**CUET (UG)**

**Physics Sample Paper - 10**

**Solved**

**Time Allowed: 45 minutes** **Maximum Marks: 200**

**General Instructions:**

1. The test is of 45 Minutes duration.
2. The test contains 50 questions out of which 40 questions need to be attempted.
3. Marking Scheme of the test:

a. Correct answer or the most appropriate answer: Five marks (+5).
b. Any incorrectly marked option will be given minus one mark (-1).
c. Unanswered/Marked for Review will be given zero mark (0).

**Attempt any 40 questions**

1. Select the correct statements. Coulomb's law correctly describes the electric force that: **[5]**

i. binds the electrons of an atom to its nucleus.
ii. binds the protons and neutrons in the nucleus of an atom.
iii. binds atoms together to form molecules.

a) (i), (ii), and (iii)
b) (i) and (iii)
c) (ii) and (iii)
d) (i) and (ii)

2. The electric charge always resides: **[5]**

a) at the interior of a charged conductor
b) at the centre of charged conductor
c) randomly all over the charged conductor
d) on the outer surface of a charged conductor

3. Gauss' law is effective for: **[5]**

a) only open irregular surfaces
b) any enclosed area
c) any unobstructed surface
d) only near uniform surfaces

4. The electric potential on the axis of an electric dipole at a distance 'r from it's centre is V. Then the potential at a point at the same distance on its equatorial line will be **[5]**

a) Zero
b) 2V
c) $\frac{V}{2}$
d) -V

5. Equal charges are given to two conducting spheres of different radii. The potential will **[5]**

a) be more on the bigger sphere
b) be equal on both the spheres
c) be less on the smaller sphere
d) depend on the radii of the sphere

6. Can two equipotential surfaces intersect each other? **[5]**

a) Yes
b) Only when surfaces intersect at $90^{o}$
c) Sometimes
d) No

7. Drift velocity of electrons is due to: **[5]**

a) repulsion to the conduction electrons due to inner electrons of ions
b) the motion of conduction electrons due to random collisions
c) the motion of conduction electrons due to electric field E
d) collision of conduction electrons with each other

8. A steady current of 8 mA flows through a wire. The number of electrons passing through a cross-section of the wire in 10 s is **[5]**

a) $5.0 \times 10^{17}$
b) $1.6 \times 10^{16}$
c) $4.0 \times 10^{16}$
d) $1.0 \times 10^{17}$

9. Drift speed of electrons is of the order of: **[5]**

a) $10^{5}$ cm/sec
b) $10^{0}$ cm/sec
c) $10^{-2}$ cm/sec
d) Zero

10. The SI unit of magnetic pole strength is **[5]**

a) ampere metre$^{2}$
b) ampere metre$^{-2}$
c) ampere per metre
d) ampere metre

11. A voltmeter has a resistance of G ohm and a range of V volt. The value of resistance used in series to convert it into a voltmeter of range nV volt is **[5]**

a) (n-1)G
b) nG

c) $\frac{G}{n-1}$ d) $\frac{G}{n}$

12. Assertion: If an electron and proton enter a perpendicular magnetic field with equal momentum, then the radius of the curve for the electron is more than that of proton. Reason: Electron has less mass than a proton. **[5]**

a) If both Assertion & Reason are true and the reason is the correct explanation of the assertion,

b) If Assertion is true statement but Reason is false

c) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion,

d) If both Assertion and Reason are false statements

13. A current loop in a magnetic field: **[5]**

a) can be in equilibrium in two orientations, both the equilibrium states are unstable

b) can be in equilibrium in two orientations, one stable while the other is unstable

c) experiences a torque whether the field is uniform or non-uniform in all orientations

d) can be in equilibrium in one orientation

14. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces a deflection of 60° and 45° respectively. The ratio of the number of turns in the coils is: **[5]**

a) $\frac{\sqrt{3}}{1}$ b) $\frac{\sqrt{3+1}}{1}$

c) $\frac{(\sqrt{3+1})}{(\sqrt{3}-1)}$ d) $\frac{4}{3}$

15. The intensity of magnetic field is H and the moment of a magnet is M Maximum potential energy is: **[5]**

a) 4 MH b) 3 MH

c) MH d) 2 MH

16. At a given place on the earth's surface, horizontal component of earth's magnetic field is $3 \times 10^{-5}T$ and resultant magnetic field is $6 \times 10^{-5}T$ . The angle of dip at the place is: **[5]**

a) 40° b) 30°

c) 60° d) 50°

17. A closely wound solenoid of 2000 turns and area of cross-section $1.6 \times 10^{-4} m^2$, carrying a current of 4.0 A, is suspended through its centre allowing it to turn in a horizontal plane. What is the magnetic moment associated with the solenoid? **[5]**

a) 3.18 $Am^2$ b) 2.08 $Am^2$

c) 1.28 $Am^2$ d) 4.38 $Am^2$

18. A bar magnet is oscillating in the earth's magnetic fields with a time period T. If its mass is quadrupled, then its time period will be: **[5]**

a) $\frac{T}{2}$ b) 4T

c) T d) 2T

19. The susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetising field. The material is a: **[5]**

a) diamagnet b) superconductor

c) ferromagnet d) paramagnet

20. The magnetic moment of a revolving electron around the nucleus varies with principal quantum number n as **[5]**

a) $\mu \propto n$ b) $\mu \propto \frac{1}{n^2}$

c) $\mu \propto n^2$ d) $\mu \propto \frac{1}{n}$

21. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2A? **[5]**

a) 3.48 T b) 5.48 T

c) 4.08 T d) 4.48 T

22. An inductor may store energy in **[5]**

a) its magnetic field b) its electric field

c) both in electric and magnetic fields d) its coils

23. When a coi is joined to a cell grows with a time constant $\tau$. The current will reach 10% less than it's steady-state value in time **[5]**

a) $\tau$ b) $\tau \ln(8)$

c) $\tau \ln(10)$ d) $0.9\tau$

24. The dimensional formula for emf $\varepsilon$ in MKS system will be **[5]**

a) $[ML^{-2}Q^{-1}]$ b) $[MLT^{-2}Q^{-2}]$

c) $[ML^{2}T^{-2}Q^{-1}]$ d) $[ML^{2}T^{-1}]$

25. On a cylindrical rod two coils are wound one above the other. What is the coefficient of mutual inductance if the inductance of each coil is 0.1H? **[5]**

a) 0.15H b) 0.05H

c) 0.20H d) 0.10H

26. Phase difference between voltage and current in a capacitor in ac circuit is **[5]**

a) $\frac{\pi}{2}$ b) 0

c) $\pi$ d) $\frac{\pi}{3}$

27. In an a.c. circuit, the voltage applied is $E = E_0 \sin \omega t$. The resulting current in the circuit is $I = I_0 \sin(\omega t - \frac{\pi}{2})$. The power consumption in the circuit will be **[5]**

a) $\frac{E_0 I_0}{2}$ b) P = 0

c) $P = \frac{E_0 I_0}{\sqrt{2}}$ d) $P = \sqrt{2}\, E_0\, I_0$

28. In an ideal inductor, L = 4H and $\omega$ = 100 rad/s. The power developed is: **[5]**

a) 0 b) $2V_0I_0$

c) $V_0I_0$ d) $\frac{V_o I_o}{2}$

29. Parameter that remains unchanged in a transformer is **[5]**

a) frequency b) voltage

c) efficiency d) current

30. The dimensions of $(\mu_0 \varepsilon_0)^{-1/2}$ are **[5]**

a) $[LT^{-1}]$ b) $[L^{-1/2}T^{1/2}]$

c) $[L^{-1}T]$

d) $[L^{1/2}T^{-1/2}]$

31. Which of the following radiations has the least wavelength? **[5]**

a) $\alpha$-rays

b) $\beta$-rays

c) X-rays

d) $\gamma$-rays

32. Electromagnetic waves propagate **[5]**

a) slower in a dielectric

b) None of these

c) at the same speed in a dielectric

d) faster in a dielectric

33. 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 **[5]**

a) act as a concave lens irrespective of side on which the object lies

b) act as a convex lens only for the objects that lie on its curved side

c) act as a concave lens for the objects that lie on its curved side

d) act as a convex lens irrespective of the side on which the object lies

34. Reflecting telescope utilizes **[5]**

a) Convex mirror

b) Concave mirror

c) Prism

d) Both Convex mirror and Concave mirror

35. A passenger in an aeroplane shall **[5]**

a) shall never see a secondary rainbow

b) may see a primary and a secondary rainbow as concentric arcs

c) never see a rainbow

d) may see a primary and a secondary rainbow as concentric circles

36. A fish at a depth of 12 cm in water is viewed by an observer on the bank of a lake. Through what height is the image of fish raised? ($\mu = \frac{4}{3}$) **[5]**

a) 9 cm

b) 3 cm

c) 12 cm

d) 3.8 cm

37. Angular width ($\theta$) of central maximum of a diffraction pattern of a single slit does not depend upon **[5]**

a) wavelength of light used
b) distance between slit and screen
c) width of the slit
d) frequency of light used

38. In an interference experiment monochromatic light is replaced by white light; we will see: **[5]**

a) uniform illumination on the screen
b) equally spaced white and dark bands
c) a few coloured bands and then uniform illumination
d) uniform darkness on the screen

39. At stopping potential, the kinetic energy of emitted photoelectron is **[5]**

a) minimum
b) zero
c) cannot de predicted
d) maximum

40. The de Broglie wave corresponding to a particle of mass m and velocity $v$ has a wavelength associated with it **[5]**

a) $\frac{mh}{v}$
b) $\frac{m}{hv}$
c) $hmv$
d) $\frac{h}{mv}$

41. The specific charge for positive rays is much less than that for cathode rays. This is because **[5]**

a) their masses are very large
b) experimental approach is defective
c) they are positively charged
d) their charge is very small

42. If light of frequency $10^{15}$ Hz is incident on sodium having work function 2.5 eV, then energy of emitted photoelectrons is **[5]**

a) $3.0 \times 10^{-19}$ J
b) $2.1 \times 10^{-19}$ J
c) $1.6 \times 10^{-19}$ J
d) $2.6 \times 10^{-19}$ J

43. The Bohr model of atoms **[5]**

a) predicts the same emission spectra for all types of atoms

b) assumes that the angular momentum of electrons is quantised

c) uses Einstein's photoelectric equation

d) predicts continuous emission spectra for atoms

44. $\frac{h}{2\pi}$ has the dimension of **[5]**

a) velocity

b) momentum

c) energy

d) angular momentum

45. In Thomson's method for finding specific charge of positive rays, the electric and magnetic fields are **[5]**

a) Crossed and simultaneous

b) Parallel and separate

c) Parallel and simultaneous

d) Crossed and separate

46. A nucleus of ${}_4Be^9$ absorbs an alpha particle and emits a neutron. The resulting nucleus will be **[5]**

a) ${}_5Be^{12}$

b) ${}_6C^{12}$

c) ${}_6C^{13}$

d) ${}_4Be^8$

47. In the nucleus of ${}_{11}Na^{23}$, the number of protons, neutrons and electrons are **[5]**

a) 12, 11, 0

b) 11, 12, 0

c) 23,12,11

d) 23, 11, 12

48. Radioactive nuclei that are injected into a patient, collect at certain sites within its body, undergoing radioactive decay and emitting electromagnetic radiation. These radiations can then be recorded by a detector. This procedure provides an important diagnostic tool called **[5]**

a) gamma camera

b) radiotracer technique

c) gamma ray spectroscopy

d) CAT scan

49. Energy required to break one bond in DNA is approximately **[5]**

a) $\approx$ 2.1eV

b) $\approx$ 1eV

c) $\approx 0.1eV$ d) $\approx 0.01eV$

50. Which of these is an example of point to point communication? **[5]**

a) AM Radio b) TV

c) Telephony d) FM Radio

# Solutions

1. **(b)** (i) and (iii)
   **Explanation:** According to Coulomb's law, electric force binds the electrons of an atom to its nucleus and atoms together to form molecules.
2. **(d)** on the outer surface of a charged conductor
   **Explanation:** Electric charge always resides on the outer surface of a charged conductor.
3. **(b)** any enclosed area
   **Explanation:** The Gauss' law is applicable for any closed surface.
4. **(a)** Zero
   **Explanation:** Potential at point (r, $\theta$) is
   $V = \frac{Kp\cos\theta}{r^2}$ [p = dipole moment]

   On equatorial line $\theta = 90^o$

   $\therefore \ V = \frac{Kp\cos 90^\circ}{r^2} = 0$
5. **(d)** depend on the radii of the sphere
   **Explanation:** As potential on the surface of conducting sphere is given by
   $V = \frac{q}{4\pi \in_0 R}$ thus if q is same for both the sphere

   $V \ \alpha \ \frac{1}{R}$.
6. **(d)** No
   **Explanation:** Intersection of two equipotential surfaces at a point will give two directions of electric field intensity at that point, which is not possible.
7. **(c)** the motion of conduction electrons due to electric field E
   **Explanation:** The motion of conduction electrons due to random collisions has no preferred direction and averages to zero. Drift velocity is caused due to motion of conduction electrons due to the applied electric field.
8. **(a)** $5.0 \times 10^{17}$

   **Explanation:** $5.0 \times 10^{17}$
9. **(c)** $10^{-2}$ cm/sec

**Explanation:** $v_d = \frac{1}{2}\left(\frac{eE}{m}\right)\left(\frac{\lambda}{\mu}\right)$

or $v_d = \frac{1}{2}E\left[\frac{1.6\times10^{-19}}{9.1\times10^{-31}}\right]\left[\frac{10^{-9}}{10^{5}}\right]$

$= 0.8 \times 10^{-3}\ E = 8 \times 10^{-4}E$

If $E = (\frac{1}{8})$ V/m, then $v_d = 10^{-4}$(m/s)

or $v_d = 10^{-2}$ cm/s

10.

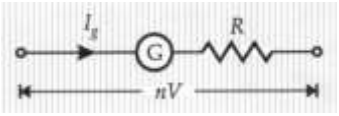
**(d)** ampere metre

**Explanation:** ampere metre

11. **(a)** (n-1)G

**Explanation:**

$I_g = \frac{V}{G}$




Also, $G + R = \frac{nV}{I_g} = nG$

or R = (n -1)G

12.

**(d)** If both Assertion and Reason are false statements

**Explanation:** As the charged particle enters in a magnetic field, it experiences rotational motion and the radius of circular path is given as

$r = \frac{qB}{mV}$

as momentum is same, so radius is same.

Therefore both assertion and reason both are false.

13.

**(b)** can be in equilibrium in two orientations, one stable while the other is unstable

**Explanation:** $\tau = mB\sin\theta$

When $\vec{m} \uparrow\uparrow \vec{B}$, $\theta = 0°$, $\tau = 0$

loop is in stable equilibrium.

When $\vec{m} \uparrow\downarrow \vec{B}$, $\theta = 180°$, $\tau = 0$

loop is in unstable equilibrium.

14. **(a)** $\frac{\sqrt{3}}{1}$

**Explanation:** For a tangent galvanometer,

$\frac{\mu_0 NI}{2R} = B_H \tan\theta$

For same I and $B_H$, N $\times$ $\tan\theta$

$\therefore \frac{N_1}{N_2} = \frac{\tan 60°}{\tan 45°} = \frac{\sqrt{3}}{1}$

15. **(d)** 2 MH

**Explanation:** $U_{max}$ = -2 MH cos 180° = +2 MH

16. **(c)** 60°

**Explanation:** $cos\delta = \frac{B_H}{B} = \frac{3 \times 10^{-5}}{6 \times 10^{-5}} = 0.5$

Hence angle of dip = 60°

17. **(c)** 1.28 $Am^2$

**Explanation:** m = NIA

$= 2000 \times 1.6 \times 10^{-4} \times 4$

$= 1.28\ Am^2$

18. **(d)** 2T

**Explanation:** $T = 2\pi\sqrt{\frac{I}{mB_H}}$

When mass is quadrupled,

I' = 4I

$\therefore T' = 2\pi\sqrt{\frac{T}{mB_H}} = 2\pi\sqrt{\frac{4I}{mB_H}} = 2T$

19. **(d)** paramagnet

**Explanation:** The susceptibility of a paramagnetic substance depends both on the temperature and strength of the magnetising field.

20. **(a)** $\mu \propto n$

**Explanation:** $L = n \cdot \frac{h}{2\pi}$ and $\mu = \frac{e}{2m} \cdot L$

$\therefore \mu = \frac{e}{2m} \cdot \frac{nh}{2\pi} \therefore u \propto n.$

21. **(d)** 4.48 T

**Explanation:** $B = \frac{\mu_o \mu_r Ni}{2\pi r} = \frac{4\pi \times 10^{-7} \times 800 \times 3500 \times 1.2}{2\pi \times 15 \times 10^{-2}} = 4.48$ T

22. **(a)** its magnetic field

**Explanation:** The energy is stored inside an inductor in the form of magnetic field.

23. **(c)** $\tau \ln(10)$

**Explanation:** $I = I_0\left(1 - e^{\frac{-t}{\tau}}\right)$

and $I = 0.9I_0$

$\frac{0.9I_0}{I_0} = 1 - e^{\frac{-t}{\tau}}$

$e^{\frac{-t}{\tau}} = \frac{1}{10}$

$\frac{t}{\tau} = \ln\frac{10}{1}$

$t = \tau \ln 10$

24. **(c)** $[ML^2T^{-2}Q^{-1}]$

**Explanation:** $\varepsilon = \frac{[W]}{[q]} = \frac{\left[ML^2T^{-2}\right]}{[Q]}$

$= [ML^2T^{-2}Q^{-1}]$

25. **(d)** 0.10H

**Explanation:** As one coil is wound over the other so that coupling is tight i.e. k = 1

$M = k\sqrt{L_1 L_2} = 1\sqrt{0.1 \times 0.1} = 0.1H$

26. **(a)** $\frac{\pi}{2}$

**Explanation:** An ac voltage $v = v_m \sin\omega t$ applied to a capacitor drives a current in the capacitor $i = i_m \sin(\omega t + \frac{\pi}{2})$. Thus, the current through the capacitor is $\frac{\pi}{2}$ ahead of the applied voltage.

27.

**(b)** P = 0

**Explanation:** Here, $\phi = \frac{\pi}{2}$

$\therefore$ Power factor, $\cos\phi = \cos\frac{\pi}{2} = 0$

The power consumed in the circuit,
$P = E_V I_V \cos\phi = E_V I_V \times 0 = 0$

28. **(a)** 0

**Explanation:** Power in an ac circuit,
$P = V_{rms} I_{rms} \cos\phi$

If only inductor is present in circuit, then voltage leads the current by $90^o$ i.e. $\phi = 90°$
Hence, P = 0 as $\cos 90° = 0$

29. **(a)** frequency

**Explanation:** Transformer does not change the frequency of the applied AC.

30. **(a)** $[LT^{-1}]$

**Explanation:** $\left(\mu_0 \varepsilon_0\right)^{-1/2} = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = c = \left[LT^{-1}\right]$

31.

**(d)** $\gamma$-rays

**Explanation:** $\gamma$-rays have got the least wavelength.

32. **(a)** slower in a dielectric

**Explanation:** Speed of light is inversely proportional to square root of dielectric constant. Hence it decreases in dielectric.

33.

**(d)** act as a convex lens irrespective of the side on which the object lies

**Explanation:**

The relation between focal length f, the refractive index of the given material $\mu$, $R_1$ and $R_2$ is known as lens maker's formula and it is $\frac{1}{f} = (\mu - 1)(\frac{1}{R_1} - \frac{1}{R_2})$

$R_1 = \infty, R_2 = -R$

$f = \frac{R}{(\mu - 1)}$

Here, R = 20 cm, $\mu$ = 1.5. On substituting the values, we get

$f = \frac{R}{\mu - 1} = \frac{20}{1.5 - 1} = 40\text{cm}$

As f > 0 means converging nature. Therefore, the lens act as a convex lens irrespective of the side on which the object lies.

34.

**(d)** Both Convex mirror and Concave mirror

**Explanation:** Concave mirror is used as objective. A secondary convex mirror is used to reflect the light reflected by objective towards eyepiece.

35.

**(d)** may see a primary and a secondary rainbow as concentric circles

**Explanation:** A passenger in an aeroplane may see primary and secondary rainbow as concentric circles because the light gets total internal reflection from other secondary droplets also.

36.

**(b)** 3 cm

**Explanation:** Apparent depth = (Real depth) / (refractive index)

Now, Height raised = real depth - apparent depth

$= \text{real depth}\left(1 - \frac{apparent\ depth}{real\ depth}\right)$

$= \text{real depth}\left(1 - \frac{1}{refractive\ index}\right)$

$= \text{d}\left(1 - \frac{1}{\mu}\right) = 12\left(1 - \frac{1}{\frac{4}{3}}\right) = 12\left(1 - \frac{3}{4}\right) = \frac{12}{4} = 3cm$

37.

**(b)** distance between slit and screen

**Explanation:** Angular width of central maximum,

$\theta_0 = \frac{\beta_0}{D} = \frac{2D\lambda}{a}\frac{1}{D} = \frac{2\lambda}{a}$

Clearly, $\theta_0$ does not depend on the distance D between the slit and screen.

38.

**(c)** a few coloured bands and then uniform illumination

**Explanation:** a few coloured bands and then uniform illumination

39.

**(b)** zero

**Explanation:** zero

40.

**(d)** $\frac{h}{mv}$

**Explanation:** de-Broglie wavelength, $\lambda = \frac{h}{p} = \frac{h}{mv}$

41. **(a)** their masses are very large
**Explanation:** Specific charge is e/m ratio. Mass of cathode rays is much greater than positive rays. Hence specific charge of positive rays is much less than cathode rays.

42.

**(d)** $2.6 \times 10^{-19}$ J

**Explanation:** $K_{max} = h\nu - \phi_o = (6.63 \times 10^{-34} \times 10^{15}) - 2.5 \times 1.6 \times 10^{-19} J$

$= (6.63 - 4) \times 10^{-19} J = 2.63 \times 10^{-19} J$

43.

**(b)** assumes that the angular momentum of electrons is quantised
**Explanation:** assumes that the angular momentum of electrons is quantised

44.

**(d)** angular momentum

**Explanation:** $\frac{h}{2\pi}$ is the angular momentum of an electron in the first orbit of hydrogen atom.

45. **(a)** Crossed and simultaneous
**Explanation:** Specific charge can be determined when the charge moves in both magnetic field and electric field which are mutually perpendicular to each other so that the net force on it is made zero. In this situation, the direction of motion of charge remains perpendicular to both electric and magnetic field.

46.

**(b)** ${}_6C^{12}$

**Explanation:** ${}^{9}_{4}\text{Be} + {}^{4}_{2}\text{He} \longrightarrow {}^{12}_{6}\text{C} + {}^{1}_{0}n$

47.

**(b)** 11, 12, 0

**Explanation:** In ${}^{23}_{11}Na$ nucleus,

Number of protons = Z = 11
Number of neutrons = A - Z =23 -11 = 12.
Number of electrons = 0.

48.

**(b)** radiotracer technique
**Explanation:** The diagnostic tool is called radiotracer technique.

49.

**(b)** $\approx$ 1eV
**Explanation:** The bond strength in DNA is nearly 1 eV.

50.

**(c)** Telephony

**Explanation:** In point to point communication,communication occurs over a link between a single transmitter and receiver.Telephony is an example of it as it needs a link between caller and receiver to transmit the information.This link is provided by various media like cable.