currents

**Explanation:** Changing magnetic flux induces circulating electrical currents (eddy currents) in the iron core, causing heating and energy loss. Lamination increases the resistance of the core, minimizing these currents.

**Q33. The speed of an electromagnetic wave in a medium of permeability  $\mu$  and permittivity  $\epsilon$  is given by:**

A)  $\sqrt{\mu \epsilon}$

B)  $1/\sqrt{\mu \epsilon}$

C)  $\mu \epsilon$

D)  $1/(\mu \epsilon)$

**Correct Answer:** B)  $1/\sqrt{\mu \epsilon}$

**Explanation:** According to Maxwell's equations, the velocity of EM waves in a medium is  $v = \frac{1}{\sqrt{\mu \epsilon}}$ . In a vacuum, it is  $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$ .

**Q34. When a ray of light passes through a glass prism, it suffers minimum deviation when:**

A) Angle of incidence equals angle of emergence ( $i = e$ )

B) Angle of incidence is  $90^\circ$

C) Angle of prism is zero

D) Refracted ray is perpendicular to the base

**Correct Answer:** A) Angle of incidence equals angle of emergence ( $i = e$ )

**Explanation:** At the position of minimum deviation, the prism is perfectly symmetrical with respect to the light ray. The ray passes parallel to the base (for an isosceles prism), and  $i = e$ .

**Q35. According to Malus's Law, if the angle between the transmission axes of a polarizer and an analyzer is  $\theta$ , the intensity of transmitted light  $I$  is proportional to:**

A)  $\sin \theta$

B)  $\cos \theta$

C)  $\sin^2 \theta$

D)  $\cos^2 \theta$

**Correct Answer:** D)  $\cos^2 \theta$

**Explanation:** Malus's law states that the intensity of plane-polarized light transmitted through an analyzer is given by  $I = I_0 \cos^2 \theta$ , where  $I_0$  is the maximum intensity.

**Q36. In the photoelectric effect, the stopping potential depends on:**

A) The intensity of incident light only

B) The frequency of incident light and nature of the material

- C) The time of illumination
- D) The angle of incidence

**Correct Answer:** B) The frequency of incident light and nature of the material

**Explanation:** Stopping potential is directly proportional to the maximum kinetic energy of the photoelectrons, which depends on the frequency of the incident light and the work function (nature) of the material, not on intensity.

**Q37. Which series of the hydrogen spectrum lies in the ultraviolet region?**

- A) Balmer series
- B) Paschen series
- C) Lyman series
- D) Brackett series

**Correct Answer:** C) Lyman series

**Explanation:** The Lyman series corresponds to transitions to the ground state ( $n=1$ ) and releases the highest energy photons, which fall in the ultraviolet region. Balmer is visible, while Paschen and Brackett are infrared.

**Q38. The relationship between half-life ( $T_{1/2}$ ) and decay constant ( $\lambda$ ) of a radioactive substance is:**

- A)  $T_{1/2} = \lambda / 0.693$
- B)  $T_{1/2} = 0.693 / \lambda$
- C)  $T_{1/2} = 0.693 \times \lambda$
- D)  $T_{1/2} = \ln(2) \times \lambda$

**Correct Answer:** B)  $T_{1/2} = 0.693 / \lambda$

**Explanation:** The half-life is the time required for half the atoms in a sample to decay. It is given by  $T_{1/2} = \frac{\ln(2)}{\lambda}$ , and  $\ln(2) \approx 0.693$ .

**Q39. A Zener diode is primarily used as a:**

- A) Rectifier
- B) Amplifier

C) Voltage regulator

D) Oscillator

**Correct Answer:** C) Voltage regulator

**Explanation:** A Zener diode operates in the reverse breakdown region. Once the breakdown voltage is reached, the voltage across it remains constant even if the current changes significantly, making it an ideal voltage regulator.

**Q40. Which of the following is known as a "Universal Logic Gate"?**

A) AND

B) OR

C) NOT

D) NAND

**Correct Answer:** D) NAND

**Explanation:** NAND and NOR are called universal gates because any basic logic gate (AND, OR, NOT) can be constructed using only NAND gates or only NOR gates.

**Q41. The work done in rotating an electric dipole of dipole moment  $p$  from stable equilibrium to unstable equilibrium in a uniform electric field  $E$  is:**

A) Zero

B)  $pE$

C)  $2pE$

D)  $-pE$

**Correct Answer:** C)  $2pE$

**Explanation:** Work done  $W = pE(\cos\theta_1 - \cos\theta_2)$ . Stable equilibrium is at  $\theta_1 = 0^\circ$  and unstable is at  $\theta_2 = 180^\circ$ .  $W = pE(\cos(0^\circ) - \cos(180^\circ)) = pE(1 - (-1)) = 2pE$ .

**Q42. Two electric bulbs rated 25W-220V and 100W-220V are connected in series to a 220V supply. Which bulb will glow brighter?**

A) 25W bulb

- B) 100W bulb
- C) Both will glow equally
- D) Neither will glow

**Correct Answer:** A) 25W bulb

**Explanation:** Resistance  $R = V^2/P$ . The 25W bulb has higher resistance. In a series circuit, current  $I$  is constant, so power consumed ( $P = I^2R$ ) is higher for the bulb with higher resistance. Thus, the 25W bulb glows brighter.

**Q43. The cyclotron frequency of a charged particle in a magnetic field is independent of its:**

- A) Mass
- B) Charge
- C) Velocity
- D) Magnetic field strength

**Correct Answer:** C) Velocity

**Explanation:** Cyclotron frequency  $\nu = \frac{qB}{2\pi m}$ . It depends on charge ( $q$ ), magnetic field ( $B$ ), and mass ( $m$ ), but is completely independent of the velocity or radius of the path.

**Q44. The self-inductance of a long solenoid is directly proportional to:**

- A) The current flowing through it
- B) The square of the number of turns
- C) The area of cross-section only
- D) The magnetic field outside it

**Correct Answer:** B) The square of the number of turns

**Explanation:** The formula for the self-inductance of a solenoid is  $L = \frac{\mu_0 N^2 A}{l}$ . It is directly proportional to the square of the total number of turns ( $N^2$ ).

**Q45. The ratio of the peak value to the RMS value of an alternating current is:**

- A) 1

- B) 2
- C)  $\sqrt{2}$
- D)  $1/\sqrt{2}$

**Correct Answer:** C)  $\sqrt{2}$

**Explanation:** The relationship is  $I_{\text{rms}} = \frac{I_0}{\sqrt{2}}$ . Therefore, the ratio of peak value ( $I_0$ ) to RMS value ( $I_{\text{rms}}$ ) is  $\sqrt{2}$  (approximately 1.414).

**Q46. The magnifying power of an astronomical telescope in normal adjustment is:**

- A)  $f_o \times f_e$
- B)  $f_o / f_e$
- C)  $f_e / f_o$
- D)  $f_o + f_e$

**Correct Answer:** B)  $f_o / f_e$

**Explanation:** In normal adjustment (final image at infinity), the magnifying power is the ratio of the focal length of the objective lens ( $f_o$ ) to the focal length of the eyepiece ( $f_e$ ).

**Q47. In a single slit diffraction experiment, if the width of the slit is decreased, the central maximum will:**

- A) Become narrower
- B) Become wider
- C) Remain the same width
- D) Disappear

**Correct Answer:** B) Become wider

**Explanation:** The angular width of the central maximum is  $2\theta = \frac{2\lambda}{a}$ , where  $a$  is the slit width. If  $a$  decreases, the width of the central maximum increases.

**Q48. An electron microscope uses which principle of modern physics?**

- A) Photoelectric effect

- B) Wave nature of particles (Matter waves)
- C) X-ray diffraction
- D) Nuclear magnetic resonance

**Correct Answer:** B) Wave nature of particles (Matter waves)

**Explanation:** Based on de Broglie's hypothesis, fast-moving electrons have a very short wavelength, allowing for much higher resolving power than optical microscopes.

**Q49. The minimum energy required to remove an electron from the ground state of a hydrogen atom is:**

- A) 1.51 eV
- B) 3.4 eV
- C) 13.6 eV
- D) 10.2 eV

**Correct Answer:** C) 13.6 eV

**Explanation:** The energy of the electron in the ground state ( $n=1$ ) is  $-13.6$  eV. To completely remove it (to  $n=\infty$  where  $E=0$ ), you must supply exactly  $+13.6$  eV. This is the ionization energy.

**Q50. The binding energy of a nucleus is equivalent to the:**

- A) Mass of protons
- B) Mass of neutrons
- C) Mass defect
- D) Total mass of the nucleus

**Correct Answer:** C) Mass defect

**Explanation:** When a nucleus forms, its actual mass is slightly less than the sum of the masses of its individual nucleons. This difference is the mass defect ( $\Delta m$ ), which is converted into binding energy according to  $E = \Delta m c^2$ .