Atomic Structure

1. Given below are two statements:

Statement I: Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.

Statement II: Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle.

In the light of the above statements, choose the most appropriate answer from the options given below: **[JEE Main, July 2021]**

(1) Statement I is false but statement II is true.

(2) Statement I is true but statement II is false.

(3) Both statement I and statement II are false.

(4) Both statement I and statement II are true.

2. Given below are two statements.

Statement I: According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in positive charges on the nucleus as there is no strong hold on the electron by the nucleus.

Statement II: According to Bohr's model of an atom, qualitatively the magnitude of velocity of electron increases with decrease in principal quantum number.

In the light of the above statements, choose the most appropriate answer from the options given below: **[JEE Main, August 2021]**

(1) Both Statement I and Statement II are false

(2) Both Statement I and Statement II are true

(3) Statement I is false but Statement II is true

(4) Statement I is true but Statement II is false

3. The difference between the radii of 3^{rd} and 4^{th} orbits of Li^{2+} is ΔR_1. The difference between the radii of 3^{rd} and 4^{th} orbits of He^{+} is ΔR_2. Ratio $\Delta R_1 : \Delta R_2$ is : **[Jee Main, 2020]**

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

4. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H-atom is suitable for this purpose ? [Atomic Structure]

[$R_H = 1 \times 10^5\ cm^{-1}$, $h = 6.6 \times 10^{-34}$ Js, $c = 3 \times 10^8\ ms^{-1}$] **[Jee Main, Jan 2019]**

(1) Paschen, $5 \rightarrow 3$

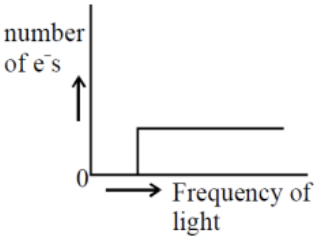
(2) Balmer, $\infty \rightarrow 2$

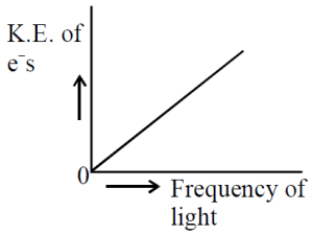
(3) Lyman, $\infty \rightarrow 1$

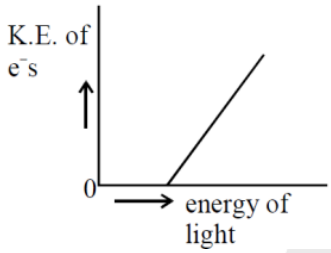
(4) Paschen, $\infty \rightarrow 3$

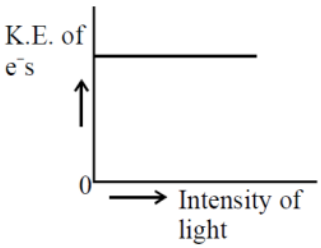
5. Which of the graphs shown below does not represent the relationship between incident light and the electron ejected form metal surface ? [Atomic structure]

[Jee Main, Jan 2019]

(1) 

(2) 

(3) 

(4) 

6. The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (v) of the incident radiation as, [v_0 is threshold frequency] : [Atomic Structure]

[Jee Main, Jan 2019]

(1) $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{2}}}$

(2) $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{4}}}$

(3) $\lambda \propto \frac{1}{(v-v_0)}$

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

7. Which one of the following about an electron occupying the 1s orbital in a hydrogen atom is incorrect ? (The Bohr radius is represented by a_0) (Atomic Structure)

[Jee Main, April 2019]

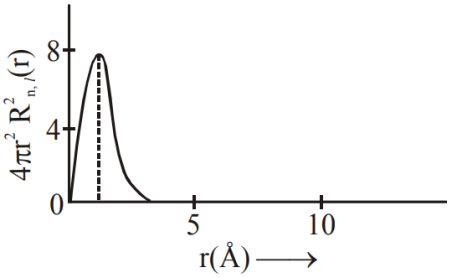
(1) The electron can be found at a distance $2a_0$ from the nucleus

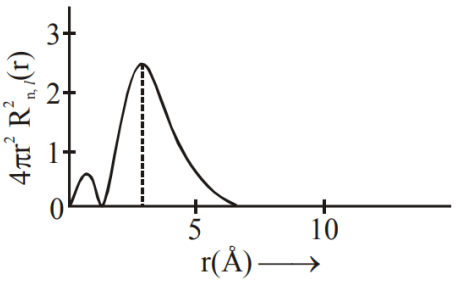
(2) The total energy of the electron is maximum when it is at a distance a_0 from the nucleus.

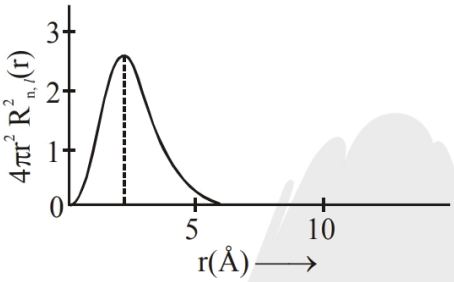
(3) The magnitude of potential energy is double that of its kinetic energy on an average.

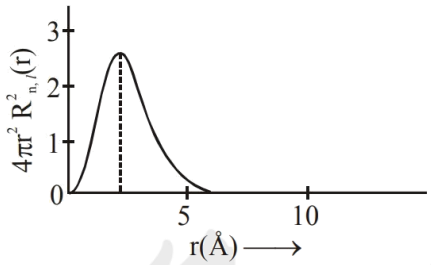
(4) The probability density of finding the electron is maximum at the nucleus.

8. The plots of radial distribution functions for various orbitals of hydrogen atom against 'r' given below

(A) 

(B) 

(C) 

(D) 

The correct plot for 3s orbital is: **[JEE Main, Feb 2021]**

(1) (B) (2) (A) (3) (D) (4) (C)

9. The number of radial and angular nodes in 4d orbital are. respectively **[JEE Main, June 2022]**

(1) 1 and 2 (2) 3 and 2 (3) 1 and 0 (4) 2 and 1

10. 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. **[JEE Main, July 2022]**

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

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

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

(3) A is true but R is false.

(4) A is false but R is true.

11. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is equal to $\frac{h^2}{xma_0^2}$. The value of 10x is _____. (a_0 is radius of Bohr's orbit) (Nearest Integer)

[Given: $\pi = 3.14$] **[JEE Main, August 2021]**

12. A proton and a Li^{3+} nucleus are accelerated by the same potential. If λ_{Li} and λ_P denote the de Broglie wavelengths of Li^{3+} and proton respectively, then the value of $\frac{\lambda_{Li}}{\lambda_P}$ is $x \times 10^{-1}$. The value of x is (Rounded off to the nearest integer) (Mass of Li^{3+} = 8.3 mass of proton)

[JEE Main, Feb 2021]

13. An accelerated electron has a speed of 5×10^6 ms^{-1} with an uncertainty of 0.02%. The uncertainty in finding its location while in motion is $x \times 10^{-9}$ m. The value of x is_____. (Nearest integer)
[Use mass of electron $=9.1\times10^{-31}$ kg, $h=6.63\times10^{-34}$ Js, π =3.14] **[JEE Main, July 2021]**

ANSWERS KEY

1.	(4)	**2.**	(3)	**3.**	(3)	**4.**	(4)	**5.**	(2)	**6.**	(1)	**7.**	(2)
8.	(3)	**9.**	(A)	**10.**	(1)	**11.**	(3155)			**12.**	(2)	**13.**	(58)