

## MCQ I

**12.1** Taking the Bohr radius as  $a_0 = 53\text{pm}$ , the radius of  $\text{Li}^{++}$  ion in its ground state, on the basis of Bohr's model, will be about

- (a) 53 pm
- (b) 27 pm
- (c) 18 pm
- (d) 13 pm

**12.2** The binding energy of a H-atom, considering an electron moving around a fixed nuclei (proton), is  $B = -\frac{me^4}{8n^2\epsilon_0^2h^2}$ . ( $m$  = electron mass).

If one decides to work in a frame of reference where the electron is at rest, the proton would be moving around it. By similar arguments, the binding energy would be

$$B = -\frac{Me^4}{8n^2\epsilon_0^2h^2} \quad (M = \text{proton mass})$$

This last expression is not correct because

- (a)  $n$  would not be integral.
- (b) Bohr-quantisation applies only to electron
- (c) the frame in which the electron is at rest is not inertial.
- (d) the motion of the proton would not be in circular orbits, even approximately.

**12.3** The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons. This is because

- (a) of the electrons not being subject to a central force.
- (b) of the electrons colliding with each other
- (c) of screening effects
- (d) the force between the nucleus and an electron will no longer be given by Coulomb's law.

**12.4** For the ground state, the electron in the H-atom has an angular momentum =  $\hbar$ , according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actuality, this is not true,

- (a) because Bohr model gives incorrect values of angular momentum.
- (b) because only one of these would have a minimum energy.
- (c) angular momentum must be in the direction of spin of electron.
- (d) because electrons go around only in horizontal orbits.

**12.5**  $O_2$  molecule consists of two oxygen atoms. In the molecule, nuclear force between the nuclei of the two atoms

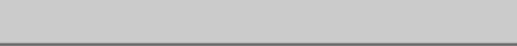
- (a) is not important because nuclear forces are short-ranged.
- (b) is as important as electrostatic force for binding the two atoms.
- (c) cancels the repulsive electrostatic force between the nuclei.
- (d) is not important because oxygen nucleus have equal number of neutrons and protons.

**12.6** Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced is

- (a) 10.20 eV
- (b) 20.40 eV
- (c) 13.6 eV
- (d) 27.2 eV

**12.7** A set of atoms in an excited state decays.

- (a) in general to any of the states with lower energy.
- (b) into a lower state only when excited by an external electric field.

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- (c) all together simultaneously into a lower state.
  - (d) to emit photons only when they collide.