



## 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 titration. 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...

<i>Math:</i>	Quantify the amount of solute in a solution.
<i>Reading:</i>	Apply technical vocabulary; find main points and meaning in written passages.
<i>Writing:</i>	Using real time writing, document, describe and organize the information
<i>Listening:</i>	Follow oral instructions and demonstrations.
<i>Science</i>	Apply scientific method and correctly format an experiment
<i>Technology:</i>	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

- ❖ 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

Activity	Instructor Notes
Review the materials	<b>Make sure you understand the concept of a mole</b>
Mix the chemical solutions	<b>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.</b>
Examine handouts.	<b>This is a simple acid/base reaction to create a salt and water. If you don't understand the chemistry, brush up at: <a href="http://gaia.fc.peachnet.edu/tutor/index4.htm">http://gaia.fc.peachnet.edu/tutor/index4.htm</a></b>

## Presentation

Explain the concept of a Mole and demonstrate the safe use of the Chemicals	<b>Ask students to describe a mole (most will be familiar with the furry blind rodent) Introduce the concept of a mole in Chemistry</b>
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## Performance and Practice

Instructions for students	Teacher notes
Go to <a href="http://gaia.fc.peachnet.edu/tutor/Molarity.html">http://gaia.fc.peachnet.edu/tutor/Molarity.html</a> or see <a href="#">handout 1</a>	<b>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</b>
In small groups or as a class, go through the powerpoint presentation ( <a href="#">handout 2</a> ) and set up the experiment	<b>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.</b>
Using real time writing, record the results, and discuss with the rest of the class	<b>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.</b>
Calculate how many Moles of Acid and Base should be in each	<b>If possible, calculate the weights directly from the periodic table</b>

solution	
Demonstrate understanding by designing another experiment using the same three chemicals	<b>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.</b>

## 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	



