# CHEMISTRY

## BOOKS - DISHA CHEMISTRY (HINGLISH)

## STRUCTURE OF ATOM

**Mcqs**

**1.** Among the following groupings which represents the collection of isoelectronic species?

A. $NO^+, C_2^2, O_2^-, CO$

B. $N_2, C_2^2, CO, NO$

C. $CO, NO^+, CN^-, C_2^{2-}$

D. $NO, CN^-, N_2, O_2^-$

**Answer: C**

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

A. $\beta$ -particles which impinged on a metal foil and got absorbed

B. $\gamma$- rays which impinged on a metal foil and ejected cloctrons

C. helium atoms which impinged on a metal foil and got scattered

D. helium nuclci which impoinged on a metal foil and got scattered

**Answer: D**

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**3.** Which of the following levels of H and $He^+$ have same energy respectively ?

$(A)1, 2 \quad (B)3, 4 \quad (C)2, 4 \quad (D)3, 6$

A. A and D

B. A and B

C. C and D

D. A, C and D

**Answer: D**

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**4.** A 600 W mercury lamp emits monochromatic rediation of wavelength 331.3 nm. How many photons are emitted from the lamp per second? $\left(h = 6.626 \times 10^{-34}\right.$ Js, velocity oflight= $\left.3 \times 10^8 ms^{-1}\right)$

A. $1 \times 10^{39}$

B. $1 \times 10^{20}$

C. $1 \times 10^{21}$

D. $1 \times 10^{23}$

**Answer: C**

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**5.** Energy of an electron is givem by $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$. Wavelength of light required to excited an electron in an hydrogen atom from level $n = 1$ to $n = 2$ will be $(h = 6.62 \times 10^{-34} Js$ and $c = 3.0 \times 10^{8} ms^{-1})$.

A. $1.214 \times 10^{-7} m$

B. $2.816 \times 10^{-7} m$

C. $6.500 \times 10^{-7} m$

D. $8.500 \times 10^{-7} m$

**Answer: A**

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**6.** The energy required to break one mole of $Cl-Cl$ bonds in $Cl_2$ is $242\ \text{kJ mol}^{-1}$. The longest wavelength of light capable of breaking a single Cl-Cl bond is

$\left(c=3\times10^{8}ms^{-1}\ \text{and}\ N_A=6.02\times10^{23}\ \text{mol}^{-1}\right)$

A. 594 mm

B. 640 mm

C. 700 mm

D. 494 mm

**Answer: D**

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**7.** The first emission line in the atomic spectrum of hydrogen in the Balmer series appears at

A. $\frac{9R_H}{400}cm^{-1}$

B. $\frac{7R_H}{144}cm^{-1}$

C. $\frac{3R_H}{4}cm^{-1}$

D. $\frac{5R_H}{36}cm^{-1}$

**Answer: D**

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**8.** Which one of the following set of quatum numbers is not possible for 4p electron ?

A. $n = 4, l = 1, m = -1, m_s = +\frac{1}{2}$

B. $n = 4, l = 1, m = 0, m_s = +\frac{1}{2}$

C. $n = 4, l = 1, m = 2, m_s = +\frac{1}{2}$

D. $n = 4, l = 1, m = -1, m_s = -\frac{1}{2}$

**Answer: C**

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**9.** What will be the difference electromagnetic radiation shown in A and B respectively ?

(i) Velocity (ii) Wavelength

(iii) Frequency (iv) Energy

A. (ii) only

B. (ii) and (iv)

C. (ii), (iii) and (iv)

D. (iv) only

**Answer: C**

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**10.** Match the colums

A. A-(r )-(ii),B-(s)-(iv),C-(p)-(iii),D-(q)-(i)

B. A-(q )-(i),B-(s)-(iv),C-(p)-(iii),D-(r)-(ii)

C. A-(p )-(iii),B-(s)-(iv),C-(r)-(ii),D-(q)-(i)

D. A-(r )-(ii),B-(p)-(iii),C-(s)-(iv),D-(q)-(i)

**Answer: A**

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**11.** The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)}\frac{h}{2\pi}$. This momentum for an s-electron will be given by

A. zero

B. $\frac{h}{2\pi}$

C. $\sqrt{2}\frac{h}{2\pi}$

D. $+\frac{1}{2}\frac{h}{2\pi}$

**Answer: A**

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**12.** The energy of a photon is given as $\Delta E/$ atom $3.03 \times 10^{-19} J\text{atom}^{-1}$. Then the wavelength $(\lambda)$ of the photon is

A. 65.6nm

B. 65.6nm

C. 0.656 nm

D. 6.56 nm

**Answer: B**

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**13.** The electrons, identified by quantum numbers n and $/(I)n = 4, l = \ = 1(II)n = 4, l = 0(III)n = 3, l = 2(IV)n = 3, l = 1$ can be placed in order of increasing energy, from the lowest to highest, as

A. $(IV) < (II) < (III) < (I)$

B. $(II) < (IV) < (I) < (III)$

C. $(I) < (III) < (II) < (IV)$

D. $(III) < (I) < (IV) < (II)$

**Answer: A**

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**14.** For Balmer series in the spectrum of atomic hydrogen, the wave number of each line is given by $v = R_{II}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ where $R_{II}$ is a constant and $n_1$ and $n_2$ are integers. Which of the following statement (s) is (are) correct ?

(i) As wavelength decreases, the lines in the series converge.

(ii) The interger $n_1$ is equal to 2.

(iii) The ionization energy of hydrogen can be calculated from the wave number of these lines.

(iv) The line of longest wavelength corresponds to $n_2 = 3$.

A. (i), (ii) and (iii)

B. (ii), (iii) and (iv)

C. (i), (ii) and (iv)

D. (ii) and (iv)

**Answer: C**

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**15.** The wavelength (in cm) of second line in the Lyman series of hydrogen atomic spectrum is (Rydberg constant $= Rcm^{-1}$)

A. $\frac{8R_H}{9}$)

B. $\left(\frac{9}{8R_H}\right)$

C. $\left(\frac{4}{3R_H}\right)$

D. $\left(\frac{3R_H}{4}\right)$

**Answer: A**

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**16.** If $\lambda_o$ and $\lambda$ be threshold wavelength and wavelength of incident light, the velocity of photoelectron ejected from the metal surface is:

A. $\sqrt{\frac{2h}{m}(\lambda_o - \lambda)}$

B. $\sqrt{\frac{2hc}{m}(\lambda_o - \lambda)}$

C. $\sqrt{\frac{2hc}{m}\left(\frac{\lambda_0-\lambda}{\lambda\lambda_o}\right)}$

D. $\sqrt{\frac{2h}{m}\left(\frac{1}{\lambda_o-\frac{1}{\lambda}}\right)}$

**Answer: C**

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**17.** If wavelength of photon is $2.2\times10^{-11}m$, $h=6.6\times10^{-34}$ Js, then momentum of photon is

A. $3\times10^{23}kg/s$

B. $3.33\times10^{22}kg/s$

C. $1.452\times10^{-44}kg/s$

D. $6.89\times10^{43}kg/s$

**Answer: A**

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**18.** Which of the following set of quantum numbers belong to highest energy ?

A. $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

B. $n = 3, l = 0, m = 0, s = +\frac{1}{2}$

C. $n = 3, l = 1, m = 1, s = +\frac{1}{2}$

D. $n = 3, l = 2, m = 1, s = +\frac{1}{2}$

**Answer: D**

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**19.** From the data given below A, B, C and D respectively are,

(A) $10e^-$, atomic no. 11 (B) $10e^-$, atomic no. 6

(C ) $10e^-$, atomic no. 10 (D) $10e^-$, atomic no. 9

A. $Na^+, C^{4-}, Ne, F^-$

B. $C^{4-}, Ne, Na^{-}, F^{-}$

C. $F^{-}, Na^{+}, Ne, C^{4-}$

D. $F^{-}, Na^{+}, C^{4-}, Ne$

**Answer: A**

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**20.** Suppose beam containing all three fundamental subatomic particles are allowed to pass through an electric field as shown in figure. The subatomic particles detected at three points A, B and C on the screen respectively are ?

A. Protons, neutrons, electrons

B. Electrons, neutrons, protons

C. Electrons, protons, neutrons

D. Neutrons, protons, electrons

**Answer: B**

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**21.** For a d-electron, the orbital angular mometum is

A. $\sqrt{6}(h/2\pi)$

B. $\sqrt{2}(h/2\pi)$

C. $(h/2\pi)$

D. $2(h/2\pi)$

**Answer: A**

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**22.** The uncertainty in the position of an electron (mass $= 9.1 \times 10^{-28} g$) moving with a velocity of $3.0 \times 10^4 cms^{-1}$ accurate upto 0.011 % will be

A. 1.92 cm

B. 7.68 cm

C. 0.175 cm

D. 3.84 cm

**Answer: C**

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**23.** The values of Planck's constant is $6.63 \times 10^{-34}$ Js. The velocity of light is $3.0 \times 10^8 ms^{-1}$. Which value is closest to the wavelength in nanometres of a quantum of light with frequency of $8 \times 10^{15} s^{-1}$ ?

A. $5 \times 10^{-18}$

B. $4 \times 10^{1}$

C. $3 \times 10^{7}$

D. $2 \times 10^{-25}$

**Answer: B**

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**24.** The wavelength associated with a golf ball weighing 200 g and moving at a speed of $5m/h$ is of the order

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-40}m$

**Answer: A**

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**25.** Given that the abundances of isotopes $^{54}Fe$, $^{56}Fe$ and $^{57}Fe$ 5%, 90% and 5%, respectively, the atomic mass of Fe is

A. 55.85

B. 55.95

C. 55.75

D. 56.05

**Answer: B**

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**26.** Based on the equation :

$$\Delta E = -2.0 \times 10^{-18} J \left( \frac{1}{n_2^2} - \frac{1}{n_1^2} \right)$$

the wavelength of the light that must be absorbed to excite hydrogen

electron from level n = 1 to level n = 2 will be $(h = 6.625 \times 10^{-34} Js, C = 3 \times 10^{8} ms^{-1})$

A. $1.325 \times 10^{-7} m$

B. $1.325 \times 10^{-10} m$

C. $2.650 \times 10^{-7} m$

D. $5.300 \times 10^{-10} m$

**Answer: A**

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**27.** If uncertainty in position and momentum are equal, then uncertainty in velocity is :

A. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

B. $\sqrt{\frac{h}{2\pi}}$

C. $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

D. $\sqrt{\frac{h}{\pi}}$

**Answer: A**

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**28.** The radius of an atomic nucleus is of the order of :

A. $10^{-10}cm$

B. $10^{-13}cm$

C. $10^{-15}cm$

D. $10^{-8}cm$

**Answer: B**

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**29.** In Cu. (At. No. 29)

A. 13 electrons have spin in one direction and 16 electons in other direction

B. 14 electrons have spin in one direction and 15 electrons in other direction

C. one electron can have spin only in the clockwise direction

D. None of the above is correct.

**Answer: B**

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**30.** The correct order of increasing energy of atomic orbitals is

A. $5p < 4f < 6s < 5d$

B. $5p < 6 < 4f < 5d$

C. $5p < 5d < 4f < 6s$

D. none of these

**Answer: B**

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**31.** What does negative sign in the electronic energy forhydrogen atom convey.

A. Energy of electron when $n = \infty$

B. The energy of electron in the atom is lower than the energy of a free electron in motion

C. The energy of electron in the atom is lower than the energy of a free electron of rest

D. The energy of electron decreases as it moves away from nucleus

**Answer: C**

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**32.** If the nitrogen atom had electronic configuration $1s^7$ it would have energy lower than that of the normal ground state configuration $1s^2, 2s^2, 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observed. It violates

A. Heisenberg's uncertainty principle

B. Hund's rule

C. Pauli exclusion principle

D. Bohr postulate of stationary orbits

**Answer: C**

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**33.** If n=6, the correct sequence for filling of electrons will be :

A. $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$

B. $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$

C. $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

D. $ns \rightarrow np \rightarrow (n-1)d \rightarrow (n-2)f$

**Answer: A**

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**34.** What is the expression of frequency (v) associated with absorption spectra of the photon.

A. $v = \frac{R_H}{h}\left(\frac{1}{n_i 2} - \frac{1}{n_f 2}\right) n_i > n_f$

B. $v = \frac{R_H}{h}\left(\frac{1}{n_i 2} - \frac{1}{n_f 2}\right) n_f > n_i$

C. $v = -\frac{R_H}{h}\left(\frac{1}{n_i 2} - \frac{1}{n_f 2}\right) n_f > n_i$

D. All the above are correct

**Answer: B**

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**35.** Chlorine exists in two isotopic forms, CI-37 and CI-35 but its atomic mass is 35.5. This indicates the ratio of CI-37 and CI-35 is approximately

A. $1:2$

B. $1:1$

C. $1:3$

D. $3:1$

**Answer: C**

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**36.** If m and e are the mass and charge of the revolving electron in the orbit of radius r for hydrogen atom, the total energy of the revolving electron will be :

A. $\frac{1}{2}\frac{e^2}{r}$

B. $-\frac{e^2}{r}$

C. $\frac{me^2}{r}$

D. $-\frac{1}{2}\frac{e^2}{r}$

**Answer: D**

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**37.** An electron, $e_1$ is moving in the fifth stationary state, and another electron $e_2$ is moving in the fourth stationary state. The radius of orbit of electron $e_1$ is five times the radius of orbit of electron $e_2$ calculate the ratio of velocity of electron $e_1(v_1)$ to the velocity of electron $e_2(v_2)$.

A. $5:1$

B. $4:1$

C. $1:5$

D. $1:4$

**Answer: D**

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**38.** The correct set of four quantum numbers for the valenuce electons of rubidium atom (Z=37) is :

A. $5, 0, 0, \pm\frac{1}{2}$

B. $5, 1, 0, +\frac{1}{2}$

C. $5, 1, 1, +\frac{1}{2}$

D. $5, 0, 1, +\frac{1}{2}$

**Answer: A**

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**39.** Among species $H, Li^{2+}, He^{+}, Be^{3+}$ and $AI^{3+}$ Bohr's model was able to explain the spectra of

A. all of these

B. none of these

C. all other species except $Be^{3+}$

D. all other species except $AI^{3+}$

**Answer: D**

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**40.** The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom ?

A. $He^{+}(n = 2)$

B. $Li^{2+}(n = 2)$

C. $Li^{2+}(n=3)$

D. $Be^{3+}(n=2)$

**Answer: D**

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**41.** The average life of an excited state of hydrogen atom is of the order $10^{-8}$s. The number of revolutions made by an electron when it is in state n=2 and before it suffers a transition to staten =9 are

A. $8.23 \times 10^6$

B. $2.82 \times 10^6$

C. $22.8 \times 10^6$

D. $2.28 \times 10^6$

**Answer: A**

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**42.** If the kinetic energy of an electron is increased four time the wavelength of the de-Broglio wave associated with it would become

A. one fourth

B. half

C. four times

D. two times

**Answer: B**

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**43.** If the radius of first orbit of H-atom is $a_0$, then de-Broglie wavelength of electron in $4^{th}$ orbit is

A. $8\pi a_0$

B. $\frac{a_0}{4}$

C. $16a_0$

D. $2\pi a_0$

**Answer: A**

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