CUET (UG)

Physics Sample Paper - 5

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. The dielectric constant K of an insulator can be: **[5]**

a) 5
b) 0.5
c) 0
d) -1

2. Electric force between two charged spheres is 18 units. If the distance between the centres of the sphere is tripled, the electric force will be **[5]**

a) 2 units
b) 54 units
c) 3 units
d) 6 units

3. Which one of the following is the unit of electric charge? **[5]**

a) Newton
b) Coulomb
c) $\frac{\text{Coulomb}}{\text{volt}}$
d) Volt

4. The dielectric constant for metal is: **[5]**

a) 100
b) infinite
c) 1000
d) zero

5. When a capacitor is connected to a battery, **[5]**

a) a current flows in the circuit for sometime and then decreases to zero
b) none of these

c) the current keeps on increasing

d) no current flows in the circuit at all

6. A variable capacitor is connected to a 200 V battery. If its capacitance is changed from 2μF to $X\mu$F, the decrease in energy of the capacitor is **[5]**

a) 1μF

b) 3μF

c) 4μF

d) 2μF

7. The potential difference across a cell in an open circuit is 8 V. It falls to 4 V when a current of 4 A is drawn from it. The internal resistance of the cell is: **[5]**

a) 4Ω

b) 1Ω

c) 2Ω

d) 3Ω

8. A current of 0.8 A flows in a conductor of 40 Ω for 1 minute. The heat produced in the conductor will be **[5]**

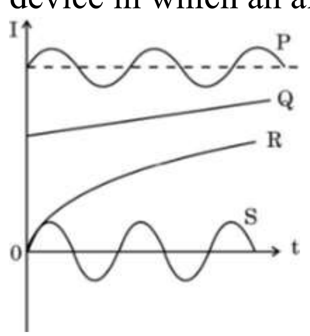
a) 1640 J

b) 1445 J

c) 1569 J

d) 1536 J

9. The figure shows variation of current (I) with time (t) in four devices P, Q, R and S. The device in which an alternating current flows is: **[5]**



a) P

b) S

c) R

d) Q

10. A positive charge is moving upward in a magnetic field that is towards the north. The particle will be deflected towards: **[5]**

a) east

b) west

c) north

d) south

11. When a charged particle enters in a uniform magnetic field, its kinetic energy. **[5]**

a) decreases

b) becomes zero

c) remains constant

d) increases

12. A magnetic field: **[5]**

a) always exerts a force on a charged particle

b) exerts a force, if the charged particle is moving along the magnetic field line

c) exerts a force, if the charged particle is moving across the magnetic field line

d) never exerts a force on charged particle

13. A proton and an α-particle follow the same circular path in a transverse magnetic field. Their kinetic energies are in the ratio: **[5]**

a) 1 : 4

b) 1 : $\sqrt{2}$

c) 1 : 1

d) 1 : 2

14. Magnetic field due to a magnet 2 cm long having a pole strength of 100 Am at a point 10 cm from each pole is **[5]**

a) $8 \times 10^{-4} T$

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

c) $2 \times 10^{-5} T$

d) $2 \times 10^{-4} T$

15. A closely wound solenoid of 800 turns and area of cross section $2.5 \times 10^{-4} \mathrm{m}^2$ carries a current of 3.0 A. What is its associated magnetic moment? **[5]**

a) 0.4 J/T

b) 0.8 J/T

c) 0.6 J/T

d) 0.5 J/T

16. According to Gauss's law for magnetism, **[5]**

a) $\oint \vec{B}.\overrightarrow{ds} = 0$

b) $\int \vec{B}.\overrightarrow{ds} = 0$

c) $\oint \vec{B}.\overrightarrow{ds} = \mu_0$

d) $\int \vec{B}.\overrightarrow{ds} = \mu_0$

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

a) ferromagnetism

b) non-magnetism

c) diamagnetism

d) paramagnetism

18. The μ_0 is also known as : **[5]**

a) magnetic dipole
b) Absolute Permittivity
c) Magnetic dipole moment
d) Magnetic flux

19. A magnet is cut in three equal parts by cutting it perpendicular to its length. The time period of original magnet is T0 in a uniform magnetic field B. Then, the time period of each part in the same magnetic field is **[5]**

a) None of these
b) $\frac{T_o}{4}$
c) $\frac{T_o}{3}$
d) $\frac{T_o}{2}$

20. A closely wound solenoid of 2000 turns and area of cross-section $1.6 \times 10^{-4} \mathrm{m}^2$, 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

21. 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

22. An emf of 100 mV is induced in a coil when current in another near by coil becomes 10 A from 0 in 0.1 s. The coefficient of mutual induction between the two coils will be: **[5]**

a) 100 mH
b) 1 mH
c) 1000 mH
d) 10 mH

23. A square of side L meters lies in the x-y plane in a region, where the magnetic field is given by $\vec{B} = B_o(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 4\hat{\mathbf{k}})$ Tesla, where B_0 is constant. The magnitude of flux passing through the square is **[5]**

a) 4 B_0L^2Wb
b) 3 B_0L^2Wb
c) $\sqrt{29} B_o L^2$Wb
d) 2 B_0L^2Wb

24. A square loop of wire of each side 50 cm is kept so that its plane makes an angle θ with a uniform magnetic field of induction IT. The magnetic field is withdrawn in 0.1 s. It is found that the induced emf across the loop is 125 mV. The angle θ is: **[5]**

a) 30^o

b) 60^o

c) 90^o

d) 45^o

25. Two inductors each of inductance L are joined in parallel. What is their equivalent inductance? **[5]**

a) 2 L

b) zero

c) L

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

26. The impedance of a series LCR circuit is **[5]**

a) $R + X_L + X_C$

b) $\sqrt{\frac{1}{X_C^2} + \frac{1}{X_L^2} + R^2}$

c) $\sqrt{X_L^3 - X_C^2 + R^2}$

d) $\sqrt{R^2 + (X_L - X_C)^2}$

27. The power dissipated in an LCR series circuit connected to an a.c. source of emf ε is **[5]**

a) $\frac{\varepsilon^2 R}{\left[R^2+\left(L\omega-\frac{1}{C\omega}\right)^2\right]}$

b) $\frac{\varepsilon^2\left[\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}\right]}{R}$

c) $\frac{\varepsilon^2 R}{\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}}$

d) $\frac{\varepsilon^2\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}}{R}$

28. The voltage across the terminals of an ac power supply varies with time according to $V\cos\omega t$. The voltage amplitude is V = 45.0 V. Root-mean-square potential difference is **[5]**

a) 35.8 V

b) 31.8 V

c) 37.8 V

d) 33.8 V

29. The current flowing in a step down transformer 220 V to 22 V having impedance 220Ω is **[5]**

a) 0.1 A

b) 0.1 mA

c) 1 A

d) 1 mA

30. The velocity of light is maximum in **[5]**

a) Vacuum
b) Diamond
c) Glass
d) Water

31. In vacuum, the wavelength of the electromagnetic wave of frequency 5×10^{19} Hz is **[5]**

a) 6×10^{-12} m
b) 15×10^{27} m
c) 1.6×10^{11} m
d) 3×10^{-8} m

32. The velocity of light is equal to **[5]**

a) $\frac{\sqrt{\varepsilon_0}}{\mu_0}$
b) $\sqrt{\varepsilon_0 \mu_0}$
c) $\frac{\varepsilon_0}{\mu_0}$
d) $\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$

33. A lamp and a screen are set up 100 cm apart and a convex lens is placed between them. The two positions of the lens forming real images on the screen are 40 cm apart. What is the focal length of the lens? **[5]**

a) 15 cm
b) 21 cm
c) 18 cm
d) 12 cm

34. An astronomical telescope of ten fold angular magnification has a length of 44 cm. The focal length of the objective is **[5]**

a) 44 cm
b) 440 cm
c) 4 cm
d) 40 cm

35. The focal length of a concave mirror is f. An object is placed at a distance x from the focus. The magnification is **[5]**

a) $\frac{f}{(f+x)}$
b) $\frac{(f+x)}{f}$
c) $\frac{f}{x}$
d) $\frac{x}{f}$

36. The diameter of a plano-convex lens is 6 cm and the thickness at the centre is 3 mm. If the speed of light in the material of the lens is $2 \times 10^8 \text{ms}^{-1}$, the focal length of the lens is **[5]**

a) 15 cm
b) 30 cm
c) 20 cm
d) 10 cm

37. Which of the following is a dichroic crystal? **[5]**

a) Tourmaline
b) Selenite
c) Mica
d) Quartz

38. The angle of incidence at which the reflected beam is fully polarized is called **[5]**

a) Critical angle
b) Malus angle
c) Brewster angle
d) Acute angle

39. The wavelength of a 1 keV photon is 1.24×10^{-9}m. What is the frequency of 1 MeV photon? **[5]**

a) 1.24×10^{18}
b) 1.24×10^{15}
c) 2.4×10^{20}
d) 2.4×10^{23}

40. When ultraviolet rays incident on metal plate then photoelectric effect does not occur. It occurs by incidence of **[5]**

a) X-rays
b) Light waves
c) Radio waves
d) Infrared rays

41. Photons of energies 1 eV and 2 eV are successively incident on a metallic surface of work function 0.5 eV. The ratio of kinetic energy of most energetic photoelectrons in the two cases will be **[5]**

a) 1 : 2
b) 1 : 1
c) 1 : 4
d) 1 : 3

42. If the maximum kinetic energy of emitted photo electrons from a metal surface of work function 2.5 eV, is 1.7 eV. If wavelength of incident radiation is halved, then stopping potential will be **[5]**

a) 6.7 V
b) 1.1 V
c) 5 V
d) 2.5 V

43. During X-ray formation, if voltage is increased **[5]**

a) intensity decreases
b) minimum wavelength decreases
c) minimum wavelength increases
d) intensity increases

44. The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons. This is because **[5]**

a) of the electrons not being subject to a central force

b) of screening effects

c) the force between the nucleus and an electron will no longer be given by Coulomb's law

d) of the electrons colliding with each other

45. If a beam goes undeflected in Thomson's experiment, then speed of the electron is (given $E = 30\ V\ cm^{-1}$ and $B = 6 \times 10^{-4}\ T$) **[5]**

a) 6.5×10^6 m/s

b) 6×10^6 m/s

c) 5.5×10^6 m/s

d) 5×10^6 m/s

46. M_n and M_p represent the mass of neutron and proton respectively. An element having mass M has N neutrons and Z protons, then the correct relation will be **[5]**

a) $M \sim N[M_n + M_p]$

b) $M > [NM_n + Z - M_p]$

c) $M = [N - M_n + Z - M_p]$

d) $M < [N - M_n + Z - M_p]$

47. The activity of a sample of radioactive material is A_1 at time t_1 and A_2 at time $t_2 (t_2 > t_1)$. If its mean life is t, then **[5]**

a) $A_2 = A_1 e^{(t_1 - t_2)/\tau}$

b) $A_1 t_1 = A_2 t_2$

c) $A_1 - A_2 = t_2 - t_1$

d) $A_2 = A_1 e^{(t_1/t_2)\tau}$

48. Isotopes have **[5]**

A. same number of protons
B. same number of nucleons
C. same number of neutrons
D. same number of positrons.

a) (C)

b) (D)

c) (B)

d) (A)

49. Hole is **[5]**

a) Gap between valence band and conduction band

b) Particle similar to that of electron

c) A vacancy created when an electron leaves a covalent bond.

d) An anti-particle of electron.

50. TV set used in a typical house is **[5]**

a) a channel

b) a repeater

c) a transmitter

d) a receiver

Solutions

1. **(a)** 5
   Explanation: K = $\frac{E}{E'}$. For an insulator, E' < E, hence K > 1,
   $\therefore$ K = 5
2. **(a)** 2 units
   Explanation: The electrostatic forces are inversely proportional to the square of distance between two charged spheres so on tripling the distance, force decreases by 9 times, hence the force becomes 2 N.
3.
   (b) Coulomb
   Explanation: The unit of electric charge is Coulomb (C).
4.
   (b) infinite
   Explanation: The permittivity of metals is very high compared to the permittivity of free space. So dielectric constant for metal is infinite.
5. **(a)** a current flows in the circuit for sometime and then decreases to zero
   Explanation: When an uncharged capacitor is connected to a battery, charges flow from the poles of the battery to the plates of the capacitor and this process continues till the potential across the capacitor attains the potential difference of the battery. The current flows in the circuit till the time the capacitor is charged and then it ceases.
6. **(a)** 1μF
   Explanation: Energy = $\frac{1}{2}CV^2$
   In 1^{st} case: E_1 = $\frac{1}{2} \times 2 \times 10^{-6} \times 200^2$
   $= 4 \times 10^{-2}$ J
   In 2^{nd} case: E_2 = $\frac{1}{2} \times (X) \times 10^{-6} \times 200^2$ J
   Decrease in energy = E_1 - E_2
   or, $2 \times 10^{-2} = 4 \times 10^{-2} - 2 \times (X) \times 10^{-2}$
   or, 2 = 4 - 2X
   $\therefore$ X = 1 μF
7.
   (b) 1Ω
   Explanation: 1Ω
8.
   (d) 1536 J
   Explanation: 1536 J
9.
   (b) S
   Explanation: S

10.

(b) west

Explanation: According to Fleming's left-hand rule, the particle will be deflected towards the west.

11.

(c) remains constant

Explanation: As the magnetic force always at right angle to the direction of motion of charged particle. So work done is zero, hence kinetic energy remains constant.

12.

(c) exerts a force, if the charged particle is moving across the magnetic field line

Explanation: A magnetic field exerts a force on a charged particle if $F = qvB\sin\theta$ is non-zero.

13.

(c) 1 : 1

Explanation: $K = \frac{1}{2}mv^2 = \frac{1}{2}m\left(\frac{qBr}{m}\right)^2 = \frac{1}{2}\frac{q^2B^2r^2}{m}$

Here r and B are same for both particles.

$\therefore \frac{K_p}{K_\alpha} = \frac{q_p^2}{q_\alpha^2} \cdot \frac{m_\alpha}{m_p} = \frac{e}{(2e)^2} \cdot \frac{4m_p}{m_p} = 1 : 1$

14.

(d) $2 \times 10^{-4}T$

Explanation: Any point at equal distances from both the poles will lie on equatorial plane. Hence magnetic field at such a point will be given by

$B_{equitorial} = \frac{\mu_o}{4\pi}\frac{m}{r^3} = \frac{\mu_o}{4\pi}\frac{q_m \times l}{r^3}$

$= \frac{10^{-7} \times 100 \times 2 \times 10^{-2}}{10^{-3}} = 2 \times 10^{-4}T$

15.

(c) 0.6 J/T

Explanation: m = NIA = $800 \times 3 \times 2.5 \times 10^{-4}$ = 0.6 J/T

16. **(a)** $\oint \vec{B}.\overrightarrow{ds} = 0$

Explanation: Since magnetic monopoles do not exist, flux entering the closed surface is equal to flux leaving the surface. Hence net magnetic flux through a closed surface is zero.

17.

(c) diamagnetism

Explanation: Diamagnetism is a universal property among all substances.

18.

(b) Absolute Permittivity

Explanation: Absolute Permittivity

19.

(c) $\frac{T_o}{3}$

Explanation: Initial time period of magnet

$T_0 = 2\pi\sqrt{\frac{I}{MB}}$

I - moment of inertia of bar magnet

M- magnetic moment of bar magnet
when the magnet is cut into three equal pieces the magnetic moment of each piece of magnet becomes $=M' = \frac{\mathrm{M}}{3}$
New moment of inertia of each magnet = $I' = \frac{\mathrm{I}}{3^3} = \frac{I}{27}$
New time period of magnet is
$T' = 2\pi\sqrt{\frac{\mathrm{I}'}{\mathrm{M}'\mathrm{B}}} = 2\pi\sqrt{\frac{\mathrm{I}/27}{(\mathrm{M}/3)\mathrm{B}}}$
$T' = \frac{T_0}{3}$

20.

(c) 1.28 Am^2
Explanation: m = NIA
$= 2000 \times 1.6 \times 10^{-4} \times 4$
= 1.28 Am^2

21.

(d) 2 MH
Explanation: U_{max} = -2 MH cos 180° = +2 MH

22.

(b) 1 mH
Explanation: $M = -\frac{e_2}{\frac{\Delta i}{\Delta t}} = \frac{100\times10^{-3}}{\frac{10}{0.1}} = 10^{-3}H$
= 1 mH

23. **(a)** 4 B_0L^2Wb

Explanation: Square lies in X-Y planes in $\bar{B}$ so $\vec{A} = L^2\hat{k}$
ϕ= B.A
$= B_0(2\hat{i} + 3\hat{j} + 4\hat{k}) \cdot \left(L^2\hat{k}\right)$ = B_0 $L^2[2 \times \hat{i}\,.\,\hat{k} + 3 \times \hat{j}\,.\,\hat{k} + 4 \times \hat{k} \cdot \hat{k}]$
= B_0L^2[0 + 0 + 4] = 4B_0L^2Wb

24. **(a)** 30°
Explanation: $\varepsilon = -\frac{\phi_2 - \phi_1}{t}$
$125 \times 10^{-3} = -\frac{0-1\times0.5\times0.5\times\cos(90^\circ-\theta)}{0.1}$
$125 \times 10^{-3} = 0.50 \times 0.50 \times \sin\theta$
$\sin\theta = \frac{125\times10^{-3}}{0.50\times0.50} = \frac{1}{2}$
$\theta = 30^\circ$

25.

(d) $\frac{L}{2}$
Explanation: If M is negligible, then for parallel combination of two inductors,
$L_{eq} = \frac{L_1L_2}{L_1+L_2}$
$= \frac{L\times L}{L+L} = \frac{L}{2}$

26.

(d) $\sqrt{R^2+(X_L-X_C)^2}$

Explanation: $\sqrt{R^2+(X_L-X_C)^2}$

27. **(a)** $\frac{\varepsilon^2 R}{\left[R^2+\left(L\omega-\frac{1}{C\omega}\right)^2\right]}$

Explanation: The power dissipated in series LCR,

$P=I^2R=\frac{\varepsilon^2}{|Z|^2}R=\frac{\varepsilon^2 R}{\left[R^2+\left(\omega L-\frac{1}{\omega C}\right)^2\right]}$

28.

(b) 31.8 V

Explanation: Maximum voltage across the terminals, V = 45 volt

Root-mean-square potential difference is,

$V_{rms}=\frac{V}{\sqrt{2}}=\frac{45}{\sqrt{2}}=31.8volt$

29. **(a)** 0.1 A

Explanation: Current in the secondary coil is given by, $i=\frac{V_s}{Z}=\frac{22}{220}=0.1A$

30. **(a)** Vacuum

Explanation: Velocity of light is maximum in vacuum and is equal to 3 × 10^8 m/s.

31. **(a)** 6 × 10^{-12} m

Explanation: $\lambda=\frac{v}{c}=\frac{3\times10^8}{5\times10^{19}}=6\times10^{-12}$ m

32.

(d) $\frac{1}{\sqrt{\varepsilon_0\mu_0}}$

Explanation: $c=\frac{1}{\sqrt{\mu_0\varepsilon_0}}$

33.

(b) 21 cm

Explanation: 

Distance between two positions of lens, L_1L_2 = 40 cm and OI = 100cm

Let distance of object from L_1 = x, therefore u = -x, hence x + 40 + x = 100 or x = 30 cm

For L_1 we have, u = -30 cm and v = 70 cm

Putting values in lens formula,

$\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$

$\frac{1}{f}=\frac{1}{70}+\frac{1}{30}$

On solving we get, f = +21 cm

34.

(d) 40 cm

Explanation: $L = f_o + f_e = 44$ and $|m| = \frac{f_o}{f_e} = 10$

This gives $f_o = 40\text{cm}$

35.

(c) $\frac{f}{x}$

Explanation: u = f + x

Using mirror formula,

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

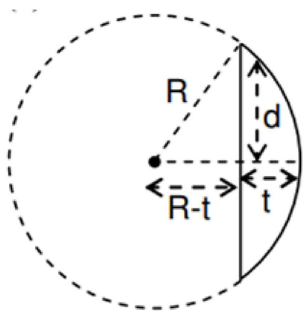
Or, $\frac{1}{v} - \frac{1}{(f+x)} = -\frac{1}{f}$

$\therefore$ v = -$\frac{f(f+x)}{x}$

So, the magnification = |m| = $\frac{v}{u} = \frac{f}{x}$

36.

(b) 30 cm

Explanation: 

$\mu = \frac{c}{v} = \frac{3}{2}$

From figure, $R^2 = d^2 + (R - t)^2$

$R^2 - d^2 = R^2\{1 - \frac{t}{R}\}^2$

$1 - \frac{d^2}{R^2} = 1 - \frac{2t}{R}$ [neglecting higher terms]

Thus, $R = \frac{d^2}{2t} = \frac{(3)^2}{2\times(0.3)} = \frac{90}{6} = 15cm$

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

$\frac{1}{f} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{15}\right)$

f = 30 cm

37. **(a)** Tourmaline

Explanation: Tourmaline absorbs one of the doubly refracted beams to a greater extent than the other.

38.

(c) Brewster angle

Explanation: At Brewster's angle, a beam of unpolarised light falling on a transparent surface gets reflected as completely plane polarised light.

39.

(c) 2.4×10^{20}

Explanation: $E_1 = \frac{hc}{\lambda_1}$ and $E_2 = h\nu_2$

$\therefore h\nu_2 \times \frac{\lambda_1}{hc} = \frac{E_2}{E_1}$ or $\nu_2 = \frac{c}{\lambda_1} \cdot \frac{E_2}{E_1}$

$= \frac{3\times10^8}{1.24\times10^{-9}} \cdot \frac{10^6\text{eV}}{10^3\text{eV}}$

= 2.4 × 10^{20} Hz

40. **(a)** X-rays

Explanation: When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it occurs by incidence of X-rays since frequency of X-rays is greater than that of U-V rays.

41.

(d) 1 : 3

Explanation: the energy of first photon, E_1 = 1eV

energy of second photon, E_2 = 2eV

work function of the surface, W = 0.5eV

K.E. = Photon energy - Work function

$\therefore \frac{K\cdot E_1}{K\cdot E_2} = \frac{1-0.5}{2-0.5} = \frac{0.5}{1.5} = \frac{1}{3}$

42. **(a)** 6.7 V

Explanation: Energy of an incident photon,

$h\nu = K_{max} + W_0$ = 1.7 + 2.5 = 4.2 eV

Now, $c = \nu\lambda = \nu'\frac{\lambda}{2} \Rightarrow \nu' = 2\nu$

$\therefore eV_0 = h\nu' - W_0 = 2h\nu - W_0$

= 2 × 4.2 - 2.5 = 6.7 eV

$\Rightarrow \nu_0$ = 6.7 V

43.

(b) minimum wavelength decreases

Explanation: As $\lambda_{min} \propto \frac{1}{V}$ if voltage is increased, the minimum wavelength of X -rays emitted decreases.

44. **(a)** of the electrons not being subject to a central force

Explanation: The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons because when we derive the formula for radius or the energy levels etc, we make the assumption that centripetal force is provided only by the electrostatic force of attraction by the nucleus. Hence, this will only work for single-electron atoms. In multi-electron atoms, there will also be repulsion due to other electrons. The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons.

45.

(d) 5 ×10^6 m/s

Explanation: If a beam goes undeflected, then

$F_E = F_M$

$qE = qvB$

$E = 30V\ cm^{-1} = 30 \times 100Vm^{-1}$

$B = 6 \times 10^{-4}T$

$v = \frac{E}{B} = \frac{30\times100}{6\times10^{-4}} = 5 \times 10^6 m/s$

46.

(d) M < [N - M_n + Z - M_p]

Explanation: The mass of a nucleus is less than the sum of the masses of its constituent nucleons.

47. **(a)** $A_2 = A_1 e^{(t_1-t_2)/\tau}$

Explanation: $A_1 = -\frac{dN_1}{dt} = \lambda N_1 = \lambda N_0 e^{-\lambda t_1}$

$A_2 = -\frac{dN_2}{dt} = \lambda N_2 = \lambda N_0 e^{-\lambda t_2}$

$\therefore \frac{A_2}{A_1} = \frac{e^{-\lambda t_2}}{e^{-\lambda t_1}} = e^{(t_1-t_2)\lambda}$

$A_2 = A_1 e^{(t_1-t_2)\lambda} = A_1 e^{\frac{t_1-t_2}{\tau}}$ .....$\left[\tau = \frac{1}{\lambda}\right]$

48.

(d) (A)

Explanation: Isoptopes have same number of protons.

49.

(c) A vacancy created when an electron leaves a covalent bond.

Explanation: A **hole** is the absence of an electron in a particular place in an atom.

50.

(d) a receiver

Explanation: The equipment that sends out a radio wave is known as a transmitter; the radio wave sent by a transmitter whizzes through the air—maybe from one side of the world to the other—and completes its journey when it reaches a second piece of equipment called a receiver. A **television antenna**, or **TV aerial**, is an antenna specifically designed for the reception of over-the-air broadcast television signal, which are transmitted at frequencies from about 41 to 250 MHz in the VHF band, and 470 to 960 MHz in the UHF band in different countries.