

13 Thermodynamics Revision Helpsheet

Lesson Objectives	Tasks		
Define and apply the terms enthalpy of formation, ionisation enthalpy, enthalpy of atomisation of an element and of a compound, bond dissociation enthalpy, electron affinity, lattice enthalpy, enthalpy of hydration and enthalpy of solution	Write definitions for the terms enthalpy of formation, ionisation enthalpy, enthalpy of atomisation of an element and of a compound, bond dissociation enthalpy, electron affinity, lattice enthalpy enthalpy of hydration and enthalpy of solution		
Construct Born-Haber cycles to calculate lattice enthalpies from experimental data.	Draw a Born-Haber cycle for lithium fluoride	Use the Born-Haber cycle to write an expression for calculating the lattice enthalpy of lithium fluoride	How would the Born-Haber cycle be different for (a) magnesium oxide (b) calcium chloride (b) sodium oxide
Compare lattice enthalpies from Born-Haber cycles with those from calculations based on a perfect ionic model to provide evidence for covalent character in ionic compounds	For compounds with some covalent character, would the lattice formation enthalpy be higher or lower than expected?	What factors increase polarisation and the tendency to have covalent character?	Explain why these factors lead to an increase in polarisation and the tendency to have covalent character
Calculate enthalpies of solution for ionic compounds from lattice enthalpies and enthalpies of hydration	Draw a thermochemical cycle to show the processes involved in dissolving sodium chloride	Use the thermochemical cycle to write an expression for calculating the enthalpy change for hydration of sodium chloride	Describe the factors that affect the enthalpy change of hydration of ions
Use mean bond enthalpies to calculate an approximate value of ΔH for other reactions	Define the mean bond enthalpy	Describe the steps needed in a calculation of bond enthalpy from the mean bond enthalpies.	
Be able to explain why values from mean bond enthalpy calculations differ from those determined from enthalpy cycles	Explain the main reason why the enthalpy changes calculated using mean bond enthalpies might differ from the actual value.		

Understand that ΔH , whilst important, is not sufficient to explain spontaneous change (e.g. spontaneous endothermic reactions)	Are most spontaneous reactions exothermic or endothermic?		
Understand that the concept of increasing disorder (entropy change ΔS) accounts for the above deficiency, illustrated by physical change (e.g. melting, evaporation) and chemical change (e.g. dissolution, evolution of CO_2 from hydrogencarbonates with acid)	What is entropy?	Explain in terms of disorder what leads to a positive value of ΔS	What are the units of entropy?
Calculate entropy changes from absolute entropy values	Write an expression for calculating the entropy change for a reaction.		
Understand that the balance between entropy and enthalpy determines the feasibility of a reaction	State which two factors are important in determining the feasibility of a reaction		
Know that this is given by the relationship $\Delta G = \Delta H - T\Delta S$	State what each of the terms are in the expression $\Delta G = \Delta H - T\Delta S$	Explain how the value of ΔG determines whether the reaction is feasible or not.	
Use the equation $\Delta G = \Delta H - T\Delta S$ to determine how ΔG varies with temperature	Calculate ΔG for a reaction at room temperature where ΔH is $+178\text{kJmol}^{-1}$ and ΔS is $+161\text{Jk}^{-1}\text{mol}^{-1}$	Calculate ΔG for a reaction at 280K where ΔH is $+178\text{kJmol}^{-1}$ and ΔS is $+161\text{Jk}^{-1}\text{mol}^{-1}$	
Use the relationship $\Delta G = \Delta H - T\Delta S$ to determine the temperature at which a reaction is feasible	At what value of ΔG is a reaction just feasible?	Rearrange the equation $\Delta G = \Delta H - T\Delta S$ to get an expression for ΔH when ΔG is zero	Rearrange the equation $\Delta G = \Delta H - T\Delta S$ to get an expression for ΔS when ΔG is zero