Richmond Public Schools

Department of Curriculum and Instruction
Curriculum Pacing and Resource Guide – Unit Plan

Course Title/ Course #: EOC Chemistry/2802 or EOC Pre AP Chemistry/ 2804

Unit Title/ Marking Period # (MP):1

Start day: Day 3

Meetings (Length of Unit): 2 Weeks

Desired Results ~ What will students be learning?

Standards of Learning/ Standards

CH.1a - CH.1j, CH. 4 a

CH.1: The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include
a) designated laboratory techniques;
b) safe use of chemicals and equipment;
c) proper response to emergency situations;
d) manipulation of multiple variables, using repeated trials;
e) accurate recording, organization, and analysis of data through repeated trials;
f) mathematical and procedural error analysis;
g) mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;
h) use of appropriate technology including computers, graphing calculators, and probeware, for gathering data, communicating results, and using simulations to model concepts;
i) construction and defense of a scientific viewpoint; and
j) the use of current applications to reinforce chemistry concepts.

CH.4a: The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include
a) Avogadro's principle and molar volume;

Essential Understandings/ Big Ideas

CH. 1

The concepts developed in this standard include the following:

 The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts

a) the natural world is understandable;
b) science is based on evidence - both observational and experimental;
c) science is a blend of logic and innovation;
d) scientific ideas are durable yet subject to change as new data are collected;
e) science is a complex social endeavor; and
f) scientists try to remain objective and engage in peer review to help avoid bias.

 Techniques for experimentation involve the identification and the proper use of chemicals, the description of equipment, and the recommended statewide framework for high school laboratory safety.

 Measurements are useful in gathering data about chemicals and how they behave.

 Repeated trials during experimentation ensure verifiable data.

Data tables are used to record and organize measurements.

 Mathematical procedures are used to validate data, including percent error to evaluate accuracy.

 Measurements of quantity include length, volume, mass, temperature, time, and pressure to the correct number of significant digits. Measurements must be expressed in International System of Units (SI) units.

 Scientific notation is used to write very small and very large numbers.

 Algebraic equations represent relationships between dependent and independent variables.

 Graphs are used to summarize the relationship between the independent and dependent variable.

 Graphed data give a picture of a relationship.

 Ratios and proportions are used in calculations.

 Significant digits of a measurement are the number of known digits together with one estimated digit.

 The last digit of any valid measurement must be estimated and is therefore uncertain.

 Dimensional analysis is a way of translating a measurement from one unit to another unit.

 Graphing calculators can be used to manage the mathematics of chemistry.

 Scientific questions drive new technologies that allow discovery of additional data and generate better questions. New tools and instruments provide an increased understanding of matter at the atomic, nano, and molecular scale.

 Constant reevaluation in the light of new data is essential to keeping scientific knowledge current. In this fashion, all forms of scientific knowledge remain flexible and may be revised as new data and new ways of looking at existing data become available.

CH.4a

 Atoms and molecules are too small to count by usual means. A mole is a way of counting any type of particle (atoms, molecules, and formula units).

 Avogadro's number = 6.02 × 1023 particles per mole.

 Molar mass of a substance is its average atomic mass in grams from the Periodic Table.

 Molar volume = 22.4 L/mole for any gas at standard temperature and pressure (STP).

Key Essential Skills and Knowledge

In order to meet this standard, it is expected that students will
 make connections between components of the nature of science and their investigations and the greater body of scientific knowledge and research.
 demonstrate safe laboratory practices, procedures, and techniques.
 demonstrate the following basic lab techniques: filtering, using chromatography, and lighting a gas burner.
 understand Material Safety Data Sheet (MSDS) warnings, including handling chemicals, lethal dose (LD), hazards, disposal, and chemical spill cleanup.
 identify the following basic lab equipment: beaker, Erlenmeyer flask, graduated cylinder, test tube, test tube rack, test tube holder, ring stand, wire gauze, clay triangle, crucible with lid, evaporating dish, watch glass, wash bottle, and dropping pipette.
 make the following measurements, using the specified equipment:
- volume: graduated cylinder, volumetric flask, buret
- mass: triple beam and electronic balances
- temperature: thermometer and/or temperature probe
- pressure: barometer and/or pressure probe.

identify, locate, and know how to use laboratory safety equipment, including aprons, goggles, gloves, fire extinguishers, fire blanket, safety shower, eye wash, broken glass container, and fume hood.
 design and perform controlled experiments to test predictions, including the following key components: hypotheses, independent and dependent variables, constants, controls, and repeated trials.
 predict outcome(s) when a variable is changed.
 read measurements and record data, reporting the significant digits of the measuring equipment.
 demonstrate precision (reproducibility) in measurement.
 recognize accuracy in terms of closeness to the true value of a measurement.
 determine the mean of a set of measurements.
 use data collected to calculate percent error.
 discover and eliminate procedural errors.
 use common SI prefixes and their values (milli-, centi-, kilo-) in measurements and calculations. demonstrate the use of scientific notation, using the correct number of significant digits with powers of ten notation for the decimal place.
 graph data utilizing the following:
- independent variable (horizontal axis)
- dependent variable (vertical axis)
- scale and units of a graph
- regression line (best fit curve).

 calculate mole ratios, percent composition, conversions, and average atomic mass.
 perform calculations according to significant digits rules.
 convert measurements using dimensional analysis.

 use graphing calculators to solve chemistry problems.
 read a measurement from a graduated scale, stating measured digits plus the estimated digit.
 use appropriate technology for data collection and analysis, including probeware interfaced to a graphing calculator and/or computer and computer simulations.
 summarize knowledge gained through gathering and appropriate processing of data in a report that documents background, objective(s), data collection, data analysis and conclusions.
 explain the emergence of modern theories based on historical development. For example, students should be able to explain the origin of the atomic theory beginning with the Greek atomists and continuing through the most modern quantum model

CH.4 a
In order to meet this standard, it is expected that students will
 perform conversions between mass, volume, particles, and moles of a substance.

Vocabulary

Accuracy	Linear Equation	Proportion
Average Atomic Mass	Mean	Scientific Notation
Conversions	Mole Ratios	SI Units
Dependent Variables	Percent Error	Significant Digits
Derived	Percent Composition	X-Axis
Dimensional Analysis	Precision	Y-Axis
Independent Variables	Procedural Error	

Assessment Evidence ~ What is evidence of mastery? What did the students master & what are they missing?

Assessment/ Evidence

Evidence of Mastery: Students will display mastery by consistently scoring at a "C" or above range on all assessments. Success and mastery will also be shown by increasing scores from the beginning of the unit to the end of the unit. Overall mastery of the content and successful learning of the Targeted Objectives will be measured by assessing the Lab Journal for the "Alka-Seltzer Lab" and the final unit assessment. Mastery will result in score 90 out of 100 points on the Alka-Seltzer Lab Rubric and the final assessment scores at or above "C".

Other Assessment Methods

- Group Discussions
- Student Reports
- Teacher-Created IA Test/Quiz
- Writing Assignment

Possible Learning Gaps: Students (including post-16 students) are often confused about the meanings and difference between some of the vocabulary in regular usage:

- Accuracy and precision
- Repeatability and reproducibility
- Systematic error and true value
- Error and mistake

- Best fit line and anomalous points.

To many students, learning the concept of significant figures seems to be the most tedious and boring aspect of science. Most students just memorize the many rules of significant figures and never really grasp what significant figures mean.
When converting units, pupils often divide instead of multiplying and vice versa. Emphasize that when changing to smaller units you multiply. It may be helpful to compare with money.

Learning Plan ~ What are the strategies and activities you plan to use

Learning Experiences/ Best Practice

- Have students color-code lab procedures and questions, using colored pencils/markers.
- Invite a local nutrition expert from a clinic, grocery store, or hospital to discuss the interpretation of nutritional labels.
- Have students work in groups to create a graph that illustrates the sodium content of snacks. Students can report findings orally or in a group report.
- Have students pick a favorite snack and, using the nutrition label, calculate the number of sodium atoms per serving. Have them share their findings in class. Provide a graph or table to record information.
- Pair students for this activity. It is important to consider students' abilities to complete the extensive written portion of this assignment. Give students with written-language-skill deficits opportunities to record their observations in pictures or on a computer in order to focus on the observations themselves rather than on the written reporting of observations.
- Have students write the general equation for converting moles to atoms and keep it in their vocabulary journals for reference.
- Prepare the data table prior to completing the moles activities so students can record information in an organized manner.
- Have students input information collected on a data chart template (computer). Data entry areas should be locked so students cannot add information or edit anything but the areas required by the activity.
- Have students use a digital balance to calculate mass.
- Have students use a digital thermometer or temperature probe that can be connected to a computer to record.
- Have students use a talking calculator to assist in the solving of mathematical calculations.

Labs
Fizzing & Foaming – Using just a few simple household materials, you can watch a glass of liquid turn into foam!
A Simple Chemistry Experiment – Here is an easy yet interesting chemistry experiment that students can try in the classroom.
Classic Chemistry Experiments – This printable PDF file has several classic chemistry experiments for students to try.

Technology Integrations

Review Power Point	**Gizmos**	**Videos**
Scientific Investigation	Unit Conversions	Calculating reliability, accuracy and precision
Lab Equipment	Unit Conversions 2 – Scientific Notations &	% Mass
Lab Safety	Significant Figures	Molar Volume of Gases
Writing the Lab Report	Seed Germination	What is a Mole?
Scientific Measurement	Disease Spread	
Scientific Notation	Hershel Experiment	**PhET Simulations:**

The SI System Metric Conversion Practice Significant Figures The Mole	Stoichiometry	Density Photoelectric Effect

Resources

VDOE Lesson Plans
Laboratory Safety and Skills (PDF) / (Word)
Scientific Inquiry: Measurement/Data (PDF) / (Word)
Moles Lab Activities (PDF) / (Word)

Mr. Christopherson's Website

Cross Curricular Connection

English: Journalists often write about "scientific proof" and some scientists talk about it, but in fact, the concept of proof — real, absolute proof — is not particularly scientific. Science is based on the principle that any idea, no matter how widely accepted today, could be overturned tomorrow if the evidence warranted it. Science accepts or rejects ideas based on the evidence; it does not prove or disprove them. To learn more about this, visit our page describing how science aims to build knowledge.

Math: Calculating mean, median & mode.

Real World: Use everyday ideas to introduce the terms and promote discussion:
– Accuracy and precision are required to succeed at darts and archery.
– A cookery book must contain recipes that are repeatable and reproducible, otherwise no one would want to buy it.