15 Energy of an Electron in the ground state atom is -2.18×10^{-18} J. Calculate the Ionization enthalpy of atomic hydrogen in terms of J Mol^{-1}

ans The Ionization Enthalpy of 1 mole atoms. Therefore ground state Energy of the atoms may be expressed as E (ground state) $= -2.18 \times 10^{-18} \text{ J} \times 6.022 \times 10^{23}$

$= -1.312 \times 10^{6}$ J

Ionization Enthalpy $= 0 - (-1.312 \times 10^{6})$

$= 1.312 \times 10^{6}$ J mol^{-1}

16 Among the second period Elements, the actual Ionization Enthalpies are the order:

$Li < B < Be < O < K < F < Ne$

Explain why

(i) Be has higher ΔH_1 than B

(ii) O has lower ΔH_1 than N and F?

(i) Be $- 1s^2 2s^2$ outer most Electron in present in 2s orbital while in B ($1s^2 2s^1 2p^1$) it is present in 2p orbital. Since 2s - Electron are more strongly attracted by the nucleus than 2p - Electrons, therefore, lesser amount of Energy is required to knock out a 2p - Electron than a 2s - Electron.

(ii) The Electronic Configuration

$N_7 = 1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$

$O_8 = 1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$

We can observe in case of nitrogen 2p - orbitals are exactly half the filled. Therefore, it is difficult to remove an Electron from N than O.

17 How would you explain the fact the first ionization Enthalpy of Sodium is lesser than that of Magnesium but its second Ionization Enthalpy is higher than that of magnesium?

ans Electronic configuration of Na and Mg are

Na - $1s^2 2s^2 2p^6 3s^1$

Mg - $1s^2 2s^2 2p^6 3s^2$

First Electron in both cases has to be removed from 3s orbital but the nuclear charge of Na (+11) is lower than of Mg (+12) therefore first ionization Energy of Sodium is lower than that of magnesium.

After the loss of first Electron, the Electron configuration

$Na^+ - 1s^2 2s^2 2p^6$

$Mg^+ - 1s^2 2s^2 2p^6 3s^1$

Here Na^+ has attained Ne configuration which is very stable and hence removal of second require much Energy.

18 What are the various factors due to which the Ionization Enthalpy of the main groups Elements tends to decrease down the group?

ans (i) Atomic size

(ii) Screening / shielding Effect