Unit Title: Acids and Bases	**Content Area:** Chemistry	**Grade Level:** 9-12

Unit Summary: Students will learn various definitions of acids and bases. Not only will each varying definition call on previous knowledge of chemistry to review for the final, but it is also an excellent unit for students to apply chemistry to daily life. In addition to the mathematical components of this unit, a heavy focus of this unit is on how we use acids and bases each day with a culminating discussion on acid rain and its implications. Topics covered in this unit are acid and base identification, pH scale, pH calculations, titration calculations, neutralization reactions (predicting products) and buffer solutions.

Cross Cutting Concepts:

2. Cause and effect: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Science and Engineering Practice:

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

Unit Essential Questions:	**Unit Enduring Understandings:**
• What acids and bases are present in our homes, schools and jobs? • How is the strength of an acid or base measured, and how does that change its applications/uses? • How is an acid or base neutralized?	• Acids and bases are all around us. They are found in our foods, cleaning supplies, medicines, batteries and many other products. • Acid and base strength can be measured by the pH scale; a substance with a pH close to 14 is a base, a substance with a pH close to 1 is an acid, and substances with a pH of 7 are neutral. • When an acid and base combine it is called a neutralization reaction - water is produced and the resulting solution has a pH closer to 7 than either of the reactants.

Possible Student Misconceptions: Students often have the notion that acids are something that 'eats away' other substances. Not only is this definition incorrect, but it also leads students to think that bases are not as dangerous or do not deserve as much caution as acids. Be sure to clarify this misconception before letting students do any acid base activities or labs. Additionally, students often get bases and acids, their ions and pH calculations backwards. Study charts or graphic organizers may help students to organize this information. Another misconception is that students often assume that acids and bases are all liquids. Try to provide solid or gas examples throughout the unit to debunk this myth.

NJCCCS: 5.2.12.A.6 Acids and bases are important in numerous chemical processes that occur around us, from industrial to biological processes, from the laboratory to the environment. 5.2.12.B.2 A large number of important reactions involve the transfer of either electrons or hydrogen ions between reacting ions, molecules, or atoms. In other chemical reactions, atoms interact with one another by sharing electrons to create a bond.

NGSS Performance Expectations: *Students who demonstrate understanding can…*

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties

HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

ETS1.C: Optimizing the Design Solution Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6)

Primary CCSS ELA/Literacy Connections:	**Primary CCSS Mathematics Connections:**
WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS2-6) RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1)	MP.4 Model with mathematics. (HS-PS1-8) HSN-Q.A.1Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-3),(HS-PS1-8),(HS-PS2-6) HSN-Q.A.3Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-3),(HS-PS1-8),(HS-PS2-6)

Lesson Pace & Sequence

Lesson Title/Number: Lesson 1 Acid Base Identification and Neutralization Reactions	**Learning Objective(s):** SWBAT identify acids and bases by formula, pH and properties SWBAT identify a neutralization reaction and	**Lesson Duration:** 40 minutes

		predict the products			
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Have students each make their own two lists of household substances. The two lists should be labeled as possible acids and possible bases. At the end of the unit students can review this lists and see how many they got correct or incorrect.	• Holt TE Pg. 530			
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Introduction to topic by the teacher: Present the class with two household substances (an acid and a base). Have them engage in a debate of which one is the acid and which one is the base. Have them provide rationale for WHY. This will lead into definitions and properties of both.		Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)	
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Direct Instruction: The teacher must present a lesson on acids and bases, their definitions and their properties. Let students fill in a graphic organizer of some sort for properties of acids and bases, pH values and examples/uses. After this information is presented have students do a gallery walk of household chemicals. At each chemical they can test it using an indicator to determine if it is an acid or base. DIFFERENTIATION TIP: There	• Gallery walk activity example: Holt Chemistry TE Pg. 535 - this can also be done with pH testing strips for less mess and faster results. Other indicators can be used as well if desired. Holt Chemistry TE Pg. 535 has a note that is the only introduction of Lewis acids/bases. Again, it is up to the teacher which acid/base definitions are taught to which levels of	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)ETS1.C: Optimizing the Design Solution Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of	Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),

	are three different definitions of acids and bases. Depending on the level of your students you may choose not to present all three - or to teach them but only test a certain one. It also depends on pacing and the depth of understanding you'd like to achieve on this unit. The Holt textbook only discusses Arrhenius acid/bases and Bronsted-Lowery acid bases. It only briefly mentions Lewis acids/bases in a note in the TE. NOTE: the next lesson is on the pH scale and calculations so for the first lesson just introduce it as a scale with values that differentiate an acid from a base. This unit can be rearranged to better suit the needs of the teacher/classroom if this order does not work well. ALTERNATE ACTIVITY: This can also be done through an online simulation listed to the right if the gallery walk is not an option.	students. • Acid-Base Simulation: http://phet.colorado.edu/en/simulation/acid-base-solutions		certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6)	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	The class can be given notecards that say acids on one side and base on the other. As the teacher calls out a household item, a pH value or a property, students can hold up the card for acid or base. This gives students practice and an excellent way for the teacher to do a whole class check for understanding.	• Video introducing acids, bases and salts. May be better used after neutralization is taught, but it is linked here and below: http://vitalnj.pbslearningmedia.org/resource/0b087bdd-72ff-46a1-83c7-41e50895715d/chemistry-1101-introduction-to-acids-bases-and-salts/ • Online Acid-Base Tutorial http://www.shodor.org/unchem/basic/ab/ • Acid-Base Tutorial http://www.visionlearning.com/en/library/Chemistry/1/			

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Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Direct Instruction continued: The teacher must introduce Neutralization reactions - the result of an acid being combined with a base. After showing students a few examples, have them do practice problems predicting the products of the reaction. While students complete practice problems independently, the teacher can work one on one with students who repeatedly held up the wrong cards. Perhaps they did not complete their chart/organizer correctly at the beginning of class or have some misconceptions that need clearing up.			PS1.B: Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2) Energy and Matter The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Administer an exit ticket, quiz or other assessment	• Pg. 538 Holt Chemistry Section 1 Review • This website has plenty of acid/base practice problems and answers https://njctl.org/courses/science/chemistry/acids-and-bases/acids-bases-practice-problems/#			
Extend: How will students deepen their conceptual understanding through use in new context?	Have students read the article linked to the right about acids in the digestive system.	• Digestion Chemistry: http://www.sciencelearn.org.nz/Contexts/Digestion-Chemistry/NZ-Research/Digestion-Chemistry			
Lesson Title/Number: Lesson 2 The pH Scale		**Learning Objective(s):** SWBAT relate the pH scale to concentrations of acids and bases through mathematical calculations			**Lesson Duration:** 40 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core***

Elements do not have to be in conducted in sequence.	***objective(s)?***	***activities?***	***of the learning objective(s)?***		***ideas?***
Elicit: How will you access students' prior knowledge?	Students can complete warm up problems on scientific notation and log functions as both are needed for this lesson.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher-lead discussion: Present students with an example of a strong acid and the damage it can cause to the human body. Then present them with a weak acid that is safe to the touch and used every day. What do students assume is the difference between them?			PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)	Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Direct Instruction: The teacher will introduce the pH scale again, but this time also include the formulas for calculating pH. This lesson can also include Kw if desired. Students should then calculate pH of the household substances they tested yesterday with indicators. They should see if their pH calculations match the tests they did the day before. If not, they know that they should check their math.	• Video introducing the pH scale and indicators: http://vitalnj.pbslearningmedia.org/resource/4159f58f-ba7d-45e8-95e8-c0f477f88e56/chemistry-1102-indicators-and-the-ph-scale/	Using Mathematics and Computational Thinking Use mathematical representations of phenomena to support claims. (HS-PS1-7)	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)	Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will complete practice problems. A climb the ladder activity (explained in units 3 and 7) can be used to differentiate this lesson. Some students may struggle with scientific notation or logarithmic functions or even how to rearrange the given equations. This activity could split them into their appropriate levels for remediation.	• Acid and Base Problems Virtual Lab with checkable answers http://chemcollective.org/activities/info/98	Using Mathematics and Computational Thinking Use mathematical representations of phenomena to support claims. (HS-PS1-7)	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)	
Elaborate: How will students apply their learning and develop a more sophisticated	Students can now be show the equation for pOH and given sample problems for this topic. It		Using Mathematics and Computational Thinking Use mathematical representations of	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic	

understanding of the concept/topic?	will re-enforce skills taught with pH but avoids confusion that would have occurred if they were taught at the same time.		phenomena to support claims. (HS-PS1-7)	scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. secondary to HS-PS1-1),(secondary to HS-PS1-3),(HS-PS2-6)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Administer an exit ticket, quiz or other assessment	• Pg. 547 Holt Chemistry Section 2 Review • This website has plenty of acid/base practice problems and answers https://njctl.org/courses/science/chemistry/acids-and-bases/acids-bases-practice-problems/#			
Extend: How will students deepen their conceptual understanding through use in new context?	Real-life connection to heartburn.	• Introduced on Pg. 545 of Holt TE • An additional article for students to read: http://www.naturalnews.com/023526_esophagus_heartburn_pH_levels.html			
Lesson Title/Number: Titrations and Lab		**Learning Objective(s):** SWBAT complete an acid/base titration experiment to find equivalence point SWBAT calculate the concentration of a given acid or base using the equivalence point and titration data			**Lesson Duration:** 80 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Review lab safety, specifically acid and base safety				

Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Propose a scenario where the students are working in a lab and find a container containing an acid. However, the label does not contain the concentration. How will the students determine if it is dangerous/how to properly handle it? Can they determine the concentration and therefore the pH?	• Animation of Titration reaction between acid and base with accompanying curve: http://www.chembio.uoguelph.ca/educmat/chm19104/chemtoons/chemtoons9.htm • ALTERNATE OPTION: Skills Toolkit provides step by step instruction with pictures on how to complete a titration. Pg. 552 of Holt TE		PS 1.A Structure and Matter The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Experiment - Drop by drop concentration. This will be best done in small groups - perhaps of two - so all students get an opportunity to use the burette. However the reality of our equipment resources means that most students will do this experiment in larger groups of 4-5.	• Holt Chemistry Pg. 804 • If materials are not available, here is an online titration simulation where students can choose the acid, base and indicator while collecting data to graph: http://www.vias.org/simulations/simusoft_titration.html • Here is a second resource for online virtual titrations: http://chemcollective.org/activities/info/101	Using Mathematics and Computational Thinking Use mathematical representations of phenomena to support claims. (HS-PS1-7)		
Explain: How will you help students connect their exploration to the concept/topic under investigation?	After completing the experiment, students will complete calculations to determine the concentration of the acid being titrated. They can then connect this to the rest of the unit by calculating pH and discussing if it was a weak or strong acid.	• Pg. 556 Holt Chemistry has sample titration problems that could be solved with the whole class before students complete analysis titration questions.	Using Mathematics and Computational Thinking Use mathematical representations of phenomena to support claims. (HS-PS1-7)	PS 1.A Structure and Matter The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students can be asked analysis questions such as if the concentration was double or tripled, how would the equivalence point change? If the acid was changed to a weaker or stronger acid, how would the equivalence pt change. Students can also perform a second or alternate experiment where they titrate an egg shell. See reference right.	• Holt Chemistry Pg. 808 offers a more in depth titration experiment where students titrate an egg shell. This can be done with more advanced students or as a part two of titration experiments.	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)	PS 1.A Structure and Matter The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6) Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students should complete a lab report for this experiment. By this point in the year they should be able to do the lab report with little lab report guidance and perhaps only a rubric or checklist for grading.		Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)Using Mathematics and Computational Thinking Use mathematical representations of phenomena to support claims.		

			(HS-PS1-7)		
Extend: How will students deepen their conceptual understanding through use in new context?	As part of the lab report students should come up with other titration experiments. If an egg shell can be titrated, what other household substances can be tested in the same way?		Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)	PS 1.A Structure and Matter The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	
Lesson Title/Number: Lesson 4 Buffer Solutions		**Learning Objective(s):** SWBAT identify conjugate acid/base pairs SWBAT define a buffer and explains its properties and applications			**Lesson Duration:** 40 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Have students guess the pH of blood and then hypothesis what happens if this pH were to change.		Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)		Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Direct instruction: The teacher will define buffers and provide examples/applications. Introduce blood as a sample buffer solution. Discuss its pH range and side effects of acid or alkaline blood. Also, you can perform a buffer DEMONSTRATION	• Information on blood pH Holt Chemistry TE Pg. 561-562 • DEMONSTRATION Pg. 561 Holt Chemistry TE			Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students must practice identifying conjugate acid/base pairs. After students are familiar with weak acids and their conjugate bases, play a class wide game of memory. Each student gets an index card with weak acid or conjugate acid or base. They place this face down on their desk. Students take turns one at a time crossing the room and flipping over a card of a classmate. They read it aloud to the class and decide if the two cards would make a buffer solution. If so, those two students earn a point. If not they flip their cards and return to their seats. This can be done in smaller groups so students get more practice.				Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Direct Instruction Con't: The teacher must explain what happens to a buffer solution when an acid or base is added. Now that students have identified the parts of a buffer solution, they must understand how buffer solutions work. Take a sample pair of cards from the game and ask students what would happen in an acid was added? What would happen if a base was added? Have students pair up and write the neutralization reactions that would occur with a pair of cards from the game.	• How buffers work: http://chemcollective.org/activities/tutorials/buffers/buffers3 • pH and Buffers defined: http://chemcollective.org/activities/tutorials/buffers/buffers1	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)	PS 1.A Structure and Matter The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)	Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2) Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Give students time to research a buffer solution in their house in small groups - they can use class computers or even their phones if they pair up with students who have them. Have each group share their buffer solution with		Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and		Patterns. Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),

	the class. For higher rigor ask them to determine the weak acid and conjugate base through their research as well.		mathematically). (HS-PS2-6)		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Administer an exit ticket, quiz or other assessment	• Pg.563 Holt Chemistry Section 3 Review • This website has plenty of acid/base practice problems and answers: https://njctl.org/courses/science/chemistry/acids-and-bases/acids-bases-practice-problems/#			
Extend: How will students deepen their conceptual understanding through use in new context?	Article on Antacids	• Pg. 564 of Holt Chemistry			
Lesson Title/Number: Lesson 5 TEST		**Learning Objective(s):** TEST			**Lesson Duration:** 40 minutes