

Lesson Plans/Activities from TESI 05

**Lesson 1 Density**

**Purpose:** To have students identify the layering of material according to their separate densities.

**Terminology:** matrix, density, sand, clay, pebble, layering

**Standards:** SC. A.1.3.1: The student identifies various ways in which substances differ (e.g. mass, volume, shape, density, texture and reaction to temperature and light)

SC.A. 1.3.6: the students knows that equal volumes of different substances may have different masses.

**Activity:** Students will use 2 liter containers to observe how a mixture of clay, sand and pebbles will separate into individual densities in a liquid environment.

**Procedure:**

1. Students working in groups of 2 with each student making their own observations and recording in their log book.
2. Each pair of students will have the following materials for the lab
  - a. 1 bag of colored sand
  - b. 1 bag of gray clay
  - c. 1 bag of pebbles
  - d. 1 2-liter bottle with cap
  - e. Water – 1 liter
  - f. Funnel
3. Using a balance determine the mass of each material and record in log book.
4. Using a graduated cylinder determine the volume of each material and record in log book.
5. Record characteristics of each bag of materials into log book.
6. On a piece of masking tape write both student's names and the class period.
7. Combine a-d (above) into a large plastic bag, and shake for 3 minutes.
8. Pour the mixed material into the 2-liter bottle.
9. Add 1 liter of water into the bottle using funnel and cap.
10. Shake bottle vigorously for 2 minutes.

11. Let bottle stand for the remainder of the class of class period and begin to observe changes.
12. In intervals of 5 minutes, write observations in log book. Add diagrams (as true to size as possible) with color.
13. At the end of class, place bottles on the table in the back of room, so they will be undisturbed till the following class period.
14. For homework – record your prediction on how the bottle will look the following day. Diagrams in color are required.
15. On day two, compare predictions to actual layering in bottle.

## Second

### Activity:

Students will brainstorm as to the why the layering occurred. A lesson on density will follow their brainstorming. Some students may recall density from the previous year. Misconceptions on mass and weight will be discussed,

**Assessment:** The students will then calculate the density of each material used, and determine if they indeed layered according to their densities. If they did not, the students will determine where the error occurred.

1-2 paragraph summary of what happened during and after the experiment,

## **Lesson 2    Hunting for Phosphorus**

**Purpose:** To show that we need a daily intake of phosphorus from the foods that we eat and why it is so important for our health.

**Terminology:** RDA, phosphorus, phosphate, ATP, DNA

**Standards:** SC.F.1.3.1: The student understands that living things are composed of major systems that function in reproduction, growth, maintenance, and regulation.  
SC.F.1.3.2: The student knows that biological adaptations include changes in structures, behaviors, or physiology that enhance reproduction success in a particular environment,  
SC.G.1.3.5: The student knows that life is maintained by a continuous input of energy from the sun and by the recycling of the atoms that make up the molecules of living organisms.

**Activity:** Students will review a variety of food products to determine the amount of phosphorus each contains (in milligrams)

- Procedure:
1. Students will be given a list of 30 food items.
  2. They will go to a grocery store and look at the ingredients of various containers to determine if the product contains some form of phosphorus.
  3. They will record the amount of phosphorus it contains, along the name of the brand of the food.

Second Activity: Students will share their findings with other in a small group and produce a graph for the products and average amount of phosphorus in each.

Assessment: By the graph produced, and by individual writing response to “Why I need phosphorus”.

### **Lesson 3 The Effects of Using Phosphate on Plants**

Purpose: To test the affects of phosphate on plant life in the environment and to apply the scientific method in experimental development.

Terminology: facts, theory, variables, hypotheses, problem, data, experiment, scientific method

Standards: SC.H.1.4.1: The student knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts and to compare different theories,  
SC.H2.4.2: The student understands that no matter how well one theory fits observations a new theory might fit them as well or better, or might fit a wider range of observations, because in science, the testing, revising and occasional discarding of theories, new and old, never ends and leads to an increasingly better understanding of how things work in the world, but not to absolute truth.  
SC.H.1.3.5: The student knows that scientists control conditions in order to obtain evidence, but when that is not possible for practical or ethical reasons, they try to observe a wide range of natural occurrences to discern patterns.  
SC.H.1.3.4: The student knows investigations are conducted to increase understanding.  
MA.B.1: The student measures quantities in the real work and uses the measures to solve real problems.  
MA.B.2: The student compares, contrasts, and converts within systems of measurement.  
MA.E.2: The student identifies patterns and makes predictions from an orderly display of data using concepts of probability and statistics

**Activity:** Design an experiment to measure the affect on percent changes in plant height and mass.

**Procedure:**

1. Review of Scientific Method
2. Phosphate fertilizer same nitrogen with varying phosphate content
3. Discussion on various experimental designs.
4. Choice and modification one experimental design for all groups to follow.
5. Set up plant trays for experiment.
6. Place plants in marked areas being sure to differentiate between control and experimental.
7. Monitor and care for plants as needed,
8. Make and record daily observations and measurements in log book.
9. After a period of three weeks, make final measurements, complete lab report. Compare your results with one other group and discuss what you believe is the cause for the difference.

**Assessment:** A completed lab report including data, analysis of data and conclusions. Report is to include observations, pictures and an evaluation of the experimental form.

#### **Lesson 4 Balancing Chemical Equations**

**Purpose:** To balance the chemical equations involved in the chemical processing of phosphate.

**Terminology:** atom, molecule, chemical formula, chemical equation, sulfur, oxygen, sulfur dioxide, sulfur trioxide, sulfuric acid, calcium phosphate, phosphoric acid, gypsum, ammonia, monoammonium phosphate, diammonium phosphate

**Standards:** SC.A.1.3.5: The student knows the difference between a physical change in a substance and a chemical change.  
SC.B.2.3.2: The student knows that most of the energy used today is derived from burning stored energy collected by organisms millions of years ago.

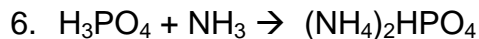
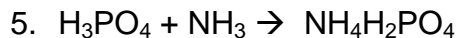
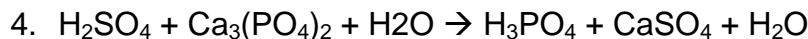
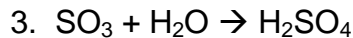
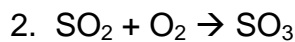
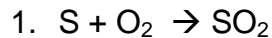
**Activity:** Student will balance chemical equations.

**Procedure:**

1. Using a CRC, or other reference book, students will need to find the chemical formulas for the words used in the statements.
2. Once the formulas have been confirmed to be correct (by teacher), students working in groups of two will balance the equations.

**Equations in Word Form:** In order for the calcium phosphate that is mined to be usable it must go through a series of chemical reactions. The first chemical it

is reacted with sulfuric acid. However, before this can be done the chemical processing plant must make the sulfuric acid. They start by burning pure sulfur. This produces sulfur dioxide, which is burned again and produces sulfur trioxide. The sulfur trioxide is then added to water, which produces the sulfuric acid. Now the sulfuric acid is added to the calcium phosphate, which yields phosphoric acid and gypsum, which is a byproduct. The phosphoric acid is reacted with ammonia and produces monoammonium phosphate. This is one of the usable forms, but not the most useful. If more ammonia is added it will produce diammonium phosphate, which is the most used form of phosphate.



Assessment: Teacher will check the completed balanced equations. At the end of the unit students will be able to name each of the products and reactants based on the chemical formulas.

## Lesson 5 E-Field Trip

Purpose: To provide an in-depth view to the laws and regulations on the phosphorous industries to include truths falsehoods, opinions on what should be done in order to correct problems with phosphogypsum stacks.

Terminology: phosphogypsum, radiation, mandate, law

Standards: SC.D.1.3.1: The student knows that mechanical and chemical activities shape and reshape the Earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.

SC.D.1.3.3: The student knows how conditions that exist in one system influence the conditions that exist in other systems.

SC.D.1.3.4: The student knows the ways in which plants and animals reshape the landscape.

SC.D.2.3.1: The student understands that quality of life is relevant to personal experience.

SC.F.1.3.7: The student knows that behavior is a response to the environment and influences growth, development, maintenance, and reproduction.

SC.F.2.3.3: The student knows that generally organisms in a population live long enough to reproduce because they have survival characteristics.

SC.F.2.3.4: The student knows that the fossil record provides evidence that changes in the kinds of plants and animals in the environment have been occurring over time.

SC.G.1.3.4: The student knows that the interactions of organisms with each other and with the non-living parts of their environments result in the flow of energy and the cycling of matter throughout the system.

SC.H.1.3.1: The student knows that scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way,

SC.H.1.3.3: The student knows that science disciplines differ from one another in topic, techniques, and outcomes but that they share a common purpose, philosophy and enterprise.

SC.H.3.3.1: The student knows that science ethics demand that scientists must not knowingly subject coworkers, students, the neighborhood or the community to health or property risks.

SC.H. 3.3.7: The student knows that computers speed up and extend people's ability to collect, sort and analyze data; prepare research reports; and share data and ideas with others.

Activity: To go on an e-field trip to answer the following questions, using specific websites.

1. What is phosphate?
2. What is the estimated amount of America's phosphate that is in Florida?
3. What makes up the phosphate in the Florida soil?
4. Who is overseeing the Environmental aspects of the Florida phosphate mining?
5. Why is there a need for these organizations?
6. What is the estimate of phosphate that is extracted on a yearly basis?
7. Phosphate plants are one of Florida's largest employers. Approximate how many people the industry employs.
8. What is the location of the Florida phosphate mines?
  - a. Outline this area on the map provided,
  - b. Explain in words or on the map where the majority of the past and present mining takes (took) place.
9. Where in Florida is the closest phosphate mine to us here in Brevard?
10. Could you as a public citizen go and visit the site? Why or why not?

11. What is reclaimed land?
12. Who is responsible for land reclamation?
13. Explain the common misconceptions of reclamation. Include in your discussion why reclamation does not mean the land will be restored to the original condition, and who is responsible for overseeing the reclamation process.
14. What is the "Bone Valley"?
15. Is there an end to the phosphate? Estimate the length of time that this mining process will continue.

Assessment: The students will be given the above questions which are analysis and evaluation questions to guide them through the e-fieldtrip. The students will be participating in a debate, based upon their findings. Their debating facts will be an assessment of the strength of their answers to the questions on the worksheet.