IB CHEMISTRY YEAR 1 - Unit 4

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<tr><td colspan="2">IB Chemistry PLC</td><td>Subject Group and Course</td><td colspan="3">Group 4 - Chemistry</td></tr>
<tr><td>Course Part and Topic</td><td>UNIT 4 - Energetics
Reactivity 1.1 - Measuring enthalpy changes
Reactivity 1.2 - Energy cycles in reactions
Reactivity 1.3 - Energy from fuels</td><td>SL or HL / Year 1 or 2</td><td>SL Year 1</td><td>Dates</td><td>Semester 2 - Weeks 10 to 18</td></tr>
<tr><td colspan="2">Unit Description and Texts</td><td colspan="4">DP Assessment(s) for Unit</td></tr>
<tr><td colspan="2">Resources for 2025 “New” Syllabus
● Textbook TBD – pending evaluation of resources
● IB Chemistry Guide First Assessment 2025
● InThinking IB subject site for Chemistry
● IB Chemistry Schoology Course
Resources for 2016 “Old” Syllabus
● Murphy et al. Oxford IB Diploma Programme: Chemistry Course Companion, 2014 edition.
● Brown and Ford. Pearson Baccalaureate Standard Level Chemistry, 2nd edition.
● Hodder Study and Revision Guide for the IB Diploma
● Hodder IA Internal Assessment for Chemistry</td><td colspan="4">● Unit 04 Summative Assessment - Paper 1 and 2 questions modeled after the real IB Exam Papers (2025 syllabus)</td></tr>
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INQUIRY: establishing the purpose of the unit

Transfer Goals *List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to “transfer” or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.*
Phenomenon: Utilizing bioethanol in internal combustion engines showcases the renewable and carbon-neutral nature of biofuels, providing a cleaner and more sustainable alternative to fossil fuels. Statement of Inquiry: Energetics allows us to investigate the exchange and transformation of energy within chemical reactions, leading to a deeper

understanding of the factors influencing enthalpy changes and their applications in real-world processes.

1. **Students can** explain the challenges of using chemical energy to address our energy needs.
2. **Students can** use temperature change to deduce information about chemical and physical changes.
3. **Students can** apply the law of conservation of energy to predict energy changes during reactions.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
Reactivity 1.1.1 **Chemical reactions involve a transfer of energy between the system and the surroundings, while total energy is conserved.** *Understand the difference between heat and temperature.* **Reactivity 1.1.2** **Reactions are described as endothermic or exothermic, depending on the direction of energy transfer between the system and the surroundings.** *Understand the temperature change (decrease or increase) that accompanies endothermic and exothermic reactions, respectively.* **Reactivity 1.1.3** **The relative stability of reactants and products determines whether reactions are endothermic or exothermic.** *Sketch and interpret energy profiles for endothermic and exothermic reactions.* ● Axes for energy profiles should be labelled as reaction coordinate x , potential energy y **Reactivity 1.1.4** **The standard enthalpy change for a chemical reaction, $\Delta H^{\ominus}$, refers to the heat transferred at constant pressure under standard conditions and states. It can be determined from the change in temperature of a pure substance.** *Apply the equations $Q = mc\Delta T$ and $\Delta H = -Q/n$ in the calculation of the enthalpy change of a reaction.* ● The units of $\Delta H^{\ominus}$ are $kJ\ mol^{-1}$. ● The equation $Q = mc\Delta T$ and the value of c, the specific heat capacity of water, are given in the data booklet. **Reactivity 1.2.1** **Bond-breaking absorbs and bond-forming releases energy.**	Learning experiences and strategies/planning for self-supporting learning: ☒ Lecture ☐ Socratic seminar ☒ Small group/pair work ☒ PowerPoint lecture/notes ☒ Individual presentations ☒ Group presentations ☒ Student lecture/leading ☐ Interdisciplinary learning Details:

Calculate the enthalpy change of a reaction from given average bond enthalpy data. ● Include explanation of why bond enthalpy data are average values and may differ from those measured experimentally. ● Average bond enthalpy values are given in the data booklet. **Reactivity 1.2.2** **Hess's law states that the enthalpy change for a reaction is independent of the pathway between the initial and final states.** *Apply Hess's law to calculate enthalpy changes in multistep reactions.* **Reactivity 1.3.1** **Reactive metals, non-metals and organic compounds undergo combustion reactions when heated in oxygen.** *Deduce equations for reactions of combustion, including hydrocarbons and alcohols.* **Reactivity 1.3.2** **Incomplete combustion of organic compounds, especially hydrocarbons, leads to the production of carbon monoxide and carbon.** *Deduce equations for the incomplete combustion of hydrocarbons and alcohols.* **Reactivity 1.3.3** **Fossil fuels include coal, crude oil and natural gas, which have different advantages and disadvantages.** *Evaluate the amount of carbon dioxide added to the atmosphere when different fuels burn.* *Understand the link between carbon dioxide levels and the greenhouse effect.* ● The tendency for incomplete combustion and energy released per unit mass should be covered. **Reactivity 1.3.4** **Biofuels are produced from the biological fixation of carbon over a short period of time through photosynthesis.** *Understand the difference between renewable and non-renewable energy sources.* *Consider the advantages and disadvantages of biofuels.* ● The reactants and products of photosynthesis should be known. **Reactivity 1.3.5** **A fuel cell can be used to convert chemical energy from a fuel directly to electrical energy.** *Deduce half-equations for the electrode reactions in a fuel cell.* ● Hydrogen and methanol should be covered as fuels for fuel cells. ● The use of proton exchange membranes will not be assessed.	*Students will learn through a combination of presentations, small group work, practice problems, and lab work.* ☒ Other(s): *practice problems, lab work* **Formative assessment(s):** *Short closer quizzes for each lesson* *Practice with Tools and Inquiries* *Daily formative checks* **Summative assessments:** Unit Exam - *Paper 1 and 2 questions modeled after the real IB Exam Papers (2025 syllabus)* Laboratory Assignment - *assessing Tools and Inquiries practiced in the Unit* **Differentiation:** ☒ Affirm identity - build self-esteem ☒ Value prior knowledge ☒ Scaffold learning ☒ Extend learning Details: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project*

	Tools and Inquiries: **<u>Reactivity 1.1.2</u>** ● Tool 1, Inquiry 2—What observations would you expect to make during an endothermic and an exothermic reaction? **<u>Reactivity 1.1.4</u>** ● Tool 1, Inquiry 1, 2, 3—How can the enthalpy change for combustion reactions, such as for alcohols or food, be investigated experimentally? ● Tool 1, Inquiry 3—Why do calorimetry experiments typically measure a smaller change in temperature than is expected from theoretical values? **<u>Reactivity 1.3.2</u>** ● Inquiry 2—What might be observed when a fuel such as methane is burned in a limited supply of oxygen?

Approaches to Learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see [the guide.]

☒ Thinking

☒ Social

☒ Communication

☒ Self-management

☒ Research

Details:

Students will be continuously challenged to develop higher-order thinking skills as they take prior knowledge, combine it with new content, and synthesize new understandings and connections.

Students will build social groups through group work and intentional reflection activities.

Students will communicate their findings to their peers in the form of small-group presentations. *Students will continue to work on self-management and organization skills.* *Students will complete background research to develop and extend their learning.*

Language and Learning *Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see [the guide.]*	**TOK Connections** *Check the boxes for any explicit TOK connections made during the unit*	**CAS Connections** *Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*
☒ Activating background knowledge ☒ Scaffolding for new learning ☒ Acquisition of new learning through practice ☒ Demonstrating proficiency Details: *Content and vocabulary introduced in previous science courses will be used in this unit.* *Students will use many of the concepts from this unit in future units throughout the two-year course.* *Students will acquire new vocabulary.* *Students will continually demonstrate proficiency with chemistry vocabulary in class*	☐ Personal and shared knowledge ☒ Ways of knowing ☐ Areas of knowledge ☐ The knowledge framework Details: *TOK knowledge questions will be included as discussion options for each lesson.*	☒ Creativity ☐ Activity ☐ Service Details: *Students will be encouraged to consider the creativity involved in scientific experimentation. Students can explore alternative ways (visual, for example) to express and explain this creativity to others.*

discussions and group work.		

Resources *List and attach (if applicable) any resources used in this unit*
Resources for 2025 "New" Syllabus ● Textbook TBD – pending evaluation of resources ● IB Chemistry Guide First Assessment 2025 ● InThinking IB subject site for Chemistry ● IB Chemistry Schoology Course Resources for 2016 "Old" Syllabus ● Murphy et al. *Oxford IB Diploma Programme: Chemistry Course Companion*, 2014 edition. ● Brown and Ford. *Pearson Baccalaureate Standard Level Chemistry*, 2nd edition. ● Hodder Study and Revision Guide for the IB Diploma ● Hodder IA Internal Assessment for Chemistry

REFLECTION: considering the planning, process, and impact of the inquiry

What worked well	**What didn't work well**	**Notes / Changes / Suggestions**
List the portions of the unit (content, assessment, planning) that were successful	*List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	*List any notes, suggestions, or considerations for the future teaching of this unit*