2013-2014 APES STUDY GUIDE

AP ENVIRONMENTAL SCIENCE

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IMPORTANT FACTS YOU SHOULD KNOW ABOUT THE APES EXAM

- 3 hours long divided equally in time between the multiple-choice and free-response sections
- Multiple-choice section is 60% of the grade, consists of 100 questions, based on recall of facts and major concepts
- The number of multiple-choice questions taken from each major topic area is reflected in the percentage of the course as designated in the "topic outline".
- 90 minutes to answer 100 multiple choice questions
- No points are deducted for wrong answers. Eliminate as many answers as possible, and then choose from those remaining in each question (see PowerPoint notes for more tips). **Answer all questions!!!**
- When there are 5 minutes left during the multiple-choice section:
  - Finish the question you are on
  - Fill in all unanswered questions on your answer sheet with "b"
  - Do not randomly guess on questions for which you have "no clue"
- The free-response section, which is 40% of the grade, emphasizes the application of principles in greater depth by combining facts that you already know with your own logic and opinions
- There are 4 free response questions with which you have 90 minutes to answer:
  - 1 data set question – usually table, graph, or chart interpretation/analysis
  - 1 document based question (DBQ) – usually a short newspaper clipping from AP's imaginary town of Fremont
  - 2 synthesis and evaluation questions – usually one contains mathematical calculations and the other requires you to design an experiment.
- No calculators allowed on the test!!

TOPIC OUTLINE

The following is a list of the 7 major areas of Environmental Science tested on the APES exam along with the percentage of multiple choice questions asked in each area. Within each category is a listing of subcategories for which you should have in-depth knowledge and understanding.

DIRECTIONS

To use this topic outline to its fullest, complete the following:

1. Look at each subtopic and determine whether or not you could write a short essay on the subtopic.
    a. If you COULD write a short essay on the subtopic, use your pencil and draw a line through that subtopic.
    b. If you COULD NOT write a short essay on the subtopic, highlight it!
    c. See example below:

> **II. The Living World (10-15%)**
>
> A. *Natural Ecosystem Change:* Biodiversity, ~~Natural Selection~~, ~~Evolution~~, ~~Ecosystem Services~~
> B. *Natural Biogechemical Cycles:* ~~Carbon~~, Nitrogen, ~~Phosphorus~~, Sulfur, ~~Water~~, ~~Conservation of Matter~~

2. Add up the number of subtopics which you did not know (the ones you highlighted and **didn't** draw a line through).
    a. In the example above, I DID NOT know enough information about Biodiversity, Nitrogen Cycles, and Sulfur Cycle. So, I had "1" for Natural Ecosystem Change and "2" for Natural Biogeochemical Cycles.
3. Whichever sections you knew the least about (had the highest numbers) are the ones you need to focus on the most when studying for the exam
4. Lastly, pay attention to the total number you have under each major topic. For example, if you missed "15" under the topic *The Living World*, but only missed "10" under the topic of *Pollution*, which should you spend more time studying? Well, 25-30% of the exam is tested on *Pollution* while, only, 10-15% is on *The Living World*. Even though you know less about *The Living World*, it would be better to spend more time studying *Pollution*.

Topic Outline

I. Earth Systems and Resources (10–15%)

A. *Earth Science Concepts*: Geologic time scale, Plate tectonics, Earthquakes, Volcanism, Seasons, Solarintensity , Latitude

B. *The Atmosphere*: Composition, Structure, Weather and climate, Atmospheric circulation and the Coriolis Effect, Atmosphere–ocean interactions, ENSO

C. *Global Water Resources and Use*: Freshwater/saltwater, Ocean circulation, Agricultural, industrial, and domestic use, Surface and groundwater issues, Global problems, Conservation

D. *Soil and Soil Dynamics*: Rock cycle, Formation, Composition, Physical and chemical properties, Main soil types, Erosion and other soil problems, Soil conservation

II. The Living World (10–15%)

A. *Ecosystem Structure*: Biological populations and communities, Ecological niches, Interactions among species, Keystone species, Species diversity and edge effects, Major terrestrial and aquatic biomes

B. *Energy Flow*: Photosynthesis and cellular respiration, Food webs and trophic levels, Ecological pyramids

C. *Ecosystem Diversity*: Biodiversity, Natural selection, Evolution, Ecosystem services

D. *Natural Ecosystem Change*: Climate shifts, Species movement, Ecological succession

E. *Natural Biogeochemical Cycles*: Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter

III. Population (10–15%)

A. *Population Biology Concepts*: Population ecology, Carrying capacity, Reproductive strategies, Survivorship

B. *Human Population*:
   1. *Human population dynamics*: Historical population sizes, Distribution, Fertility rates, Growth rates and doubling times, Demographic transition, Age-structure diagrams
   2. *Population size*: Strategies for sustainability, Case studies, National policies
   3. *Impacts of population growth*: Hunger, Disease, Economic effects, Resource use, Habitat destruction

IV. Land and Water Use (10–15%)

A. *Agriculture*
   1. *Feeding a growing population*: Human nutritional requirements, Types of agriculture, Green Revolution genetic engineering and crop production, Deforestation, Irrigation, Sustainable agriculture
   2. *Controlling pests*: Types of pesticides, Costs and benefits of pesticide use, Integrated pest management, Relevant laws

B. *Forestry*: Tree plantations, Old growth forests, Forest fires, Forest management, National forests

C. *Rangelands*: Overgrazing, Deforestation, Desertification, Rangeland management, Federal rangelands

D. *Other Land Use*:
   1. *Urban land development*: Planned development, Suburban sprawl, Urbanization
   2. *Transportation infrastructure*: Federal highway system, Canals and channels, Roadless areas, Ecosystem impacts
   3. *Public and federal lands*: Management, Wilderness areas, National parks, Wildlife refuges, Forests, Wetlands
   4. *Land conservation options:* Preservation, Remediation, Mitigation, Restoration
   5. *Sustainable land-use strategies*

E. *Mining*: Mineral formation, Extraction, Global reserves, Relevant laws and treaties

F. *Fishing*: Fishing techniques, Overfishing, Aquaculture, Relevant laws and treaties
G. *Global Economics*: Globalization, World Bank, Tragedy of the Commons, Relevant laws and treaties

V. Energy Resources and Consumption (10–15%)

A. *Energy Concepts*: Energy forms, Power, Units and conversions, Laws of Thermodynamics
B. *Energy Consumption*
   1. History: Industrial Revolution, Exponential growth, Energy crisis
   2. Present global energy use
   3. Future energy needs
C. *Fossil Fuel Resources and Use*: Formation of coal, oil, and natural gas, Extraction/purification methods, World reserves and global demand, Synfuels, Environmental advantages/disadvantages of sources
D. *Nuclear Energy*: Nuclear fission process, Nuclear fuel, Electricity production, Nuclear reactor types, Environmental advantages/disadvantages, Safety issues, Radiation and human health, Radioactive wastes, Nuclear fusion
E. *Hydroelectric Power*: Dams, Flood control, Salmon, Silting, Other impacts
F. *Energy Conservation*: Energy efficiency, CAFE standards, Hybrid electric vehicles, Mass transit
G. *Renewable Energy*: Solar energy and electricity, Hydrogen fuel cells, Biomass, Wind energy, Small-scale hydroelectric, Ocean waves and tidal energy, Geothermal, Environmental advantages/disadvantages

VI. Pollution (25–30%)

A. *Pollution Types*
   1. *Air pollution*: Sources—primary and secondary, Major air pollutants, Measurement units, Smog, Acid deposition—causes and effects, Heat islands and temperature inversions, Indoor air pollution, Remediation and reduction strategies, Clean Air Act and other relevant laws
   2. *Noise pollution*: Sources, Effects, Control measures
   3. *Water pollution*: Types, Sources, causes, and effects, Cultural eutrophication, Groundwater pollution, Maintaining water quality, Water purification, Sewage treatment/septic systems, Clean Water Act and other relevant laws
   4. *Solid waste*: Types, Disposal and reduction
B. *Impacts on the Environment and Human Health*
   1. *Hazards to human health*: Environmental risk analysis, Acute and chronic effects, Dose-response relationships, Air pollutants, Smoking and other risks
   2. *Hazardous chemicals in the environment*: Types of hazardous waste, Treatment/disposal of hazardous waste, Cleanup of contaminated sites, Biomagnification, Relevant laws
C. *Economic Impacts*: Cost-benefit analysis, Externalities, Marginal costs, Sustainability

VII. Global Change (10–15%)

A. *Stratospheric Ozone*: Formation of stratospheric ozone, Ultraviolet radiation, Causes of ozone depletion, Effects of ozone depletion, Strategies for reducing ozone depletion, relevant laws and treaties
B. *Global Warming*: Greenhouse gases and the greenhouse effect, Impacts and consequences of global warming, Reducing climate change, relevant laws and treaties
C. *Loss of Biodiversity*:
   1. Habitat loss: Overuse, Pollution, Introduced species, Endangered and extinct species
   2. Maintenance through conservation
   3. Relevant laws and treaties

TIPS FOR WRITING APES ESSAYS

Tips for Writing AP Environmental Essays

- Read the question carefully - note terms such as *describe, discuss, explain, compare* and *design*. These have different meanings, and you must ensure that you address the question properly.
- Do not bother restating the question. It wastes your time and does not impress the readers. This is not an essay for your English class. Just start your answer. Do not make a conclusion paragraph. You do not need to sum up your essay.
- Your opinion about an issue is irrelevant in most cases - just address the question as asked.
- Pace yourself. You only have about 22 minutes per question - do not dawdle.
- Read all four questions before you begin. Make an outline of what you want to address before beginning writing. Use your question book for this on exam day.
- Be sure to define every term you use. Tossing out terms like "biomagnification" does not mean you know what you are talking about. Define it and throw in a quick example to elaborate to ensure that you receive credit.
- If you cannot recall a specific term, describe what you know and explain the concept. Get as close as you can.
- Do not be repetitive, but develop your ideas completely. Most students fail to finish their thoughts, and thus do not get the total points possible in a section due to an incomplete answer.
- Be concise - do not regurgitate every thing you know about a topic - *answer the question*.
- Be sure that you follow any instructions.
  - If you are asked to give ***an*** example - this means one.
  - If you are asked to give two examples, give two. You will be graded on the first two, regardless of how many you give. If the first two you list are incorrect, you will get no points.
  - Be sure to give complete answers, including examples of the two that you describe.
- Attempt to answer *all* questions.
  - You will not receive penalty for an answer unless it contradicts a previous one. You can only receive points for correct answers - so at least try!
  - We have tried to cover every topic in the Acorn book. Just relax and if you don't remember something - move to another question and come back if you have time.
  - If you have no idea exactly what the question is asking - try to address the *concept* being asked. For example, one exam asked for specifics about a particular law. If you don't know/recall specifics, explain what the law is and how it is applied. Frequently you will pick up points for your explanation.
- Often a question will incorporate ideas from several aspects of the class which at first glance may seem unrelated. For example, a question about pest management may address soil erosion. You must make sure that the whole question is carefully answered, showing that you understand the relationships in many different subject areas of the class.
- If you are asked to draw a graph, consider the following:
  - Independent variable on X axis and dependent variable on Y axis
  - Put units on both axes and label the variables
  - Give graph an appropriate title.
  - Make sure to place proportional increments on both axes.
  - Plot points and draw line - see if question asks for points to be connected or a best fit curve.
  - If you need to make two lines, ensure that the reader is easily able to determine which line is which.

- You may be asked to design an experiment. Consider the following:
  - Make the experiment feasible - preferably a lab experiment as opposed to field work if possible.
  - Generate an hypothesis - null is fine.
  - Only test ***one*** variable.
  - Be sure to define the test group and control group. Mention variables that will be standard or constant in both. (soil, water, light, amounts, etc)
  - Explain how you will conduct the experiment and what materials you will need.
  - Explain what you will be measuring (growth, death, survival, height, etc.).
  - Explain what your dependent and independent variables will be.
  - Explain how your data will be analyzed and what results you anticipate.
  - State how your conclusion will be derived.
  - Be creative, well organized, and knowledgeable about conducting laboratory exercises.
- Write an essay - no charts, diagrams, or outlines are acceptable alone. You may make a diagram, but it must enhance your written answer. Be sure to label it carefully.
- Frequently you will be asked to do calculations. You will not receive credit for calculations unless all work is shown in the question and all units are shown. Simply put your work and answer in a factor/labeling format and you will be fine.
- Be sure that you label each part of the question. Most have parts a, b, c, d and may have subparts i, ii, and iii. Be sure the reader knows which part of the question you are answering.
- Write only in blue or black ink.
- Write neatly - if the reader cannot read your handwriting, you cannot receive points.
- If you do not like what you have written - simply draw a line through that line and begin again. Do not excessively scratch out sentences.
- Remember - there is no such thing as a hard exam - *just a thorough one for which you did not adequately prepare*. Make sure that you are well rested and have studied carefully prior to all tests.
- Do the best you can and don't quit. Keep writing until the proctor calls time!!

Advanced Placement
Environmental Science
Helping Students Avoid Common Errors on APES Free Response

Free Response Question Types

- One document based question
- Two synthesis and analysis questions
- One data set question

Establishment and Application of Rubrics

- The tentative rubrics are designed by the chief reader, question leaders, and table leaders at the APES reading in June
- The readers are permitted input and rubrics are applied to student essays
- The readers adhere stringently to the rubrics as they view student examinations
- The mean of each question should be between 4 and 6 with a high standard error to discriminate student abilities
- Well written questions discriminate between students' AP scores and correlate well with the students score on the multiple choice portions of the examination

Student preparation for exams

- Students must have taken Algebra I (preferably Algebra II), Chemistry or Physics, and Biology
- Time must be allotted for review of the bulk of the material prior to the examination
- Students should be provided with a handout on essay writing skills
- A practice AP exam is always a good idea to demonstrate to the student their weaknesses and strengths, in order to focus their studies on weaknesses, as they will tend to continue to study material they have previously mastered

Student preparation for exams

- Do not allow students to use calculators during tests
- If you use previous CB exam questions, be sure to stringently apply the rubrics to your students' essays. If you spot them points, or grade easily, you do not give them an accurate assessment of their writing ability or what scores they are actually making on the exams
- Allow students to anonymously grade other student's exam answer applying a CB rubric
- Draw lines through irrelevant portions of student essays to show them they must be more focused and concise with their answers

Student Weaknesses on Exams

- Students have difficulty with calculations, particularly those using scientific notation and energy conversions.
  - Give a worksheet with simple to complex conversions
  - Review factor labeling / factor analysis skills with students
  - Remind students to use units throughout the calculations in order to get the correct

units in the answer
- Ensure that students show all of their work on each problem, and do not give them points if they do not
- Review with students feasible numbers as answers on questions as they really have no idea when it comes to these numbers and their use
  - A $50,000 gas bill for winter heating is excessive
  - 12 billion tons of coal in a power plant is not excessive

Student Weaknesses on Exams

- Students have problems generating good scientific arguments for or against a particular subject.
  - An argument should be a series of sentences that supports an original premise
- Students have difficulty distinguishing between a pollutant and an effect—ie they may think that SO_2 causes global warming.
  - Have students make a chart of the most common pollutants, citing their sources, environmental effects, adverse human health effects, and ways to decrease pollutants

Student Weaknesses on Exams

- Students have a tendency to explain the cause of an environmental problem, but do not relate it to an effect and consequence. Frequently they are on the right track, but they do not continue their thought.
- Students must learn to *describe* or *explain* properly, fully answering the question.
  - If the question asks students to both identify and describe – they must do both, as many times the entire explanation will be worth one point for the identification and description
- Students have a tendency to waste time by reiterating the question and writing summaries. They would gain more time by just addressing the question.

Student Weaknesses on Exams

- Students should be able to not only describe environmental problems, but they should be able to hypothesize solutions which may include interpreting scientific data
  - When interpreting trends shown in a graph or chart, students should use all of the information provided, and explain the observed changes carefully
- Students must be able to use the mathematical models taught in the course
  - Growth rates
  - CBR and CDR
  - Logistic vs. exponential growth

Student Weaknesses on Exams

- Students must be able to appropriately apply laws / legislation when asked
- Students may be asked to suggest a policy – this should be a policy that is feasible
  - For example, taxing gasoline to discourage driving to decrease NO_x will not work, as gasoline already is taxed – but the tax on gasoline could be increased which would discourage driving which might decrease the pollutant

Student Weaknesses on Exams

- Students tend to mix up the words ecological, environmental, and economic when answering questions
- Students mix up biotic and abiotic
- Last year students mixed up pesticides and fertilizers
- If students are asked to identify a pro and a con of an issue, they should never be the same just restated for the opposing argument

Student Weaknesses on Exams

- When asked to list and describe two factors, students may list three and describe only the last two. The readers must grade only the first two given, and thus even if the last two were correct, the student would only receive one point.
- When students list the source of a pollutant they are not specific enough – ie coal does not release SO_2 but combustion of coal does release SO_2

Buzz Words

- Students use buzz words without demonstrating an understanding of the terms
  - Bioaccumulation, integrated pest management, eutrophication, etc.
  - The following are never complete answers to a question
    - Pollution
    - habitat destruction
    - alters the environment
    - organisms negatively affected
    - environmental degradation
    - Changes water, soil, or air quality
    - Adverse effects on ecosystem

Graphing errors

- Students do not title X and Y axes
- Students do not appropriately scale the axes
- If two lines are required, students must generate a key to differentiate them
- X and Y axes frequently switched – must know dependent vs. independent variables
- Students must generate the graph described – lines (best fit or smooth curve) vs. histograms

Experimental Design Problems

- Students have trouble designing controlled, logical experiments after devising an hypothesis.
  - Work together as a class to design experiments, then allow them to work in pairs to design experiments
  - Allow students to design and then conduct experiments in the lab
  - Ensure that the hypothesis tests a specific parameter that is not too general (nutrient, pollutant) – the parameter tested should be very specific
  - Ensure that the parameter tested is not too general (health of organism, change in growth) as these are vague

IMPORTANT ENVIRONMENTAL LEGISLATION

National Environmental Policy Act of 1969 (NEPA) – policies to protect the environment from humans; requires environmental impact statements for construction projects regulated by federal government

FIFRA of 1972 – registration of pesticides required; testing of pesticides required

Ocean Dumping Act of 1972 – dumping of sewage sludge and industrial waste is prohibited. In addition, radiological, chemical, or biological warfare agents, high-level radioactive waste, or medical waste may not be dumped.

Marine Mammal Protection Act of 1972 – protections of marine mammals

Endangered Species Act of 1973 – USFWS and USNMF must establish protocols to protect endangered organisms; establishes federal involvement in their protection

Safe Drinking Water Act of 1974 – sets minimum standards and regulates public drinking water

Energy Policy and Conservation Act of 1975 – promotes conservation and efficiency

Federal Land Policy and Management Act of 1976 – BLM land is multiple use sustained yield

Resource Conservation and Recovery Act of 1976 - (RCRA) - track hazardous wastes; states develop solid waste management plans

Surface Mining Control and Reclamation Act of 1977 - (SMCRA) - regulates restoration of surface coal mines

Clean Water Act – regulates discharges of pollutants into water; gave EPA the authority to implement pollution control programs; sets water quality standards for all contaminants in surface waters; unlawful to discharge any pollutant from a point source into navigable waters; funded the construction of sewage treatment.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 - (CERCLA or Superfund) – uses Superfund to clean up hazardous waste sites (new regulations established with SARA – Superfund Amendments and Reauthorization Act in 1986)

Clean Air Amendments of 1990 – control sulfur oxides and nitrogen oxides; air pollution credits established – trade or sale

International Treaties to know

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora – in effect since 1975 – monitors international trade in endangered species – organisms are placed on specific lists and trade is tightly controlled or sometimes prohibited

Convention of the Prevention of Marine Pollution by Dumping of Waste and other Matter (London Dumping Convention or LDC) – control ocean pollution; specifically prohibits dumping of high level radioactive wastes, heavy metals, numerous toxic and hazardous wastes

Montreal Protocol on Substances that Deplete the Ozone Layer - 1987 – phase out use and production of CFCs

Important Environmental Legislation (in chronological order)

Lacey Act of 1900 - prohibits the transport of live or dead wild animals or parts of animals across state lines without a federal permit

Antiquities Act of 1906 – areas of scientific and/or historical interest on federal lands can be reserved as national monuments

National Park Service Act of 1916 – established the NPS

Migratory Bird Treaty Act of 1918 – imposed restrictions on the hunting of migratory birds

Taylor Grazing Act – gave the secretary of the Interior power to create grazing districts, issue grazing permits, and collect grazing fees on public domain lands

Soil Conservation Act of 1935 – established the Soil Conservation Service in the USDA; addressed erosion control

Federal Aid in Wildlife Restoration Act of 1937 – aka Pittman Robertson Act – federal funds for wildlife protection made available to states

Federal Food, Drug and Cosmetic Act of 1938 – protect consumers using these items

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) - protects from dangerous and persistent pesticides; amended in the 1970s

Price – Anderson Act of 1957 – promoted nuclear power by limiting the liability of the owner of a power plant and the government in the event of a major accident

Delaney Clause – 1958 – amendment to the Federal Food, Drug and Cosmetics of 1938 – prohibited the addition of any known carcinogen to any processed food, drug or cosmetics

Multiple Use and Sustained Yield Act of 1960 – included in the use of national forests recreation and hunting as benefits, not just timber and mining

Clean Air Act of 1963 – air quality hearings

Wilderness Act of 1964 – established the National Wilderness Preservation System

Federal Water Pollution Control Act of 1964 – aka Clean Water Act – restore and maintain US waters; amended in 1972 and 1977

Species Conservation Act of 1966 – government protect rare organisms and habitats

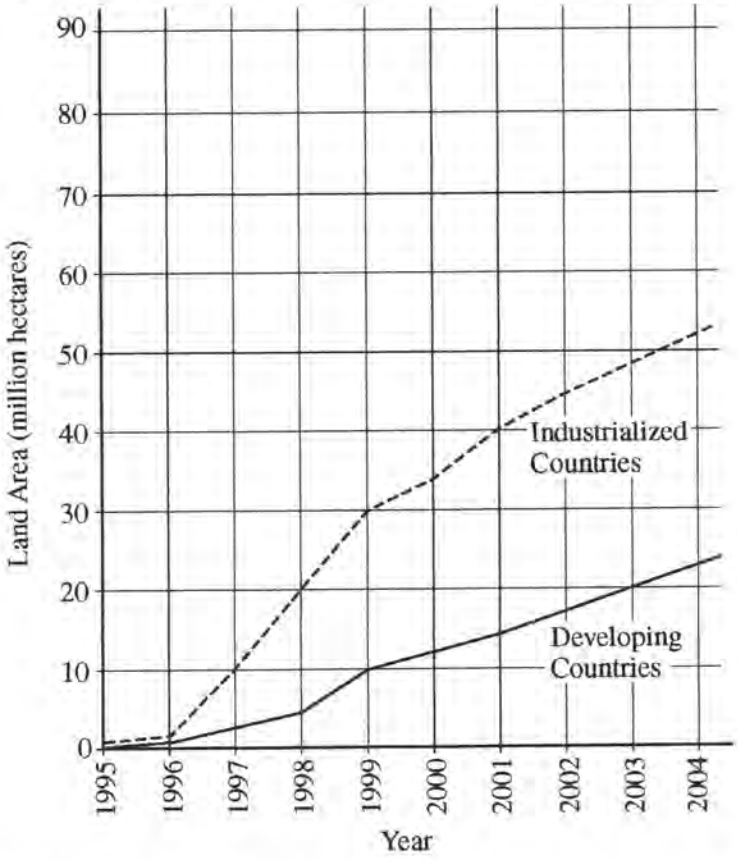
National Wild and Scenic Rivers Act – protect unique and beautiful river sections

Clean Air Act of 1970 – protects air as a resource from area, stationary and mobile sources of pollution; authorizies the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment; amended in 1977 primarily to set new dates for achieving attainment of NAAQS since many areas of the country had failed to meet the deadlines; 1990 amendments to the Clean Air Act intended to meet unaddressed or insufficiently addressed problems such as acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics.

EXAMPLE DATA SET QUESTION

2009 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

4. The major issues in modern agriculture include the use of genetically modified (GM) crops and the implementation of sustainable agricultural practices. The following graph shows the increase in the use of GM crops in both developing and industrialized countries from 1995 to 2004.



(a) Reply to the following questions based on the data in the graph above.

(i) Calculate the increase in the area of land used for growing GM crops in developing countries from 1999 to 2003. Express your answer as a percentage of the 1999 value.

(ii) Calculate the annual rate of increase in land area used for growing GM crops in industrialized countries from 1997 to 1999.

(iii) Using the rate you calculated in part (ii), project the area of land that would have been expected to be used for GM crops in industrialized countries in 2004.

(iv) Identify one likely cause for the difference between the projected land area for GM crops in industrialized countries in 2004 and the actual land area for GM crops in industrialized countries in 2004.

GO ON TO THE NEXT PAGE.

2009 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

(b) Describe one environmental advantage and one environmental disadvantage of using GM crops.

(c) Describe one economic advantage and one economic disadvantage of using GM crops.

(d) A healthy soil ecosystem is of primary importance in sustainable agriculture. Describe TWO viable agricultural practices that farmers can use to maintain or improve soil quality.

(e) Identify and describe one environmental advantage and one economic advantage of consuming locally grown produce.

STOP

END OF EXAM

EXAMPLE DOCUMENT BASED QUESTION (DBQ)

2002 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

4. Read the article below and answer the questions that follow.

10 FREMONT DAILY GAZETTE

El Niño Linked to Disease Epidemics

Scientists have long realized the strong linkage between the ocean and atmosphere and the effect of this linkage on global climate patterns. Only recently however, have scientists established a possible link between climate change and health-related epidemics. Every few years a dramatic climate shift known as the El Niño-Southern Oscillation (ENSO) disrupts the normal interaction between ocean and atmosphere and alters the normal pattern of water temperatures and winds. ENSOs occur every 3 to 7 years and typically last from several months to over a year. During an El Niño, normal climatic patterns are severely disrupted and the longer the phenomenon lasts, the more disruptive it can be. When an ENSO lasts 12 months or longer it can also disrupt populations of oceanic and other aquatic organisms and set off a series of environmental problems throughout the world. Recently scientists studying ENSOs established a link between the climate-related changes during an El Niño event and the spread of such diseases as cholera and yellow fever.

The linkage apparently is the result of changing surface temperatures during the event, producing conditions suitable for the rapid spread of various vector-transmitted diseases in affected areas. The same changing conditions are also linked to several other environmental problems.

Recently, scientists at the Max Planck Institute in Germany reported that, based on a computer simulated model, human-induced global warming affects ENSOs. The model predicts more frequent El Niño events with increases in greenhouse gases, and if this model is correct, then we can expect further increases in disease epidemics in various parts of the world.

(a) Describe what an El Niño is and clearly indicate where it occurs.

(b) Describe the connection between the climate change associated with an El Niño and the transmission of diseases. Explain whether the article is correct in its reporting of the various disease epidemics that occur in response to an El Niño.

(c) People in what part of the world would be most likely to be affected by this link between El Niño and disease?

(d) Clearly describe two other important environmental problems associated with ENSOs.

END OF EXAMINATION

EXAMPLE SYNTHESIS AND EVALUATION QUESTION

2010 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

4. Scientific evidence shows a direct relationship between sea level and the global mean atmospheric temperature at Earth's surface. Increases in the global mean atmospheric temperature during the past century have been accompanied by a gradual increase in sea level; currently the average rate of increase in sea level is 3.0 mm/yr. Additional increases in sea level are expected during the next century as global mean atmospheric temperatures continue to rise. These increases in sea level will affect coastal ecosystems as well as human activity along coastal margins.

   (a) Based on the rate cited above, calculate the expected increase in sea level, in meters, during the next 50 years.

   (b) Identify TWO phenomena that result from an increase in global mean atmospheric temperature and that contribute to increases in sea level. For each phenomenon that you identify, explain how it causes sea level to increase.

   (c) Describe TWO environmental impacts that increasing sea level will have on an estuarine ecosystem such as those in the Mississippi Delta, Chesapeake Bay, and San Francisco Bay.

   (d) Although sea level has been rising for over a century, human populations in coastal areas have increased dramatically during this period.

      (i) Describe one negative economic impact that an increase in sea level will have on people who live along a coastline.

      (ii) Describe TWO viable strategies that governments could use to discourage people from moving to coastal areas.

STOP

END OF EXAM

115 WAYS TO GO APE!

This is your last minute, night before the test, day of the test cram review sheet. Good Luck!!

APES REVIEW

115 WAYS TO GO APE

1. Ionizing radiation: enough energy to knock electrons from atoms forming ions, capable of causing cancer (ex gamma-X-rays-UV)
2. High Quality Energy: organized & concentrated, can perform useful work (ex fossil fuel & nuclear)
3. Low Quality Energy: disorganized, dispersed (heat in ocean or air wind, solar)
4. First Law of Thermodynamics: energy is neither created nor destroyed, but may be converted from one form to another
5. Second Law of Thermodynamics: when energy is changed from one form to another, some useful energy is always degraded into lower quality energy (usually heat)
6. Natural radioactive decay: unstable radioisotopes decay releasing gamma rays, alpha & beta particles
7. Half life: the time it takes for ½ the mass of a radioisotope to decay
8. Estimate of how long a radioactive isotope must be stored until it decays to a safe level: approximately 10 half-lives
9. Nuclear Fission: nuclei of isotopes split apart when struck by neutrons
10. Nuclear Fusion: 2 isotopes of light elements (H) forced together at high temperatures till they fuse to form a heavier nucleus. Expensive, break even point not reached yet
11. Ore: a rock that contains a large enough concentration of a mineral making it profitable to mine
12. Mineral Reserve: identified deposits currently profitable to extract
13. Best solution to Energy shortage: conservation and increase efficiency
14. Surface mining: cheaper & can remove more mineral, less hazardous to workers
15. Humus: organic, dark material remaining after decomposition by microorganisms
16. Leaching: removal of dissolved materials from soil by water moving downwards
17. Illuviation: deposit of leached material in lower soil layers (B)
18. Loam: perfect agricultural soil with equal portions of sand, silt, clay
19. Solutions to soil problems: conservation tillage, crop rotation, contour plowing, organic fertilizers
20. Parts of the hydrologic cycle: evaporation, transpiration, runoff, condensation, precipitation, infiltration
21. Aquifer: any water bearing layer in the ground
22. Cone of depression: lowering of the water table around a pumping well
23. Salt water intrusion: near the coast, overpumping of groundwater causes saltwater to move into the aquifer
24. ENSO: El Nino Southern Oscillation, see-sawing of air pressure over the S. Pacific
25. During an El Nino year: trade winds weaken & warm water sloshed back to SA
    During a Non El Nino year: Easterly trade winds and ocean currents pool warm water in the western Pacific, allowing upwelling of nutrient rich water off the West coast of South America
26. Effects of El Nino: upwelling decreases disrupting food chains, N US has mild winters, SW US has increased rainfall, less Atlantic Hurricanes
27. Nitrogen fixing: because atmospheric N cannot be used directly by plants it must first be converted into ammonia by bacteria
28. Ammonification: decomposers covert organic waste into ammonia
29. Nitrification: ammonia is converted to nitrate ions (NO-3)
30. Assimilation: inorganic N is converted into organic molecules such as DNA/amino acids & proteins
31. Denitrification: bacteria convert ammonia back into N
32. Phosphorus does not circulate as easily as N because: it does not exist as a gas, but is released by weathering of phosphate rocks
33. Because soils contain very little phosphorus: it is a major limiting factor for plant growth
34. Excess phosphorus is added to aquatic ecosystems by: runoff of animal wastes, fertilizer discharge of sewage
35. Photosynthesis: plants convert atmospheric C (CO2) into complex carbohydrates (glucose $C_6H_{12}O_6$)
36. Aerobic respiration: oxygen consuming producers, consumers & decomposers break down complex organic compounds & convert C back into CO_2
37. Largest reservoirs of C: carbonate rocks first, oceans second
38. Biotic/abiotic: living & nonliving components of an ecosystem
39. Producer/Autotroph: photosynthetic life
40. Major trophic levels: producers-primary consumer-secondary consumer-tertiary consumer
41. Energy flow in food webs: only 10% of the usable energy is transferred
42. Why is only 10% transferred: usable energy lost as heat (2nd law), not all biomass is digested & absorbed, predators expend energy to catch prey
43. Primary succession: development of communities in a lifeless area not previously inhabited by life (lava)
44. Secondary succession: life progresses where soil remains (clear cut forest)
45. Mutualism: symbiotic relationship where both partners benefit
46. Commensalism: symbiotic relationship where one partner benefits & the other is unaffected
47. Parasitism: relationship in which one partner obtains nutrients at the expense of the host

48. Biome: large distinct terrestrial region having similar climate, soil, plants & animals
49. Carrying capacity: the number of individuals that can be sustained in an area
50. R strategist: reproduce early, many small unprotected offspring
51. K strategist: reproduce late, few, cared for offspring
52. Natural selection: organisms that possess favorable adaptations pass them onto the next generation
53. Malthus: said human population cannot continue to increase.. consequences will be war, famine & disease
54. Doubling time: rule of 70 70 divided by the percent growth rate
55. Replacement level fertility: the number of children a couple must have to replace themselves (2.1 developed, 2.7 developing)
56. World Population is: over 6 billion
57. Preindustrial stage: birth & death rates high, population grows slowly, infant mortality high
58. Transitional stage: death rate lower, better health care, population grows fast
59. Industrial stage: decline in birth rate, population growth slows
60. Postindustrial stage: low birth & death rates
61. Age structure diagrams: (broad base, rapid growth)(narrow base, negative growth)(uniform shape, zero growth)
62. 1st & 2nd most populated countries: China & India
63. Most important thing affecting population growth: low status of women
64. Ways to decrease birth rate: family planning, contraception, economic rewards & penalties
65. Percent water on earth by type: 97.5% seawater, 2.5% freshwater
66. Salinization of soil: in arid regions, water evaporates leaving salts behind
67. Ways to conserve water: (agriculture, drip/trickle irrigation)(industry, recycling)(home, use gray water, repair leaks, low flow fixtures)
68. Point vs non point sources: (Point, from specific location such as pipe) (Non-point, from over an area such as runoff)
69. BOD: biological oxygen demand, amount of dissolved oxygen needed by aerobic decomposers to break down organic materials
70. Eutrophication: rapid algal growth caused by an excess of N & P
71. Hypoxia: when aquatic plants die, the BOD rises as aerobic decomposers break down the plants, the DO drops & the water cannot support life
72. Minamata Disease: mental impairments caused by mercury
73. Primary air pollutants: produced by humans & nature (CO, CO_2, SO_2, NO, hydrocarbons, particulates)
74. Secondary pollutants: formed by reaction of primary pollutants
75. Particulate matter (source,effect,reduction): (burning fossil fuels & car exhaust) (reduces visibility & respiratory irritation) (filtering, electrostatic precipitators, alternative energy)
76. Nitrogen Oxides: (Source: auto exhaust) (Effects: acidification of lakes, respiratory irritation, leads to smog & ozone) (Equation for acid formation: $NO + O_2 = NO_2 + H_2O = HNO_3$) (Reduction: catalytic converter)
77. Sulfur oxides: (Source: coal burning) (Effects: acid deposition, respiratory irritation, damages plants) (Equation for acid formation: $SO_2 + O_2 = SO_3 + H_2O = H_2SO_4$) (Reduction: scrubbers, burn low sulfur fuel)
78. Carbon oxides: (Source: auto exhaust, incomplete combustion) (Effects: CO binds to hemoglobin reducing bloods ability to carry O_2, CO_2 contributes to global warming) (Reduction: catalytic converter, emission testing, oxygenated fuel, mass transit)
79. Ozone: (Formation: secondary pollutant, NO_2+UV=NO+O $O+O_2=O_3$, with VOC's) (Effects: respiratory irritant, plant damage) (Reduction: reduce NO emissions & VOCs)
80. Industrial smog: found in cities that burn large amounts of coal
81. Photochemical smog: formed by chemical reactions involving sunlight (NO, VOC, O)
82. Acid deposition: caused by sulfuric and nitric acids resulting in lowered pH of surface waters
83. Greenhouse gases: (Examples: H_2O, CO_2, O_3, methane (CH_4), CFC's) (EFFECT: they trap outgoing infrared (heat) energy causing earth to warm
84. Effects of global warming: rising sealevel (thermal expansion), extreme weather, droughts (famine), extinctions
85. Ozone depletion caused by: CFC's, methyl chloroform, carbon tetrachloride, halon, methyl bromide all of which attack stratospheric ozone
86. Effects of ozone depletion: increased UV, skin cancer, cataracts, decreased plant growth
87. Love Canal, NY: chemicals buried in old canal and school & homes built over it causing birth defects & cancer
88. Municipal solid waste is mostly: paper
89. Most municipal waste is: landfilled
90. Sanitary landfill problems and solutions: (leachate, liner with collection system) (methane gas, collect gas and burn) (volume of garbage, compact & reduce)
91. Incineration advantages: volume of waste reduced by 90% & waste heat can be used
92. Incineration disadvantages: toxic emissions (polyvinyl chloride—dioxin), scrubbers & electrostatic precipitators needed, ash disposal
93. Best way to solve waste problem: reduce the amounts of waste at the source
94. Keystone species: species whose role in an ecosystem are more important than others
95. Indicator species: species that serve as early warnings that an ecosystem is being damaged

96. Most endangered species: have a small range, require large territory or live on an island
97. In natural ecosystems, 50-90% of pest species are kept under control by: predators, diseases, parasites
98. Major insecticide groups and examples: (chlorinated hydrocarbons, DDT) (organophosphates, malathion) (carbamates, aldicarb)
99. Pesticide pros: saves lives from insect transmitted disease, increases food supply, increases profits for farmers
100. Pesticide cons: genetic resistance, ecosystem imbalance, pesticide treadmill, persistence, bioaccumulation, biological magnification
101. Natural pest control: better agricultural practices, genetically resistant plants, natural enemies, biopesticides, sex attractants
102. Electricity is generated by: using steam (from water boiled by fossils fuels or nuclear) or falling water to turn a generator
103. Petroleum forms from: microscopic aquatic organisms in sediments converted by heat & pressure into a mixture of hydrocarbons
104. Pros of petroleum: cheap, easily transported, high quality energy
105. Cons of petroleum: reserves depleted soon, pollution during drilling, transport and refining, burning makes CO_2
106. Steps in coal formation: peat, lignite, bituminous, anthracite
107. Major parts of a nuclear reactor: core, control rods, steam generator, turbine, containment building
108. Two most serious nuclear accidents: (Chernobyl, Ukraine) (Three Mile Island, PA)
109. Alternate energy sources: wind, solar, waves, biomass, geothermal, fuel cells
110. LD 50: the amount of a chemical that kills 50% of the animals in a test population
111. Mutagen, Teratogen, Carcinogen: causes hereditary changes, Fetus deformities, cancer
112. Multiple use US public land: National Forest & National Resource lands
113. Moderately restricted use land: National Wildlife Refuges
114. Restricted Use lands: National Parks, National Wilderness Preservation System
115. Volcanoes and Earthquakes occur: at plate boundaries (divergent, spreading, mid-ocean ridges) (convergent, trenches) (transform, sliding, San Andreas)

LAWS, LAWS & MORE LAWS

1. Surface Mining Control & Reclamation Act: requires coal strip mines to reclaim the land
2. Madrid Protocol: Moratorium on mineral exploration for 50 years in Antarctica
3. Safe Drinking Water Act: set maximum contaminant levels for pollutants that may have adverse effects on human health
4. Clean Water Act: set maximum permissible amounts of water pollutants that can be discharged into waterways.. aim to make surface waters swimmable and fishable
5. Water Quality Act: attempt to reduce non-point source pollution
6. Ocean Dumping Ban Act: bans ocean dumping of sewage sludge & industrial waste
7. National Environmental Policy Act: Environmental Impact Statements must be done before any project affecting federal lands can be started
8. Clean Air Act: Set emission standards for cars, and limits for release of air pollutants
9. Kyoto Protocol: controlling global warming by setting greenhouse gas emissions targets for developed countries
10. Montreal Protocol: phase-out of ozone deleting substances
11. Resource Conservation & Recovery Act: controls hazardous waste with a cradle to grave system
12. Comprehensive Environmental Response, Compensation & Liability Act: Superfund, designed to identify and clean up abandoned hazardous waste dump sites
13. Endangered Species Act: identifies threatened and endangered species in the US, and puts their protection ahead of economic considerations
14. Convention on International Trade in Endangered Species: lists species that cannot be commercially traded as live specimens or wildlife products
15. Federal Insecticide, Fungicide, Rodenticide Act: regulates the effectiveness of pesticides
16. Food Quality Protection Act: set pesticide limits in food, & all active and inactive ingredients must be screened for estrogenic/endocrine effects
17. Low Level Radioactive Policy Act: all states must have facilities to handle low level radioactive wastes
18. Nuclear Waste Policy Act: US government must develop a high level nuclear waste site by 2015

Slide 1

APES Review 2014

Study the test, not just what the test claims to test!

Slide 2

APES Test Overview

Monday, May 5, 2014 at 8:00am

Slide 3

APES Test Overview

- This is the FIRST AP Test you will be taking if you are taking more than one AP Test this year.
- Your guidance department can give you more info on how to fill out paperwork and where, specifically, you will be taking the test.
- http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2128.html

Slide 4

APES Test Overview

- Most 4-year colleges/universities will accept a 4 or 5 on the AP Environmental Science Test.
- Most colleges will accept a passing score on the APES Exam in lieu of AP Bio, AP Chem, or AP Physics.
- Check with your college to determine what score you need to get on the APES Exam to earn college science credit

Slide 5

APES Test Overview

- Passing the APES Exam can get you more than just credit for Environmental Science!!
- Keep the syllabus from your APES class and show it to your college during registration. They can give you credit for an introductory Biology, Chemistry, or Physics class!

Slide 6

Topics Covered on APES Exam

- Earth Systems and Resources (10-15%)
- The Living World (10-15%)
- Population (10-15%)
- Land and Water Use (10-15%)
- Energy Resources and Consumption (10-15%)
- Pollution (**25-30%**)
- Global Change (10-15%)

Slide 7

What does the APES Exam look like?

- Multiple Choice
  - 60% of your score
  - 100 questions
  - Most are recall questions but some will require you to interpret information, analyze a graph, or evaluate a situation
  - 2 types:
    - "regular"
    - "sophisticated matching"

Slide 8

What does the APES Exam look like?

- Free Response:
  - 40% of your score
  - 4 questions with 4-5 parts
    - 1 Document Based Question (DBQ)
    - 1 Data Set Question
    - 2 Synthesis and Evaluation Questions
  - You will be asked to solve the world's problems by showing what you already know and using that knowledge to come up with reasonable solutions

Slide 9

How do I score a 4 or 5?

1. Know the test taking tips and strategies I'm about to give you.
2. Review only the science that you need to know and eliminate the "fluff"
   -I've cut away all the "fluff", so everything I give you is the bare minimum that you need to know to pass.
3. Study what you don't know, not what you do know.

Slide 10

Test Taking Strategies

- Strategy 1: Pace Yourself
- Strategy 2: The 3-pass System
- Strategy 3: Process of Elimination (POE)
- Strategy 4: Aggressive Guessing
- Strategy 5: Word Associations
- Strategy 6: Mnemonics
- Strategy 7: Identify Question Types
- Strategy 8: The Art of the ETS Essay

Slide 11

Strategy 1: Pace Yourself

- You have 90 minutes to answer 100 multiple choice questions.
- You will have a 10 min break
- You will have 90 minutes to answer 4 – free response questions that contain 4-5 sections each
- Answer ALL QUESTIONS!!!
- There are no point deductions for wrong answers!! (many study books aren't updated)

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Strategy 2: The 3-Pass System

1. First Pass - Read each question:
   1. If you know the answer, answer it
   2. If you're not sure, move on to the next
2. Second Pass - Re-read the questions you're not sure about:
   1. If you think you can answer it, take some time and answer it
   2. If you have no idea about the question, move on to the next.
3. Third Pass – mark "**b**" for every question you don't know
   1. **DO NOT CHRISTMAS TREE**…statistically you will get more answers right if you answer the questions you don't know with the same answer!

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Strategy 3: Process of Elimination (POE)

- Do this during your second pass
- You've been doing this strategy for years on multiple choice tests. Don't stop now.

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Strategy 4: Aggressive Guessing

- Remember that when you do POE, you increase your chances of getting the correct answer.
- If you cannot eliminate any answers, choose "b"

Slide 15

Strategy 5: Word Associations

- Memorize the vocab words I will be giving you
- Group words by association
- Remember that much of what you have learned crosses many chapter's in your text book.
  - Example: Ozone depletion is touched on in the intro chapters, the air pollution chapter, the Global Change chapters, etc.
- Key words are repeated over again throughout the course, associate the words together when answering questions

Slide 16

Strategy 6: Mnemonics

- When memorizing a list (like the 6 major air pollutants), create a funny sentence or word that you'll remember. Make it dirty if you want…whatever it takes to get you to remember the list
  - Example: SPLONC – Some Pollution Lands On Nature Constantly
  - **S**ulfur dioxide, **P**articulates, **L**ead, **O**zone, **N**itrogen dioxide, **C**arbon Monoxide.

Slide 17

Strategy 7: Identifying Question Types

- Don't get confused when they ask you "EXCEPT", "NOT", "LEAST" Questions.
- Spot all the right statements and cross them off.
- You'll wind up with the wrong statement, which happens to be the correct answer

Slide 18

Strategy 8: The Art of the ETS Essay

- You will have 90 min to complete 4, 4-part, free response questions.
  - One DBQ, One Data Set, Two Synthesis and Evaluation Questions
  - You will have to do calculations on one question and create a controlled experiment on another
- Brainstorm and Outline – spend no more than 5 min doing this on each question
- Label Diagrams and Figures
- Refer to Labs you did in class, and your unique experiences and geography of South Florida (ie Everglades)