1. What is **environmental science**?

2. The **environment** includes:

    a.

    b.

    c.

    d.

3. Environmental science is **interdisciplinary** because....

    a. Examples:

4. Using the example of coal-for-electricity, describe how each of these fields of study is involved.

    a. Economics –

    b. Geology –

    c. Engineering –

    d. Chemistry –

    e. Meteorology –

    f. Ecology –

    g. Politics -

Major Ways Humans Have Changed the Environment

5. Hunter-Gatherer societies:

a. What did they do to change the environment?

b. What were the effects of the Hunter-Gatherer societies?

6. Agricultural Revolution:
   a. What was done to change the environment?

   b. What were the effects of the Ag Revolution?

7. Industrial Revolution:
   a. What was done to change the environment?

   b. What were the effects of the Industrial Revolution?

8. Globalization:
   a. What was/is being done to change the environment?

   b. What are the effects of Globalization?

Three Major Environmental Problems

9. Define **natural resource** –

Resource Depletion:

10. Define **renewable resource** –

    a. Give one example of a renewable resource.

11. Define **nonrenewable resource** –

    a. Give one example of a nonrenewable resource.

    b. What is the estimated remaining supply of coal?

Pollution:

12. Define **biodegradable pollution –**

13. Define **nondegradable pollution –**

14. Mark the areas with the greatest concentrations of air pollution.

Loss of Biodiversity:

15. Define **biodiversity –**

16. Define **extinction –**

17. How many known major extinction events have occurred in the history of Earth?

    a. What caused the most recent one?

18. What is the **background rate** for mammal extinctions?

    a. How many mammal extinctions have occurred in Australia since 1788? What is the cause of these extinctions?

19. Define **conservation** –

    a. Give examples of conservation –

20. Define **preservation** –

    a. Give examples of preservation -

Environmental Ethics

21. What is **environmental ethics**?

22. What does **anthropocentrism** mean? Describe the philosophy.

23. What does **ecocentrism** mean? Describe the philosophy.

24. The proposed Hetch Hetchy dam was the first big debate between anthropocentrists and ecocentrists. Explain what each group wanted to do.

    Anthropocentrists-

    Ecocentrists -

25. Was the dam constructed? Describe the reasoning. What environmental ethics philosophy aligns with this reasoning?

26. What was the focus of the **resource conservationism** philosophy?

    a. What two federal systems were created during this time?

27. Two events lead to the beginning of the **modern environmentalism** movement. What were they?

a. What is the primary concern of modern environmentalists?

28. What is **global environmentalism**?

The Tragedy of the Commons

29. Who wrote the *Tragedy of the Commons*?

30. The *Tragedy of the Commons* essay describes the source of environmental problems as...

31. What is a **commons**?

a. What tends to happen to commons areas?

b. What are modern examples of commons areas?

Economics and the Environment

32. Define **supply-and-demand** –

a. Give an example.

33. Define **cost/benefit analysis –**

a. Give an example.

34. Describe the conditions found in a **developing country**.

35. Describe the conditions found in a **developed country**.

36. Which type of country has the smaller population size? Which consumes more resources?

37. Compare and contrast developing and developed countries:

	Developed United States	**Developing Indonesia**
Life expectancy		
Population Growth Rate		
Wealth		
Energy Use		
Pollution Rate		
Waste Creation		

38. What factors are considered when calculating an ecological footprint?

39. What is **sustainability**?

40. Sustainability is important because the Earth is a **closed system**. What does this mean?

History of Conservation & Preservation in the US –

Date	Happenings
1626	
1634	
1639	
1641	
1650	
1698	
1817	
1844	
1865	
1872	
1875	
1885	
1890	
1892	
1900	
1902	
1903	
1905	

1907	
1909	
1916	
1917/27	
1933	
1933	
1936	
1940	
1949	
1955	
1956	
1960	
1965	
1970	
1970	
1973	
1990	
2006	

Scientific Method:

O:

H:

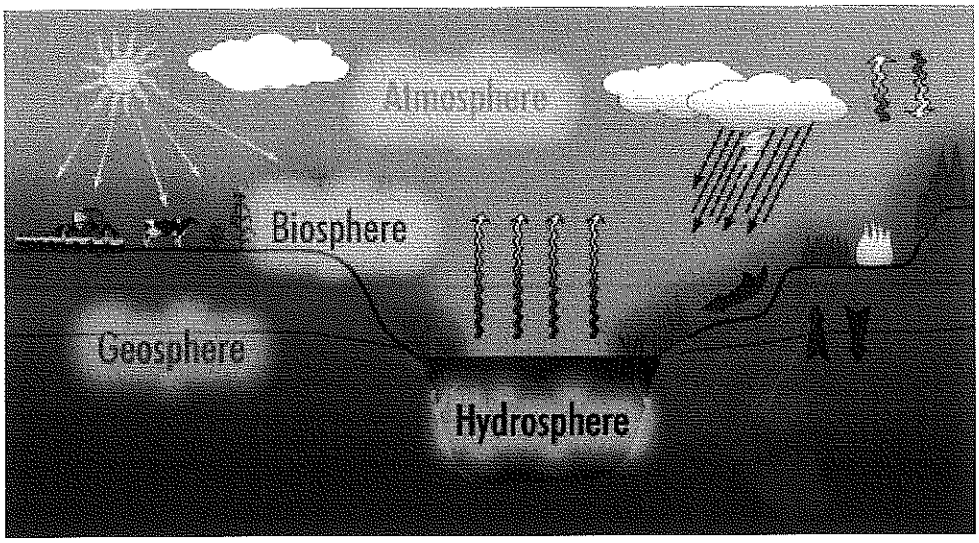
P:

E:

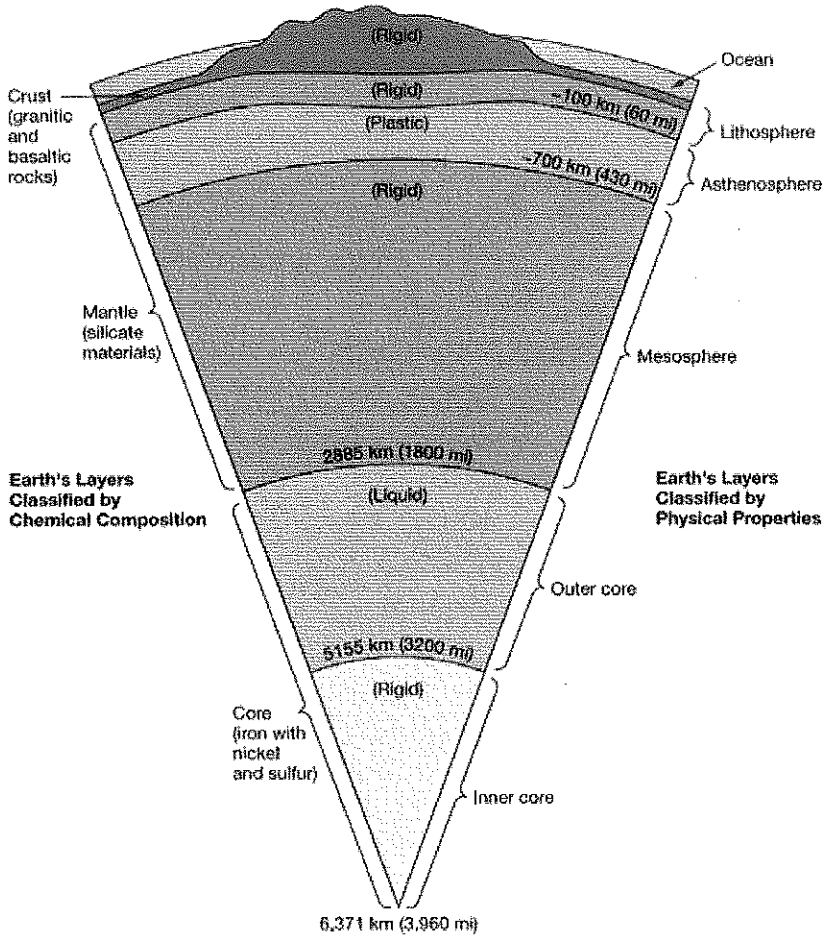
D:

C:

The Dynamic Earth –



- The Geosphere
  - Composed of _____, _____, & _____



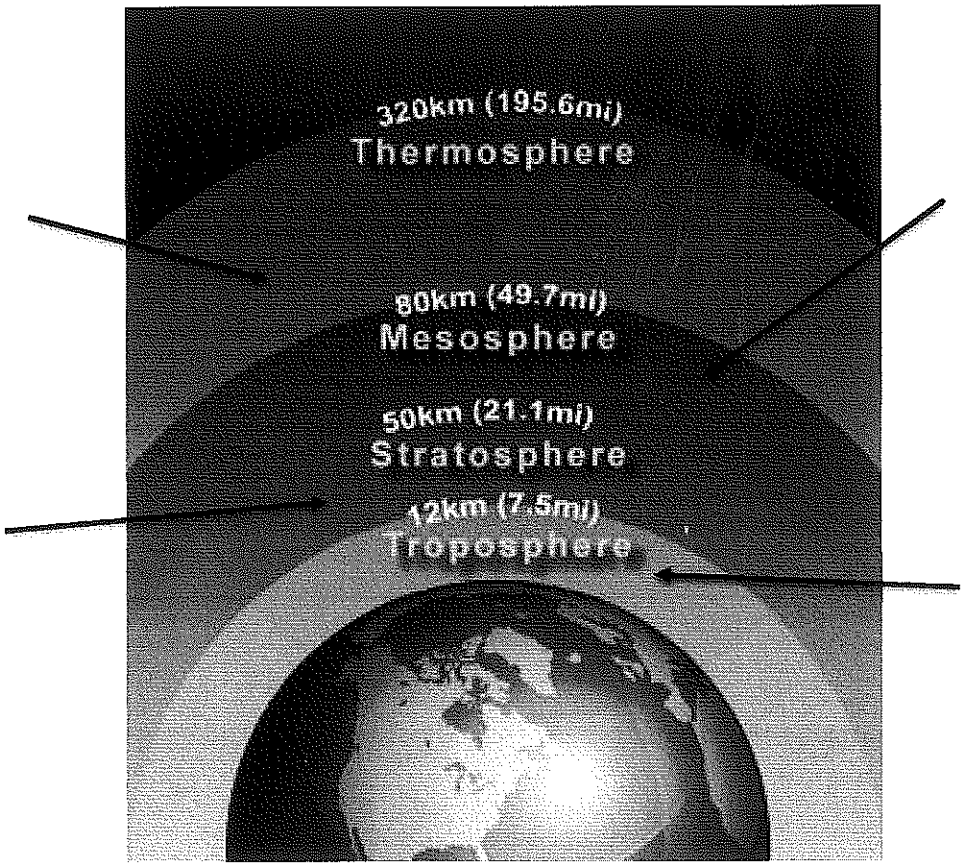
Compositional Layers:

- Crust:
- Mantle:
- Core:

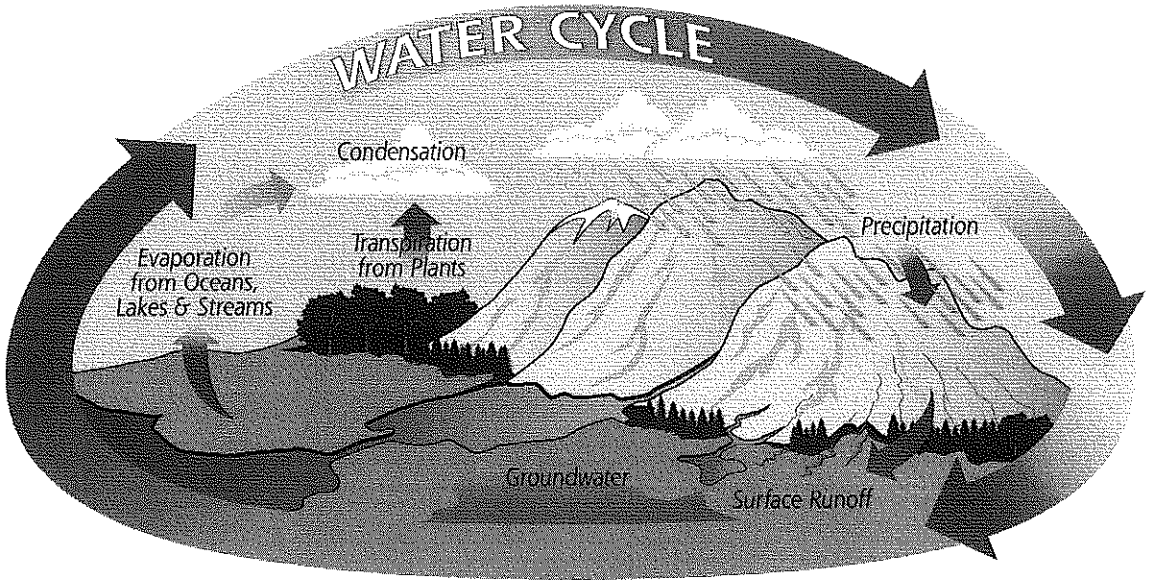
Physical Layers:

- Lithosphere:
- Asthenosphere:
- Mesosphere:
- Outer Core:
- Inner Core:

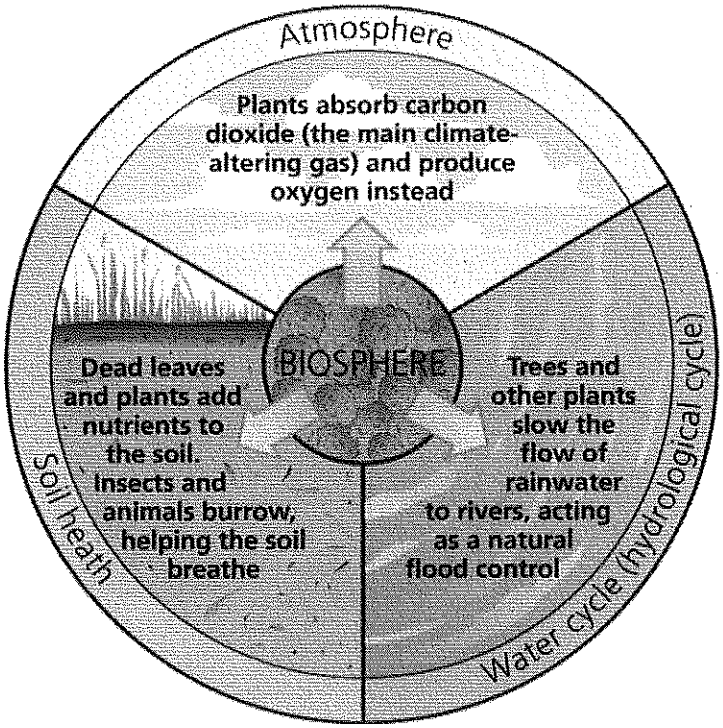
- The Atmosphere



- The Hydrosphere



- The Biosphere



  - Closed System:

  - Open System:

Name _____ Class _____ Date _____

Skills Practice Lab

MODELING

Concentration of Earth's Greenhouse Gases

Earth's atmosphere is a mixture of gases. About 99 percent of the atmosphere is made up of nitrogen and oxygen. Certain other gases present in smaller amounts are critical to Earth processes. Water vapor and carbon dioxide gas are important in regulating the amount of energy absorbed by the atmosphere. Ozone gas helps control the amount of ultraviolet radiation that reaches Earth's surface. Scientists are particularly interested in measuring changes in the amounts of greenhouse gases, including water vapor, carbon dioxide, methane, and nitrous oxide. These gases occur in such small amounts in the atmosphere that scientists describe their concentration in units of parts per million (ppm), or even parts per billion (ppb). Imagine pouring one can of soda into a large swimming pool, and you are thinking on the order of parts per million. If you can imagine adding one pinch of salt to 10 tons of potato chips, you're thinking on the order of parts per billion!

In this activity, you will dilute a substance to extremely small concentrations. After calculating these concentrations, you will relate the data to the concentration of important gases in Earth's atmosphere.

OBJECTIVES

Describe the meaning of the units parts per million and parts per billion.

Explain why these units are used to describe the concentration of some atmospheric gases.

Create solutions of diminishing concentration.

Compare the concentration of solutions created in the experiment to the concentration of certain atmospheric gases.

MATERIALS

- eyedropper or pipette
- food coloring
- ice cube tray white, or clear plastic trays with white paper underneath
- marker, permanent
- plastic cups, small (3)
- water jug, filled with water

Procedure

1. Use the marker to number the outside of each section of the ice cube tray from 1 to 10. Each section is a "cell" in which you will create a solution with a certain concentration.
2. Fill the three plastic cups about half full with water. The water will be used for cleaning the eyedropper or pipette during the experiment.

3. Put 10 drops of food coloring in cell #1. The concentration of this substance is 1 million parts per million. It represents a pure substance. Write the concentration of this substance as a fraction. Examine how this data has been recorded in Table 1.

_____

TABLE 1: FOOD COLORING CONCENTRATION

Cell Number	Food Coloring Concentration (parts per million)
1	1,000,000
2	100,000
3	
4	
5	
6	
7	
8	
9	
10	

4. Take one drop of food coloring from cell #1 and add it to cell #2. Rinse the dropper in one of the plastic cups until all traces of food coloring are removed. Add 9 drops of clean water to cell #2 and stir. The mixture is now diluted to $\frac{1}{10}$ the concentration of the original substance. The concentration of the new substance is 100,000 parts of food coloring per million parts of solution. Write the concentration of the substance as a fraction. Examine how this data has been recorded in Table 1.

_____

5. Take one drop from cell #2 and add it to cell #3. Rinse the dropper completely. Add 9 drops of clean water to cell #3 and stir. How has the food coloring concentration changed? Record the food coloring concentration of cell #3 in Table 1.

_____

_____

6. Repeat this procedure for cells 4 through 10. Record the concentration of each cell in Table 1.

7. Greenhouse gases affect the temperature of Earth's atmosphere. Study Table 2 on the following page, which shows the concentrations of these gases. Use the information given, as well as the data from Table 1, to determine which of the food coloring cells is closest in concentration to the concentration of each greenhouse gas.

TABLE 2: CONCENTRATION OF GREENHOUSES GASES IN EARTH'S ATMOSPHERE

Gas	Concentration	Cell Number
Carbon dioxide	355 ppm	
Methane	1.7 ppm	
Nitrous oxide	0.3 ppm	
Chlorofluorocarbon-12	0.0005 ppm	
Chlorofluorocarbon-11	0.0003 ppm	

Analysis

1. **Describing Events** What changes did you notice in the color of the solutions you created as you moved from cell #1 to cell #10?

2. **Explaining Events** Some of the solutions created were colorless. Was there any food coloring in those cells? How do you know?

Conclusions

3. **Drawing Conclusions** Imagine that the food coloring in the experiment represents carbon dioxide. What do the water drops added to each cell represent?

Extension

1. **Research and Communication** The concentration of each greenhouse gas in parts per million is incredibly small. How can gases that have such small concentrations have such a large impact on Earth's atmosphere? Use library resources to research one greenhouse gas. In written or oral form, describe the role this gas plays in Earth's atmosphere.

Famous Examples of the Scientific Method

Introduction

The scientific method is not a new idea; it has been utilized by generations of scientists. This activity will introduce you to some of the most famous scientific experiments and discoveries – ones that continue to influence our lives even today! See if you can identify the different parts of the scientific method and experimental design in each.

The Strange Case of BeriBeri

In 1887 a strange nerve disease attacked the people in the Dutch East Indies. The disease was called "beriberi". Symptoms of the disease included weakness and loss of appetite, victims often died of heart failure.

Experiment #1:

Scientists thought the disease might be caused by bacteria. They injected chickens with blood from patients with the beriberi disease. The injected chickens became sick. However, so did the other group of chickens that were not injected with bacteria.

1. What was the initial hypothesis in this example?

2. A hypothesis is always based on prior knowledge, research, or observation. What do you think scientists based this hypothesis on?

3. What **independent variable** were the scientists studying in this case? What **dependent variable** were the scientists measuring?

4. What was the **experimental group** in their study? What was the **control group**?

5. Why is a control group important? What conclusion might the scientists have reached if they did not use a control group in this example?

6. Would this first experiment be considered a failure? Explain why or why not.

Experiment #2:
One of the scientists studying Beriberi was named Dr. Eijkman. He realized that before the experiment, all the chickens had eaten whole-grain rice, but during the experiment, the chickens were fed only polished rice. Dr. Eijkman researched this further by testing two new groups of chickens. One group was fed the polished rice, the other group was fed the whole-grain rice. Only the polished rice chickens got the illness. As a result, he believed that the polished rice was missing a nutrient needed to prevent the disease.

7. What **observation** did Dr. Eijkman make during the first Beriberi experiment?

8. What **independent variable** was Dr. Eijkman studying in this case? What **dependent variable** did he measure?

9. What was the **experimental group** in this study? What was the **control group**?

10. Explain what Dr. Eijkman would need to do next in order to share his discovery with other scientists and have his conclusions be considered valid.

The Discovery of Penicillin

In 1928, Sir Alexander Fleming was studying Staphylococcus bacteria growing in culture dishes. He noticed that a type of mold called Penicillium was also growing in some of the dishes. A clear area existed around the mold because all the bacteria that had grown in this area died.

Experiment #3:
Fleming thought that the mold must be producing a chemical that killed the bacteria. He decided to isolate this substance and test it to see if it would kill bacteria. Fleming transferred the mold to a liquid broth solution. This solution contained all the materials the mold needed to grow. After the mold grew, he removed it. He then grew two identical groups of bacteria. He then took the mold-infused broth and added it to of the groups of bacteria. Those bacteria died. Fleming then added a liquid broth that did not contain mold to the second group of bacteria. This group survived.

11. What **independent variable** were the scientists studying in this case? What **dependent variable** were the scientists measuring?

12. What was the **experimental group** in their study? What was the **control group**?

13. When an experiment is designed, all variables between the experimental group and control group must be held **constant**. How did Fleming's experimental design meet this requirement?

Spontaneous Generation

From the time of the ancient Romans, through the Middle Ages, and until the late nineteenth century, it was generally accepted that some life forms arose spontaneously from non-living matter. Such "spontaneous generation" appeared to occur primarily in decaying matter. For example, a seventeenth century recipe for the spontaneous production of mice required placing sweaty underwear and wheat in an open-mouthed jar, then waiting for about 21 days, during which time it was alleged that the sweat from the underwear would penetrate the husks of wheat, creating mice.

Experiment #4:

The first serious attack on the idea of spontaneous generation was made in 1668 by Francesco Redi, an Italian physician and poet. At that time, it was widely held that maggots arose spontaneously in rotting meat. Redi believed that maggots developed from eggs laid by flies.

Place yourself in the role of Francesco Redi. Design an experiment that will test this idea. Remember, you are challenging an idea that has been accepted for *hundreds of years*! You must follow the scientific method closely, account for all variables, and carefully document your procedure to have a chance at disproving this theory!

14. State a hypothesis. Remember to include the **variable** you are testing and a **prediction** of the effects of this variable.

15. Write a step-by-step procedure for this experiment. Include an **experimental group** and a **control group**. Remember that <u>every variable should be held constant between your two groups except the one you are testing</u>. This even includes exposure to air!

Unit 1: Introduction to Environmental Science Name _____

My Ecological Footprint –

Go to the following website (link on omarascience.weebly.com) & take the Ecological Footprint Quiz

http://www.footprintnetwork.org/en/index.php/GFN/page/personal_footprint/

1. How many earths are necessary to sustain you given your current lifestyle? _____

2. Construct a practical plan of action for reducing your ecological footprint. This should include changes that you could realistically make in your lifestyle; you don't want the changes that you make to be so drastically different from your current lifestyle that there is no way you could ever make them. Include 10 small changes you could make in your everyday life.

3. Retake the ecological footprint quiz & include your changes.

    a. Was there an effect on your footprint? _____

    b. How many earths are necessary to sustain your changed lifestyle? _____

4. Do you think these are changes you will actually make in your life? Why or why not?

Unit 1: Introduction to Environmental Science Name _____

Environmental Problems –

1. Classify each of the following environmental problems as either resource depletion, pollution, or loss of biodiversity – some may be a combination of two of the three categories.

Environmental Problem	Category
Desertification	
Global Warming	
Ozone Depletion	
Soil Erosion	
Pesticide Run-off	
Overfishing	
Emission of wastes from companies	
Overuse of fresh water	
Improper disposal of household wastes	
Deforestation	
Mineral Mining	
Destruction of Native Habitats	
Slash & burn farming	
Poaching	
Burning of Fossil Fuels	
CO2 Emissions	
Unsustainable Agriculture	

2. Choose ten of the above listed environmental problems & discuss specific human activities that contribute to the problems.