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UNIVERSITY OF CENTRAL FLORIDA

UCF RET Site: Collaborative Multidisciplinary Engineering Design Experiences for Teachers

2003350: Chemistry Honors

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2003350: CHEMISTRY HONORS

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RET Site: CoMET Lesson/Unit Plan

Course(s): Chemistry Honors
Grade Level: 10-12
Suggested Length of Lesson: 3-4 days (45/day)

Materials/Technology Needed

- **PH sensor**
- **TI Graphing Calculator**
- **Data Mate Program**
- **Cola Soft Drink**
- **.50 M NaOH**
- **Deionized H_2O**
- **50ml Buret**
- **100ml GC**
- **250ml Beaker**

Where this Fits

- **This lesson falls after Reaction Rates and Equilibrium in which students have mastered demonstration of explaining various factors such as concentration, temperature gradient and catalyst functions within a reaction. This lesson builds upon that knowledge with the introduction of titration.**

Lesson Objective(s)/Learning Goal(s)

- **Students will be able to determine the amount of phosphoric acid, H_3PO_4, in a variety of soft drinks by titrating each sample with sodium hydroxide, NaOH.**

Standard(s)/Benchmark(s) Addressed

- *Standards:*
  - **SC.912.P.88 Characterize types of reactions, for example, redox, acid-base, synthesis, single-double replacement.**
  - **SC.912.P.12.13 – Relate acidity and basicity to hydronium and hydroxyl ion concentration and PH.**
  - **SC.912.P.12.13 – Explain the concepts of dynamic equilibrium in terms of reversible processes occurring at the same rate.**
  - **HS-PS1-5 - Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.**
  - **HS-PS1-5 - Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.**

Standards for Mathematical Practice

- **MACC.912.S.IC.2.6 – Evaluate reports based on data.**
- **MAFS.912.A.SSE.1.1 – Interpret expressions that represent a quantity in terms of its context.**
- **HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.**

Instructional Strategies

- **Guided Inquiry**
- **Cooperative Learning**
- **Experimental Reasoning**
- **Theoretical Reasoning**
- **Independent Inquiry**

Evidence of Learning (Assessment Plan)

▪ **Students will deliver results via Lab Report, Pretest, Post Discussion and Real-time procedural evaluation.**	

Description of Lesson Activity/Experiences

1. **Day 1: Pre-Lan (Preparation) – using provided material, students will be required to research Phosphoric Acid and its PH level in solution, be able to identify the type of reaction taking place and the proper use and function of a PH sensor. Develop a hypothesis based off of various types of acidic properties in soft drinks.**
2. **Day 2: Students will be given a purpose and an independent inquiry-based questionnaire that correlates with the lab procedures. After performing the procedures (collaborative effort) students will develop an independent lab report and complete the data charts and graphs presented in the attached worksheet. In lieu of the titration portion, students will be given a short tutorial on the Data Mate program.**
3. **Day 3: Lab calculations will be finalized and hypothesis statements verified and re-stated. I will continue to monitor for progress and success while re-directing as needed. This lab, although guided, will also continue to be a reflection of prior knowledge and a preview into the next lesson - oxidation. At this time, the students will be invited to open discussion and results and hypothesis analysis.**

Recommended Assessment(s) and Steps

- **Students will work in groups of ¾ for maximum efficiency and use of time.**
- **A pre-lab assessment will be given prior to day 1 of lab in order to check on background and forward knowledge.**
- **A lab report will be required; this report will allow students to journal their thought processes, develop and outline and compute calculations while experimenting. Students will also self-assess and correct any misconception.**
- **A post assessment will follow after completion and discussion of the lab practical**

List of Materials/Resources Used

- **Pearson Chemistry Book/etext**
- **HP Lap Top**
- **Composition Note Book**
- **PH Sensor/Data Mate program**
- **TI Graphing Calculator**
- **Lab Pre/Post Assessment**

Important Vocabulary

Term	Definition
Titration	process where the volume of two substances are carefully measured to determine the concentration of another.
Bronsted Lowry Model	Acids donate hydrogen ions; bases accept hydrogen ions.
Acid	has a PH of less than 7 on a PH scale.

Base	has a PH of more than 7 on a PH scale.
PH	Measuring how acidic or basic a solution is.
Titration Curve	Contains the volume of the titrant as the independent and the PH of the solution as the dependent.
Hydroxide ion	OH-, the conjugate base ion that is made during self-ionization of H_2o.
Conjugate Acid	The compound that is produced when a substance accepts a hydrogen from an acid.
Conjugate Base	The compound that is produced when a substance donates a hydrogen ion to a base.

Troubleshooting Tips

All troubleshooting will be performed by the instructor, through checking and verifying all parts of the PH sensor for damage, wetness and or calibration.

Other Helpful Information

The point at which all the titrand has reacted, the end point, is reached. How do you know when the end point is reached? Usually a color change in the titrand's solution. This is caused by an indicator, which is included in the titrand's solution for this purpose. The unknown amount of titrand in solution can usually be determined by setting up a proportion with the known amount of titrating solution added. How this is done depends solely on the exact titration reaction being used.

Attachments

- PowerPoints for lecture
- Handouts (Worksheets, Daily activities).

References

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