

Highland School
Science Department

2019-20 AP Environmental Science Summer Assignment

Welcome to APES! AP Environmental Science is a course designed to examine ecological, biological, chemical, physical, and geological concepts and interactions. A student in this course should be familiar with local, regional, and global concerns within her or his local or regional environment.

The objective of this summer assignment is to get you thinking environmentally, to prepare you for some of the math you will need to have mastered in order to excel in this course, and to review some foundational concepts necessary for success in this course. Please note that this assignment will be collected on the second day of school—Wednesday, September 4th.

APES is perhaps the most relevant class one can take in high school, and completion of the summer assignment will do three very important things for you:

1. Make the class during the year EASIER for you,
2. Make the class MORE ENJOYABLE and MORE INTERESTING to you,
3. IMPROVE YOUR SCORE ON THE AP EXAM in May, 2020.

The key word with the essay is CONCISE. I truly believe in the advantages of this assignment, and don't want it to be overwhelming to any student, so if you have any questions, at any time, feel free to contact me at arossi@highlandschool.org. Please give me some time to respond to your emails since I don't always check my account during the summer as often as I would during the school year.

I hope that you have an enjoyable, exciting, and educational summer! I look forward to meeting you (or seeing you again) in September!

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Deliverables

1. You may begin with any part (math, reading and writing, or textbook work).
2. Either a hard or electronic copy is fine.
3. The summary of the book should be a minimum of twelve complete sentences. The summary should be written in your own words and should not include direct quotes.
4. Show all your work for each math problem.
5. For the multiple choice questions, just indicate the correct letter for each problem on a separate sheet of paper.
6. If handwriting any part of the assignment, all writing should be legible.
7. All work is due at the *beginning* of class on Wednesday, September 4th.

Essay Instructions

Please read *Virginia Climate Fever* by Stephen Nash and *Drawdown: The most comprehensive plan ever proposed to reduce global warming* (edited by Paul Hawken). The Cliff Notes, or the Spark Notes, or any other easier and less informative method of attempting to earn points for the assignment is not acceptable. Environmental journalist Stephen Nash published *Virginia Climate Fever* in 2014. In it, he discusses the impacts of climate change specific to Virginia's cities, shorelines, and forests. *Drawdown* was published in 2017 in support of Project Drawdown, a climate change mitigation project editor Paul Hawken initiated with climate activist Amanda Joy Ravenhill.

Please read all of both books. Neither of them are excessively long (the editions I have are 165 pages (*Virginia Climate Fever*) and 225 pages (*Drawdown*)). But, when considered along with the rest of your summer work, this is an appreciable amount of material. So please plan accordingly. (i.e., you won't be able to start this assignment on September 3rd). I'd start early and read a few chapters each day.

Please write a summary for each book that provides a reflection of the book as a whole. The summary should also be complete, concise, and include the following:

- Did you enjoy or not enjoy the book, and why?
- What information did you learn or agree with?
- What information or opinions do you disagree with or have concerns with?
- Do you believe the book to be accurate or inaccurate (or both) and why?
- Do you believe the author to be biased or unbiased and why?
- Would you recommend the book to a friend or not, and why?
- The most important thing to take away from the book and why.

Math Instructions

Please answer the following questions. Copy each heading and problem number onto your answer page. You do not need to re-write word problems. For the first time ever, calculators will be allowed on the 2020 AP Environmental Science exam, so feel free to use a calculator. However, please *show all your work* for each problem.

Dimensional analysis word problems

1. Every three times I clean my bedroom, my mother makes me an apple pie. I cleaned my bedroom 9 times. How many apple pies does she owe me?
2. You have the heebie-jeebies. Your grandmother sends you a remedy for the heebie-jeebies with the following instructions: "Take 1 drop per 10 lbs. of body weight per day divided into 4 doses until the heebie-jeebies are gone." How many drops do you take per dose?
3. You're throwing a pizza party for 15 people and figure that each person will eat 4 slices. You call up the pizza place and learn that each pizza will cost you \$14.78 and it will be cut into 12 slices. How much is the pizza going to cost you? You only have \$70. Will you have enough money?
4. In my environmental science class, 28 students are each given 3 pens. If there are 8 pens in one package, priced at \$1.88 per package, what is the total cost of giving away pens?
5. The only time you are likely to see an adult sea turtle on the beach is during nesting season. Every two years, adult Loggerhead sea turtles find mates and the females come up on the sandy beaches to dig nests and to lay their eggs. A female Loggerhead will lay about 100 eggs per nest. In a nesting year, she will lay about five nests. Of those eggs, about 80% emerge as hatchlings. It is estimated that only 1 in 1,000 hatchlings survives to become an adult sea turtle. If Loggerhead sea turtles reach sexual maturity at age 25, how many years must a female loggerhead live to produce enough adult turtles in the next generation to replace both her and her mate?

Calculating percent increase or decrease

Hint: Use the following equation: $\text{change in amount} / \text{original amount} \times 100\%$

1. A price rose from \$5 to \$7. What percent increase is this?
2. A quantity decreased from 90 to 75. What percent decrease is this?

3. An item went on sale for \$13 from \$16. What percent decrease is this?
4. A scientist monitoring a population of water beetles noticed that in 2006 the population was 500 beetles. Ten years later, she counts only 300 water beetles in the population. What is the percent decrease of this population?
5. Say the population went from 500 water beetles in 2006 to 600 in ten years. What is the percent increase of the population?

Scientific notation

Hint: When multiplying numbers in scientific notation, add the exponents. When dividing numbers in scientific notation, subtract the bottom exponent from the top exponent. When adding or subtracting numbers in scientific notation, convert them to the same exponent first.

Express each number in scientific notation.

1. 0.000006
2. 60
3. 0.000004
4. 4 million
5. 4 billion

Express each number in standard notation.

1. 0.9×10^{-1}
2. 2×10^5
3. 2.66×10^4
4. 7.75×10^{-1}
5. 9.5×10^7

Solve using scientific notation.

1. $(6 \times 10^3)(2 \times 10^5)$
2. $(4 \times 10^6)(3 \times 10^6)$
3. $18 \times 10^6 / 4 \times 10^4$
4. $(67 \times 10^6) + (4 \times 10^9)$
5. $(7 \times 10^8) - (4 \times 10^6)$

6. The world's population is over 7.5 billion people. There are about 325 million people in the United States of America. Approximately what percentage of the world's population is represented by the United States? (Round to the nearest whole number.)

Textbook Instructions

You will need the textbook *Environmental Science for AP*, 2nd Edition, by Friedland and Relyea for this course. The first two chapters of this book serve as an introduction to the rest of the class and are foundational concepts as such. Much of the material in these chapters should be review from prior classes you have taken, particularly chemistry. Since the subjects covered on the AP Environmental Science test are so wide-ranging, we are pressed for time to get through all the material in this class during the school year. With all these considerations in mind, you will be reading the first two chapters on your own during the summer and answering the multiple choice questions below. These questions follow the format of the types of multiple choice questions you will see on the AP exam. You may use your book to answer the questions. Please indicate your answers to each problem on another sheet of paper.

1. The environment refers to

- A. all conditions surrounding us on Earth.
- B. species interactions that affect human life.
- C. conditions that cause negative effects on our health.
- D. interactions that harm the atmosphere.
- E. the sum of all the conditions surrounding us that influence life.

2. Ecosystem services

- A. are the processes by which life supporting resources are produced.
- B. indicate the current state of the environment.
- C. are valued for their beauty.
- D. refer to abiotic features of the environment.
- E. are the processes that humans use to address environmental problems.

3. Evidence of biodiversity is seen in

- A. genetic variation among human populations.
- B. number of species in a region.
- C. number of ecosystems and habitats in a region.
- D. genetic variation among plants and animals in a region.
- E. All of these answers are correct.

4. A population is better able to respond to environmental change if it has

- A. fewer numbers but high genetic diversity.
- B. large numbers but low genetic diversity.
- C. the ability to provide ecosystem services.
- D. evolved more recently.
- E. migrated to its current habitat.

5. The number of species on Earth that have not yet been identified is estimated at

- A. 50 - 100 billion
- B. 5 - 10 billion
- C. 5 - 100 million
- D. 1 - 2 million
- E. 5,000 - 100,000

6. Two square km is equal to _____ square meters.

- A. 200,000
- B. 2,000,000
- C. 20,000,000
- D. 200,000,000
- E. 2,000,000,000



7. According to the figure above, which statement about the overall trend in per capita wheat production is correct?

- A. Per capita wheat production increased from 1950 through the mid-1980's and then started to decrease.
- B. There is no discernible trend.
- C. Per capita wheat production was stable between 1950 and 1960, and then decreased through 2005.
- D. Per capita wheat production has not changed since the 1950's.
- E. Per capita wheat production has steadily increased since the 1950's through today.

8. Factors that are responsible for grain production not keeping up with worldwide population include

- A. crop diseases.
- B. soil degradation.
- C. use of food crops for fuel.
- D. government encouragement to let land remain uncultivated.
- E. All of these answers are correct.

9. The concentration of carbon dioxide in the atmosphere

- A. is increasing in part due to fossil fuel use.
- B. has not significantly changed in the past 200 years.
- C. is increasing in part due to deforestation.
- D. has been decreasing since the 1800's.
- E. can not be reliably measured.

10. Human population today is closest to

- A. 3 billion.
- B. 5 billion.
- C. 6 billion.
- D. 7 billion.
- E. 12 billion.

11. Which is NOT a non-renewable resource?

- A. aluminum.
- B. oil.
- C. coal.
- D. copper.
- E. timber.

12. People living in developed nations tend to

- A. use fewer non-renewable resources.
- B. consume more resources.
- C. restrict their use of resources.
- D. have a smaller ecological footprint
- E. consume fewer resources per capita.

13. If land is cleared at a rate of 456 hectares per week, approximately how many acres per year are being cleared? (2.47 acres = 1 ha)

- A. 16,500
- B. 180
- C. 9,500
- D. 66,400
- E. 58,600

14. Sustainable development

- A. requires giving up the use of all fossil fuels in the next 50 years.
- B. requires resources to be stored for future generations.
- C. is achieved when the amount of food grown equals the amount needed.
- D. balances human needs and resource management.
- E. is not possible on a planet of over 7 billion people.

15. Which is an example of a sustainable practice?

- I. Replanting a logged forest
- II. Developing substitutes for nonrenewable resources
- III. Banning the use of all fossil fuels

- A. I only
- B. II only
- C. I and III
- D. I and II
- E. I, II, and III

16. An ecological footprint considers

- A. per capita resource use of a nation.
- B. how much an individual consumes in terms of land area.
- C. average yearly individual consumption of resources.
- D. resources that an entire nation consumes in an average year.
- E. the ratio of resources consumed in developed nations to less developed nations.

Questions 17 through 21 refer to the following passage:

An experiment is designed to determine if wheat grows better when it is planted alone or with clover. The design calls for 3 pans of each treatment. Pans A, B, and C contain only wheat. Pans D, E, and F contain clover and wheat planted in alternating rows. Each pan contains a total of 100 seeds. All treatments contain the same type of soil, are planted in the same size pan, are exposed to the same amount of sunlight, and are maintained at the same temperature throughout the course of the experiment.

17. The treatments planted with only wheat are the

- A. sample size.
- B. control.
- C. environmental variable.
- D. null hypothesis.
- E. replication.

18. The following statement provides a hypothesis for this experiment:

- A. Wheat grows taller when planted by itself than when it is alternated with clover.
- B. Clover grows better when planted by itself
- C. Wheat grows better when planted together with clover.
- D. Clover grows better when planted together with wheat.
- E. Both A and C are legitimate hypotheses for this experiment.

19. The experimental design includes several pans of each treatment. This is known as

- A. replication.
- B. constants.
- C. control.
- D. environmental variable.
- E. a null hypothesis.

20. Constants in this experiment are

- A. the pan of wheat, temperature, soil type.
- B. temperature, number of seeds in each pan, sunlight.
- C. number of seeds in each pan, sunlight, one pan of wheat and clover.
- D. the pans in which wheat is alternated with clover.
- E. soil type and sunlight.

21. Studies conducted to determine the effect of pesticides on humans

- A. use human subjects to test for possible toxicity.
- B. compare the health of people who been exposed with those who have not been exposed.
- C. are typically conducted overseas where testing protocols are not as strict.
- D. are designed so that the control group consists of younger, healthier people.
- E. are typically conducted as a natural experiment using rats.

22. The study of environmental science differs from study of other natural sciences because it

- A. doesn't use experiments.
- B. does not require any mathematical calculations.
- C. also includes politics, law and economics.
- D. does not require an understanding of biology.
- E. uses the scientific process.

23. A natural experiment occurs when

- A. a group of scientists do an experiment outside the laboratory.
- B. a scientist observes a group of primates in its natural setting.
- C. there is no plan for a control.
- D. two scientists arrive at the same conclusion independently.
- E. a natural event acts as an experimental treatment in an ecosystem.

24. Problems developed at Mono Lake because

- A. the San Francisco earthquake of 1906 diverted several of its source rivers.
- B. its source water has been redirected for use by people in the Los Angeles area.
- C. its source water was redirected to support the development of Los Vegas.
- D. it became highly polluted by detergents and other runoff.
- E. birds no longer used it as a migratory stop.

25. Matter is

- A. anything that occupies space and has mass.
- B. a measurement of an object's weight.
- C. the smallest particle that can contain the chemical properties of an element.
- D. a molecule containing more than one element.
- E. a particle that contains more than one atom.

26. Electrons have

- A. a negative charge.
- B. a negative charge in groups of three.
- C. no electrical charge.
- D. a positive charge.
- E. a negative charge or a positive charge depending on the isotope.

27. Elements that gain or lose electrons to form compounds create

- A. ionic bonds.
- B. protons.
- C. covalent bonds.
- D. molecular bonds.
- E. isotopes.

28. To produce sodium chloride—common table salt—a single electron in the outer shell of a sodium atom is transferred to the outer shell of the chlorine atom. This is an example of

- A. the formation of an ionic bond.
- B. the formation of a covalent bond.
- C. radioactive decay.
- D. the formation of a hydrogen bond.
- E. the formation of an isotope.

29. The polarity of the water molecule is the result of

- A. the slight negative charge of the hydrogen atoms.
- B. shared electrons spending more time near the oxygen atom than near the hydrogen atoms.
- C. shared electrons spending more time near the hydrogen atoms than near the oxygen atom.
- D. the ionic bond between a hydrogen atom and an oxygen atom.
- E. two positive sides repelling each other.

30. As a solid or a liquid, water reaches its lowest density at

- A. 4°C.
- B. 39°F.
- C. 100°F.
- D. 100°C.
- E. 0°C.

31. Water's ability to act as a solvent explains which of the following phenomena?

- I. High concentrations of dissolved ions in seawater
- II. The capacity of living organisms to store many types of molecules in solution in their cells
- III. Easy transport of toxic substances through the environment

- A. I only
- B. II only
- C. I and II
- D. I and III
- E. I, II, and III

32. Which is the neutral value on the pH scale?

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

33. A substance with a pH of 4 has _____ times the hydrogen ion concentration of a substance with a pH of 6.

- A. 2
- B. 5
- C. 10
- D. 100
- E. 1000

34. According to the law of conservation of matter

- I. matter can be created.
- II. matter cannot be destroyed.
- III. matter can change form.

- A. I only
- B. II only
- C. III only
- D. I and II
- E. II and III

35. Organic compounds may contain

- I. carbon-carbon bonds.
- II. carbon-hydrogen bonds.
- III. hydrogen-oxygen bonds.

- A. I only
- B. II only
- C. III only
- D. I, II, and III
- E. I and III

36. What is DNA?

- A. A compound composed of carbon, hydrogen, and oxygen atoms
- B. A compound that contains carbon-carbon and carbon-hydrogen bonds
- C. A nucleic acid that contains the code for reproduction
- D. A nucleic acid that makes possible the synthesis of proteins
- E. A smaller organic biological molecule that does not mix with water

37. The ability to do work describes

- A. power.
- B. joules.
- C. energy.
- D. heat.
- E. radiation.

38. Energy is measured in

- A. hertz.
- B. joules or calories.
- C. kilowatts.
- D. wavelengths.
- E. watts.

39. The difference between potential and kinetic energy is

- A. potential energy is stored, kinetic energy is the energy of motion.
- B. kinetic energy is stored, potential energy is the energy of motion.
- C. potential energy is measured in calories, kinetic energy is measured in joules.
- D. potential energy is measured in watts, kinetic energy is measured in joules.
- E. kinetic energy cannot be captured, potential energy can be captured.

40. Twenty-five Btu = _____ joules. (1 Btu = 1,055 J)

- A. 45
- B. 56,375
- C. 4,416
- D. 26,375
- E. 42

41. A dishwasher uses 700 watts each time it is run. The cycle takes one hour. It is run 150 times per year. How much energy does it use in one year?

- A. 105 kWh
- B. 1050 kWh
- C. 1050 J
- D. 700 kWh
- E. 0.10 MJ

42. The ease with which an energy source can be used for work is known as

- A. energy quantity.
- B. entropy.
- C. energy efficiency.
- D. input.
- E. energy quality.

43. The second law of thermodynamics states that

- A. no energy is lost in an energy conversion.
- B. all systems move toward increased entropy.
- C. new energy is available in all systems.
- D. matter can be neither created nor destroyed.
- E. velocity increases as a dropped object nears the earth's surface.

44. A systems analysis of an ecosystem could involve

- I. inputs of nutrients.
- II. outputs of energy.
- III. evaporation.

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I, II, and III

45. A positive feedback loop occurs

- A. when feedback into a system increases a rate of response.
- B. when feedback into a system decreases a rate of response.
- C. when a system is in a steady state.
- D. when a system responds to a change by returning it to its original state.
- E. when input is greater than output.

46. A negative feedback loop occurs

- A. when feedback into a system increases a rate of response.
- B. when feedback into a system decreases a rate of response.
- C. when a system is in a steady state.
- D. when a system responds to a change by returning it to its original state.
- E. when input is greater than output.

47. Which is an example of a positive feedback loop?

- I. Warmer temperatures on Earth's surface decrease the evaporation of water.
- II. Water evaporation creates low-altitude clouds that reflect sunlight back into clouds.
- III. Water evaporation creates high-altitude clouds which absorb terrestrial energy that would otherwise escape the atmosphere.

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I, II and III

48. Which is an example of applying new energy to decrease entropy?

- A. Eating lunch to have the energy to clean up your lab station
- B. An instructor littering a desk with books and papers by the end of class
- C. A lawnmower dropping clippings all over the lawn
- D. Hot tea cooling after a few minutes.
- E. A student turning on the lights in a dark room

49. What does APES stand for?

- A. All People Eat Sausages
- B. Advanced Placement Environmental Science
- C. Alligators Please Exit Speedily
- D. Adrian Peterson Every Score
- E. Always Pat Elephants Smoothly

50. How excited are you for AP Environmental Science class 2019-20 Edition?
- A. So excited you actually remembered your reusable grocery bags instead of leaving them at home
 - B. So excited you hit up the thrift store for that wedding you're going to next month
 - C. So excited you had a dream that Chuck Norris roundhouse-kicked every plastic bottle off the planet
 - D. So excited you tried to see the ozone layer but forgot to use your solar eclipse glasses (public service announcement: don't stare at the sun)
 - E. So excited you actually just might be looking forward to coming back to school in the fall