Q1 - 25 July - Shift 1

Which of the following sets of quantum numbers is not allowed ?

(A) $n = 3, l = 2, m_l = 0, s = +\frac{1}{2}$

(B) $n = 3, l = 2, m_l = -2, s = +\frac{1}{2}$

(C) $n = 3, l = 3, m_l = -3, s = -\frac{1}{2}$

(D) $n = 3, l = 0, m_l = 0, s = -\frac{1}{2}$

Space for your notes:

Q2 - 25 July - Shift 2

When the excited electron of a H atom from n = 5 drops to the ground state, the maximum number of emission lines observed are _____

Space for your notes:

Q3 - 26 July - Shift 1

The wavelength of an electron and a neutron will become equal when the velocity of the electron is x times the velocity of neutron. The value of x is_____. (Nearest Integer)

(Mass of electron is 9.1×10^{-31} kg and mass of neutron is 1.6×10^{-27} kg)

Space for your notes:

Q4 - 26 July - Shift 2

Consider an imaginary ion $^{48}_{22}X^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is ____. [nearest integer]

Space for your notes:

Q5 - 27 July - Shift 1

Given below are two statements. One is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : Energy of 2s orbital of hydrogen atom is greater than that of 2s orbital of lithium.

Reason R : Energies of the orbitals in the same subshell decrease with increase in the atomic number.

In the light of the above statements, choose the ***correct*** answer from the options given below.

(A) Both **A** and **R** are true and **R** is the correct explanation of **A.**

(B) Both **A** and **R** are true but **R** is NOT the correct explanation of **A.**

(C) **A** is true but **R** is false.

(D) **A** is false but **R** is true.

Space for your notes:

Q6 - 27 July - Shift 2

The correct decreasing order of energy, for the orbitals having, following set of quantum numbers:

(A) n = 3, l = 0, m = 0

(B) n = 4, l = 0, m = 0

(C) n = 3, l = 1, m = 0

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

(A) (D) > (B) > (C) > (A)

(B) (B) > (D) > (C) > (A)

(C) (C) > (B) > (D) > (A)

(D) (B) > (C) > (D) > (A)

Space for your notes:

Q7 - 28 July - Shift 1

Identify the incorrect statement from the following.

(A) A circular path around the nucleus in which an electron moves is proposed as Bohr's orbit.

(B) An orbital is the one electron wave function (Ψ) in an atom.

(C) The existence of Bohr's orbits is supported by hydrogen spectrum.

(D) Atomic orbital is characterised by the quantum numbers n and *l* only

Space for your notes:

Q8 - 28 July - Shift 2

If the wavelength for an electron emitted from H-atom is 3.3×10^{-10}m, then energy absorbed by the electron in its ground state compared to minimum energy required for its escape from the atom, is _____ times. (Nearest integer).

[Given : h = 6.626×10^{-34} Js,

Mass of electron = 9.1×10^{-31}]

Space for your notes:

Q9 - 29 July - Shift 1

The minimum uncertainty in the speed of an electron in an one dimensional region of length $2a_O$ (Where a_0 = Bohr radius 52.9 pm) is _____km s^{-1}.

(Given : Mass of electron = 9.1×10^{-31} kg, Planck's constant h = 6.63×10^{-34} Js)

Space for your notes:

Q10 - 29 July - Shift 2

Given below are the quantum numbers for 4 electrons.

A. $n = 3, l = 2, m_l = 1, m_s = +1/2$

B. $n = 4, l = 1, m_l = 0, m_s = +1/2$

C. $n = 4, l = 2, m_l = -2, m_s = -1/2$

D. $n = 3, l = 1, m_l = -1, m_s = +1/2$

The correct order of increasing energy is :

(A) D < B < A < C (B) D < A < B < C

(C) B < D < A < C (D) B < D < C < A

Space for your notes:

Answer Key

Q1 (C) **Q2** (4) **Q3** (1758) **Q4** (4)

Q5 (A) **Q6** (A) **Q7** (D) **Q8** (2)

Q9 (548) **Q10** (B)

Q1 (C)

$$l = 0, 1, 2 \ldots\ldots (n-1)$$

$$\therefore \quad \text{for } n = 3$$

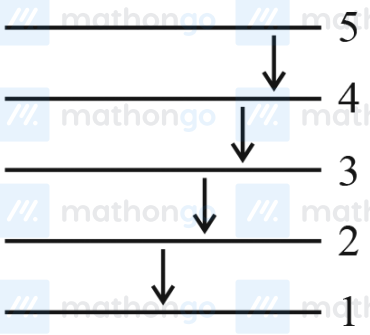
$$l = 0, 1, 2$$

$$\Rightarrow \quad l = 3,$$

$$\text{not possible for } n = 3$$

Q2 (4)

Since only a single H atom is present, maximum number of spectral lines = 4



Q3 (1758)

$$v_e = x\, v_N$$

$$\lambda_e = \lambda_N$$

$$\Rightarrow \frac{h}{m_e v_e} = \frac{h}{m_N v_N}$$

$$v_e = \frac{m_N}{m_e} . v_N$$

$$= \frac{1.6 \times 10^{-27}}{9.1 \times 10^{-31}} v_N$$

$$v_e = 1758.24 \times v_N$$

$$\therefore \quad x = 1758.24$$

Q4 (4)

$^{48}_{22}X^{3-}$

No. of neutrons = 26

No. of electrons = 25

% of extra neutrons than electrons $= \frac{26-25}{25} \times 100 = 4$

Q5 (A)

Energy of orbitals decreases on increasing the atomic number.

Q6 (A)

(A) $n + \ell = 3 + 0 = 3$

(B) $n + \ell = 4 + 0 = 4$

(C) $n + \ell = 3 + 1 = 4$

(D) $n + \ell = 3 + 2 = 5$

Higher $n + \ell$ value, higher the energy & if same $n + \ell$ value, then higher n value, higher the energy.

Thus : D > B > C > A.

Q7 (D)

Atomic orbital is characterised by n, l, m.

Q8 (2)

$$\lambda = \frac{h}{\sqrt{2mK}}$$

$$K = \frac{h^2}{2m\lambda^2}$$

$$K = \frac{h^2}{2m\lambda^2} = \frac{43.9 \times 10^{-68}}{2 \times 9.1 \times 10^{-31} \times 10.89 \times 10^{-20}}$$

$$K = 2.215 \times 10^{-18}$$

$$E_{abs} = E_{req} + K$$

$$\frac{E_{abs}}{E_{req}} = 1 + \frac{K}{E_{req}} = 1 + \frac{2.215 \times 10^{-18}}{13.6 \times 1.602 \times 10^{-19}} = 2.0166$$

Q9 (548)

Heisenberg's uncertainty principle

$$\Delta x \times \Delta p_x \geq \frac{h}{4\pi}$$

$$\Rightarrow 2a_0 \times m\Delta v_x = \frac{h}{4\pi} (\text{minimum})$$

$$\Rightarrow \Delta v_x = \frac{h}{4\pi} \times \frac{1}{2a_0} \times \frac{1}{m}$$

$$= \frac{6.63 \times 10^{-34}}{4 \times 3.14 \times 2 \times 52.9 \times 10^{-12} \times 9.1 \times 10^{-31}}$$

$$= 548273 \text{ ms}^{-1}$$

$$= 548.273 \text{ km s}^{-1}$$

$$= \boxed{548} \text{ km s}^{-1}$$

Q10 (B)

Energy order of subshell decided by $(n+\lambda)$ rule.

$A \Rightarrow 3d \Rightarrow n + l = 5$

$B \Rightarrow 4p \Rightarrow n + \lambda = 5$

$C \Rightarrow 4d \Rightarrow n + \ell \Rightarrow 6$

$D \Rightarrow 3s \Rightarrow (n+\ell) = 4$

$D < A < B < C$