AP ENVIRONMENTAL SCIENCE (APES) SUMMER PACKET

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You can *contact me over the summer with any questions and if you don't receive a reply within 48 hours, please contact the Science Department Supervisor using the following: Email: psullivan@oceanschools.org or Phone: 732-531-5600 ex 1008*

Welcome to AP Environmental Science – APES!

This is OPTIONAL Work and you will receive extra credit if completed:
Please complete the following packet to introduce yourself to AP Environmental Science. This can be worked on over the summer or when you return to school. **It will be due one week after the first day of class. Check google classroom for date.**

Part I

AP Environmental Science is an interdisciplinary course that focuses on processes in the environment and man's impact. Read the famous except from **Rachel Carson** below and answer the analysis questions:

The history of life on earth has been a history of interaction between living things and their surroundings. To a large extent, the physical form and the habits of the earth's vegetation and its animal life have been molded by the environment. Considering the whole span of earthly time, the opposite effect, in which life actually modifies its surroundings, has been relatively slight. Only within the moment of time represented by the present century has one species—man—acquired significant power to alter the nature of his world.

During the past quarter century this power has not only increased to one of disturbing magnitude but it has changed in character. The most alarming of all man's assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials. This pollution is for the most part irrecoverable; the chain of evil it initiates not only in the world that must support life but in living tissues is for the most part irreversible. In this now universal contamination of the environment, chemicals are the sinister and little-recognized partners of radiation in changing the very nature of the world—the very nature of its life. Strontium 90, released through nuclear explosions into the air, comes to the earth in rain or drifts down as fallout, lodges in soil, enters into the grass or corn or wheat grown there, and in time takes up its abode in the bones of a human being, there to remain until his death. Similarly, chemicals sprayed on croplands or forests or gardens lie long in the soil, entering into living organisms, passing from one to another in a chain of poisoning and death. Or they pass mysteriously by underground streams until they emerge and, through the alchemy of air and sunlight, combine into new forms that kill vegetation, sicken cattle, and work unknown harm on those who drink from once pure wells. As Albert Schweitzer has said, "Man can hardly even recognize the devils of his own creation."

It took hundreds of millions of years to produce the life that now inhabits the earth—eons of time in which that developing and evolving and diversifying life reached a state of adjustment and balance with its surroundings. The environment, rigorously shaping and directing the life it supported, contained elements that were hostile as well as supporting. Certain rocks gave out dangerous radiation, even within the light of the sun, from which all life draws its energy, there were short-wave radiations with power to injure. Given time—time not in years but in millennia—life adjusts, and a balance has been reached. For time is the essential ingredient; but in the modern world there is no time.

The rapidity of change and the speed with which new situations are created follow the impetuous and heedless pace of man rather than the deliberate pace of nature. Radiation is no longer merely the background radiation of rocks, the bombardment of cosmic rays, the ultraviolet of the sun that have existed before there was any life on earth; radiation is now the unnatural creation of man's tampering with the atom. The chemicals to which life is asked to make its adjustment are no longer merely the calcium and silica and copper and all the rest of the minerals washed out of the rocks and carried in rivers to the sea; they are the synthetic creations of man's inventive mind, brewed in his laboratories, and having no counterparts in nature.

To adjust to these chemicals would require time on the scale that is nature's; it would require not merely the years of a man's life but the life of generations. And even this, were it by some miracle possible, would be futile, for the new chemicals come from our laboratories in an endless stream; almost five hundred annually find their way into actual use in the United States alone. The figure is staggering and its implications are not easily grasped—500 new chemicals to which the bodies of men and animals are required somehow to adapt each year, chemicals totally outside the limits of biologic experience.

Among them are many that are used in man's war against nature. Since the mid-1940's over 200 basic chemicals have been created for use in killing insects, weeds, rodents, and other organisms described in the modern vernacular as "pests"; and they are sold under several thousand different brand names.

These sprays, dusts, and aerosols are now applied almost universally to farms, gardens, forests, and homes—nonselective chemicals that have the power to kill every insect, the "good" and the "bad," to still the song of birds and the leaping of fish in the streams, to coat the leaves with a deadly film, and to linger on in the soil—all this though the intended target may be only a few weeds or insects. Can anyone believe it is possible to lay down such a barrage of poisons on the surface of the earth without making it unfit for all life? They should not be called "insecticides," but "biocides."

The whole process of spraying seems caught up in an endless spiral. Since DDT was released for civilian use, a process of escalation has been going on in which ever more toxic materials must be found. This has happened because insects, in a triumphant vindication of Darwin's principle of the survival of the fittest, have evolved super races immune to the particular insecticide used, hence a deadlier one has always to be developed—and then a deadlier one than that....

The "control of nature" is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man. The concepts and practices of applied entomology for the most part date from that Stone Age of science. It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth.

[1] Rachel Carson, "Silent Spring," in Diane Ravitch, ed., *The American Reader: Words that Moved a Nation* (New York: HarperCollins, 1990), 323-325.

1)Who is the one species responsible for altering the environment?

2)What are some of the sources of the “rain of chemicals” discussed in this article?

3)How many humans are on the earth today (look up on internet)?

4)What are some environmental problems you are aware of?

5)What do you think are some ways humans can help save the environment?

II. Worldviews

Review the powerpoint titled Environmental Worldviews on google slides

https://docs.google.com/presentation/d/1gGfm6YCeT4KILB4BFTWzHDq65WX4KHnKaB-Rsift4Es/edit?usp=sharing

Answer the analysis questions below:

1)What does anthropocentric mean?

2)What is a steward?

3)What is your worldview or a principle that you would follow?

III. Math Section

AP Environmental Science has a Math component which includes quantitative problem solving as well as conceptual knowledge of environmental issues such as ecology, energy sources, and pollution.

***Calculators are now permitted:**

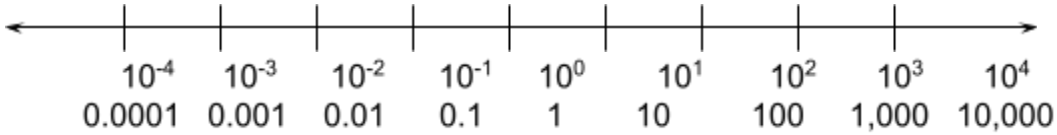
Conversions

There are some basic conversions you should know:
1 meter (m) = 100 centimeters (cm)
1 megawatt (Mw) = 1000 kilowatt (kw)
1 kilowatt (kw) = 1000 watts (w)
1 kilogram (kg) = 1000 grams (g)
1 meter (m) = 1000 millimeters (mm)

Scientific Notation

Environmental Science often deals with very large numbers (e.g. biomass production of a forest) and very small numbers (contamination of an aquifer). To better manage this data, and to decrease errors, scientists have developed a shorter method to express numbers using scientific notation. Scientific notation is based on powers of the base number 10. The number is rewritten as a product of two numbers: a coefficient and 10 raised to a power.

The larger a number is, the larger the power of 10 needed to represent it. Positive exponents of 10 result in numbers greater than 1 (large numbers). The smaller a number is, the smaller the power of 10 needed to represent it. Negative exponents of 10 result in numbers less than 1 (decimals).



For example: The number 60,200 is written in scientific notation as 6.02×10^{4}.
It is the same as 6.02 x 10,000.
For example: The number 0.0072 is written in scientific notation as 7.2×10^{-3}.
It is the same as 7.2 x 0.001.

An easy way to determine what power of 10 is used in scientific notation is to count how many places the decimal is moved.
For example: In 60,200 to get to the scientific notation coefficient of 6.02, the decimal was moved 4 places to the left (raised the 10 to the 4^{th} power).
For example: In 0.0072 to get to the scientific notation coefficient of 7.2, the decimal was moved 3 places to the right (raised the 10 to the -3^{rd} power).

Basic Formulas:

Here are some formulas used for environmental problems that you may have used in your past science studies:

Density is m/V
Volume = Length x Width x Height – measured in cubic units
Volume = Area x Height [Area = Length x Width]
Surface Area – Length x Width x # of sides – measured in squared unit

Percentage Change - FINAL/NEW -ORIGINAL/ORIGINAL X 100%

Ex - In the year 1900 there were 10 gallons of water used per person per day. By the year 2000, there were 12 gallons of water used per day per person. What is the percent increase?

12-10 = 2/10 x 100% = 20%

Graphin/Charts
Students will be expected to interpret different graph styles such as line, scatter plot, bar, and pie chart. More application based questions are on the current AP exam.

Dimensional Analysis
This is a valuable tool used to convert units and perform environmental problems.

Ex – How many seconds in 25 years?

25 years (start with given) x 365 days/year x 24 hours/1 day x 60 minutes/1 hour x 60 seconds/1 minute =

Answer = 31536000 or 3.1×10^7 seconds
***** If you cancel out like units, the answer should be left Ex - seconds on top**

The APES Examination will require you to do mathematical calculations. It is mandatory to show all work on the free response section of the APES exam. This worksheet is designed to prepare you for some of the calculations you may see.
WORK NEEDS TO BE SHOWN

Scientific Notation – Being able to work comfortably with scientific notation, will help you tackle many APES problems.

Write in scientific notation (do not need to show work here)

1. Twenty three thousand
2. 7 billion
3. 300 million

Unit Conversions - PLEASE SHOW WORK

4. The average gas mileage for a small gasoline-powered sport utility vehicle (SUV) is 22 miles per gallon (mpg) in the city. The average gas mileage for a small hybrid SUV is 36 mpg in the city. One commuter sells their gasoline-powered SUV and replaces it with a hybrid SUV. **Calculate** the percent change in gas mileage between the gasoline-powered SUV and the hybrid SUV based on the data provided. **Show** your work.

5. Both the gasoline-powered SUV and the hybrid SUV have 14-gallon gas tanks. As stated in part D, the average gas mileage for a small gasoline-powered sport utility vehicle (SUV) is 22 miles per gallon (mpg) in the city. The average gas mileage for a small hybrid SUV is 36 mpg in the city. **Calculate** how many more miles the owner can drive in the hybrid SUV in the city than they could have driven in the gasoline-powered SUV. **Show** your work.

6. The school plans to upgrade its lighting to save money and reduce both its electricity use and its ecological footprint. The sustainability committee proposes that the school reduce its electricity use by switching to energy-efficient light-emitting diode (LED) bulbs. The school building uses 2.8×10^4 bulbs. The LED bulbs would each use 0.0085 kilowatts per hour. Each bulb would be used for an average of 2,340 hours per year. **Calculate** the energy use in the school building in kilowatts per year using LED light bulbs. **Show** your wo

Volume/Surface Area

7. A male wood thrush needs a minimum of 800 m2 of territory for reproduction. The municipal development committee has set a biodiversity preservation target of 275 male wood thrush territories. Calculate the area that must be set aside to support the goal of 275 male thrush territories. Show your work.

8. A sanitary landfill with a surface area of $6000m^2$ receives a yearly rainfall amount of 300mm. About 20% of this precipitation is runoff and does not infiltrate the surface. What is the volume of leachate in m^3?

Density

9. What is the volume of a tank that can hold 10,000 Kg of methanol whose density is $0.500\ g/cm^3$?

Percentages

10. In 1990 the total MSW (municipal solid waste) was 150 million tons. By 2012, the total was 250 million tons. What was the percent increase?

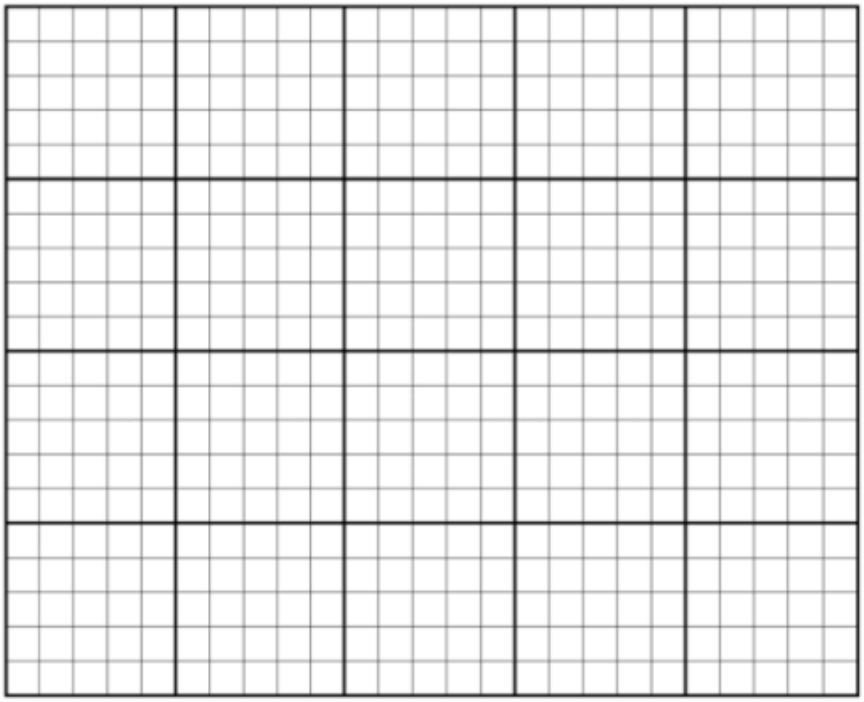
11. Review parts of the APES FRQ below:

Populations of large terrestrial animals, such as African elephants and snow leopards, are in decline arou
world. Many of these large animals are now on the verge of extinction.

ESTIMATED AFRICAN ELEPHANT POPULATION ON THE AFRICAN CONTINENT

Year	Population
1970	2,000,000
1980	1,300,000
1990	600,000
1995	550,000
2000	400,000
2005	550,000
2010	650,000
2015	600,000

(a) Using the data provided in the table above, **plot** the elephant population data as points on the grid below, placing the independent variable on the *x*-axis. Clearly **label** the axes.



(b) **Calculate** the percent loss of elephants in Africa from 1970 to 2000. Show all work.

(c) The International Union for Conservation of Nature (IUCN) estimates that the elephant population will decline by 20 percent between 2015 and 2022. Use this estimate to **calculate** how many elephants will be left in Africa in 2022. Show all work.