APES REVIEW GUIDE

AP exam

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## The six-week study plan

*Use this calendar to help you systematically prep for the AP exam. If you are a quick learner, use the lower suggested time. If you take more time studying, use the higher suggested time. You can also study other items such as the review books and apps. I suggest you cross off or highlight items on the chart as you do them. It’ll motivate you to see your progress!*

*Study tips: Eliminate distractions. Put your phone in another room. Don’t watch TV or have social media/games open on the computer while you use it. Listen to classical or soothing music or none at all. Find a quiet area. Eat a healthy snack for brain power*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *Week 1*  *March 25* | *Week 2*  *April 1* | *Week 3*  *April 8* | *Week 4*  *April 15* | *Week 5*  *April 22* | *Week 6*  *April 29* |
| *Time* ***per day*** | *15-30 min* | *15-30 min* | *15-30 min* | *30-60 min* | *30-60 min* | *60-90 min* |
| *Topics to review* | *Ecology* | *Earth systems, Soil and Agriculture* | *Human Populations, Toxicology & Waste* | *Energy and Mining* | *Air and Water pollution* | *Everything* |
| *Practice FRQs*  *Found Publicly. Type “APES FRQ (YEAR) (NUMBER)” Answer keys have also been released.* | *2000 #3*  *2010 #2*  *2014 #4* | *2009 #4*  *2005 #2*  *2004 #4* | *2008 #4*  *2003 #2*  *2000 #4*  *2008 #2* | *2012 #1*  *2011 #1*  *2009 #2*  *2008 #3* | *2013 #1*  *2011 #2*  *2007 #3*  *2006 #2* |  |
| *Spend extra time on these concepts* | *Nitrogen cycle, succession, primary productivity, invasive species* | *El Nino, soil texture, salinization, desertification* | *Population graphs and math, Bio-accumulation, IPM* | *Energy pros and cons; math; env. Impacts of mining* | *Eutrophication, water quality testing, climate change, pollutant source and effect* |  |
| *Bozeman science videos\*\**  [*http://www.bozemanscience.com/ap-environmental-science*](http://www.bozemanscience.com/ap-environmental-science) | *001, 007, 008, 009, 010, 011, 012, 035* | *002, 003, 006, 016, 017, 018* | *013, 014, 015, 021, 031, 032* | *019, 022, 023, 024, 025, 026, 027, 028* | *004, 005, 020, 029, 030, 033, 034* |  |
|  |  |  |  |  |  |  |

*\*As you look back at the material, highlight or make note of the topics you have trouble remembering. You can ask for help during class and focus your studying in the end on the harder topics.*

*\*\* Bozeman website:* [*http://www.bozemanscience.com/ap-environmental-science*](http://www.bozemanscience.com/ap-environmental-science)

*Keys to Passing the APES Exam (Obviously this will not be the case this year. 45 Minutes of FRQ).*

**Below are some general test-taking skills that should help you in this section.**

# Free Response Questions Hints

**Overview of the types of questions**

There are three types of questions. An **Analysis of a Data Set** question where you interpret graphs, maps or charts. One **Environmental Problem** question, you will have to read a document and answer questions/perform calculations based on that information as well as your general knowledge. There is one **Experimental Design** question. This question will involve formation of a hypothesis/null hypothesis, identification of variables and constants, and explanation of appropriate data collection.

Each question is graded on a 10-point scale. Some of the grading rubrics are set up to contain slightly more than 10 points (e.g., 11-13). However, you can only earn a maximum of 10 points on any one question. Use a ballpoint pen with dark black ink.

**Task Verbs**

Pay close attention to the task verbs used in the free-response questions. Each one directs you to complete a specific type of response. Here are the task verbs you’ll see on the exam:

* **Calculate:**Perform mathematical steps to arrive at a final answer, including algebraic expressions, properly substituted numbers, and correct labeling of units. Showing work is required.
* **Describe:**Provide the relevant characteristics of a specified topic.
* **Explain:**Provide information about how or why a relationship, process, pattern, position, situation, or outcome occurs, using evidence and/or reasoning to support or qualify a claim. Explain “how” typically requires analyzing the relationship, process, pattern, position, situation, or outcome; whereas, explain “why” typically requires analysis of motivations or reasons for the relationship, process, pattern, position, situation, or outcome. Also phrased as “give one reason.”
* **Identify:**Indicate or provide information about a specified topic, without elaboration or explanation.
* **Justify:**Provide evidence to support, qualify, or defend a claim and/or provide reasoning to explain how that evidence supports or qualifies the claim.
* **Make a claim:**Make an assertion that is based on evidence or knowledge.
* **Propose a solution:**Provide a proposed solution to a problem based on evidence or knowledge.

**Succeeding on the FRQs**

The national average for the essay section will be about 50% correct (i.e., 5/10). It is very likely that you will not know everything, this is expected, but it is very likely that you do know something about each essay, so relax and do the best you can. Don't panic or get angry because you are unfamiliar with the question. Often they’ll pick topics from the news that you may or may not be familiar with. You probably have read or heard something about the subject - be calm and think... look for classroom connections to the topics and use those clues to guide your answers.

1. Don't leave questions blank. Each point you earn on an essay question is the equivalent of two correct multiple-choice questions, and there is no penalty for a wrong guess, bad spelling or bad grammar. Make an effort on every question! **Don't Quit!**
2. **You cannot list items in an outline form**. Use normal sentence structure to give a list of items.
3. Read all three questions first, before you attempt to answer them. Start with the question you find the easiest for you to answer, many times while answering one question, you will recall answers to other questions, write down this information so you don’t forget it.
4. Before you begin to answer any question, carefully reread the question, circle key words. Be sure to answer the question(s) asked and **only** those questions; and answer all parts of the question. If you are given a choice of parts to answer, choose carefully. It is best if you can answer the question parts in the order called for, but you don’t have to.
5. It is a great idea to label the parts "a", "b", "c", etc. as they are labeled in the question. You can always answer the earlier parts later and you don’t need to save space, just label the section. If you can’t answer all of the parts of the question, answer what you can, you get credit for what you write if it fits the rubric, some points are better than none.
6. Outline the answer to avoid confusion and disorganization. Pay close attention to words used in the directions, such as **describe**, **explain**, **compare**, **contrast, identify, support, provide evidence for**, **graph**, **calculate**, etc., and be sure to follow those directions.
7. If it asks for two examples, then only the first two are graded, if you give three and the first one is incorrect, then you won’t get that point. Extra points are usually available for elaboration, when they are given.
8. Outlines and diagrams, no matter how elaborate and accurate, are not essays, and will not get you much credit, if any, by themselves, write the essay.
9. If asked to draw a diagram, be sure to label the components carefully and correctly.
10. Define and/or explain any terms you use. Say something about each of the important terms that you use. Rarely would the exam ask for a list of buzzwords.
11. Write clearly and neatly. If the grader can’t read the answer because of penmanship, then you will more than likely receive a Zero (0) for the question.
12. Go into detail that is on the subject and to the point. Be sure to include the obvious (for example, "light is necessary for photosynthesis"). Answer the question thoroughly.
13. If you cannot remember a word exactly, take a shot at it, get as close as you can. Even if you don't remember the name of the concept, describe the concept.
14. Remember that no detail is too small to be included as long as it is to the point. Be sure to include the obvious, most points are given for the basics anyway.
15. Be concise. Be precise. This is a science test not an English test. Give examples whenever you can, but still be concise.

# Tips for the mathematical FRQ

Do this FRQ last! Save all the mathematical calculations for last since they take time.

1. Most math based FRQs have written questions following them. You can earn significant amounts of points on these sections. Often students get stuck on a math problem and run out of time to answer the easier points. Answer the written portions first if you can and then go back and calculate last.
2. On the math- write out the formulas and show your work! Many times, points are awarded for setting up the problem. If you provide only the answer and did not show how you obtained the answer, you will receive no points.
3. **Show all units!** Be really specific about what your numbers represent.
4. Show all your calculations in the answer spaces. You can use your question booklet to think through the problem but then show an organized solution in the answer booklet showing all your work.

# When they ask for experimental design…

There have been several years where there has been an experimental design question. You have a lot of practice with this in the lab! Think through how we do experiments and write a full lab report. Do all of those same actions on the FRQ. If you are asked to design or describe an experiment, be sure to include the following:

* hypothesis and/or predictions
* identify the independent variable - what treatments will you apply
* identify the dependent variable - what will you measure
* identify several variables to be controlled (very important)
* describe the materials you would use to conduct the experiment. Be specific!
* describe what you will actually do. Give a specific list of steps you’d follow.
* describe how you will actually take and record data
* describe how the data will be graphed and analyzed
* state how you will draw a conclusion (claim-evidence-reasoning with comparison of outside sources)

Your experimental design needs to be at least theoretically possible and it is very important that your conclusions/predictions be consistent with the principles involved and with the way you set up the experiment. When designing the experiment, I suggest you plan it backwards. Work from the expected result to the hypothesis. This is a great place to use the question booklet for planning.

# When they ask you to graph…

* set up the graph with the independent variable along the x-axis and the dependent variable along the y-axis
* mark off axes in ***equal*** (proportional) increments and ***label*** with proper units
* plot points and attempt to sketch in the curve (line)
* if more than one curve is plotted, write a label on each curve
* label each axis
* give your graph an appropriate title (what is it showing?)

Science Practices

The AP Environmental Science practices describe what a student should be able to do while exploring course concepts. The table that follows presents these practices

# A screenshot of a social media post Description automatically generated

A screenshot of a cell phone

Description automatically generated

# Topic Outline

|  |
| --- |
| ***Unit 1: The Living World - Ecosystems*** |
| * 1. **Introduction to Ecosystems**   2. **Terrestrial Biomes**   3. **Aquatic Biomes**   4. **The Carbon Cycle**   5. **The Nitrogen Cycle**   6. **The Phosphorous Cycle**   7. **The Water Cycle**   8. **Primary Productivity**   9. **Trophic Levels**   10. **Energy Flow and the 10% Rule**   11. **Food Chains and Food Webs** |
| ***Unit 2: The Living World - Biodiversity*** |
| * 1. **Introduction to Biodiversity**   2. **Ecosystem Services**   3. **Island Biogeography**   4. **Ecological Tolerance**   5. **Natural Disruptions to Ecosystems**   6. **Adaptations**   7. **Ecological Succession** |
| ***Unit III. Populations (10 – 15%)*** |
| * 1. **Generalist and Specialist Species**   2. **K-Selected and R-Selected Species**   3. **Survivorship Curves**   4. **Carrying Capacity**   5. **Population Growth and Resource Availability**   6. **Age Structure Diagrams**   7. **Total Fertility Rate**   8. **Human Population Dynamics**   9. **Demographic Transitions** |
| ***Unit IV. Earth Systems and Resources(10 – 15%)*** |
| * 1. **Plate Tectonics**   2. **Soil Formation and Erosion**   3. **Soil Composition and Properties**   4. **Earth’s Atmosphere**   5. **Global Wind Patterns**   6. **Watersheds**   7. **Solar Radiation and Earth’s Seasons**   8. **Earth’s Geography and Climate**   9. **El Nino and La Nina** |

|  |
| --- |
| ***Unit V. Land and water Use (10 – 15%)*** |
| **5.1 The Tragedy of the Commons**  **5.2 Clearcutting**  **5.3 The Green Revolution**  **5.4 Impacts of Agricultural Practices**  **5.5 Irrigation Methods**  **5.8 Pest Control Methods**  **5.7 Meat Production Methods**  **5.8 Impacts of Overfishing**  **5.9 Impacts of Mining**  **5.10 Impacts of Urbanization**  **5.11 Ecological Footprints**  **5.12 Introduction to Sustainability**  **5.13 Methods to reduce Urban Runoff**  **5.14 Integrated Pest Management**  **5.15 Sustainable Agriculture**  **5.16 Aquaculture**  **5.17 Sustainable Forestry** |

|  |
| --- |
| ***Unit VI. Energy Resources and Consumption (10 – 15%)*** |
| **6.1 Renewable and Nonrenewable Resources**  **6.2 Global Energy Consumption**  **6.3 Fuel Types and Uses**  **6.4 Distribution of Natural Energy Resources**  **6.5 Fossil Fuels**  **6.6 Nuclear Power**  **6.7 Energy from Biomass**  **6.8 Solar Energy**  **6.9 Hydroelectric Power**  **6.10 Geothermal Energy**  **6.11 Hydrogen Fuel Cell**  **6.12 Wind Energy**  **6.13 Energy Conservation** |
| ***Unit VII. Atmospheric Pollution (7-10%)*** |
| * 1. **Introduction to Air Pollution**   2. **Photochemical Smog**   3. **Thermal Inversion**   4. **Atmospheric CO2 and Particulates**   5. **Indoor Air Pollutants**   6. **Reduction of Air Pollution**   7. **Acid Rain**   8. **Noise Pollution** |
| ***Unit VIII. Aquatic and Terrestrial Pollution (7-10%)*** |
| * 1. **Sources of Pollution**   2. **Human Impacts of Ecosystems**   3. **Endocrine Disruptors**   4. **Human Impacts on Wetlands and Mangrovescvbn**   5. **Eutrophication**   6. **Thermal Pollution**   7. **Persistent Organic Pollutants (POPs)**   8. **Bioaccumulation and Biomagnification**   9. **Solid Waste Disposal**   10. **Waste Reduction Methods**   11. **Sewage Treatment**   12. **Lethal Dose 50% (LD50)**   13. **Dose Response Curve**   14. **Pollution and Human Health**   15. **Pathogens and Infectious Diseases** |

|  |
| --- |
| ***Unit IX. Global Change (15 – 20%)*** |
| **9.1 Stratospheric Ozone Depletion**  **9.2 Reducing Ozone Depletion**  **9.3 The Greenhouse Effect**  **9.4 Increases in Greenhouse Gases**  **9.5 Global Climate Change**  **9.6 Ocean Warming**  **9.7 Ocean Acidification**  **9.8 Invasive Species**  **9.9 Endangered Species**  **9.10 Human Impact on Biodiversity** |

Unit 1: The Living World (6-8%)

# Vocabulary:

1. abiotic
2. aerobic respiration
3. ammonia
4. ammonification
5. aquifer
6. assimilation
7. autotroph
8. bacteria
9. benthos
10. biogeochemical cycle
11. biome
12. biosphere
13. biotic
14. deciduous plants
15. carbon cycle
16. carbon sink
17. carrying capacity
18. climax community
19. coastal wetland
20. commensalism
21. community
22. coniferous trees
23. coral reef
24. deciduous plants
25. decomposer
26. denitrification
27. detritivore
28. detritus
29. detritus feeder
30. diffusion
31. ecology
32. ecosystem
33. energy productivity
34. estuary
35. eutrophication
36. fermentation
37. first law of thermodynamics
38. food chain
39. food web
40. freshwater life zones
41. fundamental niche
42. gross primary productivity (GPP)
43. groundwater
44. habitat
45. herbivore
46. heterotroph
47. host
48. hydrologic cycle
49. infiltration
50. kilocalorie (kcal)
51. law of conservation of energy
52. law of conservation of matter
53. leaching
54. limiting factor
55. mutualism
56. net primary productivity (NPP)
57. niche
58. nitrate
59. nitrogen cycle
60. nitrous oxide
61. nitrogen fixation
62. nitrogen oxides
63. nitrification
64. omnivore
65. parasitism
66. phosphate
67. phosphorus cycle
68. photosynthesis
69. phytoplankton
70. plankton
71. precipitation
72. predation
73. primary consumer
74. primary productivity
75. producer
76. pyramid of energy flow
77. riparian zones
78. runoff
79. scavenger
80. second law of energy
81. second law of thermodynamics
82. secondary consumer
83. species
84. sulfur cycle
85. sulfur dioxide (SO2)
86. sulfuric acid (H2SO4)
87. surface runoff
88. surface water
89. Symbiotic Relationships
90. terrestrial
91. tertiary (higher-level) consumers
92. transpiration
93. trophic level
94. water cycle
95. water table
96. zone of aeration
97. zone of saturation

# Review Questions:

* 1. What are five biotic and five abiotic factors we might study in an ecosystem? How might these impact the carrying capacity of an ecosystem?
  2. List and describe (or draw a picture and add captions) of the water cycle. Which steps are humans most likely to interfere (intentionally or otherwise)?
  3. List and describe (or draw a picture and add captions) of the carbon cycle. Which steps are humans most likely to interfere (intentionally or otherwise)? What would be the likely consequence(s) of such interferences?
  4. List and describe (or draw a picture and add captions) of the nitrogen cycle. Which steps are humans most likely to interfere (intentionally or otherwise)? What would be the likely consequence(s) of such interferences?
  5. List and describe (or draw a picture and add captions) of the phosphorus cycle. Which steps are humans most likely to interfere (intentionally or otherwise)? What would be the likely consequence(s) of such interferences? How is the phosphorus cycle different from the other biogeochemical cycles?
  6. Complete the following table for these biogeochemical cycles:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trait** | **Carbon** | **Nitrogen** | **Phosphorus** | **Water** |
| Importance to life |  |  |  |  |
| Largest reservoir |  |  |  |  |
| Methods of transport |  |  |  |  |
| Cycle duration (long/short) |  |  |  |  |

* 1. Name the molecules that match each step of the nitrogen cycle: (FIXNAAD ANPAN)

Nitrogen **fix**ation

**N**itrification

**A**ssimilation

**A**mmonification

**D**enitrification

* 1. For each of the following species interactions, define it and give a common example.

|  |  |  |
| --- | --- | --- |
| **Symbiotic Relationship** | **Definition** | **Two Examples of Each**  Indicate with a +/- which benefits and which is harmed, if applicable |
| Mutualism |  |  |
| Commensalism |  |  |
| Parasitism |  |  |
| Competition |  |  |
| Predation |  |  |

* 1. What climatic patterns determine the type of biome an area will have?
  2. For each of the following biomes, identify a specific country in which each biome occurs in relative abundance:

Taiga \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Desert

Tropical rainforest \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Temperate grassland

Tropical grassland \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Coral reef

Temperate deciduous forest Tundra

* 1. Fill out the chart below on the various biomes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Biome** | **Typical Location** | **Typical Climate** | **Characteristic adaptations for survival** |
| Tropical Rain Forest |  |  | Plants –  Animals – |
| Temperate Deciduous Forest |  |  | Plants –  Animals – |
| Taiga (Boreal) Forest |  |  | Plants –  Animals – |
| Tropical Grasslands (Savanna) |  |  | Plants –  Animals – |
| Temperate Grassland (Prairie) |  |  | Plants –  Animals – |
| Tundra  (Cold Grassland) |  |  | Plants –  Animals – |
| Desert |  |  | Plants –  Animals – |

* 1. List two environmental benefits of wetlands.

2. 1. Label the four major zones of life in the appropriate areas on the diagram representing a temperate lake in the box to the right.

B. Energy Flow

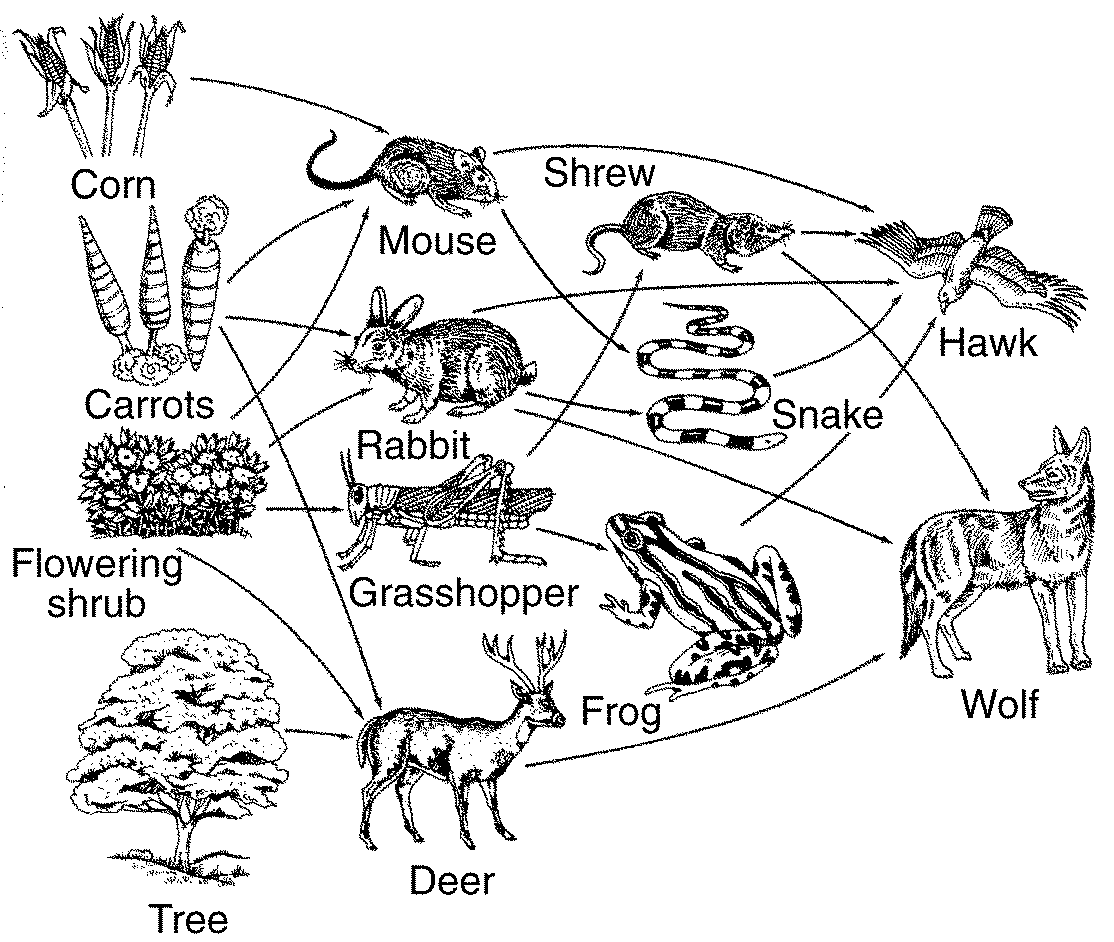
* 1. Write the balanced chemical equation for photosynthesis in the box on the right. Label the reactants and products.

Photosynthesis:

Cellular Respiration:

* 1. Write the balanced chemical equation for cellular respiration in the box on the right. Label the reactants and products.
  2. Perform the following calculation. Show all of your work. If the grasses on a 100-hectare area of grassland grow at an average rate of 1 cm/day, the average volume of grass that is added to the grassland each day is \_\_\_\_\_\_\_\_\_\_\_\_ m3. If the density of the grasses that grow in the grassland averages 400 kg/m3, the net primary productivity is approximately \_\_\_\_\_\_\_\_\_\_\_\_\_ g/m2/day or \_\_\_\_\_\_\_\_\_\_\_\_\_ g/m2/year.
  3. The net annual primary productivity of a particular wetland ecosystem is found to be 8,000 kcal/m2 . If respiration by the aquatic producers is 12,000 kcal/m2 per year, what is the gross annual primary productivity for this ecosystem, in kcal/m2 per year?

* 1. On the following food web, classify each species into its trophic level.

****

* 1. Next to the food web, draw an ecological pyramid using the food web above and determine the biomass of the deer if the wolf consumes 8943 kg. Label each trophic level in the pyramid.
  2. Explain how the law of conservation of matter relates to the cycling of carbon through a food web.
  3. How does Easter Island depict the flow of matter through an ecosystem?
  4. Before a group of volunteers planted 400 mangrove trees, the gross annual primary productivity of a particular wetland ecosystem is found to be 22,000 kcal/m2 . The trees have increased the gross primary productivity by 20%. What is the new GPP of the wetland?

Unit 2: The Living World: Biodiversity (6-8%)

Vocabulary:

1. adaptation
2. allele
3. artificial selection
4. background extinction
5. biodiversity
6. biological diversity
7. bottleneck effect
8. climax community
9. competitive exclusion
10. cultural services
11. ecological diversity
12. ecological niche
13. ecosystem services
14. endangered species
15. edge effect
16. endemic species
17. evolution
18. extinction
19. fitness
20. founder effect
21. fundamental niche
22. fundamental niche
23. gene flow
24. gene pool
25. generalist species
26. genetic diversity
27. genetic drift
28. geographic isolation
29. habitat
30. inbreeding depression
31. indicator species
32. interspecific competition
33. intraspecific competition
34. island biogeography
35. keystone species
36. limiting factor
37. mass extinction
38. mutation
39. natural selection
40. niche
41. pioneer species
42. population
43. provisional service
44. primary succession
45. range
46. range of tolerance
47. realized niche
48. regulating service
49. reproductive isolation
50. resource partitioning
51. secondary succession
52. Shannon Index
53. specialist species
54. speciation
55. species
56. species evenness
57. species diversity
58. species richness
59. supporting services
60. theory of evolution

# Review Questions:

* 1. Match the following:
  2. generalist species Zebra mussel
  3. specialist species Galapagos tortoise
  4. invasive species American Alligator
  5. keystone species Tiger salamander
  6. indicator species Norway rat

f. endemic Species Giant Panda

* 1. Contrast genetic, ecosystem and species biodiversity.
  2. If a forest is fragmented due to deforestation, explain how the edge effects impact species diversity and population sizes.
  3. What are two ways to reduce habitat fragmentation?

# Ecosystem Diversity

* 1. Explain how preserving biodiversity is directly related to the availability of natural capital.
  2. Explain how biodiversity increases the survival of a species during the process of natural selection and evolution.
  3. What is the bottleneck effect? What is the founder effect? Provide an example of each and explain what happens to the representation of alleles in the gene pool.
  4. Answer the question below and explain why each answer choice is correct or incorrect.

A farmer observes that increasingly higher concentrations of a particular pesticide have been required each year over the past ten years to achieve the same level of effectiveness on a specific insect pest. Which of the following best helps explain the observation?

* + - * 1. Some individual insects live longer than others and pass on traits acquired during their lives.
        2. Only the most aggressive and territorial insects survive and reproduce.
        3. Some individual insects are more likely than others to survive and reproduce due to their inherited traits.
        4. Some individual insects produce many offspring, and thus their offspring live longer.
        5. Some individual insects reproduce before the pesticide is applied, thereby avoiding its harmful effects.
  1. Compare/Contrast natural selection and artificial selection.
  2. Two islands, different distances from the mainland have different rates of extinction, this is explained by the theory of island \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  3. Complete the following table:

|  |  |
| --- | --- |
| **Ecosystem Service** | **Description of ecosystem service and two examples** |
| Regulating |  |
| Supporting |  |
| Cultural |  |
| Provisioning |  |

* 1. What are three examples of keystone species? Why are they so important?
  2. Why are amphibians often considered an indicator species?

* 1. Contrast primary and secondary ecological succession. What types of events cause each? Contrast the pioneer species found in each.

Unit 3: Population 10-15%

# Vocabulary

1. age structure
2. baby bust
3. baby boom
4. biotic potential
5. birth rate
6. carrying capacity (K)
7. competitors
8. crude birth rate
9. crude death rate
10. death rate
11. demographic transition
12. demography
13. density dependent factors
14. density independent factors
15. developed country
16. developing country
17. doubling time
18. growth rate
19. ecological footprint
20. economy
21. emigration
22. environmental degradation
23. environmental ethics
24. environmental resistance
25. environmentally sustainable economic development
26. exponential growth
27. family planning
28. famine
29. fertility
30. globalization
31. gross domestic product (GDP)
32. immigration
33. industrialization
34. infant mortality rate
35. K-Selected Species
36. J-curve
37. less developed country (LDC)
38. life expectancy
39. limiting factor
40. linear growth
41. logistic growth
42. malnutrition
43. more developed country (MDC)
44. natural capital
45. opportunist
46. overnutrition
47. overshoot
48. per capita
49. population density
50. population dispersion
51. population distribution
52. population dynamics
53. population momentum
54. population size
55. post industrial
56. post- reproductive age
57. poverty
58. pre-industrial
59. pre-reproductive age
60. post-industrial
61. replacement-level fertility
62. R-Selected Species
63. rule of 70
64. S- curve
65. surplus
66. survivorship curve
67. total fertility rate (TFR)
68. transitional

# A. Population Biology Concepts

Population

Time

1. Use the axes to the right for the following:
   1. Draw and label a line that represents linear growth.
   2. Draw and label a line that represents exponential growth.
   3. Label carrying capacity (k)
2. List the four most populated countries in the world.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3)
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (4)
5. On the axes below, draw a line showing a population that exemplifies logistic growth. (s-curve) and label the carrying capacity.

Population

Time

1. In 1987, the population of Black Footed Ferrets in the world was 18 individuals. By 1989 through captive breeding, the number rose to 120. What percent change is this? (round to nearest whole %)
2. There are 300 births in a population of 1800 mountain lions. What is the birth rate?
3. Describe the three survivorship types

Type 1:

Type 2:

Type 3:

1. Fill in the chart below comparing R and K Selected Species

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **R-Selected Species** | **K-Selected Species** |
| Typical Organism Size |  |  |
| Time to Reach Reproductive Maturity |  |  |
| Number of Offspring Per Reproductive Event |  |  |
| Gestational Time |  |  |
| Reproductive Events in a Lifetime |  |  |
| Life Expectancy |  |  |

1. Graph the three survivorship types below. Label R- and K- selected species. Label the environmental resistance and biotic potential.





# B. Human Populations

1. In what regions of the world is population density the greatest concern? How is population distribution a food and water security issue?
2. Explain two reasons why a population can continue to grow even if fertility rates decrease.
3. Perform the following calculations: (Show all of your work in a logical progression to the final answer.)
   1. A city has a population of 45,000 in 2012. If the population of the city grows at an annual rate of 3%, the year in which the population will reach 100,000 is \_\_\_\_\_\_\_\_\_\_\_\_\_ and the year it will reach 200,000 is \_\_\_\_\_\_\_\_\_\_\_\_\_.
   2. A country’s population was 9 million in 1992 and in 2012 it is 24 million. If the population grew at a constant rate, that percent rate of growth was \_\_\_\_\_\_\_\_\_\_\_\_\_.
   3. The area of Chicago is 200,000 square kilometers. The population density is 100 people per square kilometer. What is the population of Chicago?
   4. India is doubling its population every 15 years. What is the growth rate of India?

1. Write an equation for the rule of 70:
2. Use the axes below to draw and label lines representing the birth rate, death rate and total population size during the idealized demographic transition of a country. Include, written directly onto the graph, an explanation for each change in the birth rate, death rate and total population size.
3. On the axes below, draw and completely label four age-structure diagrams that represent slow growth, rapid growth, negative growth, and zero population growth (include labels on the x- and y-axes)

Rate / Population size

Time

1. Contrast the types of disease you find in developed countries versus undeveloped countries.
2. What happens to the birth rate, death rate, and growth rate for each of the demographic transitions? Explain why these changes occur.

Phase 1 (Preindustrial) –

Phase 2 (Transitional) –

Phase 3 (Industrial) –

Phase 4 (Postindustrial) -

1. Complete the following table by writing “high” or “low” in each box below.

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **More Economically Developed Countries (MEDCs)** | **Less Economically Developed Countries (LEDCs)** |
| per capita GDP |  |  |
| degree of industrialization |  |  |
| infant mortality rate |  |  |
| per capita fossil fuel use |  |  |
| ecological footprint |  |  |
| greenhouse gas emissions |  |  |
| risk from heart disease |  |  |
| risk from infectious diseases |  |  |

1. How is the stage of demographics directly related to the economy of a country?
2. Contrast resource use in each demographic stage.

Unit 4- Earth Systems and Resources

# Vocabulary:

1. A Horizon
2. Albedo
3. altitude
4. asthenosphere
5. atmospheric pressure
6. B Horizon
7. C Horizon
8. clay
9. climate
10. cold front
11. condensation
12. convection current
13. convection cells
14. convergent plate boundary
15. core (Earth’s)
16. Coriolis effect
17. crust
18. density
19. divergent plate boundary
20. earthquake
21. E Horizon
22. elevation
23. erosion
24. front
25. greenhouse effect
26. greenhouse gases
27. groundwater
28. gully erosion
29. hot spots
30. humus
31. hydrosphere
32. igneous rock
33. infiltration
34. inorganic compounds
35. jet stream
36. latitude
37. leaching
38. lithosphere
39. loams
40. mantle
41. metamorphic rock
42. micronutrients
43. mineral resource
44. monsoons
45. natural recharge
46. O Horizon
47. organic compounds
48. ozone layer
49. parent material
50. permeability
51. porosity
52. precipitation
53. rain shadow effect
54. rift
55. rill
56. ring of fire
57. runoff
58. sand
59. sedimentary rock
60. sheet
61. silt
62. soil erosion
63. soil horizons
64. soil permeability
65. soil porosity
66. soil profile
67. soil structure
68. soil texture
69. stratosphere
70. subduction
71. surface runoff
72. surface water
73. tectonic plate
74. temperature inversion
75. terrestrial
76. thermal inversion
77. trade winds
78. transform fault
79. transpiration
80. troposphere
81. upwelling
82. warm front
83. water cycle
84. waterlogging
85. water table
86. watershed
87. weather
88. weathering
89. zone of aeration
90. zone of illuviation
91. zone of saturation

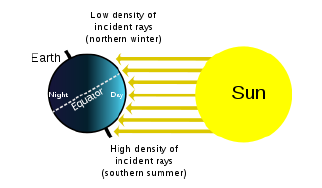
# Earth Science Concepts

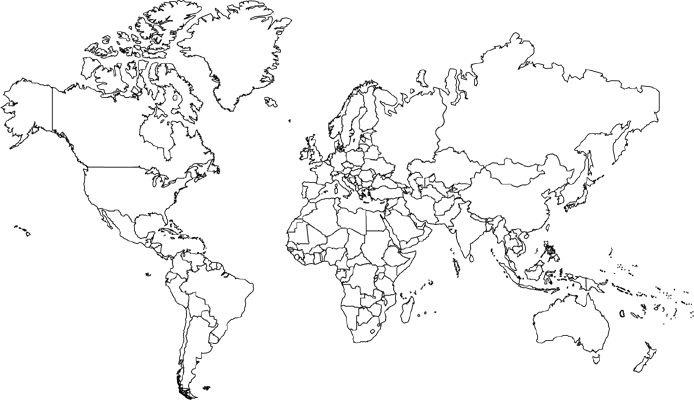
1. The approximate age of the Earth is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years.



1. FRQ sample- Plate tectonic theory states that the Earth’s lithosphere is broken into very slowly moving pieces or plates. Plate movements over vast stretches of time have led to the current orientation of our continents and oceans. Individual events along plate boundaries, such as earthquakes and volcanic eruptions, pose periodic threats to human activity and ecosystems. The “Ring of Fire” is a term that describes the location of increased seismic and volcanic activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.
2. Japan, Indonesia and the Philippines are examples of volcanic island chains that have formed along subduction zones between plates in the western Pacific.
3. Describe what happens when two tectonic plates collide along a subduction zone.

ii. Explain how subduction leads to volcanic activity.

1. Identify the following locations on the map above.
   1. Area that exhibits island arcs
   2. Area that exhibits a growing non-volcanic mountain chain due to uplift
   3. Area where new crust is being created at a divergent plate boundary
2. What causes seasons to occur in temperate zones?
3. Describe how solar insolation shown at the right affects wind currents and precipitation patterns. 
4. On the world atlas below, label the following:
   1. Equator
   2. Arctic circle
   3. Antarctic circle
   4. Tropic of cancer
   5. Tropic of Capricorn
   6. Polar region
   7. Temperate region
   8. Tropic region
   9. Northern Hemisphere
   10. Southern Hemisphere
   11. Label the major continents.



# The Atmosphere

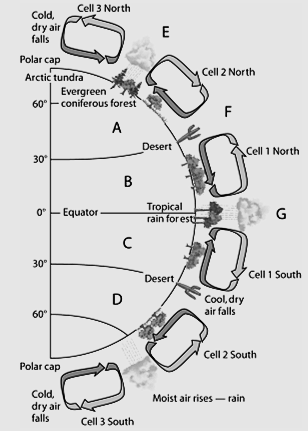
1. Use the axes below for the following:
   1. Draw a line representing the Earth’s atmosphere.
   2. Label each layer of the Earth’s atmosphere and identify where the greenhouse effect occurs and the ozone layer is situated.

Altitude (km)

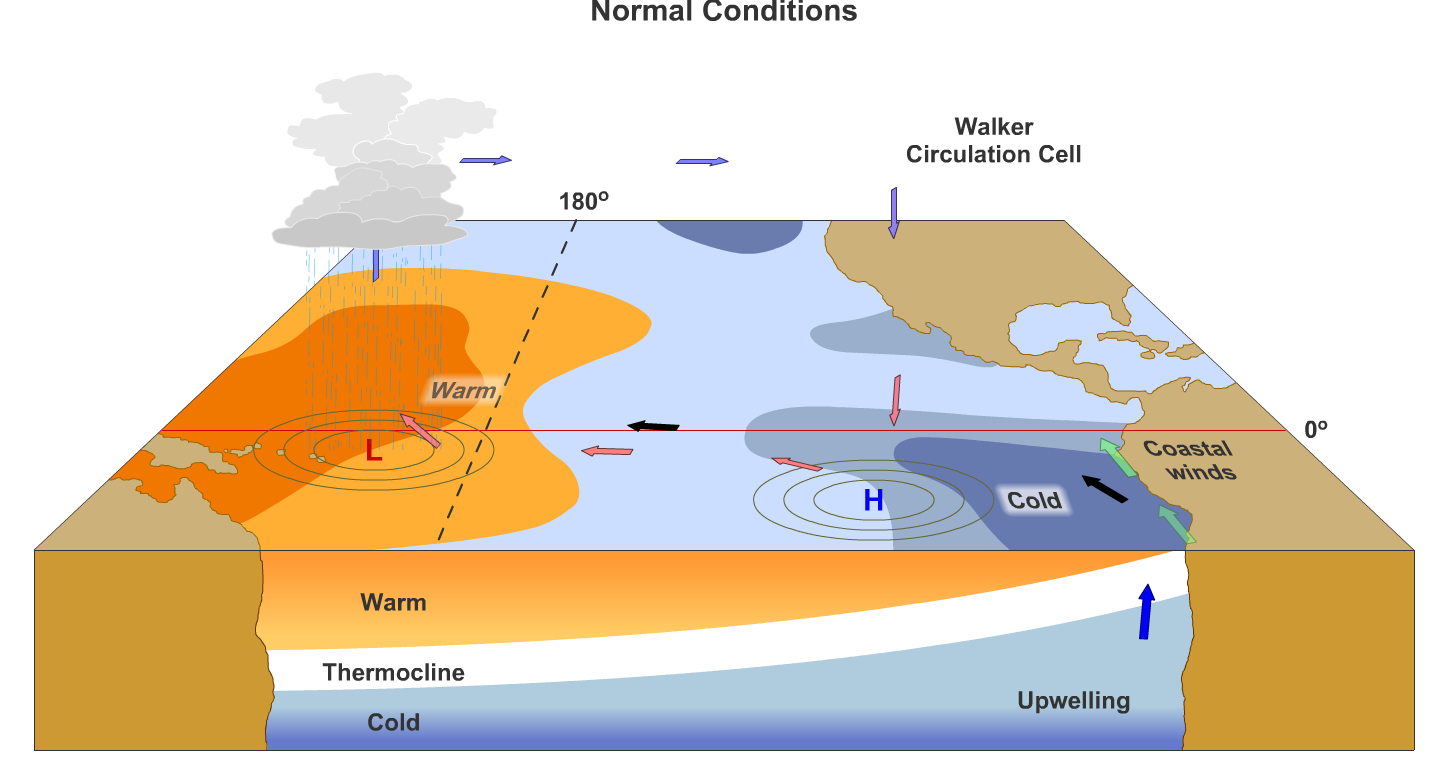
Temperature (°C)

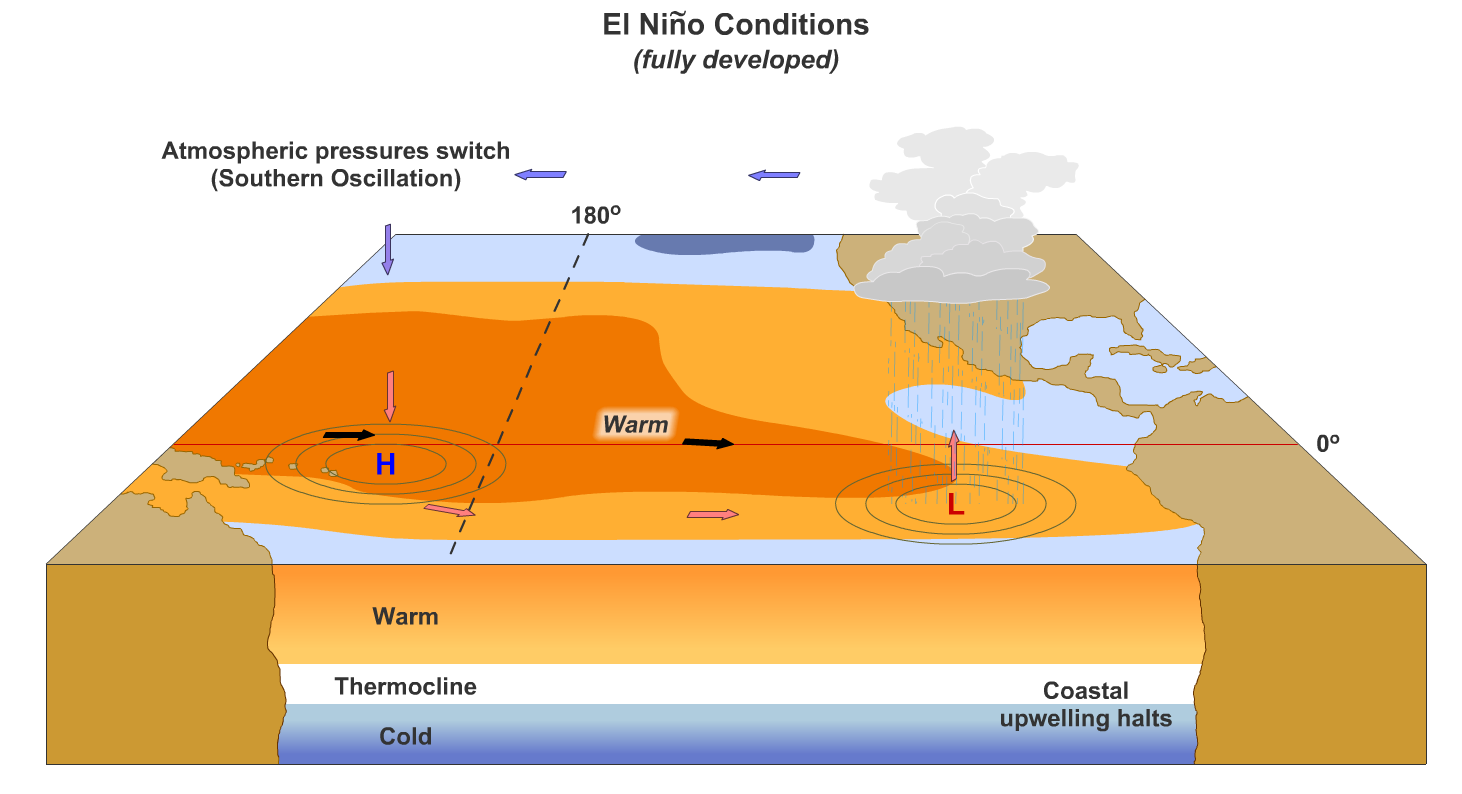
1. The box to the right contains a crude depiction of a mountain, use it to sketch and label the essential attributes of a rain shadow. Include labels for the direction of the prevailing winds and nearest ocean.
2. Describe how the ocean currents, temperature and gas concentrations are directly related to those of the atmosphere.

1. The acronym ENSO refers to \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, a phenomenon that occurs in the \_\_\_\_\_\_\_\_\_\_\_\_\_ Ocean.
2. Describe the following diagram of the Coriolis effect. How does the solar intensity and atmospheric convection currents influence the location of the major biomes?



1. Using the following diagrams, explain what an *El Niño* event is and why it is significant.



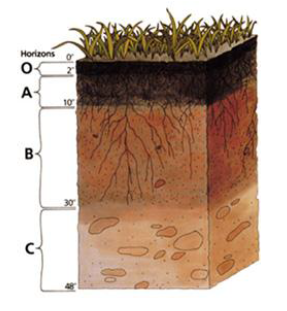


1. How does the Richter scale work? What does it measure?

|  |  |  |
| --- | --- | --- |
| **Type of Boundary** | **What happens? What can result? Give at least**  **one real world example.** | **Draw a picture** |
| Divergent |  |  |
| Convergent |  |  |
| Transitional (Transform) |  |  |

# Soil and Soil Dynamics

1. Explain the rock cycle. What are the three types of rocks and the forces that convert one form to another?
2. Contrast the processes of weathering and erosion.

Which horizon do you find the following layers? Add in a description of each:

* 1. Eluviation layer \_\_\_\_\_\_\_\_\_
  2. Top soil \_\_\_\_\_\_\_\_\_\_
  3. Parent material \_\_\_\_\_\_\_
  4. Sub soil \_\_\_\_\_\_\_\_
  5. Leaf litter \_\_\_\_\_

1. Identify the percent sand, silt, and clay for points (A) and (B) on the soil triangle below:

![A close up of a map

Description automatically generated](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAc0AAAF9CAMAAABRUcNaAAADAFBMVEUAAAD////g4IBggMCmyvD/+/DA3MCgYEAgIEBggIDgwIBgQEBAQICAoMDAoIBAQECAwMDAgEBAYICgoMBgYICAoICggICAgMDAwMCAQECAgICgoIDgoIBgQIBgYEAgYIBgoMCgwMCAYICgYIBgIIAgYMCAQIAggMDgoEAAYMCggEBgIEAgoMBAgMCAIECAYEDAgICgoKRAYEAAAABAIAAgQIBAIEDAwIAAIEDggEBAYMCgQEBgYMAgQEAAAEAgQACAQACgIEBgwMDAoMCAgEBgQABAgIBAoMDAYEDAoEBggEAAgMBAQAAgAEBgIACgoEDgwEBgoIAAQICAYMBAIIAgIIAAQEDA4ICgwIAAYIAggICAwICAIABAgEDgoMBAAEAgYECggMDggIDAgMCgYMCAAACAoEDggMDAYMCg4IBgAEDAwEDAYIBgwIAAgICgQIDg4ECgwEDgwADA4EBAoIBgwEAggEBgoEAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAABHMqiEAAAAAXRSTlMAQObYZgAAYOxJREFUeNrsvfl3G9edL/itqlsACjtQWEiRFBeRlChSixUrm2MndvycdDvt7nTH/Z5nTveZM2d+eb/kj8k5c+bMT/Om5wdnopzufp3nN+nOi52W4yyWI8uSqM0SRQokQSyFHagC6lbdqcK+FIAiCVEUxTpHAgjcKlTdz/1873e9l6Lg+DgyB33cBcdoHh/HaB4fx2geH8doHqN5fByjeXwco3l8PIUDPUf3SlGUAsBSFFCyglhKQZSEOx6GUxQrlT1G83m4VSdFpQA5GIpSmbRfw1ZWodDeIKxq/zMF5VjSHnosuXHVpb2wNmcyTTMTJRSPF9wupr2NFeKJDJ485ubzcFSlKnKsA1jUMtg0ClIdglZhFO0zyY3wMTcPO5RixJfX3+xo71OQtul3nupsI+r/hV9gxe55fXRHoN83BSDHaD5nR7Gv5uoE6hjN5+aY1uZOP6C8pL33d0z7DAeaUhRjjiXtc3PYHy4hymIruz0exBKlwxpJMBziTtx7YZWg50qnrSpDAkvbIUdIPCDb8UaHUMXlcZSFtRc4m4J5jp5dsmYJ0GrBacE5TCfdNpu9quUCy9Bq9Q0le+n8i+s8AOoojORxUGNwfBwNrzuLijQ6hvKIoBnAnjR/DOXRQBOlqJ2g5RjKI4EmCvIJwuOLx1g+XzqtMZh8iSlBwh5X1GM0n3tuUtiRAiDhysoxmM+9hYJ4y47uZaeW10r4hUfzeZe0QVotVt8oDk5Sj9F8vqnpKuZq7yRLCb/waD7n8yZPHPVoJhEqy+iYm881NS1SrvkHEZZ3jrn5HB8rlrlWogHxx8PH3HyOqcmoG21/inPZinqM5vN6nM9Txfa/Cc0Vj9F8XqlZRomOD0Q79WJbKc/zvBmCUGd6HqHgxfYIPcdoImZqteujBMTQMZrPJZgrONqdOUvCLzY5R+envWS65fURUdOb6smDpgLFF9ldO0LBdH3ksFdvkFsk9D0JKMcp8jintFEzluxNaieqY+5Gx+nUzJqilwKeWbUVjzzOh13SIk69r25YbZRNVtSpUCvzmb+rGlUopMJrqANMr7daWKaqvOvoVzSMzkIZj466YfX+FguluOJmT9v8N5N0marUPw/TTNrwhITd3bJSEEeR0DahPc50onjSWiDH3Hy23NyewFhKVTYfRQBvu+2Nj8dRvzkCFfm2r+Y9OrROvVzQ7jrWaZ/xIYELIRucJC8XNKICUweKj4FgfAIRPHRT3uD8nWQRQIETCuD0MZrPfCaQbtpWZlpkI3V9Fip9T9kpvrChsUP/3NJZRGyn1+jPQOeYUqMdT/pRUwfcEe9RBu7p/+WP0Xzmx20FqAmQTpU2wJZjakaGBQZFMpNcIIE7VT13RkExz7GkfdaHzcagM2JZsiQZpFhqjAxjZZB2SpzQlfqekCYRe0JQjtF8xgc+5bDHyxLZ0V5d5aoIRRZIDDwngTrrUrAUStjZe+IxN/d3XNpvNgCWYw4HKWMs6K+5qgDlS+HBhiNR0qHGe9miMZLcYRwO6uiXAj7defMi7JsPONb5qlOTWR1yUiJQZuXaaXCj+r989FWgp87Nu9H50V+UzyrDfDokbAm8iBbKU0Uz7EzAyKt9EOaE4YowVXwRbc6n+swY4Y3CqG+YF7MmYiFKVyzlGM19X7tQBrS8Ndoidl7kSiZuWlihX8AF2p6mpF1ZAoiN+BfQuEcw1fD2kyA65uZIR4oemB5PjJIjKwJvMqCW5XgBH6M5Mh0oqvc7e44foahlY2jVZFPiAP5FW6nk6UlalElWrfeHmRGOmOUKbzrinETj6JibI2LROQBdAXLP115Hc9GIfdV0YyLGXjRyPjU05XrSV+76CC8aJJVdJINkx/ALptc+V/m0LAPCLpoTBV6wZYSeKzQDYluViQnWJZAFHaN5SI8wsgi7miMIj1eO0TykhwV3xLRMkHMVIuwxmoeTmqCmdqnAEfXFiqU8P2giLKZMKbTtnE2FEXuM5iEEk5ez5qyTds6SKA4co3n4Dop2mgOzczoV1FPsMZqH7lgeT8CuqanL2keBF8dKOWxPiqh5DpL0OmI9JxyftBKzwrHw3kqCSPIbalssBbFfzcPjnKIXEtpvSEfMVXTYqnFZG/KIaT5umXnsKXkyje5GwaK41wKvUBm1MsRYBQenpUQypBQcY5vlwjGaezAu6LDJvA7OGb6NwgKiAk8URHsbCc0XI9b4nh9xjL/d4CDiPFEFObk8pb1SM1L8aGVlHsy8KZheXUKCLQaKYLHpCZSzuak6CDFI7PnHiSi0PEL2ShW/efAqwGwdNZ/8waCJTa8uwUhl71QFWChSgJ9AsvbpStq6j0LabGssYSGlSduTALYqtMc67Z6O2xAxrW/JAuoq50OCL7GPHydKayxhYH0LW/n7xxbK/shpKjiF2PJcqUT7xkFfqdRf/3QFD1BoTcVSBNTUmb0zkUxBOnEk0TyoldmSbjZnZnAtqRuKWuYk1ZUmiHJV3T+oYNnY33i0Ekdde2Ucc5+XCLB5Ogv0mFokx9zcGzlNFRg9SC0BchatBbSE2BM1jTPkUAd1uglyClCseYSQzfm5flECHicKZ4/anmMH5gta5c1sQINlK21lENqUN2lGXasaKGwhnDLjABmEquoYq72ZTCCr1eqbFGmayTNHrQbw4PZcCIuibGLiBH4cogKuvt5Sqo4DSO5bHlLLQkV3ISDtqtqR2dQ+gSd5+RjNPR4aKnvKkw5bKqn9z25UAEXgyB8H53XHSbSXnCuWLgkjUFWImg2jYzRHd8h4D9nKyI9GA0LKgo/+prkHuXZ0mbHueqFuxiGMaHFvCZ9NqsfcfKbkDBRHZUTgpRh/zM1RkrO8sMsdS8L0ZFwDQh0y6LA6rIVmvyQ9oaNOzgPNPZAtu4yOI1xdsGLoSQiGlyhoNk9k5ZibIzwcpbldkTOIypKpMUcPbaJ9n3AVy+oxN0d2CBDbTc4VskN2hL9OwnDEE/gOFk2sgncXzXlMmTc1TaW+A3uM5ijJaTM/cyJa2UVY01TqOxztBL4DRhOru6jz4VFoN14gc7EU6hjNUZJzzXRbkV/dDYpmWHfE61IOeh8x1WENZMxJzvPqYzLqASnOu0jxGM3ReRDmtsvm7qww0TlrYmPY8K7ES4KwJfUYzZGRkzg4M1YfWummJj2SucLGWI+u0XnwdSiCqSQE4IWetWT2mP3aeVpKEfljbo6OnILiHs4O1pHfHtHI6zqtxJ48su7aZ2B+yQFoDqF6ZkdUaCaO1I/lCFcakVHU9Yhk7l7XMkLaTTxhY9XXaEo+5uYuFSFyuuGttZ5kKO0QQuLJe0mn3JStLJFGtdhzD6MTNmvHDrqIk+Iytpf1V1Jm1GM0dydr/U6h3mc4Fo1Gd5gSxaVE4i7SDTjDFeuoqNkrn92Zs+2+f3IKF8E1F7MAjdFpS/YYzV2Ss+BtK7VDX98ou+RyWVUsjnpKJGtnkk9PzRPD+faJm5NIiaaYjN2fwmqh+DyL2mdSWy072rzfiP1CJAF9OX/J1/hsLP1U5V0FtXuE5EIOUbYd+qxQHdnMMZq7lbWVZnciShG1Xqzt2FavJgqX/Kmn+fMp3J54j2XwceVZkq9aTmPH9uaubU5Li5xonuoyJBG2KGZ8enuuviRq17msxxOljoAZ+mzQxCos199SVrtumNQ02JpfgbeHTVET7RlkQba3yMmyeDuaEe2V6vqaO8do7p6cUK/BQ6ik54okgQN0ouiufkQrq/uhphkTOqu0zFDk06ZKjC/dKWlif87yPBcaMc8m3qc6QqEqC2jr7GYZ1IKdGmODsKmjGEybs07oXRglPces4G7EUliXtcKznlUIW+3EC8+zhUI9q+jtxbVcjRg5fS1ExC4gyD2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Identify three examples organic compounds and three examples of inorganic compounds.

(1)

(1)

Organic: (2) Inorganic: (2)

(3) (3)

1. Arrange the following particles in order of smallest to largest: clay, sand, silt

(1) (2) (3)

1. Explain how each of the following anthropogenic issues contribute to erosion
   1. Agricultural practices
   2. Urban development
   3. River channelization
   4. Deforestation
   5. Mining
2. Explain what human activities lead to
   1. Desertification
   2. Salinization
3. What strategies can be used in the following issues to conserve soil nutrients while preventing erosion, desertification and/or salinization?
   1. Agricultural practices
   2. Urban development
   3. River channelization
   4. Deforestation
   5. Mining

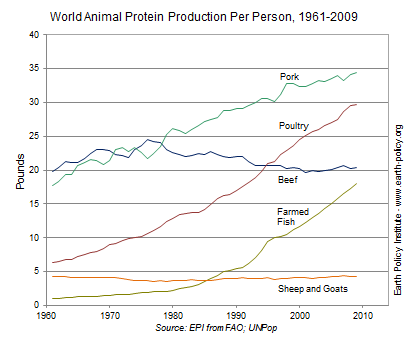
Unit 5: Land and Water Use 10-15%

# Vocabulary

1. agricultural revolution
2. agroforestry
3. alley cropping
4. anthropocentric
5. aquaculture
6. aquifer
7. arable land
8. area strip mining
9. bathyal
10. benthos
11. biomagnification
12. bioaccumulation
13. by-catch
14. clear-cutting
15. commercial inorganic fertilizer
16. conservation
17. conservationist
18. conservation-tillage farming
19. contour farming
20. contour strip mining
21. controlled burning
22. conventional-tillage farming
23. cost-benefit analysis (CBA)
24. crop rotation
25. desalinization
26. Desertification
27. Drainage basin
28. dredging
29. ecological restoration
30. euphotic
31. environmentalist
32. environmentally sustainable economic development
33. environmentally sustainable society
34. erosion
35. estuary
36. euphotic zone
37. eutrophic
38. externalities
39. CAFO
40. fertility
41. fertilizer
42. fish farming
43. fish ranching
44. fishery
45. food security
46. fungicide
47. Green Revolution
48. genetically modified crops (GMO)
49. Gentrification
50. globalization
51. herbicide
52. high-input agriculture
53. human capital
54. industrialized agriculture
55. insecticide
56. integrated pest management (IPM)
57. intercropping
58. land degradation
59. land-use planning
60. long line fishing
61. low-input agriculture
62. intertidal zone
63. macronutrient
64. malnutrition
65. mangrove forest
66. mass transit
67. maximum sustainable yield (MSY)
68. mineral resource
69. monocropping
70. mountaintop removal
71. Multi-Use Zoning
72. natural capital
73. natural recharge
74. no-till farming
75. old-growth forest
76. open-pit mining
77. ore
78. organic farming
79. overfishing
80. overgrazing
81. overnutrition
82. pasture
83. persistence
84. pest
85. pesticide
86. plankton
87. polyculture
88. polyvarietal cultivation
89. rangeland
90. reforestation
91. reserves
92. restoration ecology
93. salinity
94. salinization
95. second-growth forest
96. selective cutting
97. strip cropping
98. strip cutting
99. strip mining
100. subsistence farming
101. subsurface mining
102. surface mining
103. sustainable agriculture
104. sustainable development
105. sustainable living
106. sustainable society
107. tailings
108. tar sand
109. terracing
110. thermal stratification
111. tragedy of the commons
112. undernutrition
113. urban sprawl
114. Urban Blight
115. watershed
116. water table
117. wetland
118. wilderness
119. xeriscaping

Unit 5- Review Questions- Land and Water Use

# A. Agriculture

UUse the information in the diagram on the left, to answer the following:

* 1. T1. The percent change in the per capita global production of protein from poultry between 1980 and 2000 was approximately \_\_\_\_\_\_\_\_.
  2. T2. The percent change in the per capita global production of protein from farmed fish between 1980 and 2000 was approximately \_\_\_\_\_\_\_\_.
  3. T3. The percent change in the per capita global production of protein from beef between 1961 and 2009 was approximately \_\_\_\_\_\_\_\_.
  4. Perform the following calculation. Show all of your work. If the grasses on a 100-hectare area of grassland grow at an average rate of 1 cm/day, the average volume of grass that is added to the grassland each day is \_\_\_\_\_\_\_\_\_\_\_\_ m3. If the density of the grasses that grow in the grassland averages 400 kg/m3, the net primary productivity is approximately \_\_\_\_\_\_\_\_\_\_\_\_\_ g/m2/day or \_\_\_\_\_\_\_\_\_\_\_\_\_ g/m2/year.
  5. The number of km2 of Wilderness area increased from 4.0 X 104 to 6.0 X 104 in a decade. What is the percent increase?
  6. Between 1950 and 2000, global meat production increased from 52 billion kilograms to 240 billion kilograms. During this period, the global human population increased from 2.6 billion to 6.0 billion.
     1. Calculate the per capita meat production in 1950 and 2000
     2. Use the values from part a to calculate the change in global per capital meat production during this 50-year period as a percentage of the 1950 value.
  7. The acronym CAFO refers to \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, which is important because:

* 1. What is different about growing plants hydroponically?
  2. What was the Green Revolution and why is it important?

* 1. The acronym GMO refers to \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, which is:
  2. Arrange the following foods in order of highest to lowest in terms of global production: corn (maize); rice; wheat.

(1) (2) (3)

* 1. List four innovations that led to the Green revolution.

(1) (3)

(2) (4)

* 1. Explain what two issues can result from over- irrigation of crops in arid regions of the world.
  2. What is a monocropping? What are two benefits of monocropping? What are two consequences?
  3. Farmers in certain states lose 2.3 x 102 kg of topsoil in a year on average. There are 4.5 x 103 farmers in this state. How much topsoil is lost in this state annually?
  4. What is the Green Revolution? What are three implications of the Green Revolution?
  5. Explain four methods of sustainable agriculture practices that help reduce erosion and desertification.
  6. Contrast industrial versus integrated pest management strategies of controlling pests.
  7. What are the main types of pesticides? What does it mean when a pesticide is persistent?
  8. What is the pesticide treadmill?
  9. How does pesticide resistance occur?
  10. What is DDT? Why is it no longer used in the United States?
  11. What are the costs and benefits of pesticides use?
  12. What are the benefits of IPM? Why might people be hesitant to utilize IPM?
  13. Explain what the FIRFA law protects you from.

# B. Forestry

* 1. Perform the following calculations: (Show all of your work.) A rectangular area of forest that measures 20 thousand meters by 400 thousand meters has an area of \_\_\_\_\_\_\_\_\_\_\_ square kilometers and \_\_\_\_\_\_\_\_\_\_\_ hectares.
  2. A 2500-hectare piece of wild chaparral was bought by a developer to turn into homes. The developer built homes on 1000 hectares and left the rest untouched. What was the percent decline in wild chaparral?
  3. A company is importing rare tropical hardwood to manufacture furniture, list three laws, regulations, treaties, or acts that the company may have violated.

(1)

(2)

(3)

* 1. In terms of biodiversity, contrast the health of an old growth forest versus a tree plantation that has remediated a deforested region.
  2. Describe the impact of natural forest fires on the health of a coniferous ecosystem. How have humans learned to manage controlled burns to maximize the fire’s benefits?

1. 31.Describe the different methods of deforestation. Rank them from most damaging to forest health to least damaging.
2. Explain how national forest land is managed by the US Forest service. Would you consider this land a common? Why or why not?

# C. Rangelands

30. Explain how overgrazing can lead to desertification and a collapse of a grassland ecosystem. What methods are used to avoid this issue?

# D. Other Land Use

31. For each of the following urban land development listed below, explain what issue(s) they create and what sustainable alternatives exist for each.

|  |  |  |
| --- | --- | --- |
| Urban land development | Issue | Sustainable alternative |
| Transportation infrastructure |  |  |
| Federal highway system |  |  |
| Canals and channels |  |  |

1. What economic and environmental issues are related to suburban sprawl?
2. What is urban blight? Is it a positive or negative feedback loop? Explain.
3. For each of the following public and federal lands, explain their purpose and challenges.

|  |  |  |
| --- | --- | --- |
| Public land | Purpose | Challenges |
| Wilderness areas |  |  |
| National parks |  |  |
| National Wildlife refuges |  |  |
| National Forests |  |  |
| Wetlands |  |  |
| Bureau of land management (BLM) |  |  |

1. Contrast the difference between the following land management techniques:
2. Preservation
3. Remediation
4. Mitigation
5. Restoration

# E. Mining

1. Explain where you find large reserves of the following mineral formations
2. Coal
3. Oil
4. Natural gas
5. Complete the following chart.

|  |  |  |
| --- | --- | --- |
| **Mining Technique** | **Description** | **Environmental consequences** |
| Open-Pit mining |  |  |
| Subsurface mining |  |  |
| Strip mining |  |  |
| Mountaintop removal |  |  |
| Drilling |  |  |

1. Strengthen this weak statement: “Mining causes pollution that may disrupt the environment.”

1. What laws prevent mining issues such as acid drainage and the displacement of tailings?

# F. Fishing

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a technique typically used to harvest scallops, crabs, and shrimp from the sea floor.
2. Contrast the environmental impact of dredging, bottom trawling and longline fishing.
3. What is the Tragedy of the Commons? How is it especially applicable to fishing?
4. Why is overfishing such a difficult issue to solve in our oceans? Explain the solutions or alternatives related to sustainable fishing practices.
5. Explain the pros and cons related to aquaculture.
6. What relevant laws and treaties prevent overfishing and preserve ocean species.
7. What is maximum sustainable yield? At which point on a population’s growth curve is it typically located?
8. In a pasture of grass and other plants, the biomass of insects makes up 5000 kilograms. This is 5% of the total biomass of the pasture. What is the total biomass of the pasture? Set up the problem and solve below:
9. Joshua trees in the Mojave Desert occupy 25% of a piece of land. The land has 450 hectares in total. How much land is made up of Joshua trees?
10. Twenty percent of a forest is cut down. The forest area is 35,000 hectares. How many hectares of trees are left?

Unit 6: Energy Resources and Consumption

1. Active solar heating system
2. Anthracite coal
3. Biofuel
4. biodiesel
5. biomass
6. bituminous coal
7. breeder nuclear fission reactor
8. clean coal
9. coal
10. cogeneration
11. commercial energy source
12. control rod
13. coolant
14. containment structure
15. crude oil
16. decommissioned
17. energy
18. energy efficiency
19. energy productivity
20. energy return on investment
21. fuel rod
22. fracking
23. geothermal energy
24. half-life
25. Hydroelectric
26. LEED program
27. lignite
28. liquefied natural gas (LNG)
29. liquefied petroleum gas (LPG)
30. natural gas
31. nonrenewable resource
32. nuclear fission
33. nuclear fusion
34. oil
35. oil sands
36. oil shale
37. ore
38. passive solar system
39. peak demand
40. peat
41. petrochemicals
42. petroleum
43. photochemical
44. photovoltaic cells (PV)
45. radioactive waste
46. reactor
47. refining
48. renewable resource
49. shale oil
50. solar energy
51. solar thermal systems
52. spent
53. subsidy
54. subsistence energy source
55. synfuels
56. synthetic natural gas (SNG)
57. tailings
58. tar sand
59. thermal mass
60. tidal power
61. turbine

Review Questions- Energy

# A. Energy Concepts

* + - 1. A Honda Civic can go 348 miles on average before it runs out of gas. The tank holds 12 gallons of gas. What is the car’s mpg? (miles per gallon)
      2. A 75-Watt light bulb that is used for an average of 4 hours each day uses \_\_\_\_\_\_\_\_\_\_\_ kilowatt-hours of electricity per year.

Show work:

* + - 1. If the cost of gas is $2.50 per gallon and the average gas mileage of a car is 28 mpg, the cost of driving the car per mile is \_\_\_\_\_\_\_\_\_\_\_\_\_ $/mi, or \_\_\_\_\_\_\_\_\_\_\_\_\_ ȼ/mi.

Show work:

* + - 1. When energy that is stored in fossil fuels are burned, it changes form. Explain, using the law of thermodynamics, how energy forms change and what happens to it during the chemical change.
      2. What is the formula for Energy Return on Investment (EROEI)? What does a larger EROEI value imply?
      3. What is the capacity factor?

-According to the U.S. Department of Energy, a typical home in the United States uses approximately 900kWh of electricity per month/ How many homes can a 500 MW Power Plant with a 0.9 Capacity Factor support?

# B. Energy Consumption

* + - 1. Explain how the major types of energy use have changed in the following historical circumstances:
* Industrial Revolution
* Exponential growth of developing nations
  + - 1. At present, what are the top five types of energy used globally?

# C. Fossil Fuel Resources and Use

* + - 1. In the box to the right, list the ranks of coal in order from highest to lowest energy content. (indicate the direction in the box.)
      2. List seven products that are derived primarily from crude oil:

* + - 1. Fracking is a common name for \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and it is a concern because…

* + - 1. The acronym ANWR refers to \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, which is important because:

* + - 1. Perform the following calculations: (Show all of your work in a logical progression to the final answer.)

A family has a total of 1800 Watts of light bulbs throughout their house, if they replace them all with LED light bulbs, which use 80% less energy, the family will now use \_\_\_\_\_\_\_\_\_\_\_\_\_ Watts of electricity.

Show work:

* + - 1. A space heater operates at 1600 Watts, if it is used for 10 hours each day for one week and the cost of electricity is 30 cents per kilowatt-hour, it will cost \_\_\_\_\_\_\_\_\_\_\_\_\_ to operate the heater for the week.
      2. A carmaker improved the mpg of a model of car from 22 to 32. What percent change is this?
      3. What are the advantages and disadvantages to using biofuels?
      4. On the following chart, summarize the environmental advantages/disadvantages of each energy source

|  |  |  |
| --- | --- | --- |
| **Energy source** | **Advantages** | **Disadvantages** |
| Nuclear |  |  |
| Hydroelectric |  |  |
| Solar electricity |  |  |
| Hydrogen fuel cells |  |  |
| Biomass |  |  |
| Wind energy |  |  |
| Ocean waves and tidal energy |  |  |
| Geothermal |  |  |

# D. Nuclear Energy

1. Explain how nuclear fission works.
2. Explain how uranium is used to make electricity in a nuclear power plant.
3. What are the safety issues associated with nuclear fission? How do nuclear power plants reduce those risks?
4. What happens during a nuclear melt down? What are the roles of control rods and circulating water?
5. Explain what happened at Fukushima and why it is significant?
6. State where Chernobyl is located and explain what happened there.
7. Perform the following calculation. Show all of your work. A radioactive cloud may contain Iodine-131, which has a half-life of 8 days. If the waste must decay to a concentration of less than 0.1% to be considered safe, it will take approximately \_\_\_\_\_\_ days to reach safe levels.
8. The half-life of Cs-137 is 30.2 years.  If the initial mass of the sample is 100g, how much will remain after 120.8 years?

W

1. What are the issues related to radioactive wastes? Explain the controversy surround Yucca Mountain as a waste disposal site.
2. Contrast nuclear fusion and nuclear fission.

# E. Hydroelectric Power

1. In the box to the right, draw a diagram that illustrates how electricity is produced by a dam
2. How are hydroelectric power plants used for flood control? What issues are related concerning flooding and sediment at dams?
3. How do hydroelectric power plants affect salmon populations? What strategies do they use to account for this?
4. What is tidal energy? Why isn’t it used more widely for electricity generation?
5. Why is electricity referred to as a secondary energy source?
6. Compare Combined Cycle and Cogeneration.

# F. Energy Conservation

1. List four things you could do to conserve energy.

(1)

(2)

(3)

(4)

# G. Renewable Energy

1. List two species that may be threatened by the construction of a solar power tower in the California Desert.

(1) \_\_\_\_\_ (2)

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the active element in most photovoltaic cells.
2. In the box below, sketch a house and the surroundings of a house that is designed to make the greatest use of passive solar energy in the northern hemisphere. Include, inside the box, the location of both the winter and summer sun, and labels to indicate the compass direction that the house faces.
3. Perform the following calculation. (Show all of your work in a logical progression to the final answer.) A family has a 85 m2 solar array on their house, which has an efficiency of 10%. If the average insolation on their array is 5 kWh/m2/day and their average cost of electricity is 30 cents per kilowatt-hour, the family has the capacity to produce \_\_\_\_\_\_\_\_\_ worth of electricity daily, and \_\_\_\_\_\_\_\_\_ annually, from the sun.

Unit 7: Atmospheric Pollution 7-10%

# Vocabulary

1. acid
2. acid deposition
3. air pollution
4. biotic pollution
5. broad spectrum agent
6. carcinogen
7. dose response curve
8. effluent
9. environmental degradation
10. Environmental Protection Agency (EPA)
11. environmental justice
12. greenhouse effect
13. greenhouse gases
14. haze
15. incineration
16. industrial smog
17. industrial waste
18. nitrogen oxides (NOx)
19. noise pollution
20. nondegradable pollutant
21. nonpersistent pollutant
22. nonpoint source
23. ozone (O3)
24. ozone depletion
25. ozone layer
26. PANs
27. particulates
28. parts per billion (ppb)
29. parts per million (ppm)
30. parts per trillion (ppt)
31. persistence
32. persistent pollutant
33. phytoremediation
34. photochemical oxidant
35. photochemical smog
36. point source
37. pollutant
38. primary pollutant
39. radon (Rn)
40. risk assessment
41. secondary pollutant
42. smog
43. stratospheric ozone
44. sulfurous smog
45. temperature inversion
46. thermal inversion
47. toxicity
48. toxicology
49. tropospheric ozone
50. volatile organic compounds (VOCs)

Pollution Review Questions

# Air pollution

1. What are primary pollutants?
2. What are secondary pollutants?

Complete the chart of air pollutants below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Compound** | **Symbol** | **Human-Derived Sources** | **Effects/Impacts** |
| Sulfur Dioxide |  |  |  |
| Nitrogen Oxides |  |  |  |
| Carbon Monoxide |  |  |  |
| Particulate Matter |  |  |  |
| Lead |  |  |  |
| Ozone |  |  |  |
| Volatile Organic Compounds |  |  |  |
| Mercury |  |  |  |
| Carbon Dioxide |  |  |  |

Identify significant sources of the following air pollutants. Indicate if they are primary or secondary pollutants:

Formaldehyde:

Radon:

Mercury:

Carbon monoxide:

Nitrous oxide:

Name the following:

SOX N2

NH4+ NOx

* 1. NO2 is converted to N2 and O2 in a \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, which also converts \_\_\_\_\_ to \_\_\_\_\_.
  2. Explain the causes of an urban heat island.
  3. In the area below, write a series of chemical reactions that leads to the formation of tropospheric ozone in photochemical smog.
  4. For each of the following substances, draw an arrow that points to an unambiguous location along the line, below, representing pH: **orange juice**; **normal rain**; **ammonia**; **lime (calcium carbonate)**; **sulfuric acid**; **acid rain**; **human blood**.



1 2 3 4 5 6 7 8 9 10 11 12 13 14

pH

* 1. Explain the cause of acid deposition and its major environmental effects
  2. How are heat islands and temperature inversions formed? Why are they concerns related to smog?
  3. Explain how ozone is “good up high but bad nearby”.
  4. Why is indoor air pollution the most unregulated form of air pollution? What sources of indoor air pollution are the biggest issues?
  5. Explain the remediation and reduction strategies for controlling radon in the home.
  6. Explain the main components of the Clean Air Act and other relevant air pollution laws

# Noise pollution

* 1. What are the sources, effects and control measures of noise pollution?

Must-Know Math Review

|  |  |
| --- | --- |
| **Things to know…..**  Million= 106  Billion= 109  Mega= 106 (ex: 1,000,000 BTU/ 1 MBTU)  Kilo= 103 (ex: 1000 watts/ 1 kW)    Half Life  1 1/2 1/4 1/8 1/16 1/32 1/64 | **Population Stuff….**  **Approximate population for:**  The world: 7.5 billion  China: 1.3 billion  India: 1.3 billion  The US: 325 million  ***Per Capita = Per Person*** |
| **Percent**  *Percent is part divided by the whole times 100!*    **Primary Productivity**  Gross primary productivity - respiration = net primary productivity | **Population Math**  *Population Density=*  Number of individuals/ area  *Growth Rate is a %*  B-D/ population size \* 100  *Rule of 70*  DT = 70/ GR |
| **Percent Change**    **N-O**  **O** | **ENERGY**  KWh= kilowatts \* hours  Efficiency can be solved using ratios |
| **ALWAYS! EVERYTIME!**  **SHOW YOUR WORK!**  Numbers must be labeled in the SET-UP (Use dimensional analysis!)  Your numbers will be neat!  If you can’t use scientific notation, count your zeroes when you multiply and reduce them when you divide. Double check!!  Always make sure your answer makes sense!  Label and identify your answers clearly! | |

