**CUET (UG)**

**Physics Sample Paper - 4**

**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. For coulomb force to be operative the least size of the atom will be **[5]**

a) $10^{-8}$ m
b) $10^{-15}$ m
c) $10^{-10}$ m
d) $10^{-12}$ m

2. Assertion: The Coulomb force is dominating force in the universe. **[5]**
Reason: The Coulomb force is weaker than the gravitational force.

a) both Assertion and Reason are false statements
b) both Assertion & Reason are true and the reason is the correct explanation of the assertion
c) Assertion is true statement but Reason is false
d) both Assertion & Reason are true but the reason is not the correct explanation of the assertion

3. Gauss's law is valid for **[5]**

a) any open surface
b) only irregular open surfaces
c) only regular closed surfaces
d) any closed surface

4. In electrolytic capacitors positive terminal is **[5]**

a) one on which aluminium oxide film is not formed
b) one on which aluminium oxide film is formed
c) none of the these
d) either of the two terminals

5. In a Van de Graaff type generator, a spherical metal shell is to be a $15 \times 10^6$ V electrode. The dielectric strength of the gas surrounding the electrode is $5 \times 10^7$ V/m. The minimum radius of the spherical shell required is: **[5]**

a) 1 m
b) 2 m
c) 1.5 m
d) 3 m

6. The capacitance of a parallel plate capacitor is $10\mu$F. When a dielectric plate is introduced in between the plates, its potential becomes $\frac{1}{4}$th of its original value. What is the value of the dielectric constant of the plate introduced? **[5]**

a) 20
b) 4
c) 40
d) 2.5

7. Resistance of a conductor is **[5]**

a) product of voltage and current
b) ratio of current to voltage
c) ratio of voltage to current
d) product of voltage and conductivity

8. The number of electrons flowing through a conductor per second is $3.3 \times 10^{19}$. The current flowing through the conductor is: **[5]**

a) 2.0 A
b) 5.3 A
c) 4.8 A
d) 3.4 A

9. A battery of emf E and internal resistance r is connected to an external circuit. The potential drop within the battery is proportional to: **[5]**

a) power dissipated in the circuit
b) current in the circuit
c) emf of the battery
d) total resistance of the circuit

10. A steel wire of length l has a magnetic moment M. It is then bent into a semicircular arc. The new magnetic moment is **[5]**

a) Ml
b) M / l
c) $\frac{2M}{\pi}$
d) M

11. Biot-Savart law indicates that the moving electrons (velocity v) produce a magnetic field B such that **[5]**

a) $B \perp v$

b) $B \parallel v$

c) it obeys inverse cube law

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

12. Magnetic field intensity at the centre of a coil of 50 turns, radius 0.05 m and carrying a current of 2 A is: **[5]**

a) $4 \times 10^{-5}$ T

b) $0.5 \times 10^{-5}$ T

c) $1.26 \times 10^{-4}$ T

d) $3 \times 10^{-5}$ T

13. If a particle is moving in a uniform magnetic field, then: **[5]**

a) its momentum changes but the total energy remain the same

b) both momentum and total energy remain the same

c) its total energy changes but momentum remain the same

d) both momentum and total energy will change

14. The angle of dip at a place on the earth gives **[5]**

a) the direction of the earth's magnetic field

b) the horizontal component of the earth's magnetic field

c) the location of geographic meridian

d) the vertical component of the earth's field

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 **[5]**

a) 6 $Am^{-1}$

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

c) 2.4 $Am^{-1}$

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

16. Angle of dip is 90° at **[5]**

a) both poles and equator

b) equator

c) poles

d) Tropic of cancer

17. The materials suitable for making electromagnets should have **[5]**

a) low retentivity and high coercivity

b) high retentivity and high coercivity

c) high retentivity and low coercivity
d) low retentivity and low coercivity

18. 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

19. The susceptibility of ferromagnetic material is: **[5]**

a) inversely proportional to square of temperature
b) inversely proportional to temperature
c) independent of temperature
d) directly proportional to temperature

20. At a point on the right bisector of a magnetic dipole, the magnetic: **[5]**

a) field varies as $r^3$
b) potential is zero at all points on the right bisector
c) field is perpendicular to the axis of dipole
d) potential varies as $\frac{1}{r^2}$

21. What should be the core of an electromagnet? **[5]**

a) none of above
b) soft iron
c) hard iron
d) rusted iron

22. Two concentric circular coils, one of small radius $r_1$ and the other of large radius $r_2$, such that $r_1 << r_2$, are placed co-axially with centres coinciding. Mutual inductance of the arrangement is **[5]**

a) $\frac{\mu_0 \pi r_1^2}{2r_2^3}$
b) $\frac{\mu_0 \pi r_1^3}{2r_2^2}$
c) $\frac{\mu_0 \pi r_1}{3r_2}$
d) $\frac{\mu_0 \pi r_1^2}{2r_2}$

23. What happens to the current in coil while accelerating a magnet inside it? **[5]**

a) Increases
b) Decreases
c) Reverses
d) Remains constant

24. When a dc motor operates at 200 V, its initial current is 5A, but when it runs at maximum speed, the current is only 3A. What is its back emf? **[5]**

a) 80 V
b) Zero
c) 100 V
d) 120 V

25. When the current changers from + 2 A to - 2 A in $0 \cdot 05\ s$, an e.m.f. of 8 V is induced in the coil. The coefficient of self-induction of the coil is: **[5]**

a) $0 \cdot 2\ H$
b) $0 \cdot 1\ H$
c) $0 \cdot 4\ H$
d) $0 \cdot 8\ H$

26. An inductor with L = 9.50 mH is connected across an ac source that has voltage amplitude 45.0 V. Phase angle for the source voltage relative to the current is **[5]**

a) $120^o$
b) $90^o$
c) $-180^o$
d) $-90^o$

27. An LRC series circuit has phase angle 31.5°. The voltage amplitude of the source is 90.0 V. Voltage amplitude across the resistor is **[5]**

a) 68.7 V
b) 76.7 V
c) 74.7 V
d) 70.7 V

28. A choke coil has **[5]**

a) high inductance and high resistance
b) low inductance and high resistance
c) low inductance and low resistance
d) high inductance and low resistance

29. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux $\phi$ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where $\phi$ is in weber, t is time in second and $\phi_0$ is a constant, the output voltage across the secondary coil is: **[5]**

a) 90 V
b) 220 V
c) 120 V
d) 30 V

30. The frequency of $\gamma$-rays, X-rays and ultraviolet rays are a, b and c respectively. Then, **[5]**

a) $a < b < c$ b) $a > b > c$

c) $a = b = c$ d) $a > c > b$

31. Which of the following electromagnetic radiations have the longest wavelength? **[5]**

a) Microwaves b) $\gamma$-rays

c) X-rays d) Radiowaves

32. Using the formula $E = h\nu$ (energy of a quantum of radiation: photon), the photon energy obtained in units of eV for $\lambda = 1$ mm is **[5]**

a) $1.34 \times 10^{-3}$eV b) $1.54 \times 10^{-6}$eV

c) $1.44 \times 10^{-6}$eV d) $1.24 \times 10^{-3}$eV

33. 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? **[5]**

a) The beam of red light would bend towards normal while it gets refracted through the second medium.

b) The beam of blue light would undergo total internal reflection.

c) The beam of green light would bend away from the normal as it gets refracted through the second medium.

d) The beam of red light would undergo total internal reflection.

34. The graph drawn with object distance along abscissa & image as ordinate for a convex lens is **[5]**

a) straight b) circle

c) rectangular hyperbola d) parabola

35. Green light of wavelength 5,460 $\mathring{A}$ is incident on an air-glass interface. If the refractive index of glass is $1 \cdot 5$, the wavelength of light in glass would be (Given that the velocity of light in air, $c = 3 \times 10^8$ m $s^{-1}$) **[5]**

a) None of these b) 3,640 $\mathring{A}$

c) 5,460 $\mathring{A}$

d) 4,861 $\mathring{A}$

36. The phenomena involved in the reflection of radiowaves by ionosphere is similar to **[5]**

a) total internal reflection of light in the air during a mirage

b) dispersion of light by water molecules during the formation of a rainbow

c) scattering of light by the particles of air

d) reflection of light by a plane mirror

37. Wavefront is the locus of all points, where the particles of the medium vibrate with the same _____. **[5]**

a) frequency

b) amplitude

c) phase

d) period

38. According to Brewster's law, except for polished metallic surfaces, the polarising angle: **[5]**

a) depends on wavelength and is different for different colours

b) depends on wavelength and is same for different colours

c) independent of wavelength and is same for different colours

d) independent of wavelength and is different for different colours

39. When the light of frequency $2\nu_0$ (where $\nu_0$ is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is $\nu_1$. When the frequency of the incident radiation is increased to $5\nu_0$, the maximum velocity of electrons emitted from the same plate is $\nu_2$. The ratio of $\nu_1$ to $\nu_2$ is **[5]**

a) 4 : 1

b) 1 : 2

c) 2 : 1

d) 1 : 4

40. Moving with the same velocity, which of the following has the longest de Broglie wavelength? **[5]**

a) neutron

b) $\alpha$-particle

c) $\beta$-particle

d) proton

41. Electrons of mass m with de-Broglie wavelength $\lambda$ fall on the target in an X-ray tube. The cutoff wavelength $(\lambda_0)$ of the emitted X-ray is **[5]**

a) $\lambda_0 = \frac{2h}{mc}$

b) $\lambda_0 = \lambda$

c) $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$ d) $\lambda_0 = \frac{2mc\lambda^2}{h}$

42. 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 **[5]**

a) $1.2 \times 10^{-3}$nm b) $1.2 \times 10^{-1}$nm

c) 1.2 nm d) $1.2 \times 10^{-6}$nm

43. 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, **[5]**

a) because electrons go around only in horizontal orbits.

b) because Bohr model gives incorrect values of angular momentum.

c) because only one of these would have a minimum energy.

d) angular momentum must be in the direction of spin of electron.

44. The radius of the hydrogen atom, in the ground state, is of the order of **[5]**

a) $10^{-7}$ cm b) $10^{-6}$ cm

c) $10^{-4}$ cm d) $10^{-8}$ cm

45. The ionisation potential of hydrogen is **[5]**

a) 8.24 eV b) 13.6 eV

c) -10.36 eV d) 14.24 eV

46. If the nuclear force between two protons, two neutrons and between proton and neutron is denoted by $F_{pp}$, $F_{nn}$ and $F_{pn}$ respectively, then **[5]**

a) $F_{pp} = F_{nn} = F_{pn}$ b) $F_{pp} \approx F_{nn} \approx F_{pn}$

c) $F_{pp} \neq F_{nn} \neq F_{pn}$ d) $F_{pp} \neq F_{nn}$ and $F_{pp} = F_{nn}$

47. An atom of mass number 15 and atomic number 7 captures an $\alpha$-particle and then emits a proton. The mass number and atomic number of the resulting atom will be respectively. **[5]**

a) 18 and 8 b) 16 and 4

c) 14 and 2 d) 15 and 3

48. In uncontrolled chain reaction, the quantity of energy released is **[5]**

a) first very high and normal b) normal

c) very low d) very high

49. The unidirectional flow of current through p-n junction makes it ideal to be used as **[5]**

a) photoelectricity b) modulator

c) oscillator d) rectifier

50. Transducer is a device that **[5]**

a) converts non electrical signals to electrical signals b) converts high power to low power

c) converts electrical signals to non electrical signals d) converts low power to high power

# Solutions

1.

**(d)** $10^{-12}$ m

**Explanation:** The distance must be greater than the nuclear size ( $\approx$ $10^{-15}$m). For r $\leq$ $10^{-15}$m, the much stronger nuclear force makes the coulombic force ineffective.

2. **(a)** both Assertion and Reason are false statements

**Explanation:** The coulomb force is stronger than gravitational force, gravitational force is dominating force as it controls the whole universe, So both assertion and reasons are false.

3.

**(d)** any closed surface

**Explanation:** Gauss's law is valid for any closed surface.

4.

**(b)** one on which aluminium oxide film is formed

**Explanation:** Aluminium electrolytic capacitors have the Aluminium foil anode (positive terminal) which is etched and covered with a layer of Aluminium Oxide which acts as a dielectric. The whole assembly is covered using a paper separator soaked in electrolyte such as, Borax or Glycol and covered by Aluminium foil which acts as cathode (negative electrode)

5.

**(d)** 3 m

**Explanation:** Given that,

V = 15 $\times$ $10^6$ V, dielectric strength = 5 $\times$ $10^7$ $Vm^{-1}$

Since, Maximum electric field, E = 10% of dielectric strength

$\therefore$ $E = \frac{10}{100} \times 5 \times 10^7$

$= 5 \times 10^6$ $Vm^{-1}$

As, $E = \frac{V}{r}$

$\therefore$ $r = \frac{V}{E}$

$= \frac{15 \times 10^6}{5 \times 10^6}$

= 3 m

6.

**(b)** 4

**Explanation:** C' = KC (where K is the dielectric constant).

$V = \frac{Q}{C}$

$V' = \frac{Q}{C'}$

$V' = \frac{V}{4} = \frac{Q}{C'} = \frac{Q}{kC} = \frac{V}{k}$

$\therefore$ k = 4

7.

**(c)** ratio of voltage to current

**Explanation:** According to Ohm's law, V = IR. Therefore R = $\frac{V}{I}$

8.

**(b)** 5.3 A

**Explanation:** 5.3 A

9.

**(b)** current in the circuit

**Explanation:** current in the circuit

10.

**(c)** $\frac{2M}{\pi}$

**Explanation:** If the steel wire is assumed to be a bar magnet of length l and pole strength $q_m$, its magnetic moment

$M = q_m l$.

When it is bent into a semicircular arc of radius r, the distance between the poles is equal to its diameter l' = 2r

The new magnetic moment $M' = q_m l' = q_m(2r)$

Since, $l = \pi r$

$\frac{M'}{M} = \frac{q_m(2r)}{q_m l} = \frac{2r}{l} = \frac{2r}{\pi r} = \frac{2}{\pi}$

$M' = \frac{2M}{\pi}$

11. **(a)** B $\perp$ v

**Explanation:** The Biot-Savart law states how the value of the magnetic field at a specific point in space from one short segment of current-carrying conductor depends on each factor that influences the field. The magnitude of $\vec{B}$ is $B \propto |q|$; $B \propto v$; $B \propto \sin\phi$, $B \propto \frac{1}{r^2}$

$B \propto \frac{|q| v \sin\phi}{r^2}$

$B = \frac{\mu 0}{4\pi} \frac{|q| v \sin\phi}{r^2}$

where $\frac{\mu_0}{4\pi}$ is a proportionality constant, 'r' is the magnitude of position vector from charge to that point at which we have to find the magnetic field and $\phi$ is the angle between $\vec{v}$ and $\vec{r}$ .

or $\vec{B} = \frac{\mu_0}{4\pi} \frac{|q|\,(\vec{v} \times \vec{r})}{\left|r^3\right|} \hat{n}$

Where $\hat{n}$ is the direction of $\vec{B}$ which is in the direction of cross product of $\vec{v}$ and $\vec{r}$. Or we can say that $\vec{B} \perp$ to both $\vec{v}$ and $\vec{r}$.

where is a proportionality constant, V' is the magnitude of position vector from charge to that point at which we have to find the magnetic field and <f) is the angle between v and F. Where h is the direction of B which is in the direction of cross product of v and F. Or we can say that $\vec{B} \perp$ to both and v and F.

12.

**(c)** $1.26 \times 10^{-4}$ T

**Explanation:** $B = \frac{\mu_0 NI}{2a} = \frac{4\pi \times 10^{-7} \times 50 \times 2}{2 \times 0.05}$ T

$= 1.26 \times 10^{-4}$ T

13. **(a)** its momentum changes but the total energy remain the same

**Explanation:** The magnetic force acts perpendicular to the direction of the velocity of the charge. No work is done by this force but it changes the direction of motion. Hence momentum changes but energy do not change.

14. **(a)** the direction of the earth's magnetic field

**Explanation:** The angle of dip gives the direction of the earth's magnetic field.

15.

**(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 $I_1 = 8\ \text{Am}^{-1}$

$B_1 = 0.6$ T, $t_1 = 4$ K

$B_2 = 0.2$ T, $t_2 = 16$ K

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

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

16.

**(c)** poles

**Explanation:** The angle of dip is 90° at poles.

17.

**(d)** low retentivity and low coercivity

**Explanation:** A material suitable for making electromagnet is that which will become a strong magnet. In an electromagnet since the magnetic effects are created through the application of a current. When current is switched on and will lose magnetism on switching off the current. Therefore, such a material should have low retentivity and low coercivity.

18.

**(d)** paramagnet

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

19.

**(b)** inversely proportional to temperature

**Explanation:** Susceptibility of a ferromagnetic material varies inversely with temperature.

20.

**(b)** potential is zero at all points on the right bisector

**Explanation:** The magnetic potential at any point is the amount of work done in bringing a unit north pole from infinity to that point. At any point on the right bisector, the potentials due to the two poles are equal and opposite.

21.

**(b)** soft iron

**Explanation:** soft iron

22.

**(d)** $\frac{\mu_0 \pi r_1^2}{2r_2}$

**Explanation:** Let a time varying current $I_2$ flow through the outer circular coil.

∴ Magnetic field at the centre of this coil is

$$B_2 = \frac{\mu_0 I_2}{2r_2}$$

Since the inner coil placed co-axially has very small radius, $B_2$ may be considered constant over its cross-sectional area.

∴ Magnetic flux associated with inner coil is

$$\phi_1 = B_2 \times \pi r_1^2 = \left(\frac{\mu_0 I_2}{2r_2}\right)\pi r_1^2 = \pi r_1^2 \frac{\mu_0 I_2}{2r_2}$$

$$\text{or } \phi_1 = \left(\frac{\mu_0 \pi r_1^2}{2r_2}\right) I_2 = M_{12} I_2$$

$$\therefore \ M_{12} = \frac{\mu_0 \pi r_1^2}{2r_2}$$

$$\text{Now, } M_{12} = M_{21} = \frac{\mu_0 \pi r_1^2}{2r_2}$$

23. **(a)** Increases
**Explanation:** A change in the magnetic field induces an emf. When there is an emf, there has to be current. Hence, when the magnet is moved inside a coil, the current in it increases.
24. **(a)** 80 V
**Explanation:** The induced e.m.f. acts in opposite direction to the applied voltage V (Lenz's law) and in known as back or counter e.m.f.

$$i = \frac{V}{R}$$

$$R = \frac{V}{i} = \frac{200}{5} = 40\Omega$$

When motor is at its maximum speed it operates at

$$V = iR = 3 \times 40 = 120V$$

i.e. back emf or oppose to applied voltage = 200 - 120 = 80V
25.
**(b)** $0 \cdot 1\ H$
**Explanation:** Here, dI = (-2) -2 = -4 A,
$dt = 0 \cdot 5\ s$ and e = 8 V

$$\text{Now, } e = -L\frac{dI}{dt}$$

$$\text{or } L = -\frac{e}{dI/dt} = -\frac{8}{-4/0 \cdot 05} = 0 \cdot 1\ H$$

26.
**(b)** $90^o$
**Explanation:** If only inductor is present in circuit, then R = 0

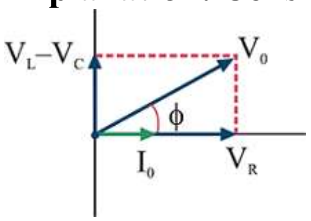
$\tan\phi = \frac{X_L}{R} = \frac{X_L}{0} = \infty$

Hence, phase angle, $\phi = 90°$

27.

**(b)** 76.7 V

**Explanation:** Consider RLC circuit phasor diagram:




Hence,

$\cos\phi = \frac{V_R}{V_o}$

$\cos 31.5° = \frac{V_R}{90}$

Thus, $V_R = 90 \times \cos 31.5° = 90 \times 0.852 = 76.7V$

28.

**(d)** high inductance and low resistance

**Explanation:** A choke coil has high inductance and low resistance.

29.

**(c)** 120 V

**Explanation:** Flux linked with the primary coil,

$\phi = \phi_0 + 4t$

Voltage across primary,

$V_p = \frac{d\phi}{dt} = 0 + 4 \times 1 = 4$ V

Voltage across secondary,

$V_s = \frac{N_s}{N_p} \cdot V_p = \frac{1500}{50} \times 4 = 120$ V

30.

**(b)** a > b > c

**Explanation:** As the wavelength of $\gamma$-rays is least and that of ultraviolet rays is maximum, so the frequency of $\gamma$-rays is maximum and that of ultraviolet rays is least.

31.

**(d)** Radiowaves

**Explanation:** Radio waves have the longest wavelength.

32.

**(d)** $1.24 \times 10^{-3}$eV

**Explanation:** $E = hv = \frac{hc}{\lambda}$

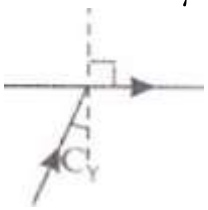
$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{10^{-3} \times 1.6 \times 10^{-19}} = 1.24 \times 10^{-3}$ eV

33.

**(b)** The beam of blue light would undergo total internal reflection.

**Explanation:** We know that if angle of refraction is $90^{o}$ for the length then incidence angle is called critical angle. So light rays are passing from denser to rarer medium.

As $\sin c = \frac{1}{\mu}$ so, $c \propto \frac{1}{\mu}$, thus ,$\mu_B > \mu_g > \mu_Y > \mu_R$




So, critical angle for $C_B < C_g < C_Y < C_R$, i.e., critical angle of blue and green light is smaller than that of yellow and it is greater for red colour light.

As the angle of refraction for yellow light is $90^{o}$ for a particular incident angle. This incidence angle is critical angle for yellow let it be $C_Y$. As $C_R > C_V$. So it will not get total internal reflection and $C_B < C_Y$, $C_g < C_Y$.

So light of blue and green colour get total internal reflection.

or Out of given colours, μ is largest for blue colour. Critical angle will be smallest for blue colour. Therefore, blue light would undergo total internal reflection.

34.

**(c)** rectangular hyperbola

**Explanation:**

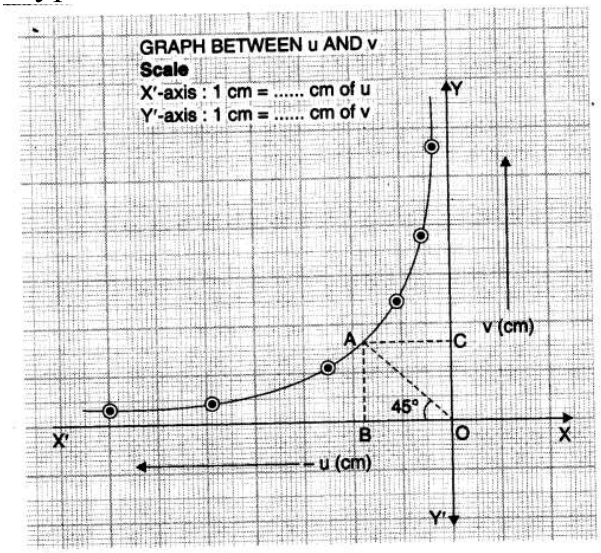



**Fig.** Graph between $u$ and $v$. It is a rectangular hyperbola.

35.

**(b)** 3,640 $\mathring{A}$

**Explanation:** Now, $\lambda' = \frac{\lambda}{\mu} = \frac{5460}{1 \cdot 5} = 3640\ \overset{\circ}{A}$

36. **(a)** total internal reflection of light in the air during a mirage
**Explanation:** The ionosphere is transparent optical medium and radio wave is reflected back. Reflection through the transparent surface is total internal reflection so that internal reflection of radio waves takes place.

37. **(c)** phase
**Explanation:** Wavefront is the locus of all points, where the particles of the medium vibrate with the same phase.

38. **(a)** depends on wavelength and is different for different colours
**Explanation:** From Brewster's laws $i_p = \tan^{-1}(\mu)$ i.e., the polarising angle depends on refractive index and hence on wavelength and therefore is different for different colours.

39. **(b)** 1 : 2
**Explanation:** Using Einstein's photoelectric equation,

$$\frac{1}{2}mv_1^2 = h\left(2v_0\right) - W_0 = h\left(2v_0\right) - hv_0 = hv_0$$

$$\frac{1}{2}mv_2^2 = h\left(5v_0\right) - hv_0 = 4hv_0$$

$$\therefore \frac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2^2} = \frac{hv_0}{4hv_0}$$

$$\Rightarrow \frac{v_1}{v_2} = \frac{1}{2} = 1 : 2$$

40. **(c)** $\beta$-particle
**Explanation:** $\lambda = \frac{h}{mv} \therefore \lambda \propto \frac{1}{m}$
As $\beta$-particle (an electron) has the smallest mass, so it has the longest de-Broglie wavelength.

41. **(d)** $\lambda_0 = \frac{2mc\lambda^2}{h}$
**Explanation:** Kinetic energy of an incident electron,

$$E = \frac{p^2}{2m} = \frac{(h/\lambda)^2}{2m} = \frac{h^2}{2m\lambda^2}$$

The maximum energy of the emitted X-ray photon will be

$E = \frac{hc}{\lambda_0}$

$\therefore \frac{h^2}{2m\lambda^2} = \frac{hc}{\lambda_0} \Rightarrow \lambda_0 = \frac{2mc\lambda^2}{h}$

42. **(a)** $1.2 \times 10^{-3}$nm

**Explanation:** The energy of the photon must be equal to the binding energy of the proton.

So Energy of photon = 1 MeV $= 10^6 \times 1.6 \times 10^{-19}$J

$\lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-13}} = \frac{6.63 \times 3}{1.60} \times 10^{-26+13}$

$= \frac{19.89}{1.60} \times 10^{-13} = 12.4 \times 10^{-13} = 1.24 \times 10^1 \times 10^{-13}$

$\lambda = 1.24 \times 10^{-9} \times 10^{-3} = 1.24 \times 10^{-3}$nm

43.

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

**Explanation:** According to Bohr's second postulate of atomic model, angular momentum of revolving electron must be some integral multiple of $\frac{h}{2\pi}$.

So, the Bohr's model of atom does not give correct value of angular momentum.

44.

**(d)** $10^{-8}$ cm

**Explanation:** Radius of first orbit of H-atom = $0.53\text{A}^{\circ} \approx 10^{-8}$ cm.

45.

**(b)** 13.6 eV

**Explanation:** Ionization potential energy is defined as the minimum energy required in eV to excite a neutral atom to its ionized state i.e it is the minimum energy required in eV to excite an electron from n=1 to infinity. lonization energy is 0-(-13.6 e V)=13.6 eV Hence, lonization potential is 13.6 eV.

46. **(a)** $F_{pp} = F_{nn} = F_{pn}$

**Explanation:** The nuclear force is independent of the nature of the charge of the nucleon.

47. **(a)** 18 and 8

**Explanation:** ${}^{15}_{7}\text{X} + {}^{4}_{2}\text{He} \rightarrow {}^{1}_{1}\text{H} + {}^{A}_{Z}\text{Y}$

By conservation of mass

A + 1 = 15 + 4 $\Rightarrow$ A = 18

By conservation of charge,

Z + 1 = 7 + 2 $\Rightarrow$ Z = 8

48.

**(d)** very high

**Explanation:** In uncontrolled chain reaction, the energy released is very high.

49. **(d)** rectifier
    **Explanation:** The unidirectional flow of current through a p-n junction enables it to be used as a rectifier.
50. **(a)** converts non electrical signals to electrical signals
    **Explanation:** Any device which converts energy from one form to another is called a transducer.It converts variation in physical quantities such as pressure,dispalcement,force,temprature etc.Like microphone converts sound signal into an electrical signal.