CUET (UG)

Physics Sample Paper - 9

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. In a certain region of space, electric field is along the z-direction throughout. The magnitude of the electric field is however not constant, but increases uniformly along the positive z-direction at the rate of 10^5 $NC^{-1}m^{-1}$. The force experienced by the system having a total dipole moment equal to 10^{-7} Cm in the negative z-direction is **[5]**

a) -10^{-2} N
b) 10^{-2} N
c) -10^{-4} N
d) 10^{-4} N

2. A particle of mass m and charge q is released from rest in a uniform electric field E. The kinetic energy attained by the particle after moving a distance x is **[5]**

a) q^2Ex
b) qEx^2
c) qEx
d) qE^2x

3. Electric lines of force: **[5]**

a) are imaginary
b) exist everywhere
c) exist only when both positive and negative charges are near one another
d) exist only in the immediate vicinity of electric charges

4. Electric potential inside a conducting sphere **[5]**

a) increases from centre to surface.
b) remains constant.
c) decreases from centre to surface.
d) is zero.

5. A parallel plate capacitor is charged by connecting it to a battery. Which of the following will remain constant if the distance between the plates of the capacitor is increased in this situation? **[5]**

a) Energy stored
b) Capacitance
c) Electric field
d) Potential difference

6. The surface charge density (in C/m^2) of the earth is about: **[5]**

a) 10^9
b) -10^9
c) 10^{-9}
d) -10^{-9}

7. Wheatstone Bridge is not suitable for measurement of **[5]**

a) medium value resistances
b) both very high value resistances and very low value resistances
c) very high value resistances.
d) very low value resistances.

8. Drift is the random motion of the charged particles within a conductor, **[5]**

a) along with a very slow net motion in the opposite direction of the field
b) along with accelerated motion in the direction of the field
c) along with a decelerated motion in the direction of the field
d) along with zero motion in the direction of the field

9. In a dc circuit the direction of current inside the battery and outside the battery respectively are **[5]**

a) negative to positive terminal and negative to positive terminal
b) positive to negative terminal and positive to negative terminal
c) positive to negative terminal and negative to positive terminal
d) negative to positive terminal and positive to negative terminal

10. A coil in the shape of an equilateral triangle of side l is suspended between the pole pieces of a permanent magnet, such that $\vec{B}$ is in plane of the coil. If due to a current I in **[5]**

the triangle, a torque $\vec{\tau}$ acts on it, the side l of the triangle is:

a) $\frac{2}{\sqrt{3}}\left(\frac{\tau}{BI}\right)$

b) $2\left(\frac{\tau}{\sqrt{3}BI}\right)^{1/2}$

c) $\frac{2}{\sqrt{3}}\left(\frac{\tau}{BI}\right)^{1/2}$

d) $\frac{1}{\sqrt{3}}\left(\frac{\tau}{BI}\right)$

11. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upward. The particle will: **[5]**

a) move in a circular path with an increased speed

b) get deflected in a vertically upward direction

c) move in a circular path with a decreased speed

d) move in a circular path with a uniform speed

12. A proton (charge +e) enters a magnetic field of strength B (Tesla) with speed v, parallel to the direction of magnetic lines of force. The force on the proton is **[5]**

a) evB/2

b) 2evB

c) zero

d) evB

13. The radius of the circular path of an electron moving in magnetic field perpendicular to its path is equal to: **[5]**

a) $\frac{me}{B}$

b) $\frac{mv}{Be}$

c) $\frac{mE}{B}$

d) $\frac{Be}{mv}$

14. Two bar magnets having same geometry with magnetic moments M and 2M are firstly placed in such a way that their similar poles are on the same side and its period of **[5]**

oscillation is T_1. Now the polarity of one of the magnets is reversed and its time period becomes T_2. Then,

a) $T_1 = T_2$

b) $T_2 = \infty$

c) $T_1 > T_2$

d) $T_1 < T_2$

15. 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

16. 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) $4.38\ Am^2$

17. The susceptibility of a paramagnetic material is χ at 27° C. At what temperature will its susceptibility be $\frac{\chi}{2}$? **[5]**

a) 54° C

b) 327° C

c) 237° C

d) 1600° C

18. 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 **[5]**

a) $6\ Am^{-1}$

b) $\frac{2}{3} Am^{-1}$

c) $2.4\ Am^{-1}$

d) $\frac{32}{3} Am^{-1}$

19. The main use of studying a hysteresis curve for a given material is to estimate the **[5]**

a) voltage loss
b) hysteresis loss
c) current loss
d) power loss

20. Time period of oscillation of a magnetic needle is **[5]**

a) $T = \sqrt{\frac{I}{MB}}$
b) $T = \pi\sqrt{\frac{MB}{I}}$
c) $T = 2\pi\sqrt{\frac{MB}{I}}$
d) $T = 2\pi\sqrt{\frac{I}{MB}}$

21. The universal property among all substances is **[5]**

a) ferromagnetism
b) non-magnetism
c) diamagnetism
d) paramagnetism

22. When current changes from +2A to -2A in 0.05 sec, an emf of 8V is induced in a coil. The coefficient of self inductance of the coil is: **[5]**

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

23. A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 60 rev/min in a plane normal to the horizontal component of earth's magnetic field B_E at a place. If B_E = 0.4 G at the place, what is the induced emf between the axle and the rim of the wheel? Note that 1 G = 10^{-4} T. **[5]**

a) 4×10^{-5}V
b) 4.24×10^{-5}V

c) 2.44×10^{-5}V

d) 3.14×10^{-5}V

24. A coil of wire of a certain radius has 100 turns and a self-inductance of 15 mH. The self-inductance of a second similar coil of 500 turns will be: **[5]**

a) 15 mH

b) 375 mH

c) 45 mH

d) 75 mH

25. A 100 mH coil carries a current of 1 A. Energy stored in the form of magnetic field is **[5]**

a) $0 \cdot 1\, J$

b) $0 \cdot 5 J$

c) $0 \cdot 05\, J$

d) 1 J

26. A step up transformer operates on a 230 volt line and a load current of 2 ampere. The ratio of the primary and secondary windings is 1 : 25. The current in the primary is: **[5]**

a) 15 amp

b) 25 amp

c) 12.5 amp

d) 50 amp

27. A condenser of 250 μF is connected in parallel to a coil of inductance 0.16 mH, while its effective resistance is 20 Ω. Determine the resonant frequency. **[5]**

a) 8×10^5 Hz

b) 9×10 Hz

c) 16×10^7 Hz

d) 9×10^4Hz

28. In a LCR-circuit, capacitance is changed from C to 2 C. For the resonant frequency to remain unchanged, the inductance should be changed from L to: **[5]**

a) L/4

b) 4 L

c) 2 L

d) L/2

29. The average power dissipation in a pure capacitor in ac circuit is: **[5]**

a) CV^2

b) $2CV^2$

c) Zero

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

30. Electromagnetic waves are transverse in nature. It is evident by: **[5]**

a) reflection
b) interference
c) polarization
d) diffraction

31. Optical and radio telescopes are built on the ground, but X-ray Astronomy is possible only from satellites orbiting the earth because **[5]**

a) Atmosphere reflects X-rays away from earth
b) Atmosphere reflects X-rays horizontally so they don't reach the earth
c) Atmosphere absorbs X-rays, while visible and radio waves can penetrate it.
d) Satellites orbiting the earth make use of interstellar effects

32. Which wavelength of the sun is used finally as electric energy? **[5]**

a) Radio waves
b) Visible light
c) Infrared waves
d) Microwaves

33. In a compound microscope, the intermediate image is: **[5]**

a) Virtual, inverted and magnified
b) Real, erect and magnified
c) Virtual, erect and magnified
d) Real, inverted and magnified

34. Which of the following is used in optical fibers? **[5]**

a) Scattering
b) Refraction
c) Diffraction
d) Total internal reflection

35. A beam of monochromatic light is refracted from vacuum into a medium of refractive index $1 \cdot 5$. The wavelength of refracted light will be **[5]**

a) smaller
b) same
c) dependent on intensity of refracted light
d) larger

36. A thin convergent glass lens ($\mu_g = 1.5$) has a power of +5.0 D. When this lens is immersed in a liquid of refractive index μ_1 it acts as a divergent lens of focal length 100 cm. The value of μ_1 must be **[5]**

a) $\frac{4}{3}$

b) $\frac{5}{3}$

c) $\frac{5}{4}$

d) $\frac{6}{5}$

37. From Brewster's law of polarisation, it follows that the angle of polarisation depends upon: **[5]**

a) plane of vibration's orientation

b) plane of non vibration's orientation

c) plane of polarisation's orientation

d) the wavelength of light

38. Phase difference between any two points of a wavefront is **[5]**

a) π

b) 0

c) $\frac{\pi}{4}$

d) $\frac{\pi}{2}$

39. The mass of a photon at rest is **[5]**

a) 9×10^{-31} kg

b) zero

c) 1.67×10^{-35} kg

d) 1 amu

40. If a potential of 10^7 volts is applied across the electrodes of a CRT, then speed attained by the electrons is approximately (given: $\frac{e}{m} = 1.76 \times 10^{11}$ C/kg) **[5]**

a) $1.94 \times 10^9 ms^{-1}$

b) $1.8 \times 10^9 ms^{-1}$

c) $1.75 \times 10^9 ms^{-1}$

d) $1.85 \times 10^9 ms^{-1}$

41. The work function of a metal is 4eV. To emit photo electrons with zero velocity from this, the wavelength of incident radiation must be **[5]**

a) $1700\overset{o}{A}$

b) $2700\overset{o}{A}$

c) $3100\overset{o}{A}$

d) $5900\overset{o}{A}$

42. The energy of a photon of wavelength λ is **[5]**

a) $\frac{\lambda h}{c}$

b) $\frac{hc}{\lambda}$

c) $\frac{\lambda}{hc}$

d) $hc\lambda$

43. In Rutherford's model, the size of the nucleus of the atom is **[5]**

a) 10^{-16} to 10^{-17} m

b) 10^{-5} to 10^{-6} m

c) 10^{-10} to 10^{-12} m

d) 10^{-15} to 10^{-14} m

44. When highly energetic cathode rays strike a heavy target of high melting point, then the rays produced are **[5]**

a) α-rays
b) X-rays
c) β-rays
d) γ-rays

45. For ionising, an excited hydrogen atom, the energy required (in eV) will be **[5]**

a) more than 13.6 eV
b) a little less than 13.6
c) 13.6
d) 3.4 or less

46. Atomic number of a nucleus is Z, while its mass number is M. What will be the number of neutrons in its nucleus? **[5]**

a) (M - Z)
b) Z
c) (M + Z)
d) M

47. As the mass number A increases, which of the following quantities related to a nucleus does not change? **[5]**

a) mass
b) binding energy
c) volume
d) density

48. When an electron is emitted from a nucleus; then effect of its neutron-proton ratio will **[5]**

a) either remain same or increase
b) remain same
c) decrease
d) increase

49. Zener diode is fabricated by **[5]**

a) heavily doping the p side and lightly doping the n side
b) heavily doping p and n sides of the junction
c) heavily doping the n side and lightly doping the p side
d) lightly doping p and n sides of the juntion

50. Electronic communication refers to **[5]**

a) transfer of information or messages encoded in electrical signals
b) transfer of information encoded in electrical signals

c) transfer of messages encoded in electrical signals

d) transfer of electricity from one point to another

Solutions

1. **(a)** -10^{-2} N

   Explanation: Dipole moment of the system, $p = q \times dl = -10^{-7}$ Cm
   Rate of increase of electric field per unit length,
   $\frac{dE}{dl} = 10^{+5}\ NC^{-1}$
   Force (F) experienced by the system is given by the relation,
   $F = qE$
   $F = q\frac{dE}{d1} \times dl$
   $= p \times \frac{dE}{dl}$
   $= 10^{-7} \times 10^{-5}$
   $= -10^{-2}$ N
   The force is -10^{-2} N in the negative z-direction i.e., opposite to the direction of electric field. Hence, the angle between electric field and dipole moment is 180^{o}. Torque (τ) is given by the relation,
   $T = pE \sin 180^{o} = 0$
   Therefore, the torque experienced by the system is zero.
2.
   (c) qEx
   Explanation: If a charge q placed in uniform electric field E, it experiences force, F = qE
   displacement = x
   W = Force $\times$ displacement = qE x
   According to work energy theorem, Net work done = change in Kinetic energy
   Hence, Kinetic energy attained = qE x.
3. **(a)** are imaginary
   Explanation: An electric line of force is an imaginary continuous line or curve drawn in an electric field.
4.
   (b) remains constant.
   Explanation: As the electric field inside a conductor is zero.
   So, the potential at any point is constant.
5.
   (d) Potential difference
   Explanation: As the battery remains connected with the capacitor, the potential difference remains constant.

6.

(d) -10^{-9}

Explanation: Surface charge density of the earth = -10^{-9} Cm^{-2}

7.

(b) both very high value resistances and very low value resistances

Explanation: Wheatstone bridge is suitable for measurement of medium value resistances because to ensure sensitivity, other resistors must be of comparable values.

8. **(a)** along with a very slow net motion in the opposite direction of the field

Explanation: The electrons in a conductor have random velocities and when an electric field is applied, they suffer repeated collisions and in the process move with a small average velocity, opposite to the direction of the field. This is equivalent to positive charge flowing in the direction of the field.

9.

(d) negative to positive terminal and positive to negative terminal

Explanation: The direction of an electric current is by convention the direction in which a positive charge would move. Thus, the current in the external circuit is directed is from positive terminal and to negative terminal of the battery.

When the battery is giving power it discharges, then the current inside the cell flows from negative terminal to positive terminal.

10.

(b) $2\left(\frac{\tau}{\sqrt{3}BI}\right)^{1/2}$

Explanation: Normal to the plane of the coil will be perpendicular to the field $\vec{B}$

$\therefore \tau = \text{IBA} \sin 90^{\circ} = \text{IBA}$

Area of an equilateral triangle,

$$A = \frac{1}{2} \times \text{ Base } \times \text{ Height} = \frac{1}{2} \times l \times l\sin 60^{\circ} = \frac{\sqrt{3}}{4} l^2$$

$$\therefore \tau = IB \times \frac{\sqrt{3}}{4} l^2 \text{ or } l = 2\left(\frac{\tau}{\sqrt{3}BI}\right)^{1/2}$$

11.

(d) move in a circular path with a uniform speed

Explanation: The perpendicular magnetic force continuously deflects the charge from its path making it move along a circular path with a uniform speed.

12.

(c) zero

Explanation: Lorentz force is given by $F = Bqv\sin\theta$

When the proton enters the magnetic field parallel to the direction of the lines of force, $\theta = 0$.

Therefore, F = 0

13.

(b) $\frac{mv}{Be}$

Explanation: Here F_m = centripetal force

$$evB\sin 90^\circ = \frac{mv^2}{r} \text{ or } r = \frac{mv}{eB}$$

14.

(d) $T_1 < T_2$

Explanation: In sum position,

$$T_1 = 2\pi\sqrt{\frac{I_1 + I_2}{\left(M_1 + M_2\right)B_H}}$$

$$= 2\pi\sqrt{\frac{I + I}{(M + 2M)B_H}}$$

$$= 2\pi\sqrt{\frac{2I}{3MB_H}}$$

In difference position,

$$T_2 = 2\pi\sqrt{\frac{I_1 + I_2}{\left(M_2 - M_1\right)B_H}}$$

$$= 2\pi\sqrt{\frac{I + I}{(2M - M)B_H}}$$

$$= 2\pi\sqrt{\frac{2I}{MB_H}}$$

$$\therefore \frac{T_1}{T_2} = \frac{1}{\sqrt{3}} < 1 \text{ or } T_1 < T_2$$

15.

(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

16.

(c) 1.28 Am^2

Explanation: m = NIA

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

$= 1.28\ \text{Am}^2$

17.

(b) 327° C

Explanation: $\frac{\chi_2}{\chi_1} = \frac{T_2}{T_1}$

$T_2 = \frac{\chi_1}{\chi_2} \cdot T_1 = \frac{\chi}{\chi/2}(273 + 27)\text{K} = 600\ \text{K} = 327°\ \text{C}$

18.

(b) $\frac{2}{3}\text{Am}^{-1}$

Explanation: On increasing the temperature magnetic susceptibility of paramagnetic material decreases or vice versa . According to Curie law, we can deduce a formula for the relation between magnetic field induction, temperature and magnetisation.

i.e., I (magnetization) $\propto \frac{B(\text{ magnetic field induction })}{t(\text{ temperature in kelvin })} \Rightarrow \frac{I_2}{I_1} = \frac{B_2}{B_1} \times \frac{t_1}{t_2}$

Let us suppose, here $I_1 = 8\ \text{Am}^{-1}$

$B_1 = 0.6\ \text{T}$, $t_1 = 4\ \text{K}$

$B_2 = 0.2\ \text{T}$, $t_2 = 16\ \text{K}$

$\Rightarrow \frac{0.2}{0.6} \times \frac{4}{16} = \frac{I_2}{8}$

$\Rightarrow I_2 = 8 \times \frac{1}{12} = \frac{2}{3}\text{Am}^{-1}$

19.

(b) hysteresis loss

Explanation: The area of hysteresis loop gives an idea of hysteresis loss of the magnetic material.

20.

(d) $T = 2\pi\sqrt{\frac{I}{MB}}$

Explanation: Time period of oscillation of a magnetic needle is $T = 2\pi\sqrt{\frac{I}{MB}}$

21.

(c) diamagnetism

Explanation: Diamagnetism is a universal property among all substances.

22.

(b) 0.1 H

Explanation: $L = -\frac{e}{\frac{\Delta i}{\Delta t}}$

$\frac{\Delta i}{\Delta t} = -\frac{4}{0.05} = -80$

e = 8 volt

$L = -\frac{8}{-80} = 0.1H$

23.

(d) $3.14 \times 10^{-5}V$

Explanation: $\omega = 2\pi n$

$n = \frac{60}{60} = 1\text{rev/sec}$

$e = \frac{1}{2}B\omega l^2 = \frac{1}{2} \times 0.4 \times 10^{-4} \times 2 \times 3.14 \times 1 \times 0.5 \times 0.5 = 3.14 \times 10^{-5}V$

24.

(b) 375 mH

Explanation: $L \propto N^2$

$\therefore L_2 = \left(\frac{N_2}{N_1}\right)^2 L_1$

$= \left(\frac{500}{100}\right)^2 \times 15\text{mH} = 375\text{ mH}$

25.

(c) $0 \cdot 05\ J$

Explanation: Here, L = 100 mH = 0 · 1 H and I = 1 A

The energy stored is given by

$U = \frac{1}{2}L I^2 = \frac{1}{2} \times 0 \cdot \ \times 1^2 = 0 \cdot 05\ J$

26.

(d) 50 amp

Explanation: $\frac{N_s}{N_p} = \frac{i_p}{i_s} = \frac{V_s}{V_p} = r$

Given that $\frac{N_p}{N_s} = \frac{1}{25}$

$i_S = 2$ amp

Thus, $\frac{25}{1} = \frac{i_p}{2}$

$i_p = 50$ amp

27. **(a)** 8×10^5 Hz

Explanation: $f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$

$= \frac{1}{2 \times 3.14}\sqrt{\frac{1}{250 \times 10^{-6} \times 0.16 \times 10^{-3}} - \frac{20 \times 20}{\left(0.16 \times 10^{-3}\right)^2}}$

$= 8 \times 10^5$ Hz

28.

(d) L/2

Explanation: The resonance frequency is given by

$f_0 = \frac{1}{2\pi\sqrt{L\,C}}$

When C is changed to 2C, f_0 will remain unchanged, if L is changed to L/2.

29.

(c) Zero

Explanation: In pure AC capacitor Circuit, the current leads the voltage by an angle of 90 degrees.

Power in Pure Capacitor Circuit Instantaneous power is given by P = VI

$P = (V_m \sin \omega t)[I_m \sin(\omega t + \frac{\pi}{2})]$

$\Rightarrow P = I_m V_m \sin \omega t \cos\omega t$

$\Rightarrow P = \frac{I_m}{\sqrt{2}} \frac{V_m}{\sqrt{2}} \sin 2\omega t$

$So,\ P_{avg} = 0$

Hence, from the above equation, it is clear that the average power in the Capacitor circuit is zero.

30.

(c) polarization

Explanation: The phenomenon of polarisation establishes the transverse nature of electromagnetic waves.

31.

(c) Atmosphere absorbs X-rays, while visible and radio waves can penetrate it.

Explanation: Optical and radio waves can penetrate the atmosphere whereas x- rays, are of very short wavelength and hence absorbed by the atmosphere. This is the reason why we can work with optical and radio telescopes on earth's surface, but x-rays astronomical telescopes must be used on the satellite orbiting above the earth's atmosphere.

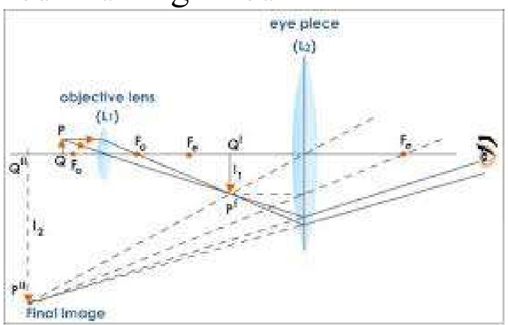
32.

(c) Infrared waves

Explanation: Infrared rays can be converted into electric energy as in solar cells.

33.

(d) Real, inverted and magnified

Explanation: 

Intermediate image (P'Q') is formed by objective which is a convex lens and the object (PQ) is placed at a distance slightly greater than the focal length. Hence, producing a real, inverted and magnified image.

34.

(d) Total internal reflection

Explanation: When light travelling in an optically dense medium hits a boundary at a steep angle, the light is completely reflected. This is called total internal reflection. This effect is used in optical fibres to confine light in the core.

35. **(a)** smaller

Explanation: When light travels from air to a medium of refractive index μ, its wavelength decreases by a factor μ i.e. becomes $1/\mu$.

36.

(b) $\frac{5}{3}$

Explanation: $f = \frac{1}{P} = \frac{1}{5}$ m = 20 cm

Now, $\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

In air, $\frac{1}{20} = \left(\frac{1.5}{1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = 0.5\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ....(i)

In liquid, $\frac{1}{-100} = \left(\frac{1.5}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ....(ii)

Dividing (i) by (ii), we get

$$-5 = \frac{0.5}{\left(\frac{1.5}{\mu_1} - 1\right)}$$

On solving we get, $\mu_1 = \frac{5}{3} = 1.67$

37.

(d) the wavelength of light

Explanation: The angle of polarisation depends upon the wavelength of light.

38.

(b) 0

Explanation: Wavefront is the locus of all points those are in same phase.

39.

(b) zero

Explanation: The rest mass of a photon is zero.

40. **(a)** $1.94 \times 10^9 ms^{-1}$

Explanation: $\frac{1}{2}mv^2 = eV$ or $v^2 = \frac{2eV}{m}$

$v = (\frac{2eV}{m})^{1/2} = (2 \times 10^7 \times 1.76 \times 10^{11})^{1/2} = 1.94 \times 10^9$ m/s

41.

(c) $3100\overset{o}{A}$

Explanation: We know that $E \ or \ \Phi = hv$

where Φ is work function of metal

Now, $hv = \frac{hc}{\lambda}$

Thus,

$\lambda = \frac{hc}{\Phi}$ {since hc is nearly equal to 1240 eV-nm}

$\lambda = \frac{1240eV - nm}{4eV}$

$\rightarrow \lambda = 310 \ nm$

Wavelength of incident light is 310 nm or $3100\overset{o}{A}$

42.

(b) $\frac{hc}{\lambda}$

Explanation: Energy of a photon, $E = hv = \frac{hc}{\lambda}$

43.

(d) 10^{-15} to 10^{-14} m

Explanation: Rutherford's experiments suggested the size of the nucleus to be about 10^{-15} to 10^{-14} m. From kinetic theory, the size of an atom was know to be 10^{-10}m.

44.

(b) X-rays

Explanation: When the cathode rays strike heavy target atoms, they knock out some electrons of the inner orbits. Then the electrons of the outer orbits jump to the inner orbits giving characteristic X-ray photons.

45.

(d) 3.4 or less

Explanation: The energy of the electron is -3.4 eV in first excited state and the magnitude is less for higher excited states.

46. **(a)** (M - Z)

Explanation: Number of neutrons = Mass number - Atomic number = M - Z

47.

(d) density

Explanation: All nucleus have equal densities irrespective of mass no. approximately equal to 2.3×10^{17} kgm^{-3}.

48.

(c) decrease

Explanation: ${}_{0}^{1}n \rightarrow {}_{1}^{1}\mathrm{H} + {}_{-1}^{0}e + \bar{v}$

When an electron is emitted from the nucleus, a neutron changes into a proton. Hence neutron-proton ratio decreases.

49.

(b) heavily doping p and n sides of the junction

Explanation: Zener diode is a special purpose semiconductor diode designed to operate under reverse bias in the breakdown region and used as a voltage regulator. Due to heavy doping of both p and n sides, depletion region formed is very thin and the electric field of the junction is very high. When applied reverse bias voltage reaches breadown voltage, there is a large change in the current, but almost insignificant change in the reverse bias.

50. **(a)** transfer of information or messages encoded in electrical signals

Explanation: When information are sent from one point to the other it has to be converted into electrical signal using transducer.The receiver receives it in its original from using receiver. Such from of communication is called electronic communication.