

AP Environmental Science Summer Assignment

WELCOME to AP Environmental Science! Let's get this party started! This summer assignment is designed to provide you with the opportunity to get familiar with what you will be learning about this year AND what will be expected of you. Please ensure you are co-enrolled in the correct courses — or have already successfully completed them. *These are necessary to do well in this course.* We will review ALL of this in class in August and throughout the year so don't stress if you feel a little lost or confused. This is just the beginning. 😊

This worksheet MUST be printed and ALL responses must be HANDWRITTEN on this worksheet. Digital assignments WILL NOT be accepted unless indicated by an IEP or 504.

I. Intro to Environmental Science

- One underestimated area of environmental science is the abundance of jobs in the field! Here is a list of just a few. Pick the one that seems the most intriguing to you and research it. (It doesn't have to be one of the ones in the list, but it does need to be related to environmental science.) Then in the space below, **describe the job AND the pathway to get there** (What kind of schooling does it require? Do you need a certification or a certain amount of experience?).
 - Marine Biologist
 - Ecologist
 - Geneticist
 - Wind Turbine Operator
 - Solar Panel Farm Operator
 - City Planning
 - Transportation Engineer
 - Sustainable Development
 - Government (policy and regulations)
- Research and **describe** three ways you can treat the environment better in YOUR day-to-day life. (*Don't just list three ideas. Describe them.*)
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- Ever heard something about the environment that you thought might not be true? Maybe about resource availability, pollution, or harmful things we are exposed to in our environments. What was it?? Write ANY questions you have ever had about the environment. I'd love to answer them!

II. Experimental Design

Okay, now I know you've learned this information before but let's review the experimental design terms you have been taught a hundred times and yet still can't seem to remember from year to year.

- **Independent variable** – the variable (thing) that the scientist is changing from one group to the next
- **Dependent variable** – the variable (thing) that the scientist is measuring. The data they are collecting.
- **Constants** – VARIABLES that are the same across all groups; there are loads of them!
- **Control GROUP** – the GROUP that does not receive the independent variable or is under normal conditions
- **Experimental groups** – all of the other groups in the experiment; the ones where the independent variable was changed; there must be at least two experimental groups
 - ◆ All great experiments have a minimum of 3 groups (one control and two experimental)
- **Hypothesis** – a prediction of the outcome of an experiment; MUST BE SPECIFIC. It should include the independent and dependent variables and be written AS A STATEMENT.
 - ◆ Template → “As (independent variable) increases, the (dependent variable) will decrease.”
- **Scientific Question** – the basis of all scientific exploration! What question are the scientists trying to answer? MUST BE SPECIFIC. It should include the independent and dependent variables and be written AS A QUESTION.
 - ◆ Template → “Does an increase in (independent variable) cause a decrease in (dependent variable)?”

Read the following experiments and answer the questions to the best of your ability.

Some organisms such as birds can move in response to environmental changes, while other organisms such as corals cannot. Researchers studying the effect of climate change on marine organisms conducted two experiments involving photosynthetic algae that have a symbiotic relationship with corals.

1. In Experiment 1, the researchers placed photosynthetic algae colonies living in coral in three different saltwater tanks. The temperature of Tank 1 was set to 27 °C, the average temperature at which most corals live. Water circulation in each tank mimicked natural ocean currents. After 30 days, the researchers counted the number of bleached corals. The tank setups are shown in the following list.

Tank 1: 27 °C and no sediment

Tank 2: 32 °C and no sediment

Tank 3: 37 °C and no sediment

- a. **Identify** the independent variable: _____
- b. **Identify** the dependent variable: _____
- c. **Identify** a likely scientific question for Experiment 1: _____

2. In Experiment 2, the researchers used the same photosynthetic algae living in corals but modified the conditions of the tanks as shown in the following list. Water circulation kept the sediment in the tanks suspended. After 30 days, the researchers counted the number of bleached corals.

Tank 1: 27 °C and no sediment

Tank 2: 27 °C and moderate sediment

Tank 3: 27 °C and high sediment

- a. **Identify** the control group: _____
- b. **Identify** various constants: _____
- c. **Identify** a likely hypothesis for Experiment 2: _____

III. Chemistry! In Environmental Science?? YES! Let's review:

For each molecule or compound listed, write the correct molecular formula (if you don't already know them, Google it 😊). This first few have been done for you, as an example.

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|------------------------------------|---------------------|-----------------------|
| • Carbon dioxide - CO ₂ | • Ammonium - | • Sulfate Ion - |
| • Methane - CH ₄ | • Nitrate Ion - | • Carbonate - |
| • Nitrous oxide - | • Nitrite Ion - | • Bicarbonate - |
| • Oxygen gas - | • Nitrogen oxides - | • Carbonic acid - |
| • Ozone - | • Nitric acid - | • Calcium Ion - |
| • Nitrogen gas - | • Sulfur dioxide - | • Calcium Carbonate - |
| • Ammonia - | • Sulfuric acid - | • Hydrogen Ion - |

IV. Now for everyone's FAVORITE part → MATH!

There is a surprising amount of math in Environmental Science. This summer, we are just going to scratch the surface. This will all be covered in class, however, we only have so many school days and SO. MUCH. information to get through. Having a solid foundation in math will set us up for success for the rest of the year!! You may use a calculator but, ***you must show your work and include units in your answer.*** Let's practice:

1. **Calculate** the area of a rectangle that has a length of 60 meters and a width of 100 meters.
2. **Calculate** the volume of a box that has an area of 80,000 m² and a height of 1,440 meters.
3. If there are 6.8 million people in a country, **calculate** the number of people there are in 17% of that population.
4. **Calculate** the number of days there are in 29 weeks.
5. **Calculate** the number of days there are in 5.7 years.
6. **Calculate** the answer to the following problem.

$$\frac{500kg}{1\ year} \times \frac{1000\ g}{1\ kg} =$$

V. Experimental Science Current Event (Text Analysis) I know! This looks like an assignment from your English classes. College Board wants you to apply those same reading comprehension skills to the sciences. So, read the following article and answer the questions to the best of your ability.

The Next Green Revolution

Half a century ago disaster loomed just as ominously (as today). Speaking about global hunger in 1959, one economist said, “At best the world outlook for the decades ahead is grave; at worst it is frightening.”

Before those visions could come to pass, the green revolution transformed global agriculture, especially wheat and rice. [S]elective breeding created a dwarf variety of wheat that put most of its energy into edible kernels rather than long, inedible stems. The result: more grain per acre. Similar work in the Philippines dramatically improved the productivity of rice – the grain that feeds nearly half the world population. From the 1960s through the 1990s, yields of rice and wheat in Asia doubled.

To keep doing that between now and 2050, we’ll need another green revolution. There are two competing visions of how it will happen. One is high-tech, with a heavy emphasis on continuing breeding better crops, but with modern genetic techniques. “The next green revolution will supercharge the tools of the old one.” Scientists, he argues, can now identify and manipulate a huge variety of plant genes, for traits like disease resistance and drought tolerance. That’s going to make farming more productive and resilient.

The signative technology of this approach – and the one that has brought both success and controversy – is genetically modified, or GM, crops. First released in the 1990s, they’ve been adopted by 28 countries and planted on 11% of the world’s arable land, including half of the cropland in the U.S. About 90% of the corn, cotton, and soybeans grown in the U.S. are genetically modified. Americans have been eating GM products for nearly two decades. But in Europe and much of Africa, debates over the safety and environmental effects of GM crops have largely blocked their use.

A recent study by the U.S. Department of Agriculture found that pesticide use on corn crops has dropped 90% since the introduction of Bt corn, which contains genes from the bacterium *Bacillus thuringiensis* that help it ward off corn borers and other pests. Reports from China indicate that harmful aphids have decreased – and ladybug and other beneficial insects have increased – in provinces where GM cotton has been planted.

1. The green revolution has improved global agricultural output. What is the **author’s perspective** on the beginning of the green revolution in the 1970s and 1980s? *(Do not copy sentences from the article. Answer this question in your own words!)*
2. **Summarize** the author’s predictions for how humans will meet the future nutritional needs of a growing population using current agricultural technology. *(Answer this question in your own words!)*
3. What **evidence (data! numbers!)** does the author provide to support the claim that genetically modified crops are beneficial?