Brain International School

Vikas Puri, New Delhi

ASSIGNMENT NO. 4

SUBJECT: PHYSICS **CLASS-XII** **OCT,2025**

	CH-ATOMS	
1	When the hydrogen atom is in first excited level, its radius is a) same b) four times c) half d) twice	
2	The ionization energy of 10 times ionized sodium atom is: a) $13.6 \times 11eV$ b) $13.6 \times (11)^2 eV$ c) 13.6 / 11 eV d) 13.6 eV	
3	The 20 cm radiowave emitted by hydrogen in interstellar space is due to the interaction, called the hyperfine interaction in atomic hydrogen. The energy of the emitted wave is nearly a) 7×10^{-15} J b) 7×10^{-8} J c) 10^{-17} J d) 10^{-24} J	
4	The wavelengths involved in the spectrum of deuterium ($_1H^2$) are slightly different from that of hydrogen spectrum, because a) nuclear forces are different in the two cases b) masses of the two nuclei are different	

	c) attraction between the electron and the nucleus is different in the two cases d) sizes of the two nuclei are different	
5	The Rydberg constant R for hydrogen is: a) $R = \left(\frac{1}{4\pi\varepsilon_0}\right) \cdot \frac{2\pi^2 me^4}{ch^2}$ b) $R = -\left[\frac{1}{4\pi\varepsilon_0}\right] \cdot \frac{2\pi^2 me^2}{ch^2}$ c) $R = \left(\frac{1}{4\pi\varepsilon_0}\right)^2 \cdot \frac{2\pi^2 me^4}{c^2 h^2}$ d) $R = \frac{me^4}{8\epsilon_0^2 h^3 c}$	
6	Using Bohr's total postulates, derive the expression for the total energy of the electron in the stationary states of hydrogen atom.	
7	State the basic assumption of the Rutherford model of the atom. Explain in brief why this model cannot account for the stability of an atom?	
8	1. In an experiment on a - particle scattering by a thin foil, draw a plot showing the number of particles scattered versus the scattering angle 0. 2. Why is it that a very small fraction of the particles is scattered at 0 > 90°? 3. Write two important conclusions that can be drawn regarding the structure of the atom from the study of this experiment.	
9	An electron in a hydrogen atom makes transitions from orbits of higher energies to orbits of lower energies. 1. When will such transitions result in (a) Lyman (b) Balmer series? 2. Find the ratio of the longest wavelength in Lyman series to the shortest wavelength in Balmer series.	
10	1. Draw the energy level diagram for the line spectra representing Lyman series and Balmer series in the spectrum of hydrogen atom. 2. Using the Rydberg formula for the spectrum of hydrogen atom, calculate the largest and shortest wavelengths of the emission lines of the Balmer series in the spectrum of hydrogen atom. (Use the value of Rydberg constant R = $1.1\times 10^{7}\ m^{-1}$)	
11	1. How is the stability of hydrogen atom in Bohr model explained by de - Broglie's hypothesis? 2. A hydrogen atom initially in the ground state absorbs a photon which excites it to n = 4 level. When it gets de - excited, find the maximum number of lines which are emitted by the atom. Identify the series to which these lines belong. Which of them has the shortest wavelength?	

12	Using Bohr's postulates derive the expression for the frequency of radiation emitted when electron in hydrogen atom undergoes transition from higher energy state (quantum number n_i) to the lower state, (n_f). When electron in hydrogen atom jumps from energy state n_i = 4 to n_f = 3, 2, 1, identify the spectral series to which the emission lines belong.	
13	State Bohr's quantization condition for defining stationary orbits. How does de - Broglie hypothesis explain the stationary orbits?	
14	The number of particles scattered at 60° is 100 per minute in an α - particle scattering experiment, using gold foil. Calculate the number of particles per minute scattered at 90° angle.	
15	Use Bohr's postulates to derive the expressions for the potential and kinetic energy of the electron moving in the n^{th} orbit of the hydrogen atom. How is the total energy of the electron expressed in terms of its kinetic and potential energies?	
	CH-NUCLEI	
16	Which one of the following is a possible nuclear reaction? 1. ${}_5B^{10} + {}_2He^4 \rightarrow {}_7N^{13} + {}_1H^1$ 2. ${}_{11}Na^{23} + {}_1H^1 \rightarrow {}_{10}N^{20} + {}_2He^4$ 3. ${}_{93}Np^{239} \rightarrow {}_{94}Pu^{239} + {}_{-1}e^0 + \bar{\nu}$ 4. ${}_7N^{11} + {}_1H^1 \rightarrow {}_6C^{12} + {}_{-1}e^0 + \bar{\nu}$ a) (B) b) (A) c) (C) d) (D)	
17	The curve of binding energy per nucleon as a function of atomic mass number has a sharp peak for helium nucleus. This implies that helium nucleus is a) radioactive b) unstable c) easily fissionable d) more stable nucleus than its neighbours	
18	If number of nucleons increases, then binding energy per nucleon of the nucleus a) remains constant with mass number b) continuously decreases with mass number c) continuously increases with mass number d) first increases and then decreases with mass number	