



## 18 - Lattice Energy

Q-1) What is the enthalpy change of formation?

> It's the enthalpy change when 1 mol of a compound is formed from its elements under standard conditions.

\* The reactants and products must be in their standard states

↓ exothermic.

Q-2) What is standard enthalpy change of atomisation?

> It's the enthalpy change when 1 mol of gaseous atoms are formed from its elements under standard conditions.

↑ endothermic.

Q-3) What is ionisation energy 1/2?

> It's the energy needed to remove one  $e^-$  from each atom / +1 ion in one mole of atoms / +1 ions in the gaseous state to form one mole of +1 / +2 ions.

↑ endothermic.

Q-4) What is electron affinity 1/2?

> It's the enthalpy change when 1 mol of  $e^-$  is added to 1 mol of gaseous atoms / -1 ions to form 1 mol of gaseous -1 / -2 ions under standard conditions.

EA1 = ↓ exothermic

EA2+ = ↑ endothermic.

Q-5) What is bond energy?

> It's the energy needed to break 1 mol of a particular bond in 1 mol of gaseous molecules

↑ endothermic

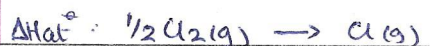
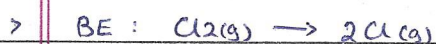


Q-6) What is lattice energy?

- > It's the enthalpy change when 1mol of an ionic compound is formed from its gaseous ions under standard conditions.

↓ exothermic

Q-7) Relationship between bond energy and  $\Delta H_{at}^\circ$



$\therefore \Delta H_{at}^\circ = \frac{1}{2}BE$

Q-8) Factors affecting lattice energy

> Size of ions:

- as size increases,  $\Delta H_{latt}$  becomes less exothermic (less -ve) as there are less forces of attraction.

> Charge on ions:

- as charge increases,  $\Delta H_{latt}$  becomes more exothermic (more -ve) as there are more forces of attraction.

$\Delta H_{latt}$  more exothermic (more -ve) when:

- small size of ion
- high charge on ion

Q-9) Thermal stability of group 2 carbonates and nitrates.



↓  
brown fumes

Ion polarisation is when the high charge density cation pulls the  $e^-$  cloud of large anion towards itself.

Down the group 2

- cation size increases.
  - charge density decreases
  - ion polarisation decreases.
- $\therefore \rightarrow$  thermal stability increases  
 $\rightarrow$  decomposition temperature increases.

Q-10) What is standard enthalpy change of solution?

- > It's the enthalpy change when 1 mol of an ionic solid dissolves completely in a solvent to give an infinitely dilute solution

$\rightarrow$  exothermic or endothermic.

Q-11) What is standard enthalpy change of hydration?

- > It's the enthalpy change when 1 mol of a gaseous ion dissolves in a solvent to form an infinitely dilute solution.

$\downarrow$  exothermic.

Q-12) Solubility of group 2 sulphates and hydroxides.

- > A compound is soluble in water when:

$$\Delta H_{\text{hyd}} > \Delta H_{\text{latt}} \quad \text{---} \circ \text{ since } \Delta H_{\text{sol}} = \Delta H_{\text{hyd}} - \Delta H_{\text{latt}}$$

Down the group 2: **SULPHATES:**

- $\Delta H_{\text{hyd}}$  and  $\Delta H_{\text{latt}}$  decreases
- BUT  $\Delta H_{\text{hyd}}$  decreases more rapidly
- $\therefore \Delta H_{\text{hyd}} < \Delta H_{\text{latt}}$ .
- $\therefore$  Solubility decreases ( $\Delta H_{\text{sol}}$  becomes more endothermic)

**HYDROXIDES:**

- BUT  $\Delta H_{\text{latt}}$  decreases more rapidly
- $\therefore \Delta H_{\text{hyd}} > \Delta H_{\text{latt}}$
- $\therefore$  solubility increases ( $\Delta H_{\text{sol}}$  becomes more exothermic)

