Unit Topic: Acids/Bases
Big Idea(s): What distinguishes the pH of an acid/base in terms of hydronium ions and/or hydroxide ions?

Learning Objective: SWBAT distinguish an acid and a base in terms of the concentration of hydronium ions versus the concentration of hydroxide ions. SWBAT to use this information to calculate the pH of a solution.
Focus questions: What distinguishes the pH of an acid/base in terms of hydronium ions and/or hydroxide ions?

Materials

1. POGIL-inspired activity
2. Laminated group role cards
3. Talk moves worksheet/reflection sheet
4. Plickers

Standard(s)

NYS Standards:
identify solutions as acid, base, or neutral based upon the pH
3.1 ss

CCSS.ELA-LITERACY.RST.9-10.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9-10 texts and topics*.
CCSS.ELA-LITERACY.RST.9-10.5
Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

NGSS

- 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)

Skill(s)/Strategies

Group work, inquiry, POGIL

<table>
<tr><td><u>Key Vocabulary:</u>

Acid, Base, hydronium, hydroxide, pH</td><td rowspan="2"><u>One on One Conferencing:</u>
<u>Class:</u>
● What distinguishes the pH of an acid/base in terms of hydronium ions and/or hydroxide ions?
● What does a low number represent?
● What does a high number represent?
● How do indicators work to distinguish between acids and bases of different pH's?</td></tr>
<tr><td><u>Rationale for Student Grouping/Differentiation/Scaffolding</u>

<u>Evidence:</u> Heterogeneous groups based on marking period grades (See attached)

Students have two types of seats in chemistry class :
1. "A" seats are heterogeneous seats
2. "B" seats are homogeneous seats

For this lesson they will be sitting in "A" groups.</td></tr>
<tr><td><u>Assessing questions</u>
● What is the scale of 0-14 represent?
● What demarcations represent an acid or a base?</td><td><u>Advancing questions</u> (Questions to advance student learning):

● What distinguishes the pH of an acid/base in terms of hydronium ions and/or hydroxide ions?
● What does a low number represent?
● What does a high number represent?
● By what factor does hydronium and hydroxide change as you change one pH unit? How does this relate to the concentration of each of these ions?</td></tr>
<tr><td colspan="2"><u>Set Up of Lesson / Mini Lesson:</u>

Before lesson: Students will complete an Edpuzzle on pH before the lesson. This edpuzzle previews these concepts with embedded questions.

Do Now: Students will complete the questions 1-8 of the activity with their group to familiarize themselves with the topic. Students will be using group role cards. The "reader" will start by reading the introduction to the activity .

*If students have the time they can push themselves to delve into completing #9</td></tr>
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Group Work Task

Students will work together to complete a POGIL- type activity. The activity starts with lower level Bloom's taxonomy questions to get students to become familiar the relationship between hydronium ion concentration and pH.

The activity then will get the students to engage in group work surrounding higher-order Bloom's taxonomy questions that will get the students to ***discover in their groups*** both the mathematical and conceptual relationship between pH and hydronium ion concentration. There is very little direct instruction in this lesson. Students instead will work together to construct their knowledge with feedback from the teacher.

Promoting group discussion:

1. **Group role cards**- promote students to take on different roles within their group to promote group unity and discussion and sharing of ideas. This is followed up by ***cold-calling*** by the teacher using popsicle sticks. Students are made aware that they can be called on at any time to share ideas from the group which incentivises them to work hard within their group to understand concepts from the lesson. Teacher will also instruct students to work to come to a consensus on their answers and even "practice their answers" with an elbow partner. This makes students feel more confident about the content and prepares them should they be called on during a group share- out.
2. **Talk moves worksheet followed up by peer discussion rubric-** students will be instructed to monitor a group member to **observe and record at least two talk moves** that their classmate made during group discussion.They are also instructed to briefly explain how their classmate used this talk more. On the back of this sheet students will be instructed to give a score to their classmate via the group discussion rubric.

Differentiation:

1. **Hints sheet**- For today's lesson the ***weaker student*** in the group will be assigned to the group role of "manager." In this role the student will be given a "Hints" sheet from the teacher. This sheet will have some helpful hints that will not be found on the activity that all students receive. The managers will be instructed that they only need to use this sheet if they feel they need a hint. Also, only the manager is allowed to look at the sheet. If her/his group members need help, the manager will have to look at the hints sheet and explain in his her own words. This pushes the weaker student in the group to become a leader in his/her group and pushes him/her to push their boundaries in terms of understanding content.
2. **Differentiation of task and self-assessment:** Part way through the lesson students will be asked to assess their knowledge of the content thus far. From that assessment, students will be directed to complete one of three sections that are differentiated based on self-assessed skill level. Then they will have a choice to complete one of two other sections based on their interest.

Wrap-up:

Students will a few plicker questions to demonstrate their understanding of today's lesson.

Addressing Misconceptions:

Students often have a hard time understanding the idea that as pH decreases the concentration of hydronium actually increases. They tend to associate the idea in their head of high pH as being more acidic. This lesson works hard at addressing that misconception because students get both a conceptual and mathematical understanding of the fact that this is actual an inverse relationship.

Homework
Students will review the concepts learned with an edpuzzle video assignment and answer questions embedded in the video **(3/26) This is a different edpuzzle than the one assigned for homework the previous night.**
Students will complete lesson in its entirety and finish it for homework on 3/28 and it will be collected.