Additional Problems for Self Practice (APSP)

PART - I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120.**
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question.
   ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

1. A 5g orbital has
(1) Zero angular node and zero radial node (2) Zero radial node and two angular nodes
(3) 4 radial nodes and 4 angular nodes (4) Zero radial node and 4 angular nodes

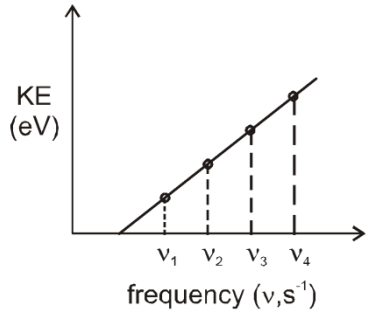
2. The threshold wavelength (λ_0) of sodium metal is 6500Å. If UV light of wavelength 360Å is used, what will be kinetic energy of the photoelectron in ergs?
(1) 55.175×10^{-12} (2) 3.056×10^{-12} (3) 52.119×10^{-12} (4) 48.66×10^{-10}

3. An electron beam can undergo diffraction by crystals. Through what potential should a beam of electrons be accelerated so that its wavelength becomes equal to 1.54 Å?
(1) 54.3 volt (2) 63.3 volt (3) 66.2 volt (4) None of these

4. Radiation corresponding to the transition n = 4 to n = 2 in hydrogen atoms falls on a certain metal (work function = 2.5 eV). The maximum kinetic energy of the photo-electrons will be :
(1) 0.55 eV (2) 2.55 eV (3) 4.45 eV (4) None of these

5. Calculate the number of photons emitted by a 100 W yellow lamp in 1.0 s. Take the wavelength of yellow light as 560 nm and assume 100 percent efficiency.
(1) 6.8×10^{20} (2) 4×10^{12} (3) 4×10^{20} (4) 2.8×10^{20}

6. In a photoelectric experiment, kinetic energy of photoelectrons was plotted against the frequency of incident radiation (ν), as shown in figure. Which of the following statements is correct?



(1) The threshold frequency is ν_1.
(2) The slope of this line is equal to Plank's constant.
(3) As the frequency of incident wavelength increases beyond threshold frequency, kinetic energy of photoelectrons decreases.
(4) It is impossible to obtain such a graph.

7. Which of the following process not lead to formation of isobars ?

(1) 1 α particle and 2β particles are emitted (2) Positron emission

(3) β particle ($_{-1}e^0$) emission (4) K-electron capture

8. If the value of E_n = – 78.4 kcal/mole, the order of the orbit in hydrogen atom is :

(1) 2 (2) 3 (3) 1 (4) 4

9. In what region of the electromagnetic spectrum would you look for the spectral line resulting from the electronic transition from the tenth to the fifth electronic level in the hydrogen atoms? ($R_H = 1.10 \times 10^5$ cm^{-1})

(1) Microwave (2) Infrared (3) Visible (4) Ultraviolet

10. Consider Xenon (Z = 54). The maximum number of electrons in this atom that can have the values for their quantum numbers as n = 4, ℓ = 3 and s = $\frac{1}{2}$ in its ground state is :

(1) Zero (2) 7 (3) 9 (4) 14

11. The increasing order for the values of e/m (charge/mass) is :

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

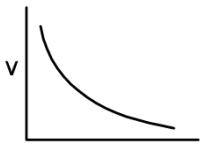
12. An electron in an atom jumps in such a way that its kinetic energy changes from x to $\frac{x}{4}$. The change in potential energy will be :

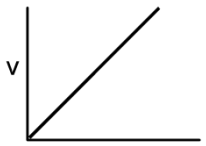
(1) $+\frac{3}{2}x$ (2) $-\frac{3}{8}x$ (3) $+\frac{3}{4}x$ (4) $-\frac{3}{4}x$

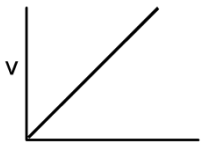
13. What atomic number of an element "X" would have to become so that the 4th orbit around X would fit inside the 1st Bohr orbit of Hydrogen ?

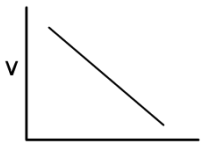
(1) 3 (2) 4 (3) 16 (4) 25

14. Select the incorrect graph for velocity of e^- in an orbit VS. Z, $\frac{1}{n}$ and n :

(1) 

(2) 

(3) 

(4) 

15. Which of the following is discreted in Bohr's theory ?

(1) Potential energy (2) Kinetic energy

(3) Velocity (4) Angular momentum

16. Which of the following sets of quantum numbers represents an impossible arrangement ?

	n	ℓ	*m*	*s*		*n*	ℓ	*m*	*s*
(1)	3	2	–2	1/2	(2)	4	0	0	1/2
(3)	3	2	–3	1/2	(4)	5	3	0	1/2

17. In any subshell, the maximum number of electrons having same value of spin quantum number is :

(1) $\sqrt{\ell\ (\ell+1)}$ (2) ℓ + 2 (3) 2ℓ + 1 (4) 4ℓ + 2

18. Which quantum number defines the orientation of orbital in the space around the nucleus ?
(1) Principal quantum number (n) (2) Angular momentum quantum number
(3) Magnetic quantum number (m_ℓ) (4) Spin quantum number (m_s)

19. For similar orbitals having different values of n :
(1) the most probable distance increases with increase in n
(2) the most probable distance decreases with increase in n
(3) the most probable distance remains constant with increase in n
(4) none of these

20. Maximum number of total nodes is present in :
(1) 5s (2) 5p (3) 5d (4) All have same number of nodes

21. The possible set of quantum no. for the unpaired electron of chlorine is :

	n	ℓ	m		n	ℓ	m
(1)	2	1	0	(2)	2	1	1
(3)	3	1	1	(4)	3	0	0

22. Which of the following has the maximum number of unpaired electrons ?
(1) Mn (2) Ti (3) V (4) Al

23. The angular velocity of an electron occupying the second Bohr orbit of He^+ ion is (in sec^{-}):
(1) 2.067×10^{16} (2) 3.067×10^{16} (3) 1.067×10^{18} (4) 2.067×10^{17}

24. An excited state of H-atom emits a photon of wavelength λ and returns in the ground state, the principal quantum number of excited state is given by :
(1) $\sqrt{\lambda R(\lambda R-1)}$ (2) $\sqrt{\frac{\lambda R}{(\lambda R-1)}}$ (3) $\sqrt{\lambda R(\lambda R-1)}$ (4) $\sqrt{\frac{(\lambda R-1)}{\lambda R}}$

25. Light of wavelength λ strikes a metal surface with intensity X and the metal emits Y electrons per second of average energy Z. What willl happen to Y and Z if X is havled?
[Mod_Book_SM_2015]
(1) Y will be halved (2) Y will double
(3) Y will be remain same (4) Z will be halved

26. Neutron scattering experiments have shown that the radius of the nucleus of an atom is directly proportional to the cube root of the number of nucleons in the nucleus. From $^{7}_{3}Li$ to $^{189}_{76}Os$, the radius is
(1) Halved (2) the same (3) Doubled (4) Tripled

27. The nucleus of an atom is located at x = y = z = 0. If the probability of finding an electron in $d_{x^2-y^2}$ orbital in a tiny volume around x=a , y =0 , z = 0 is 1×10^{-5}, what is the probablility of finding the electron in the same size volume around x = 0 ,y = a, z = 0 ?
(1) 1×10^{-5} (2) $1 \times 10^{-5} \times a$ (3) $-1 \times 10^{-5} \times a$ (4) zero

28. The energy of a I, II and III energy levels of a certain atom are E, $\frac{4E}{3}$ and 2E respectively. A photon of wavelength λ is emitted during a transition from III to I. What will be the wavelength of emission for transition II to I ?
(1) $\frac{\lambda}{2}$ (2) λ (3) 2λ (4) 3λ

29. A compound of vanadium has a magnetic moment of 1.73 BM. What will be the electronic configurations:

(1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$

(3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$

30. Calculate the minimum and maximum number of electrons which may have magnetic quantum number, m = +1 and spin quantum number, $s = -\frac{1}{2}$ in chromium (Cr) :

(1) 0, 1 (2) 1, 2 (3) 4, 6 (4) 2, 3

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

1. The fraction of volume occupied by the nucleus with respect to the total volume of an atom is
(1) 10^{-15} (2) 10^{-5} (3) 10^{-30} (4) 10^{-10}

2. The proton and neutron are collectively called as :
(1) Deutron (2) Positron (3) Meson (4) Nucleon

3. Which of the following is always a whole number
(1) Atomic weight (2) Atomic radii (3) Equivalent weight (4) Atomic number

4. How many photons of light having a wavelength of 5000 Å are necessary to provide 1 joule of energy.
(1) 2.8×10^{18} photons (2) 2.5×10^{17} photons
(3) 2.5×10^{18} photons (4) 2.6×10^{14} photons

5. Ratio of radii of second and first Bohr orbits of H atom
(1) 2 (2) 4 (3) 3 (4) 5

6. Calculate the number of proton emitted in 10 hours by a 60 W sodium lamp (λ or photon = 5893 Å)
(1) 6.4×10^{24} (2) 7.2×10^{24} (3) 2.1×10^{19} (4) 3.3×10^{19}

7. Electromagnetic radiations of wavelength 242 nm is just sufficient to ionise sodium atom. Calculate the ionisation energy of sodium in kJ mol^{-1}.
(1) 495 kJ/mol (2) 821 kJ/mol (3) 136 kJ/mol (4) None

8. Which of the following statements is wrong :
(1) Kinetic energy of an electron is half of the magnitude of its potential energy
(2) Kinetic energy of an electron is negative of total energy of electron
(3) Energy of an electron decreases with increases in the value of principal quantum number
(4) All of these

9. The ratio of the velocity of the electron in the third and fifth shell for He^+ would be :
(1) 5 : 3 (2) 1 : 2 (3) 3 : 5 (4) 3 : 4

10. The energy of first shell in hydrogen is 13.6 eV, the energy of second shell will be :
(1) 3.4 eV (2) 10.2 eV (3) 1 eV (4) 3.02 eV

11. De broglie equation describes the relationship of wavelength associated with the motion of an electron and its :
(1) Mass (2) Energy (3) Momentum (4) Charge

12. The uncertainty in the position of a moving bullet of mass 10 gm is 10^{-5}. Calculate the uncertainty in its velocity

(1) $5.2 \times 10^{-28}\,m/sec$ (2) $3.0 \times 10^{-28}\,m/sec$ (3) $5.2 \times 10^{-22}\,m/sec$ (4) $3 \times 10^{-22}\,m/sec$

13. The de-Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is :

(1) 6.6×10^{-33} m (2) 6.6×10^{-35} m (3) 6.6×10^{-36} m (4) 6.6×10^{-37} m

14. Which set of quantum numbers is possible for the last electron of Mg^{+} ion -

(1) n = 3 , ℓ = 2 , m = 0 , s = +1/2 (2) n = 2 , ℓ = 3 , m = 0 , s = +1/2

(3) n = 1 , ℓ = 0 , m = 0 , s = +1/2 (4) n = 3 , ℓ = 0 , m = 0 , s = +1/2

15. How many unpaired electron are present in Ni^{++} -

(1) 0 (2) 2 (3) 4 (4) 8

16. The electronic configuration (outermost) of Mn^{2+} ion (atomic number of Mn = 25) in its ground state is

(1) $3d^5, 4s^0$ (2) $3d^4, 4s^1$ (3) $3d^3, 4s^2$ (4) $3d^2, 4s^2, 4p^2$

17. The quantum number 'm' of a free gaseous atom is associated with :

(1) the effective volume of the orbital
(2) the shape of the orbital
(3) the spatial orientation of the orbital
(4) the energy of the orbital in the absence of a magnetic field

18. For principal quantum number n = 4, the total number of orbitals having l = 3 is

(1) 3 (2) 5 (3) 7 (4) 9

19. Which is not permissible sub shell :

(1) 3s (2) 4f (3) 6p (4) 2d

20. The angular momentum of an electron is zero, In which orbital may it be present ?

(1) 2s (2) 2p (3) 3d (4) 4f

21. The orbital angular momentum of an electron revolving in a p-orbital is

(1) zero (2) h/ $\sqrt{2}\,\pi$ (3) (1/2)h/2π (4) h/ $2\sqrt{2\pi}$

22. The periodic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction yielding element X as shown below. To which group, element X belongs in the periodic table?

$^{63}_{29}Cu + ^{1}_{1}H \rightarrow 6^{1}_{0}n + ^{4}_{2}\alpha + 2^{1}_{1}H + X$

(1) 8 (2) 1 (3) 4 (4) 3

23. In an atom, the total number of electrons having quantum numbers n = 4, $|m_\ell| = 1$ and $m_s = -1/2$ is

(1) 8 (2) 6 (3) 4 (4) 3

24. Not considering the electronic spin, the degeneracy of the second excited state (n = 3) of H atom is 9, while the degeneracy of the second excited state of H^- is

(1) 8 (2) 6 (3) 4 (4) 3

APSP Answers

PART - I

1.	(4)	**2.**	(3)	**3.**	(2)	**4.**	(4)	**5.**	(4)
6.	(2)	**7.**	(1)	**8.**	(1)	**9.**	(2)	**10.**	(1)
11.	(4)	**12.**	(1)	**13.**	(3)	**14.**	(4)	**15.**	(4)
16.	(3)	**17.**	(3)	**18.**	(3)	**19.**	(1)	**20.**	(4)
21.	(3)	**22.**	(1)	**23.**	(1)	**24.**	(2)	**25.**	(1)
26.	(4)	**27.**	(1)	**28.**	(4)	**29.**	(1)	**30.**	(4)

PART - II

1.	(1)	**2.**	(4)	**3.**	(4)	**4.**	(3)	**5.**	(2)
6.	(1)	**7.**	(1)	**8.**	(3)	**9.**	(1)	**10.**	(1)
11.	(3)	**12.**	(1)	**13.**	(1)	**14.**	(4)	**15.**	(2)
16.	(1)	**17.**	(3)	**18.**	(3)	**19.**	(4)	**20.**	(1)
21.	(2)	**22.**	(1)	**23.**	(2)	**24.**	(4)		

APSP Solutions

PART - I

1. Total number of nodes = n – 1 = 5 – 1 = 4

Angular node = ℓ = 4.

Zero radial node and 4 angular nodes.

2. The threshold frequency (ν_0) corresponding to the wavelength 6500 Å is c/λ_0.

Therefore, the threshold energy = $h\nu_0 = hc/\lambda_0$.

Substituting for h, c and λ_0 we get, threshold energy = 3.056×10^{-12} ergs.

The energy of the incident photons is given by $E = hc/\lambda_0$, since incident wavelength λ = 360 Å. Therefore, incident energy = 55.175×10^{-12} ergs.

The kinetic energy of the photoelectrons will be the difference of incident energy and threshold energy,

$\therefore$ $KE = h\nu - h\nu_0 = (55.175 \times 10^{-12}) - (3.056 \times 10^{-12})$ ergs. = 52.119×10^{-12} ergs

3. For an electron $\frac{1}{2}mu^2 = eV$ and $\lambda = \frac{h}{mu}$

Thus, $\frac{1}{2}m \times \frac{h^2}{m^2\lambda^2} = eV$

or $V = \frac{1}{2}\frac{h^2}{m\lambda^2 e} = \frac{1 \times (6.62 \times 10^{-34})^2}{2 \times 9.108 \times 10^{-31}(1.54 \times 10^{-10})^2 \times 1.602 \times 10^{-19}}$ = 63.3 volt.

4. $E_n = -\frac{13.6}{n^2}$ eV; $E_2 = \frac{13.6}{2^2}$

$E_4 = -\frac{13.6}{4^2}$ eV/atom $\Delta E = E_4 - E_2 = 2.55$ eV

Absorbed energy = work function of metal + K.E. 2.55 = 2.5 + K.E. ; K.E. = 0.05 eV

5. The number of photon is $N = \frac{E}{h\nu} = \frac{P\Delta t}{h(c/\lambda)} = \frac{\lambda P\Delta t}{hc}$

Substitution of the data gives

$$N = \frac{(5.60\times10^{-7}\,m)\times(100\,Js^{-1})\times(1.0s)}{(6.626\times10^{-34}\,s)\times(3\times10^{8}\,ms^{-1})} = 2.8\times10^{20}$$

7. ${}_{X}A^{Z} \rightarrow {}_{X-2}B^{Z-4} + {}_{2}He^{4}$

${}_{X-2}B^{Z-4} \rightarrow {}_{X-1}C^{Z-4} + {}_{-1}e^{0}$

${}_{X-1}C^{Z-4} \rightarrow {}_{X}D^{Z-4} + {}_{-1}e^{0}$

8. E_n = – 78.4 kcal/mole = – 78.4 × 4.2 = – 329.28 kJ/mole

$= -\frac{329.28}{96.5}$ eV = – 3.4 eV.

(energy of II orbit of H atom).

9. Wave numbers are the reciprocals of wavelengths and are given by the expression $\bar{\nu} = \frac{1}{\lambda}$.

$\frac{1}{\bar{\nu}} = 1.1\times10^{5}\left[\frac{1}{n_1}-\frac{1}{n_2}\right]$

11. Charge/mass for n = 0, for α = $\frac{2}{4}$,

for p = $\frac{1}{1}$, for $e^{-} = \frac{1}{1/1837}$

12. Change in P.E. = $-\frac{2x}{4} + (2x) \Rightarrow \frac{3}{2}x$

13. r_1 = 0.529 Å; $r_{4(X)} = r_1 \times \frac{n^2}{Z}$;

$r_{4(X)} \Rightarrow \frac{0.529\times(4)^2}{Z}$; Z = 16

16. Value of m cannot be more than ℓ.

17. Maximum number of electrons with same spin is equal to maximum number of orbitals, i.e., $(2\ell+1)$.

18. It is fact.

19. It is fact.

20. Total nodes = n – 1.

21. Cl_{17} : [Ne] $3s^2\,3p^5$.

Unpaired electron is in 3p orbital.

∴ n = 3, ℓ = 1, m = 1, 0, – 1.

23. Velocity of an electron in He^+ ion in an orbit = $\frac{2\pi Ze^2}{nh}$ .....(i)

Radius of He^+ ion in an orbit = $\frac{n^2h^2}{4\pi^2me^2Z}$ .....(ii)

By equations (i) and (ii),

Angular velocity (ω) = $\frac{u}{r} = \frac{8\pi^3Z^2me^4}{n^3h^3}$ ....(iii)

$= \frac{8\times(22/7)^3\times(2)^2\times(9.108\times10^{-28})\times(4.803\times10^{-10})^4}{(2)^3\times(6.626\times10^{-26})^3}$ = **2.067×10^{16} sec^{-1}.**

24. $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)$; $n_1 = 1$, $n_2 = ?$;

$\frac{1}{\lambda} = R\left(\frac{1}{1}-\frac{1}{n_2^2}\right) \Rightarrow n_2^2 = \frac{R\lambda}{R\lambda-1}$

$\Rightarrow n_2 = \sqrt{\frac{\lambda R}{\lambda R-1}}$

25. Number of emitted electron ∝ Intensity of incident light.

26. $\frac{R_{Os}}{R_{Li}} = \left(\frac{189}{7}\right)^{1/3} = 3$

27. It would be same in x and y axis for $d_{x^2-y^2}$.

28. For II to I transition, $\Delta E = \frac{4E}{3} - E = \frac{hc}{\lambda_{II\to I}}$; $\frac{E}{3} = \frac{hc}{\lambda_{II-I}}$

For III to I transition, $\Delta E = 2E - E = \frac{hc}{\lambda}$ or $E = \frac{hc}{\lambda}$

$\therefore \quad \frac{hc}{3\times\lambda} = \frac{hc}{\lambda_{II-I}}$ $\lambda_{II-I} = 3\lambda$

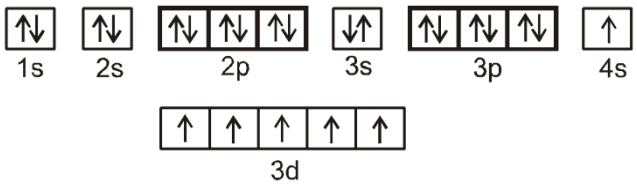
29. Number of unpaired elecron are given by Magnetic moment = $\sqrt{[n(n+2)]}$ where n is number of unpaired electrons or 1.73 = $\sqrt{[n(n+2)]}$ or $1.73 \times 1.73 = n^2 + 2n$

$\therefore$ n = 1.

Now vanadium atom must have one unpaired electron and thus its confiuration is :

$_{23}V^{4+}$: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$

30.



Out of 6 electrons in 2p and 3p must have on electron with m = + 1 and s = $\frac{1}{2}$ but in 3d-subshell an orbital having m = + 1 may have spin quantum no. – $\frac{1}{2}$ or + $\frac{1}{2}$. Therefore, minimum and maximum possible values are 2 and 3 respectively.

PART - II

1. Volume fraction = $\frac{\text{Volume of nucleus}}{\text{Total vol. of atom}} = \frac{(4/3)\ \pi\ (10^{-13})^3}{(4/3)\ \pi\ (10^{-8})^3} = 10_{-15}$

2. It is fact.

3. Atomic number is always whole number as it is the number of Protons.

4. n = $\frac{E\lambda}{hc}$ = 2.5 × 10_{18} photons

5. Bohr radius = $= \frac{r_2}{r_1} = \frac{(2)^2}{(1)^2} = 4$

6. Energy emitted by sodium lamp in one sec.

= Watt × sec = 60 × 1 J

Energy of photon emitted = $\frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{5893 \times 10^{-10}}$ = 3.37 × 10_{-19} J

∴ No of photons emitted per sec. = $\frac{60}{3.37 \times 10^{-19}}$

∴ No. of photons emitted in 10 hours = 17.8 × 10_{19} × 10 × 60 × 60 = **6.41 × 10_{24}**

7. Energy associated with a photon of 242 nm = $\frac{6.625 \times 10^{-34} \times 3.0 \times 10^8}{242 \times 10^{-9}}$ = 8.21 × 10_{-19} joule

∵ 1 atom of Na for ionisation requires = 8.21 × 10_{-19} J

∴ 6.023 × 10_{23} atoms of Na for ionisation requires

= 8.21 × 10_{-19} × 6.023 × 10_{23} = 49.45 × 10_4 J = **494.5 kJ mol_{-1}**

9. $V_n = \frac{V_0 Z}{n} \Rightarrow \frac{V_3}{V_5} = \frac{5}{3}$

10. $E = \frac{13.6}{n^2} = \frac{13.6}{(2)^2} = \frac{13.6}{4} = 3.4$ eV

11. According to de-Broglie equation $\lambda = \frac{h}{mv}$ or $\frac{h}{p}$ or $\frac{h}{mc}$.

12. Uncertainty of moving bullet velocity

$$\Delta v = \frac{h}{4\pi \times m \times \Delta v} = \frac{6.625 \times 10^{-34}}{4 \times 3.14 \times .01 \times 10^{-5}} = 5.2 \times 10^{-28} m/sec$$

14. Electronic configuration : $1s^2\ 2s^2\ 2p^6\ 3s^1$

For 3s orbital n = 3 , ℓ = 0 , m = 0 , s = +1/2

15. Electronic configuration : $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^8$
number of unpaired electron = 2

16. Mn : $4s^2\ 3d^5$
Mn^{2+} : $4s^0\ 3d^5$

17. Magnetic quantum number m is associated with spatial orientation of the orbital.

18. For n = 4 , E.C= $1s^2 2s^2 2p^6 3s^2$, $3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^{14}$
l = 3 means f subshell which has 7 orbitals.

19. 2d is not permissible subshell because according to Aufbau 2 has only 2 sub shell (s and p)

20. For 2s, l = 0. momentum = $\sqrt{l\ (l+1)}\ h\ /2\pi = 0$

21. For p-orbital, ℓ =1. Orbital angular momentum

$= \sqrt{\ell\ (\ell+1)}\ h\ /2\pi = \sqrt{\ell\ (\ell+1)}\ h\ /2\pi = \sqrt{2}\ h/2\pi = h/\sqrt{2}\pi$

22. $^{63}_{29}Cu + ^{1}_{1}H \rightarrow 6^{1}_{0}n + ^{4}_{2}\alpha + 2^{1}_{1}H + X$

64 = 6 + 4 + 2 + A ⇒ A = 52
29 + 1 = 30 = 0 + 2 + 2 + z ⇒ z = 26
Element X should be iron in group 8.

23. n = 4, m_ℓ = 1, –1

Hence ℓ can be = 3,2,1

i.e. H_f ; 2 orbitals
H_d ; 2 orbitals
H_p ; 2 orbitals

Hence total of 6 orbitals, and we want $m_s = -\frac{1}{2}$, that is only one kind of spin. So, 6 electrons.

24. Energy order of orbitals of H is decided by only principle quantum number (n)
while energy order of H^- is decided by (n + ℓ) rule :

Electronic configuration of 'H^-' is - $1s^2$ its Energy order is decided by n+ℓ rule.

$H^- = 1s^2 2s^0 2p^0$
Its 2nd excited state is 2p and degenery 2p is '3'.