Marietta City Schools

2025–2026 District Unit Planner

Teacher(s)	Audrey Wakeley	Subject Group and Course	Group 4 - IB Chemistry		
Course Part and Topic	**UNIT 3 - Proton Transfer Reactions** Reactivity 3.1 - Proton Transfer Reactions	SL or HL / Year 1 or 2	SL Year 2	Dates	11/03-12/12
Unit Description and Texts		**DP Assessment(s) for Unit**			
• Chemistry for the IB Diploma Third Edition, Hodder Education		• Unit 03 Summative Assessment - *Paper 1 and 2 questions modeled after the real IB Exam Papers (2025 syllabus)*			

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: Human blood maintains a remarkably stable pH around 7.4, even though metabolic processes constantly produce acidic and basic byproducts like CO_2 and lactic acid. This stability arises from a network of proton transfer reactions involving buffer systems, particularly the carbonic acid–bicarbonate equilibrium. Investigating this system reveals how biological acid–base balance depends on conjugate acid–base pairs, equilibrium dynamics, and the role of proton donors and acceptors in resisting pH changes under physiological stress.

Statement of Inquiry: Proton transfer reactions are central to understanding chemical behavior in everyday systems, from maintaining human health and designing effective medicines to addressing environmental issues like acid rain and ocean acidification.

1. **Students can** deduce the Bronsted-Lowry acid and base in a reaction.
2. **Students can** deduce the formula of the conjugate acid or base of any Bronsted-Lowry base or acid.
3. **Students can** interpret and formulate equations to show acid-base reactions of these species.
4. **Students can** perform calculations involving the logarithmic relationship between pH and $[H^+]$.
5. **Students can** recognize solutions as acidic, neutral, and basic from the relative values of $[H^+]$ and $[OH^-]$.
6. **Students can** recognize that acid-base equilibria lie in the direction of the weaker conjugate.
7. **Students can** formulate equations for the reactions between acids and metal oxides, metal hydroxides, hydrogen carbonates, and carbonates.
8. **Students can** sketch and interpret the general shape of the pH curve.

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 3.1.1 - Bronsted-Lowry acid is a proton donor and a Bronsted-Lowry base is a proton acceptor. Deduce the Bronsted-Lowry acid and base in a reaction. *A proton in aqueous solution can be represented as both H^+ (aq) and H_3O^+ (aq).* *The distinction between the terms "base" and "alkali" should be understood.* **Reactivity 3.1.2 - A pair of species differing by a single proton is called a conjugate acid-base pair.** Deduce the formula of the conjugate acid or base of any Bronsted-Lowry base or acid. **Reactivity 3.1.3 - Some species can act as both Bronsted-Lowry acids and bases.** Interpret and formulate equations to show acid-base reactions of these species. **Reactivity 3.1.4 - The pH scale can be used to describe the $[H^+]$ of a solution:** **$pH = -\log_{10}[H^+]$; $[H^+] = 10^{-pH}$** Perform calculations involving the logarithmic relationship between pH and $[H^+]$. *Include the estimation of pH using universal indicator, and the precise measurement of pH using a pH meter/probe.* *The equations for pH are given in the data booklet.* **Reactivity 3.1.5 - The ion product constant of water, K_w, shows an inverse relationship between $[H^+]$ and $[OH^-]$. $K_w = [H^+][OH^-]$** Recognize solutions as acidic, neutral, and basic from the relative values of $[H^+]$ and $[OH^-]$. *The equation for K_w and its value at 298 K are given in the data booklet.* **Reactivity 3.1.6 - Strong and weak acids and bases differ in the extent of ionization.** Recognize that acid-base equilibria lie in the direction of the weaker conjugate. *HCl, HBr, HI, HNO_3, and H_2SO_4 are strong acids, and group 1 hydroxides are strong bases.* *The distinction between strong and weak acids or bases and concentrated and dilute reagents should be covered.*	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: *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*

Reactivity 3.1.7 - Acids react with bases in neutralization reactions.
Formulate equations for the reactions between acids and metal oxides, metal hydroxides, hydrogen carbonates, and carbonates.
Identify the parent acid and base of different salts.
Bases should include ammonia, amines, soluble carbonates, and hydrogen carbonates; acids should include organic acids.

Reactivity 3.1.8 - pH curves for neutralization reactions involving strong acids and bases have characteristic shapes and features.
Sketch and interpret the general shape of the pH curve.
Interpretation should include the intercept with the pH axis and equivalence point.
Only monoprotic neutralization reactions will be assessed.

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:

Reactivity 3.1.4
- Tools 1, 2, 3 - What is the shape of a sketch graph of pH against $[H^+]$?
- Tool 2 - When are digital sensors (e.g. pH probes) more suitable than analogue methods (e.g. pH paper/solution)?

Reactivity 3.1.6
- Tool 1, Inquiry 2 - What physical and chemical properties can be observed to distinguish between weak and strong acids or bases of the same concentration?

	Reactivity 3.1.7 ● Tool 1 - How can the salts formed in neutralization reactions be separated? **Reactivity 3.1.8** ● Tools 1 and 3 - How can titration be used to calculate the concentration of an acid or base in solution?

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 discussions and group work.*	☐ 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.*

Resources *List and attach (if applicable) any resources used in this unit*
• Chemistry for the IB Diploma Third Edition, Hodder Education • IB Chemistry Guide First Assessment 2025 • InThinking IB subject site for Chemistry • IB Chemistry Schoology Course

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

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