Allegheny–Clarion Valley School District

Chemistry - Organic: Unit 3 - Acid/Base Reactions

Unit #:	ACVSD-00067725	Date(s)	10-27-2018 to 11-16-2018

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Grade(s): 11, 12
Subject(s): Science

Unit Focus

This unit focuses on the importance of acid-base chemistry as it relates to the study of Organic Chemistry. This is not a traditional study of acid-base chemistry as in an inorganic course. This unit looks at 4 factors like the strength of conjugate acids and bases and their impact on chemical reactions, as well as resonance, induction, and orbitals. It also looks at the quantitative relationships of pKa values and equilibrium shifts.

Prior Learnings/Connection

For students that have taken chemistry II, they will better be able to relate the concepts of acid-base chemistry (Chemistry II units 14 & 15) and chemical equilibrium (Chemistry II unit 18), For students that have not taken chemistry II, they may need to spend more time on this unit to become more familiar with the concepts because they will not have seen them before. All students will have taken chemistry I, so they would be familiar with periodic trends such as electronegativity.

Stage 1: Desired Results - Key Understandings

Standard(s)

Pennsylvania Assessment Anchors and Eligible Content
Chemistry: 11

- Classify physical or chemical changes within a system in terms of matter and/or energy. *CHEM.A.1.1.1*
- Classify observations as qualitative and/or quantitative. *CHEM.A.1.1.2*
- Relate the physical properties of matter to its atomic or molecular structure *CHEM.A.1.1.4*
- Compare properties of solutions containing ionic or molecular solutes

Transfer

What kinds of long-term, independent accomplishments are desired? Students will be able to independently use their learning to...

Meaning

Understanding(s)

What specifically do you want students to understand? What inferences should they make? Students will understand that...

U1 Students will understand that..

- Acid-Base reactions are important parts of chemical reactions in organic chemistry.

Essential Question(s)

What thought-provoking questions will foster inquiry, meaning making, and transfer? Students will keep considering...

Q1

- How can you qualitatively and quantitatively compare the strength of an acid and its conjugate base?

(e.g., dissolving, dissociating). *CHEM.A.1.2.1*
- Use illustrations to predict the polarity of a molecule. *CHEM.B.1.3.3*
- Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures). *CHEM.B.1.4.1*
- Utilize Lewis dot structures to predict the structure and bonding in simple compounds. *CHEM.B.1.4.2*

- That acid-base reactions are reversible reactions, in most cases.
- Once an acid loses its proton (deprotonates) it create a conjugate base.
- The strength of an acid is determined by the stability of the conjugate base that is formed.
- There are four factors to use to consider when determining if a conjugate base is stable: charge, resonance, induction, and orbitals. (Using this method is qualitative.)
- When determining the effect of the charge, atoms can be compared to other atoms in either the same row or period.
- A quantitative method for comparing the strength of acids and their conjugate bases is to compare pKa values.
- The smaller the pKa value, the more acidic the proton on the acid is.
- Acid-Base reactions do not continue to total completion, there is an aspect of equilibrium that must be taken into account.
- Mechanisms are drawn for all organic chemistry reactions.
- It is important to know how to draw and read basic mechanisms for acid-base reactions.

- How do charges, induction, resonance, and orbitals affect the strength of an acid (or the stability of the conjugate base)?
- How can drawing a mechanism help us to understand what is going on in a reaction?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
What facts and basic concepts should students know and be able to recall? Students will know...	*What discrete skills and processes should students be able to use? Students will be skilled at...*

	K1 Vocabulary that the students must know and be able to use in scientific settings: • acid • base • strong/weak acids and bases • conjugate acid • conjugate base • deprotonate • stability of charge • electronegativity • localized vs delocalized electrons • induction • pKa • equilibrium • mechanism	S1 The students will be able to: • Write the generic equation for an acid-base reaction. • Identify the parts of the acid-base reaction (acid, base, conjugate acid, conjugate base). • Explain how the strength of the acid is directly related to the strength of its conjugate base. • Explain how the charge on a particular atom can effect the stability of a conjugate base. • Explain how resonance can help stabilize the charge over a molecule and relate to the acidity of a conjugate base. • Draw/predict the conjugate base(s) of an acid. • Determine which proton is the more acidic proton in a molecule. • Explain the stability of conjugate bases. • Explain how induction can affect the stability of a conjugate base. • Explain how the position/size/location of orbitals can affect the stability/strength of a conjugate base. • Compare the strengths of acids when provided with pKa values. • Predict the position of equilibrium by use of comparing the four factors of the atom, resonance, induction, and orbitals. • Read and draw mechanisms for acid-base reactions.

Stage 2: Assessment Evidence

Performance Task(s)

Alignment	Code	Assessment Evidence
	PT1	**Untitled** **Performance Task** *Diagnostic:* • Classroom questioning and discussion • Google Classroom activities/ YouTube videos • Notes/practice problems on the board *Formative:* • Homework (Detailed assignments are listed in the Learning Plan) • In-class assignments (reading packet and practice problems) *Summative:* • Chapter test - Acid/Base reactions in Organic Chemistry

Stage 3: Learning Plan

Alignment	Code	Learning Activities
	LA1	**Chapter 3 Learning Plan** **Learning Activity** Day 1: • The students will begin by reading the beginning of chapter 3, Acid-Base Reactions. They will then continue on to section 3.1- Factor 1 - What Atom is the Charge On? Day 2: • We will practice writing generic acid-base reactions together. Many students will not have seen this concept in chemistry before. We may need to discuss this in more detail depending on how they receive the information and how well they write the practice problems and use the second factor - Resonance. • In-class/HW: they will complete the practice problems pages 56 and 57 of their packet, where they will be required to draw the two possible conjugate acids for each molecule.

		Day 3: The students will read/annotate/highlight section 3.3 which covers factor 3 - induction. • In-class/HW: they will complete the practice problems on pages 64-65 of their packet, where they will be required to draw the two possible conjugate acids for each molecule and predict their stability. Day 4: