

1. Explain the similarity and difference between chemical bonding and lattice energy.

Chemical bonding and lattice energy are two important concepts in chemistry, which are related to the formation and stability of chemical compounds.

Similarity:

The similarity between chemical bonding and lattice energy is that they both involve the interaction between atoms or ions. In chemical bonding, atoms come together to form a molecule or a compound, whereas in lattice energy, ions come together to form an ionic solid. In both cases, the interaction between the atoms or ions determines the stability and properties of the resulting substance.

Difference:

The main difference between chemical bonding and lattice energy is that chemical bonding involves the sharing or transfer of electrons between atoms, while lattice energy involves the electrostatic attraction between ions.

In chemical bonding, the atoms share or transfer electrons to achieve a more stable electron configuration. This can result in the formation of covalent bonds, where electrons are shared between atoms, or ionic bonds, where electrons are transferred from one atom to another.

On the other hand, in lattice energy, ions are attracted to each other by their opposite charges, forming a crystal lattice structure. This electrostatic attraction between ions determines the strength of the lattice energy and the stability of the ionic compound.

Another difference between chemical bonding and lattice energy is that chemical bonding can occur between atoms of the same element (as in the case of diatomic molecules), while lattice energy is only relevant for ionic compounds.

Overall, while chemical bonding and lattice energy are both important concepts in chemistry, they involve different types of interactions between atoms or ions. Chemical bonding involves the sharing or transfer of electrons, while lattice energy involves the electrostatic attraction between ions in an ionic compound.

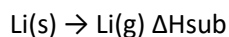
- 2. Based on the following information, calculate the enthalpy of formation of Lithium fluoride. Ionization energy of Li = 520kJ/mol, bond dissociation Energy of F₂=155kJ/mol, electron affinity of F = 155kJ/mol, enthalpy of formation of LiF = -590kJ/mol and lattice energy of LiF = 1016kJ/mol.**

(Show Born Haber cycle and all necessary steps)

To calculate the enthalpy of formation of lithium fluoride, we need to use the Born-Haber cycle, which is a series of steps that relate the enthalpy of formation of an ionic compound to its constituent elements.

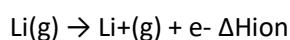
The Born-Haber cycle involves the following steps:

Formation of gaseous lithium atoms (Li) from solid lithium metal:



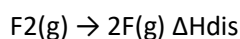
where ΔH_{sub} is the enthalpy of sublimation of lithium.

Ionization of gaseous lithium atoms to form Li⁺ ions:



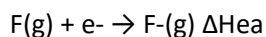
where ΔH_{ion} is the enthalpy of ionization of lithium.

Formation of gaseous fluorine atoms (F) from F₂:



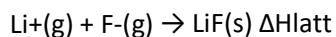
where ΔH_{dis} is the bond dissociation energy of F₂.

Addition of an electron to a gaseous fluorine atom to form F⁻ ion:



where ΔH_{ea} is the electron affinity of fluorine.

Formation of solid LiF from Li⁺ and F⁻ ions:



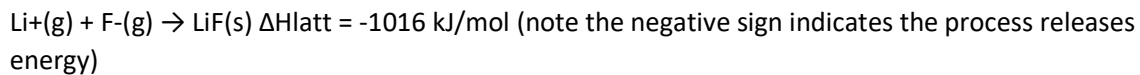
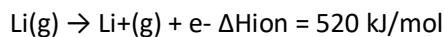
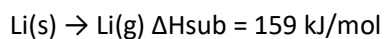
where ΔH_{latt} is the lattice energy of LiF.

Calculation of the enthalpy of formation of LiF:

$$\Delta H_f^\circ(\text{LiF}) = \Delta H_{\text{sub}} + \Delta H_{\text{ion}} + 1/2\Delta H_{\text{dis}} + \Delta H_{\text{ea}} + \Delta H_{\text{latt}}$$

where $\Delta H_f^\circ(\text{LiF})$ is the enthalpy of formation of LiF.

We are given the following data:



$$\Delta H_f^\circ(\text{LiF}) = -590 \text{ kJ/mol}$$

We can now use these values to calculate the enthalpy of lithium ionization energy:

$$\Delta H_{\text{ion}} = \Delta H_f^\circ(\text{LiF}) - \Delta H_{\text{sub}} - 1/2\Delta H_{\text{dis}} - \Delta H_{\text{ea}} - \Delta H_{\text{latt}}$$

$$\Delta H_{\text{ion}} = -590 \text{ kJ/mol} - 159 \text{ kJ/mol} - 1/2(155 \text{ kJ/mol}) - (-328 \text{ kJ/mol}) - (-1016 \text{ kJ/mol})$$

$$\Delta H_{\text{ion}} = +543 \text{ kJ/mol}$$

Therefore, the enthalpy of lithium ionization energy is +543 kJ/mol.