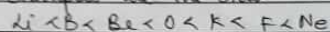


15 Energy of an electron in the ground state atom is  $-2.18 \times 10^{-18} \text{ J}$ . Calculate the ionization enthalpy of atomic hydrogen in terms of  $\Delta H^\circ$

Ans The ionization enthalpy of 1 mole atoms. Therefore ground state energy of the atom may be expressed as  $\Delta H^\circ$  (ground state)  $= -2.18 \times 10^{-18} \text{ J} \times 6.022 \times 10^{23}$   
 $= -1.312 \times 10^6 \text{ J}$

$$\text{Ionization enthalpy} = 0 - (-1.312 \times 10^6) \\ = 1.312 \times 10^6 \text{ J mol}^{-1}$$

16 Among the second period elements, the actual ionization enthalpies are the order:



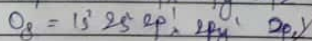
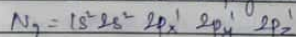
Explain why

(i) Be has higher  $\Delta H$ , than B

(ii) O has lower  $\Delta H$ , than N and F

(i) Be  $= 1s^2 2s^2$  outer most electron is present in  $2s$  orbital while in B ( $1s^2 2s^2 2p^1$ ) it is present in  $2p$  orbital. Since  $2s$  - electrons 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.

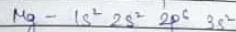
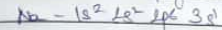
(ii) The electronic configuration



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

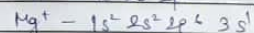
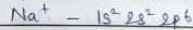
17 How would you explain the fact the first ionization enthalpy of sodium is lesser than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

Ans Electronic configuration of Na and Mg are



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

After the loss of first electron, the electronic configuration



Here  $\text{Na}^+$  has attained Ne configuration which is very stable and hence removal of second requires much energy.

18 What are the various factors due to which the ionization enthalpy of the main group elements tends to decrease down the group?

Ans (i) Atomic size

(ii) Screening / shielding effect