Atomic Structure

DPP-3

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Remember : $\frac{1}{R_H} = 911.5\ \text{Å}$

1. Identify each parameter in the Bohr energy expression $E_n = -k^2 \frac{2\pi^2 mZ^2 e^4}{n^2 h^2}$

2. Calculate the radius of the first allowed Bohr orbit for hydrogen.

3. (a) Calculate the radii of the first two Bohr orbits of Li^{2+}

(b) Calculate the difference in total energy between these orbits.

(c) Calculate the difference in potential energy between these two orbits

4. The energy of an electron in the first Bohr orbit for hydrogen is –13.6 eV. Which one(s) of the following is (are) possible excited state(s) for electrons in Bohr orbits of hydrogen?
(a) –3.4 eV (b) –6.8 eV (c) –1.7 eV (d) + 13.6 eV

5. A 25 watt bulb emits monochromatic yellow light of wavelength of 0.57μm. Calculate the rate of emission of quanta per second. **(NCERT Problem)**

6. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800Å. Calculate threshold frequency (v_0) and work function (W_0) of the metal. **(NCERT Problem)**

7. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2 ?

(NCERT Problem)

8. What is the maximum number of emission lines when the excited electron of a H atom in n = 6 drops to the ground state ? **(NCERT Problem)**

9. Bohr model can explain

(a) The spectrum of hydrogen atom only

(b) spectrum of an atom or ion containing two electrons

(c) The spectrum of hydrogen molecules

(d) solar spectrum

10. The energy expression for an H atom is given by

(a) $E_n = hcR\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ (b) $E_n = hcR\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$

(c) $E_n = Rz^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ (d) $E_n = -hcR\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

11. The radius of the hydrogen atom in the ground state is 0.53 Å. The radius of $_3Li^{2+}$ in the similar state is

(a) 1.06Å (b) 0.256Å (c) 0.17 Å (d) 0.53 Å

12. In an atom, two electrons move round the nucleus in circular orbits of radii R and 4R. The ratio of the time taken by them to complete one revolution is

(a) 1 : 4 (b) 4 : 1 (c) 1 : 8 (d) 8 : 1

13. The frequency of revolution of an electron in a circular Bohr orbit is

(a) directly proportional to the quantum number n

(b) inversely proportional to the quantum number n

(c) inversely proportional to n^3

(d) directly proportional to n^2

ANSWERS

2. 0.529 Å

3. **(a)** $r_1 = 0.176$Å, $r_2 = 0.704$Å, **(b)** 1.41×10^{-17}J, **(c)** 2.83×10^{-17}J

4. **(a)** –3.4 eV **5.** $7.197 \times 10^{19}\ s^{-1}$ **6.** $4.41 \times 10^{14}\ s^{-1}$, 2.91×10^{-19}J

7. 486 nm **8.** 15 emission lines

9. (a) **10.** (a) **11.** (c) **12.** (c)

13. (c)