Topic: Titration and Molarity

http://gaia.fc.peachnet.edu/tutor/Molarity.html

Grade 9-Adult

An integrated lesson plan covering one session of approximately 1.5 - 2 hours.

Lesson-Planning Approach

Some learners perceive their "world" as a whole, where all things are interconnected and dependent upon each other. These "integrated" students face major challenges in coping with our dominant educational, social, and economic systems, which tend to present information in a linear fashion without the necessity of integration into meaningful context. Integrated students are at-risk of failing as they attempt to grasp information in ways that do not match their experience. Among large populations of at-risk students are many from Native American and similar cultures who do not regard their world as a sum of parts but as a blend of all that they experience.

This lesson plan does include some traditional, linear approaches to delivering information (checklists, rules, analysis, problem solving and organization). In addition to the traditional, linear delivery of information, this lesson plan also includes some of the following strategies, designed to appeal to at-risk students as they learn academic/life skills:

- Integration of technology
- Story telling/anecdotal information
- Non-competitive group and team work
- Performance-based assessment and rubrics
- Visual presentations and practice through technology and other means
- Project-based assignments that integrate family and community
- Activities appealing to multiple intelligences (Gardner)
- Application of Scientific Method to formulate and solve a problem.

Lesson Overview

This lesson is designed to familiarize students with the concept of molarity and how this relates to the concentration of a solution. Animations and resources are available on the internet. Students will determine the molarity of an unknown concentration of HCL using an indicator and an NaOH tirtation. From their results, they will write a summary using real time writing, apply relevant vocabulary, and answer questions about the project using correct punctuation, sentence structure, and experimental method.

Lesson Objectives

Project Objectives: When students complete this session, they will be able to…

- Define mole and titration.
- Explain how to create a known concentration of a solution
- Describe how a specific molar solution is created with solids and liquids.
- Design and carry out an experiment to test a hypothesis about molarity.

Integration of Other Functional/Academic Skills: (Critical thinking is required throughout the lesson.) Students will be able to…

Math:	Quantify the amount of solute in a solution.
Reading:	Apply technical vocabulary; find main points and meaning in written passages.
Writing:	Using real time writing, document, describe and organize the information
Listening:	Follow oral instructions and demonstrations.
Science	*Apply* scientific method and correctly format an experiment
Technology:	Apply basic features of Microsoft Word and search sites on the Internet. Safely mix and use chemicals.

State/National Standards (Complete as Appropriate)

http://www.cde.state.co.us/cdeassess/sci.htm#standards 1,2,5,6

Websites

Required:

http://gaia.fc.peachnet.edu/tutor/Molarity.html

Support:
http://antoine.frostburg.edu/chem/senese/101/index.shtml: General Chemistry Online
http://www.thinkquest.org/ Think Quest

Pre-requisites: Read at sixth grade level or above.

Required Materials

- 250 mls of a .1 molar solution of Sodium Hydroxide and .08 M solution of Hydrochloric Acid
- Phenolphthalein indicator
- 12 well plate or 8 small cups
- Disposable pipettes
- Distilled Water

Handouts (Icluded at the end of this document)

- Mole Explanation (Mole Explanation) (http://gaia.fc.peachnet.edu/tutor/Molarity.html)
- Lesson Checklist (Handout 2)
- Experimental Design (Handout 3)
- Lesson Rubric (Handout 4)

Required Equipment/Technology

- 1 computer, with Internet connection and a MS Word for every group of 2-3 students

THE LESSON

Note: Students do not learn from what you do but from what you have them do.

PART I

Preparation (Power Point Presentation)

Activity	Instructor Notes
Review the materials	**Make sure you understand the concept of a mole**
Mix the chemical solutions	**Mix, or buy 250 mls of a .08 molar solution of Hydrochloric Acid, .1 M Sodium Hydroxide, and Phenolphthalein Indicator. You can these materials from any supply house already mixed, or the school science dept can mix them for you. If you haven't handled chemicals before, have them mix the chemicals. These are nasty in the pure state.**
Examine handouts.	**This is a simple acid/base reaction to create a salt and water. If you don't understand the chemistry, brush up at:** http://gaia.fc.peachnet.edu/tutor/index4.htm

Presentation

Explain the concept of a Mole and demonstrate the safe use of the Chemicals	**Ask students to describe a mole (most will be familiar with the furry blind rodent) Introduce the concept of a mole in Chemistry**

Performance and Practice

Instructions for students	**Teacher notes**
Go to http://gaia.fc.peachnet.edu/tutor/Molarity.html or see handout 1	**Mole is a tough concept. It helps to have students go through the website and do a couple of problems before doing the experiment. Try a couple more after the experiment**
In small groups or as a class, go through the powerpoint presentation (handout 2) and set up the experiment	**Let the students set up the experiment from the directions. Try to resist fixing things. They can always repeat the experiment. Science is about paying attention.**
Using real time writing, record the results, and discuss with the rest of the class	**Emphasize accuracy. I have students practice making the drop size the same. If all goes well, it should take 8 drops of NaOH to titrate a .08M solution of acid solution of the same dilution.**
Calculate how many Moles of Acid and Base should be in each	**If possible, calculate the weights directly from the periodic table**

solution	
Demonstrate understanding by designing another experiment using the same three chemicals	**This is tough for some, and you may only have time to do this orally, or you can pick the best idea and try it.**

Lesson Assessment Strategy (Formative – As the lesson progresses)

Preparation, Presentation and Overall Implementation (Instructor)

1. Are the instructions and expectations for the class clear from the beginning?
2. Am I spending sufficient time on modeling the skills I want students to acquire?
3. Is there enough variety in the lesson to appeal to most learning preferences?
4. How many learning intelligences am I addressing?
5. Are students "connecting" to lesson objectives? How?
6. How is this lesson "integrated?"

Performance and Practice (Student)

1. Do all students have the skills to follow instructions? If not, what measures am I taking to address the challenge?
2. Are all students participating in the activities either by active observation or by voicing their thoughts?
3. Am I identifying the strengths of each student and pairing/grouping people accordingly? What results am I getting?
4. How are students performing? Are all of them able meeting 80% of the lesson objectives? If not, what am I doing to help them achieve more?

Technology

1. Is the technology working?
2. How are students reacting to the technology, and what do I need to remember when I teach this lesson again?
3. How are students applying or wanting to apply their technical skills in other areas?

Activity Checklist (Handout 2)

Discuss the topic.	
Handle and examine the materials.	
Examine and discuss handouts.	
Observe how to find URL's and navigate the relevant sites.	
Go through the powerpoint presentaion	
Orally describe the experiment	
Discussing the main points, especially what you are hoping to discover	
Respond in writing to the results	
Summarize your understanding of molarity in your own words.	
In a group, brainstorm other possible experiments.	
Try a few more sample problems and calculate the molarity of other solutions	

Molarity

As is clear from its name, molarity involves moles. Boy, does it!
The molarity of a solution is calculated by taking the moles of solute and dividing by the liters of solution.

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

This is probably easiest to explain with examples.

Suppose we had 1.00 mole of sucrose (it's about 342.3 grams) and proceeded to mix it into some water. It would dissolve and make sugar water. We keep adding water, dissolving and stirring until all the solid was gone. We then made sure that when everything was well-mixed, there was exactly 1.00 liter of solution.
What would be the molarity of this solution?

$$\text{Molarity} = \frac{1.00\ \text{mol}}{1.00\ \text{L}}$$

The answer is 1.00 mol/L. Notice that both the units of mol and L remain. Neither cancels.
A replacement for mol/L is often used. It is a capital M. So if you write 1.00 M for the answer, then that is correct.
Some textbooks make the M using italics and some put in a dash, like this: 1.00-*M*. When you handwrite it; a good, old block capital M is just fine.
When you say it out loud, say this: "one point oh oh molar." You don't have to say the dash.
And never forget this: replace the M with mol/L when you do calculations. The M is just shorthand for mol/L.

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Name:
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Date: Wed. Dec 12, 2001
Course: Science

Acid/Base Reactions

Explore properties of Acids and Bases

Expectations:

Criteria:	**Level 4** (80% - 100%)	**Level 3** (70% - 79%)	**Level 2** (60% - 69%)	**Level 1** (50% - 59%)
Knowledge				
describe some of the physical and chemical properties of hydrocarbons	research and describe some of the physical and chemical properties of acid/bases with complete information	research and describe some of the physical and chemical properties of acid/bases with good information	research and describe some of the physical and chemical properties of acid/bases with some information	research and describe some of the physical and chemical properties of acid/bases with limited information
Experimenting				
use a titration procedure to determine the concentration of an acid or base	uses a titration procedure to determine the concentration of an acid or base with excellent effectiveness	uses a titration procedure to determine the concentration of an acid or base with considerable effectiveness	uses a titration procedure to determine the concentration of an acid or base with some effectiveness	uses a titration procedure to determine the concentration of an acid or base with limited effectiveness
experiment to find the effect of dilution on the pH of an acid or a base	experiments to find the effect of dilution on the pH of an acid or a base with excellent success	experiments to find the effect of dilution on the pH of an acid or a base with considerable success	experiments to find the effect of dilution on the pH of an acid or a base with some success	experiments to find the effect of dilution on the pH of an acid or a base with limited success
Communication				
explain the difference between strong and weak acids and bases	explains the difference between strong and weak acids and bases with accurate reference to degree of dissociation	explains the difference between strong and weak acids and bases with considerable reference to degree of dissociation	explains the difference between strong and weak acids and bases with some reference to degree of dissociation	explains the difference between strong and weak acids and bases with limited reference to degree of dissociation
write balanced chemical equations for reactions involving acids and bases	writes balanced chemical equations for reactions involving acids and based with excellent accuracy	writes balanced chemical equations for reactions involving acids and based with considerable accuracy	writes balanced chemical equations for reactions involving acids and based with some accuracy	writes balanced chemical equations for reactions involving acids and based with limited accuracy