SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

ATOMIC STRUCTURE UT-03

1. The particles present in HD^+ ion is

1) 1 proton, 1 neutron, 2 electrons 2) 2 proton, 2 neutron, 1 electrons
3) 2 proton, 1 neutron, 1 electrons 4) 1 proton, 1 neutron, 1 electrons

2. An increasing order for the values of e/m for electro, proton (p), neutron (n) and α-particles is

1) e, p, n, α 2) n, p, e, α 3) n,p,α,e 4) n, α, p, e

3. Which of the following is/are postulates of Dalton's atomic theory

1) The atoms of the same element have same properties and atoms of different elements differ form each other in their properties
2) Atoms of different elements can combine in simple ratios to form compounds
3) Atoms can be neither created nor destroyed
4) All the above

4. To provide 1.0 Joule energy of light associated with wave length $6000A^0$, the number of photons required are

1) 3.0×10^{20} 2) 3.0×10^{18} 3) 2×10^{23} 4) 3.0×10^{10}

5. A gas absorbs a photon of 355nm and emits two wavelength. If one of the wave length of radiation is 680nm. Then the other wavelength is

1) 3.25 nm 2) 518nm 3) 743 nm 4) 1035 nm

6. What is the work function of the metal if the light of wavelength $4000A^0$ generates photoelectron of velocity 6×10^5 ms^{-1} from it? (mass of electron = 9×10^{-13}kg velocity of light (C) = 3×10^8m/s, Planck's constant (h) =6.626×10^{-34}Js)

1) 0.9ev 2) 2.1 ev 3) 3.1ev 4) 4.0ev

7. Which of the following transitions will have minimum wave length

1) $n_4 \rightarrow n_1$ 2) $n_2 \rightarrow n_1$ 3) $n_4 \rightarrow n_2$ 4) $n_3 \rightarrow n_1$

8. The difference in the energies of 1st and 2nd Bohr orbits of H- atom

1) 313.6 KJ/mole 2) 885.1 KJ/mole 3) 102.4 KJ/mole 4) 984 KJ/mole

9. If the radius of second orbit of H-atom 'X' then radius of 6th orbit of H – atom is

1) 3X 2) 6X 3) 9X 4) X/9

10. If the velocity of an electron in the second orbit of hydrogen atom is "X", then the velocity in fourth orbit will be

1) x/2 2) x/4 3) x/16 4) 16x

11. Which of the following statement is not correct about the characteristic of cathode rays

1) They start from the cathode and move towards the anode
2) They travel in straight line in the absence of an external electric (or) magnetic field
3)Characteristics of cathode rays do not depend upon the material of electrodes in cathode ray tube
4) Characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube.

12. Rutherford's experiment, which established the nuclear model of the atom, used a beam of

1) β- particles, which impinged on a metal foil and got absorbed
2) γ-rays, which impinged on a metal foil and ejected electrons
3) Helium atoms, which impinged on a metal foil and got scattered
4) Helium nuclei, which impinged on a metal foil and got scattered

13. The angular momentum of an electron in a given orbit is J. Its kinetic energy will be

1) $\frac{J^2}{2mr^2}$ 2) $\frac{JV}{r}$ 3) $\frac{J^2}{2m}$ 4) $\frac{J^2}{2\pi}$

14. The mass of a particle is 10^{-10}g and its radius is 2×10^{-4} cm. If its velocity is 10^{-6}.cm.sec^{-1} with 0.0001 % uncertainty in measurement. The uncertainty in its position is

1) 5.2×10^{-8}m 2) 5.2×10^{-7}m 3) 5.2×10^{-9}m 4) 5.2×10^{-6}m

15. For a 'f' electron the orbital angular momentum is

1) $\sqrt{12}\frac{h}{\pi}$ 2) $\sqrt{6}\frac{h}{\pi}$ 3) $\sqrt{3}\frac{h}{\pi}$ 4) $\sqrt{15}\frac{h}{\pi}$

16. The ionisation energy of a hydrogen atom in terms of Rydberg constant (R_H) is given by the expression

1) R_H.hC 2) R_H.C 3) 2R_H.h C 4) R_H.h C N_A

17. The electro magnetic radiations are

a) visible light b) IR light c) U.V. light d) Microwaves

The correct order of increasing energy from lowest to highest is

1) a>b>c>d 2) a<b<c<d 3) d<b<a<c 4) b<c<d<a

18. The distance between 4th and 3rd Bohr orbits of He^+ is

1) $2.645\times10^{-10}m$ 2) $1.322\times10^{-10}m$ 3) $1.851\times10^{-10}m$ 4) $6.8\times10^{-10}m$

19. The potential energy of an electron in the hydrogen atom is -6.8 ev. Indicate in which excited state the electron is present ?

1) first 2) second 3) third 4) fourth

20. The number of revolutions made by electron in Bohr's 2nd orbit of 'H' atom is

1) 6.55×10^{15} 2) 8.2×10^{14} 3) 1.64×10^{15} 4) 2.62×10^{16}

21. The wavelength of the radiation emitted, when electron falls from infinity to stationary state '1' in a hydrogen atom would be $\left(R=1.097\times10^{7}m^{-1}\right)$

1) 91 nm 2) 9.1×10^{-8}nm 3) 406nm 4) 192 nm

2. The deBroglie wavelength of a car of mass 1000 Kg and velocity 36 Km/hr is $\left(h=6.626\times10^{-34}J.S\right)$

1) $6.626\times10^{-34}m$ 2) $6.626\times10^{-38}m$ 3) $6.626\times10^{-31}m$ 4) $6.626\times10^{-30}m$

23. The de-Broglie wavelength (λ) **associated with a photo electron varies with the frequency (*v*) of the incident radiation as , [** v_0 **is threshold frequency]**

1) $\lambda\ \alpha\ \frac{1}{(v-v_0)^{3/2}}$ 2) $\lambda\ \alpha\ \frac{1}{(v_0-v)}$ 3) $\lambda\ \alpha\ \frac{1}{(v-v_0)^{1/2}}$ 4) $\lambda\ \alpha\ \frac{1}{(v-v_0)^{1/4}}$

24. How many emission spectral lines are possible when hydrogen atom is excited to nth energy level

1) $\frac{n(n+1)}{2}$ 2) $\frac{n+1}{2}$ 3) $\frac{(n-1)n}{2}$ 4) $\frac{n^2}{4}$

25. The Kinetic energy (in J) of particle of mass 4. 5 $\times10^{-31}$Kg having a wavelength of 1000nm is $\left(h=6.62\times10^{-34}Js\right)$

1) 2.43×10^{-24} 2) 2.43×10^{-26} 3) 4.86×10^{-24} 4) 4.86×10^{-25}

26. When uncertainty in position and momentum are equal then uncertainty in velocity is

1) $\sqrt{\frac{h}{\pi}}$ 2) $\frac{1}{2}\sqrt{\frac{h}{\pi}}$ 3) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ 4) $2m\frac{h}{\pi}$

27. The number of peaks appearing in the radial distribution curves drawn for 'S' orbital is equal to

1) n 2) $n-l$ 3) $n-l-1$ 4) $n-1$

28. The quantum number not obtained from the Schrodinger's wave equation is

1) n 2) l 3) m 4) s

29. The number of nodes in $2P_x$ orbital is

1) 1 2) 0 3) 2 4) 3

30. The number of radial node in '3p' orbital is

1) 0 2) 1 3) 2 4) 3

31. For the configuration $1s^2 2s^1$, the quantum number for the outermost electron are

1) 2, 1, 0, -1/2 2) 2, 0, 0, +1/2 3) 2, 1, 0, +1/2 4) 2, 0, 1, +1/2

32. The radius of the second Bohr orbit in terms of the Bohr radius, a_0 in Li^{+2} is

1) $\frac{2a_0}{3}$ 2) $\frac{4a_0}{9}$ 3) $\frac{4a_0}{3}$ 4) $\frac{2a_0}{9}$

33. The number of orbitals associated with quantum number n = 5, m_s = +1/2 is

1) 11 2) 25 3) 50 4) 15

34. The maximum spin multiplicity is for

1) V^{+2} 2) Cr^{+2} 3) Mn^{+2} 4) Fe^{+2}

35. A particle "A" moving with a certain velocity has a debroglie wavelength of $1A^0$. If particle B has mass 25% of that A and velocity 75% that of A, the de-Broglie wave length of B. will be approximately.

1) $1A^0$ 2) $5.3A^0$ 3) $3A^0$ 4) $0.1A^0$

36. The momentum of a particle of wavelength $1A^0$ is

1) $6.625\times10^{27}\ g\ cm\ s^{-1}$ 2) $6.625\times10^{-19}\ g\ cm\ s^{-1}$

3) $6.625\times10^{-16}\ g\ cm\ s^{-1}$ 4) $6.625\times10^{-23}\ g\ cm\ s^{-1}$

37. Identify the correct statement

a) In an atom, the possible maximum number of electrons with n =4 and m_s = +1/2, is 16

b) There are 4 subshells associated with n = 5

c) n =2, *l* =1, m_1 = 0 and m_3 = -1/2 is a possible set of quantum numbers

d) The number of radial nodes for 3s orbital is 2

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

38. The wave number of the first emission line in the Balmer series of H-spectrum is (R= Rydberg constant)

1) $\frac{3}{4}R$ 2) $\frac{7}{6}R$ 3) $\frac{5}{36}R$ 4) $\frac{9}{400}R$

39. Consider the following statements

a) electron density in XY plane in $3d_{x^2-y^2}$ orbital is zero

b) Electron density in XY plane in $3d_{z^2}$ orbital is zero

c) 2s orbital has only one spherical node

d) For $2p_z$ orbital YZ is the nodal plane

The correct statements are

1) 2 & 3 2) 1, 2, 3, 4 3) Only 2 4) 1 & 3

40. Choose the incorrect statement (s) ?

1) At node the value of 'R' changes from positive to negative

2) The number of radial nodes is given by $(n-l-1)$

3) In the plot of radial probability function $\left(4\pi r^2R^2dr\right)$ against 'r' the number of peaks is given by *l*

4) ψ is the amplitude of the wave at a point with co-ordinates and ψ^2 gives the probability of finding the electron are (x, y, z)

INTEGER TYPE QUESTION

41. A sample of hydrogen contains equal number of $_1H^1$,$_1H^2$ and $_1H^3$ atoms the ratio of total number of protons and neutrons (p/n) in the sample is …….

42. Nitrogen has an atomic number of '7' and oxygen has an atomic number of 8. The total number of electrons in the nitrate ion $\left(NO_3^-\right)$ is ……

43. Two bulbs 'A' and 'B' emit red light and Yellow light at $8000A^0$ and $4000A^0$ respectively the number of photons emitted by both the bulbs per second is the same. If the red bulb is labelled as 100 watts, x×10 the wattage of the yellow bulb find x …….

44. **The speed of the dust particle (m = 10^{-3}g) is measured with the uncertainty of $\frac{3.313}{\pi}\times 10^{-3} m/s$. The minimum uncertainty in position of the dust particle (in order of 10^{-26}m) is ..**

45. **De-Broglie wave length $'\lambda'$ of an ideal gas molecule at any given temperature is given as $\lambda \alpha\ m^{-1}\ \alpha\ T^{-y}$ where m = mass of one gas molecule T = Temperature (k) Give X+Y = …**

46. **Total different spectral lines observed in between 11th excited state and 3rd energy level in H-atom emission spectrum are ……..**

47. **The work function (ϕ) of same metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is**

Metal	**Li**	**Na**	**K**	**M**	**Cu**	**Ag**	**Fe**	**Pt**	**W**
ϕ **ev**	**24**	**23**	**2.2**	**3.7**	**4.8**	**4.3**	**4.7**	**6.3**	**4.75**

48. **The number of waves made by a Bohr electron in Hydrogen atom in one complete revolution in the 3rd orbit is ……..**

49. **How many d- electron in Cu^{+}[Z=29] can have the spin quantum [-1/2]**

50. **The maximum number of electrons can have principal quantum number n = and spin quantum number M_s = -1/2 is …….**

KEY
CHEMISTRY

1) **3**	2) **4**	3) **4**	4) **2**	5) **3**	6) **2**	7) **1**	8) **4**	9) **3**	10) **1**
11) **4**	12) **4**	13) **4**	14) **1**	15) **3**	16) **1**	17) **3**	18) **3**	19) **1**	20) **2**
21) **1**	22) **2**	23) **3**	24) **3**	25) **4**	26) **3**	27) **2**	28) **4**	29) **1**	30) **2**
31) **2**	32) **3**	33) **2**	34) **3**	35) **2**	36) **2**	37) **3**	38) **3**	39) **1**	40) **3**
41) **1**	42) **32**	43) **20**	44) **5**	45) **2**	46) **45**	47) **4**	48) **3**	49) **5**	50) **9**

SOLUTIONS

1. In HD^+

$\therefore$ No.of $e^- = 1+1-1=1$

No.of $P = 1+1=2$

No.of Neutron $(A-Z) = 0+1=1$

[Electron,e;Proton,p]

2. e/mof $e^- = 1/1837 = 1837$

e/mof p $= 1/1 = 1$

e/mof n $= 0/1 = 0$

e/mof $\alpha = 2/4 = 0.5$

4. $E = N\,h\dfrac{c}{\lambda}$

5. $\dfrac{1}{\lambda} = \dfrac{\lambda_1+\lambda_2}{\lambda 1\,\lambda_2}(or)\dfrac{\lambda\lambda_1}{\lambda 1-\lambda}$

6. $E = W + K.E.$

$\dfrac{hC}{\lambda} = W + \dfrac{1}{2}mV^2$

$\left[1eV = 1.6\times10^{-19}\,J\right]$

8. $E_n = -\dfrac{1312}{n^2}$ kJ/mole

$E_2 - E_1 = \left[\dfrac{-1312}{2^2}\right] - \left[\dfrac{-1312}{1^2}\right]$

9. $r_n = 0.529\times n^2 A^0$

$r_2 = 0.529\times(2)^2,\ r_6 = 0.529\times(6)^2$

$X = 0.529\times 4\quad,\ r_6 = 0.529\times 36$

$r_6 = 0.529\times 4\times 9$

10. $\dfrac{V_1}{V_2} = \dfrac{n_2}{n_1}$

14. $\Delta x\ .m\,\Delta V = \dfrac{h}{4\pi}$

$\Delta V = \dfrac{10^{-6}\times 0.001}{100}$

$= 10^{-12}\,\text{cm sec}^{-1}$

$$\Delta x = \frac{6.625\times10^{-27}}{4\times3.14\times10^{-10}\times10^{-12}}$$

15. $L = \sqrt{l(l+1)}\ h/2\pi$

16. $I.E = E_1$

$= -\left[-R_H Ch\right] = R_H C\,h$

Where $R_H = \dfrac{2\pi^2 e^4 m}{Ch^3}$

$E = \dfrac{-2\pi^2 me^4}{m^2h^2}$

18. $r_n = \dfrac{0.529\times n^2}{Z}$

19. $P.E = 2(T.E)$

$T.E(E) = \dfrac{-13.6}{n^2}$

20. Number of revolution per second $= \dfrac{V}{2\pi r}$

$r = 0.529\times n^2 A^0$

$V = \dfrac{2.188\times10^8}{n}$ cm/sec

21. $\bar{\upsilon} = \dfrac{1}{\lambda} = \dfrac{R}{n_1^2}$

22. $\lambda = h/mV$

23. $h\upsilon = h\upsilon_o + \dfrac{1}{2}mv^2$

$h\upsilon = -h\upsilon_o + \dfrac{1}{2}mv^2$

$h|\upsilon - \upsilon_o| = \dfrac{1}{2}\mathrm{mv}^2$

$V = \left|2h\dfrac{\upsilon-\upsilon_o}{m}\right|^{\frac{1}{2}}$

$\lambda = \dfrac{h}{mV}$

$\lambda = \dfrac{h\sqrt{m}}{m\sqrt{2h(\upsilon-\upsilon_0)}}$

25. $\lambda = \dfrac{h}{\sqrt{2.k.E.m}}$

26. $\Delta\mathrm{x}.\mathrm{m}\Delta V = \dfrac{h}{4\pi}$

$\mathrm{m}\Delta V.\mathrm{m}\Delta V = h/4\pi\left[\because \Delta x = \mathrm{m}\Delta V\right]$

30. The no. of radial nodes = n – l - 1

32. $r = \dfrac{a_o.n^2}{z}$

33. No. of orbitals $= n^2$

34. The spin multiplicity = 2s+1

[S = total spin]

35. $\frac{\lambda_A}{\lambda_B} = \frac{m_B V_B}{m_A V_A}$

36. $\lambda = \frac{h}{P}$

38. $\bar{\vartheta} = R\left[\frac{1}{n^2} - \frac{1}{n_2^2}\right]$

For 1st line in balmer series

i.e., H_∞ line $n_1 = 2, n_2 = 3$

39. For $dx^2 - y^2$ orbital lobes are on xy plane.

40. Number of peaks = n -1

41. No. of protons = 1 +1 +1 = 3

No. of neutrons = 0 +1 +2 = 3

42. Total number of electrons

$$= 7 \times (8 \times 3) + 1$$
$$= 7 + 24 + 1$$
$$= 32$$

43. $E = \frac{NhC}{\lambda}$

44. $\Delta x . m \Delta v = \frac{h}{4\pi}$

45. $\lambda \ \alpha \ \frac{1}{m} \ \alpha \ \frac{1}{T}$

46. Maximum no.of spectral lines produced when an electron from n_2 to n_1 starts for a simple atom:-

$\sum n_2 - n_1$

[No. of spectral lines in a series = $\sum n_2 - n_1$]

47. Incident radiation energy is 4.13 eV

Condition : - $E > E_0$

48. No. of waves in n^{th} orbit = n

49. Electron configuration of Cu^+ = [Ar] $4s^0 3d^{10}$

50. No. of electron = $2n^2$ = 18

Electrons with m_s = -1/2 = 9