**1.** The following quantum no. are possible for how many orbitals n = 3, $\ell$ = 2, m = +2
(1) 1 (2) 2
(3) 3 (4) 4

**2.** The energy of second Bohr orbit of the hydrogen atom is –328 KJ/mol. Hence the energy of fourth Bohr orbit should be :
(1) –41 KJ/mol (2) –1312 KJ/mol
(3) –164 KJ/mol (4) –82 KJ/mol

**3.** The measurement of the electron position is associated with an uncertainty in momentum, which is equal to $1\times10^{-18}$ g cm $s^{-1}$ . the uncertainty in electron velocity is : (mass of electron = $9\times10^{-28}$g)
(1) $1\times10^{11}$ cm $s^{-1}$
(2) $1\times10^{9}$ cm $s^{-1}$
(3) $1\times10^{6}$ cm $s^{-1}$
(4) $1\times10^{5}$ cm $s^{-1}$

**4.** Maximum number of electrons in a subshell of an atom is determined by the following :-
(1) $2n^2$ (2) $4\ell + 2$
(3) $2\ell + 1$ (4) $4\ell - 2$

**5.** A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be
(h = $6.6\times10^{-34}$ Js) :-
(1) $6.6\times10^{-34}$ m (2) $1.0\times10^{-35}$ m
(3) $1.0\times10^{-32}$ m (4) $6.6\times10^{-32}$ m

**6.** The energies $E_1$ and $E_2$ of two radiations are 25 eV and 50eV respectively. The relation between their wavelengths i.e. $\lambda_1$ and $\lambda_2$ will be :
(1) $\lambda_1 = \lambda_2$ (2) $\lambda_1 = 2\lambda_2$
(3) $\lambda_1 = 4\lambda_2$ (4) $\lambda_1 = \frac{1}{2}\lambda_2$

**7.** Smallest wavelength occurs for
(1) Lyman series
(2) Balmar series
(3) Paschen series
(4) Brackett series

**8.** Maximum number of electrons in a subshell with $\ell$ = 3 and n = 4 is:
(1) 10 (2) 12
(3) 14 (4) 16

**9.** The value of Planck's constant is $6.63\times10^{-34}$ Js. The speed of light is $3\times10^{17}$ nm $s^{-1}$. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of $6\times10^{15}$ $s^{-1}$ ?
(1) 75 (2) 10
(3) 25 (4) 50

**10.** The energy of an electron of $2p_y$ orbital is
(1) greater than $2p_x$ orbital
(2) Less than $2p_z$ orbial
(3) same as that of $2p_x$ and $2p_z$ orbital
(4) Equal to 2s orbital

**11.** A and B are two elements which have same atomic weight and are having atomic number 27 and 30 respectively. If the atomic weight of A is 57 then number of neutron in B is :-
(1) 27 (2) 33 (3) 30 (4) 40

**12.** Energy required to remove an $e^-$ from M shell of H-atom is 1.51 eV, then energy of $I^{st}$ excited state will be :-
(1) –1.51 eV (2) +1.51 eV
(3) –3.4 eV (4) –13.6 eV

**13.** Number of possible orbitals (all types) in n = 3 energy level is :-
(1) 1 (2) 3
(3) 4 (4) 9

**14.** When 3d orbital is complete, the new electron enters into :-
(1) 4p orbital
(2) 4f orbital
(3) 4s orbital
(4) 4d orbital

**15.** Which orbital diagram does not obey Aufbau principle :-
(1)  (2) 
(3)  (4) 

**16.** Species which are isoelectronic to one another are
(a) $CN^-$ (b) $OH^-$
(c) $CH_3^+$ (d) $N_2$
(e) CO
Correct Ans :-
(1) a, b, c (2) a, c, d
(3) a, d, e (4) b, c, d

**17.** $\frac{h}{2\pi}$ is angular momentum in.....orbit of $He^+$
(1) First (2) Second
(3) Third (4) Infinite

**18.** I[st] shell energy of $He^+$ is –54.4 eV. Then energy of its 2[nd] shell is :-

(1) –54.4 eV (2) –13.6 eV
(3) –27.2 eV (4) +27.2 eV

**19.** Third line of Balmer series is produced by which transition in spectrum of H–atom
(1) 5 to 2
(2) 5 to 1
(3) 4 to 2
(4) 4 to 1

**20.** The ratio of radii of 3rd and 2nd Bohr's orbits of hydrogen atom is :–

(1) 3 : 2 (2) 4 : 9
(3) 9 : 4 (4) 9 : 1

**21.** A metal in its dipositive state has the electronic configuration 2, 8, 14 and has the atomic weight equal to 56. Number of neutrons in its nucleus would be

(1) 30 (2) 32 (3) 34 (4) 28

**22.** In Balmer series of hydrogen atom spectrum which electronic transition causes third line :-
(1) Fifth Bohr orbit to second
(2) Fifth Bohr orbit to first
(3) Fourth Bohr orbit to second
(4) Fourth Bohr orbit to first

**23.** The ratio between kinetic energy and the total energy of the electrons of hydrogen atom according to Bohr's model is :-

(1) 2 : 1 (2) 1 : 1
(3) 1 : –1 (4) 1 : 2

**24.** Correct statement is :-

(1) K = $4s^1$ , Cr = $3d^4$ $4s^2$,Cu = $3d^{10}$ $4s^2$
(2) K = $4s^2$ , Cr = $3d^4$ $4s^2$ , Cu = $3d^{10}$ $4s^2$
(3) K = $4s^2$ , Cr = $3d^5$ $4s^1$,Cu = $3d^{10}$ $4s^2$
(4) K = $4s^1$ , Cr = $3d^5$ $4s^1$,Cu = $3d^{10}$ $4s^1$

**25.** Which of the following pairs is correctly matched

(1) Isotopes $^{40}_{20}Ca$ , $^{40}_{19}K$

(2) Isotones $^{30}_{14}Si$,$^{31}_{15}P$,$^{32}_{16}S$

(3) Isobars $^{16}_{8}O$, $^{17}_{8}O$, $^{18}_{8}O$

(4) Isoelectronic $N^{-3}$, $O^{-2}$, $Cr^{+3}$

**26.** The relative abundance of two rubidium isotopes of atomic weights 85 and 87 are 75% and 25% respectively. The average atomic wt. of rubidium is:–

(1) 75.5 (2) 85.5
(3) 86.5 (4) 87.5

**27.** The ratio of specific charge of a proton and an α–particle is :–

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

**28.** In an atom $_{13}Al^{27}$. number of protons is (a) electron is (b) and neutron is (c). Hence ratio will be [in order c : b : a]

(1) 13 : 14 : 13 (2) 13 : 13 : 14
(3) 14 : 13 : 13 (4) 14 : 13 : 14

**29.** An isotone of $_{32}Ge^{76}$ is :-

(i) $_{32}Ge^{77}$ (ii) $_{33}As^{77}$
(iii) $_{34}Se^{77}$ (iv) $_{34}Se^{78}$
(1) (ii) & (iii) (2) (i) & (ii)
(3) (ii) & (iv) (4) (ii) & (iii) & (iv)

**30.** For $Li^{+2}$, $r_2 : r_5$ will be :-

(1) 9 : 25 (2) 4 : 25
(3) 25 : 4 (4) 25 : 9

## ANSWER KEY — Exercise-I

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

## PREVIOUS YEARS' QUESTIONS — EXERCISE-II

**1.** The energy of an electron in the first Bohr orbit of H atom is – 13.6 eV . The possible energy value(s) of the excited state(s) for electrons in Bohr orbits of hydrogen is/are : **[JEE 1998]**

(1) – 3.4 eV (2) – 4.2 eV

(3) – 6.8 eV (4) + 6.8 eV

**2.** The number of nodal planes in a $p_x$ orbital is: **[JEE 2000]**

(1) one (2) two

(3) three (4) zero

**3.** An atom has a mass of 0.02 kg and uncertainty in its velocity is $9.218 \times 10^{-6}$ m/s then uncertainty in position is ($h = 6.626 \times 10^{-34}$ Js) **[AIEEE 2002]**

(1) $2.86 \times 10^{-28}$ m (2) $2.86 \times 10^{-32}$ cm

(3) $1.5 \times 10^{-27}$ m (4) $3.9 \times 10^{-10}$ m

**4.** Energy of H- atom in the ground state is –13.6 eV, Hence energy in the second excited state is- **[AIEEE 2002]**

(1) –6.8 eV (2) –3.4 eV

(3) –1.51 eV (4) –4.3 eV

**5.** Uncertainty in position of a particle of 25 g in space is $10^{-5}$ m. Hence uncertainty in velocity ($ms^{-1}$) is (Planck's constant $h = 6.6 \times 10^{-34}$ Js) **[AIEEE-2002]**

(1) $2.1 \times 10^{-28}$ (2) $2.1 \times 10^{-34}$

(3) $0.5 \times 10^{-34}$ (4) $5.0 \times 20^{-24}$

**6.** The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{\ell(\ell+1)} \cdot \frac{h}{2\pi}$. This momentum for an s-electron will be given by **[AIEEE-2003]**

(1) $\sqrt{2}.\frac{h}{2\pi}$ (2) $+\frac{1}{2}.\frac{h}{2\pi}$

(3) zero (4) $\frac{h}{2\pi}$

**7.** The number of d-electrons retained in $Fe^{2+}$ (At. no. of Fe = 26) ion is : **[AIEEE-2003]**

(1) 6 (2) 3 (3) 4 (4) 5

**8.** The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately : **[AIEEE 2003]**

(1) $10^{-25}$ metres (2) $10^{-33}$ metres

(3) $10^{-31}$ metres (4) $10^{-16}$ metres

**9.** Which of the following sets of quantum number is correct for an electron in 4f orbital ? **[AIEEE-2004]**

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

(2) n = 4, $l$ = 4, m = – 4, s = – 1/2

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

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

**10.** Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l$ = 1 and 2 are, respectively **[AIEEE-2004]**

(1) 16 and 5 (2) 12 and 5

(3) 16 and 4 (4) 12 and 4

**11.** The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state 1, would be **[AIEEE-2004]**
(Rydberg constant = $1.097 \times 10^7$ $m^{-1}$) :

(1) $9.1 \times 10^{-8}$ nm (2) 192 nm

(3) 406 nm (4) 91 nm

**12.** Which one of the following sets of ions represents the collection of isoelectronic species ? **[AIEEE-2004]**

(1) $Na^+$, $Mg^{2+}$, $Al^{3+}$, $Cl^-$ (2) $Na^+$, $Ca^{2+}$, $Sc^{3+}$, $F^-$

(3) $K^+$, $Cl^-$, $Mg^{2+}$, $Sc^{3+}$ (4) $K^+$, $Ca^{2+}$, $Sc^{3+}$, $Cl^-$

**13.** The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom? **[JEE 2004]**

(1) $He^+$ (n = 2) (2) $Li^{2+}$ (n = 2)

(3) $Li^{2+}$ (n = 3) (4) $Be^{3+}$ (n = 2)

**14.** In a multi-electron atom, which of the following orbitals described by the three quantum members will have the same energy in the absence of magnetic and electric fields ? **[AIEEE-2005]**

(A) n = 1, $l$ = 0, m = 0

(B) n = 2, $l$ = 0, m = 0

(C) n = 2, $l$ = 1, m = 1

(D) n = 3, $l$ = 2, m = 1

(E) n = 3, $l$ = 2, m = 0

(1) (D) and (E) (2) (C) and (D)

(3) (B) and (C) (4) (A) and (B)

**15.** Of the following sets which one does not contain isoelectronic species ? **[AIEEE-2005]**

(1) $BO_3^{3-}$, $CO_3^{2-}$, $NO_3^-$ (2) $SO_3^{2-}$, $CO_3^{2-}$, $NO_3^-$

(3) $CN^-$, $N_2$, $C_2^{2-}$ (4) $PO_4^{3-}$, $SO_4^{2-}$, $ClO_4^-$

**16.** Which of the following statements in relation to the hydrogen atom is correct ? **[AIEEE-2005]**

(1) 3s, 3p and 3d orbitals all have the same energy

(2) 3s and 3p orbitals are of lower energy than 3d orbitals

(3) 3p orbital is lower in energy than 3d orbital

(4) 3s orbitals is lower in energy than 3p orbital

**17.** According to Bohr's theory angular momentum of electron in 5th shell is :- **[AIEEE-2006]**

(1) 1.0 h/π (2) 10 h/π

(3) 2.5 h/π (4) 25 h/π

**18.** Uncertainty in the position of an electron (mass = $9.1 \times 10^{-31}$ Kg) moving with a velocity 300 $ms^{-1}$, accurate upto 0.001%, will be :- ($h = 6.63 \times 10^{-34}$ Js) **[AIEEE-2006]**

(1) $5.76 \times 10^{-2}$ m (2) $1.92 \times 10^{-2}$ m

(3) $3.84 \times 10^{-2}$ m (4) $19.2 \times 10^{-2}$ m

**19.** Which of the following sets of quantum numbers represents the highest energy of an atom ? **[AIEEE-2007]**

(1) n = 3, l = 1, m =1, s = +½

(2) n = 3, l = 2, m =1, s = +½

(3) n = 4, l = 0, m =0, s = +½

(4) n = 3, l = 0, m =0, s = +½

**20.** The ionziation enthalpy of hydrogen atom is $1.312 \times 10^6$ J $mol^{-1}$. The energy required to excite the electron in the atom from n =1 to n =2 is **[AIEEE-2008]**

(1) $8.51 \times 10^5$ J $mol^{-1}$ (2) $6.56 \times 10^5$ J $mol^{-1}$

(3) $7.56 \times 10^5$ J $mol^{-1}$ (4) $9.84 \times 10^5$ J $mol^{-1}$

**21.** In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005%. Certainity with which the position of the electron can be located is ($h = 6.6 \times 10^{-34}$ kg $m^2$ $s^{-1}$, mass of electron, $e_m = 9.1 \times 10^{-31}$ kg):- **[AIEEE-2009]**

(1) $1.92 \times 10^{-3}$ m (2) $3.84 \times 10^{-3}$ m

(3) $1.52 \times 10^{-4}$ m (4) $5.10 \times 10^{-3}$ m

**22.** Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3$ $ms^{-1}$ (Mass of proton = $1.67 \times 10^{-27}$ kg and $h = 6.63 \times 10^{-34}$ Js):- **[AIEEE-2009]**

(1) 2.5 nm (2) 14.0 nm

(3) 0.032 nm (4) 0.40 nm

**23.** Ionisation energy of $He^+$ is $19.6 \times 10^{-18}$ J $atom^{-1}$. The energy of the first stationary state (n = 1) of $Li^{2+}$ is:- **[AIEEE-2010]**

(1) $8.82 \times 10^{-17}$ J $atom^{-1}$

(2) $4.41 \times 10^{-16}$ J $atom^{-1}$

(3) $-4.41 \times 10^{-17}$ J $atom^{-1}$

(4) $-2.2 \times 10^{-15}$ J $atom^{-1}$

**24.** The frequency of light emitted for the transition n = 4 to n = 2 of $He^+$ is equal to the transition in H atom corresponding to which of the following **[AIEEE-2011]**

(1) n = 3 to n = 1 (2) n = 2 to n = 1

(3) n = 3 to n = 2 (4) n = 4 to n = 3

**25.** The electrons identified by quantum numbers n and $\ell$ :- **[AIEEE-2012]**

(a) n = 4 , $\ell$ = 1 (b) n = 4, $\ell$ = 0

(c) n = 3, $\ell$ = 2 (d) n = 3, $\ell$ = 1

Can be placed in order of increasing energy as

(1) (a) < (c) < (b) < (d) (2) (c) < (d) < (b) < (a)

(3) (d) < (b) < (c) < (a) (4) (b) < (d) < (a) < (c)

**26.** The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [$a_0$ is Bohr radius] **[JEE 2012]**

(1) $\frac{h^2}{4\pi^2 m a_0^2}$ (2) $\frac{h^2}{16\pi^2 m a_0^2}$

(3) $\frac{h^2}{32\pi^2 m a_0^2}$ (4) $\frac{h^2}{32\pi^2 m a_0^2}$

| PREVIOUS YEARS QUESTIONS | | | | ANSWER KEY | | | | | | Exercise-II |
|---|---|---|---|---|---|---|---|---|---|---|
| **Que.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Ans.** | **1** | **1** | **1** | **3** | **1** | **3** | **1** | **2** | **3** | **2** |
| **Que.** | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| **Ans.** | **4** | **4** | **4** | **1** | **2** | **1** | **3** | **2** | **2** | **4** |
| **Que.** | 21 | 22 | 23 | 24 | 25 | 26 | | | | |
| **Ans.** | **1** | **4** | **3** | **2** | **3** | **3** | | | | |