Year 11 Chemistry Learning Page
- Module 4 Drivers of Reactions

Our goal for this term is to:

Investigate factors that initiate and drive a reaction. Students will also examine the relationship between enthalpy and entropy in calculating the Gibbs free energy. They also examine the roles that enthalpy and entropy play in the spontaneity of reactions. Students are provided with opportunities to understand that all chemical reactions involve the creation of new substances and associated energy transformations, which are commonly observed as changes in temperature of the surrounding environment and/or emission of light.

Students conduct investigations to measure the heat energy changes that occur in chemical reactions. They describe reactions using terms such as endothermic and exothermic, and explain reactions in terms of the law of conservation of energy. They use Hess's Law to calculate enthalpy changes involved in the breaking and making of bonds.

We will achieve this by exploring the following inquiry questions:

Inquiry Question 1: What energy changes occur in chemical reactions?
Inquiry Question 2: How much energy does it take to break bonds, and how much is released when bonds are formed?
Inquiry Question 3: How can enthalpy and entropy be used to explain reaction spontaneity?

#	**Learning Intention** The goal of these lessons is to answer the following question...	**Lesson Activities** To achieve this goal we will...	**Success Criteria** I will know I have achieved this goal when I can ...
1	Inquiry Question 1: What energy changes occur in chemical reactions?	• conduct practical investigations to measure temperature and enthalpy changes in examples of endothermic and exothermic reactions, including: - combustion - dissociation of ionic substances in aqueous	1. Define and identify examples of endothermic and exothermic reactions. 2. Define the following terms: enthalpy, temperature, quantity of heat, specific heat capacity, calorimetry. 3. Identify and apply the equation $q=mc\Delta T$ to calculate the heat released or

		solution ▪ Investigate enthalpy changes in reactions using calorimetry and $q=mc\Delta T$ (heat capacity formula) to calculate, analyse and compare experimental results with reliable secondary-sourced data, and to explain any differences ▪ construct energy profile diagrams to represent and analyse the enthalpy changes and activation energy associated with a chemical reaction (ACSCH072)	absorbed in a reaction. 4. Conduct and describe an investigation to safely measure temperature and enthalpy changes of physical and chemical changes including the following types of reactions: - combustion - dissociation of ionic substances in aqueous solutions. 5. Compare experimental results with enthalpy values of combustion from secondary sources 6. Calculate ΔH of a range of reactions, such as dissolution reactions and combustion reactions. 7. Evaluate the reliability, accuracy and validity of first-hand investigations of enthalpy. 8. Draw and interpret energy profile diagrams for endothermic and exothermic reactions and the impact of a catalyst. 9. Solve a range of problems involving enthalpy of reaction calculations. 10. Draw and interpret energy profile diagrams for endothermic and exothermic reactions including those demonstrating the impact of a catalyst. 11. Model and analyse the role of catalysts in reactions

		▪ model and analyse the role of catalysts in reactions	
2	Inquiry Question 2: How much energy does it take to break bonds, and how much is released when bonds are formed? –	● explain the enthalpy changes in a reaction in terms of breaking and reforming bonds, and relate this to: - the Law of Conservation of Energy ● Investigate Hess's Law in quantifying the enthalpy change for a stepped reaction using standard enthalpy change data and bond energy data, for example: (ACSCH037) - carbon reacting with oxygen to form carbon dioxide via carbon monoxide ▪ Apply Hess's Law to simple energy cycles and solve problems to quantify enthalpy changes within reactions, including but not limited to: - heat of combustion - enthalpy changes involved in photosynthesis - enthalpy changes involved in respiration	1. Explain that enthalpy is a measure of the difference between energy required in breaking bonds (reactants) and energy released in making bonds (products) and relate this to the Law of Conservation of Energy. 2. Apply Hess's Law to determine the change in enthalpy of a stepped reaction using standard enthalpy change data and bond energy data including carbon reacting with oxygen to form carbon dioxide via carbon monoxide. 3. Conduct and describe an investigation using heat of formation to calculate enthalpy change of a chemical reaction. 4. Apply Hess' Law to determine the enthalpy change during a chemical reaction using bond energies and heat of formation values. 5. Apply Hess's Law to the enthalpy changes involved in photosynthesis and respiration.
3	Inquiry Question 3: How can enthalpy and entropy be used to explain reaction spontaneity?	● Analyse the differences between entropy and enthalpy ● Use modelling to illustrate entropy changes in reactions ● Predict entropy changes from balanced chemical reactions to classify as increasing or decreasing entropy	1. Define the term 'entropy' and compare it to enthalpy. 2. Model the entropy changes in reactions. 3. Predict the entropy changes of a reaction as either increasing or decreasing by analysing the balanced equation. 4. Define 'Gibbs Free Energy' and use the equation $\Delta G=\Delta H-T\Delta S$ to describe the relationship to enthalpy and entropy.

		• Explain reaction spontaneity using terminology, including: - Gibbs free energy - enthalpy - entropy ▪ Solve problems using standard references and (Gibbs free energy formula) to classify reactions as spontaneous or nonspontaneous ▪ Predict the effect of temperature changes on spontaneity	5. Determine reaction spontaneity using Gibbs Free Energy calculations. 6. Explain and predict the effect of temperature changes on reaction spontaneity.