**A.P. Environmental Science Workbook**

**What you should look at:**

Multiple Choice Test Questions:

1. 1998 Released Multiple Choice Exam
2. 2003 Released Multiple Choice Exam
3. AP Environmental Science Exam (a combination of questions from Mr. Ben Smith, Mr. Kevin Bryan). Please note there are currently 341 questions in this test bank with more being added. The answer key is not up to date yet.

As you go through the questions, make sure you know the vocabulary and the concepts. You should be able to write on any material that you are given, make notes, write brief definitions by the vocabulary and solve problems.

Free Response Questions

1. Released FRQs from 1999 – 2006, available from your teacher if they got a CD from Mr. Bryan, or online at the College Board. Make sure you get the questions and scoring guides.
2. FRQs developed by Mr. Bryan, most based on the national FRQs. Not all of these have answer keys.

You should read all the questions, try answering some of the FRQs, and review all of the scoring guides. You can work by yourself or in groups. When reviewing the study guides, pay good attention to the tables on water quality testing, air pollution and other tables that are provided.

**Good Luck on Tuesday, May 12, 2009Table of Contents**

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**Keys to Passing the APES Exam**

***About the Exam:***

The exam is three hours long, 90 minutes for 100 multiple choice questions and 90 minutes for four free response questions. The multiple choice section is worth 60% of your score and the free response makes up the remaining 40%. The number of questions on each topic is provided below. Bring a small clock or wrist watch to carefully monitor your time. You may not use a calculator for this exam. The numbers used in the math section have been rounded off to help speed the calculation process.

The multiple choice questions are scored by a machine soon after the exam in mid May. In early June, the free response questions are scored by college professors and highly qualified high school teachers at the AP Reading. The reading takes about seven days. The first day is devoted to helping the readers learn and adjusted the scoring rubric established by the question leader and table leaders for each question. This ensures that each student is graded as fairly as possible. The rest of the time is spent actually grading the exams.

Two of the nine years of multiple choice questions have been released, 1998 (the first year) and 2003. Since Environmental Science is a fairly new program the 1998 exam was released early to give students an idea of what is expected of them. The College Board only releases them every five years, the next expected release is the 2008 exam. There was a huge change in the difficulty between the 1998 and the 2003 exam. I believe that the difficulty will remain similar to the 2003 exam. Please study both exams for knowledge.

***Succeeding on the Multiple Choice Questions***

The multiple choice questions cover a broad range of topics, therefore nothing is going to succeed more than a solid background in the subject. Students will be tested on their ability to recall and understand material learned in the course. There may be several questions that ask you to solve math problems, don’t worry these are fairly easy if you have taken the time to learn the types of math problems asked of this course.

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

1. **Read each question carefully**. This is as much a reading test as it is a science exam. You will have an average of 54 seconds for each multiple choice question, one hundred questions in ninety minutes.
2. To ensure that you get the maximum number correct, **it is important to at least see every question.**  Some of the questions at the end of the test might be very easy for you to answer. You just have to make sure you get to them in the time allotted. If you try to answer an early question that takes a long time to reason out, you may not even get to read the questions at the end of the exam. To guarantee the highest number of correct answers, start by reading the whole test and answering only the questions that you know the answer to immediately or with a minimum of thought. Go all the way to question number 100, even though you probably are skipping quite a few. Now you can be reasonably sure that all your answers are correct. Remember the 54 seconds per question. Time saved here can be used later to answer the questions that are more difficult.
	1. Use a scoring system for the questions you skip, give them a plus **(+)** if you know you can answer them and a minus **(–)** if you can’t answer them. Trust me while you are working through the exam you brain will be churning away and some of those minus questions will become clear to you. Make a note to yourself so you remember how to answer that question later, don’t try to hunt for the question now.
	2. Some students prefer using Y and N
3. Now go back and answer skipped questions that you marked with a plus. Go through the whole test again doing this. **Be very careful** that your responses on the answer sheet match the number of the question you are answering.
4. Finally go through the test again, now concentrating on the questions that you are not totally sure of (the minus questions).
	1. There is a penalty for guessing. The scoring formula will subtract ¼ point for each incorrect answer while adding 1 point for each correct one. Random guessing to fill in your answer sheet will probably result in a lowering of your score. If you can eliminate two or more choices as being incorrect, it is to your advantage to take an informed guess. **Statistically, if you guess at four questions and get three wrong and only one right, you will still add ¼ of a point to your score**.
5. Force yourself to move through twenty questions each ten minutes and the full one-hundred questions in fifty minutes.
6. Now make a second pass concentrating on the "Y" questions **only**. Do not spend any time on the "N" questions. If you don’t know the correct answer see if some key piece of knowledge will allow you eliminate two or three of the choices. Complete this pass in forty minutes.
7. Now make your third pass. Focus **only** on the "N" questions. Attempt to eliminate at least two choices. If you can, then make an intelligent guess. If not, leave it blank.  You have only ten minutes, so make it count!
8. Before time expires, count the number that you have answered. You should answer at least sixty (60) questions.

## *Free Response Questions Hints*

## Overview of the types of questions

One of the four questions will involve the **Analysis of a Data Set** - similar to the "dishwasher" or "fossil fuel plant" questions. (Calculators not allowed)

One of the questions will be a **Document-Based** question. You will have to read a document and answer questions based on that information as well as your general knowledge.

The last two questions are **Synthesis and Evaluation**. One of these questions will require you to set up an experiment to show some particular effect.

Each question is graded on a 10-point scale. Usually the grading rubric is 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.

## Things To Do

Read all the questions first, before you attempt to answer them. Start with the question you find the easiest first, many times while answering one question, you will recall answers to other questions. Before you begin to answer any question, carefully reread the question. 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 and label them "a", "b", "c", etc. as they are labeled in the question. But if you cannot answer one part, be sure to answer later parts in the question. You can always answer the earlier parts later and you don’t need to save space. **AND** be sure to label the parts.

The questions are in a separate exam booklet from the answer booklet. You may write in the question booklet, but that booklet will be returned to you after the exam. It is a great place to make notes, outline your answer or do your calculations. Only answers written on the answer sheet will be graded.

Outline the answer to avoid confusion and disorganization. Pay close attention to the verbs used in the directions, such as **describe**, **explain**, **compare**, **give evidence for**, **graph**, **calculate**, etc., and be sure to follow those directions. Thinking ahead helps to avoid scratch outs, asterisks, skipping around and rambling.

Write the essay. Outlines and diagrams, no matter how elaborate and accurate, are not essays, and will not get you much credit, if any, by themselves. Exceptions, if you are asked as a part of an essay on a laboratory to calculate a number, this does not require that you write an essay, but be sure to show how you got your answer. Show formulas used, and the values inserted into those formulas. Also be sure to show all units. If asked to draw a diagram, be sure to label the components carefully and correctly.

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.

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.

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.

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.

Use a ballpoint pen with dark black ink.

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.

Carefully label your diagrams (otherwise they get no points). Place them in the text at the appropriate place, not attached at the end.

Widen your margins a little. This will make the essay easier for most folks to read.

Bring a watch to the exam so you can pace yourself. You have four essays to answer with about 22 minutes for each.

Understand that the exam is written to be hard. 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. Write thorough answers.

The AP Exam may include what are called synthesis and conceptual questions. These questions may ask you to indicate the relationship between two or more concepts. If you do not know the relationship between the concepts, at least tell what you do know about them individually.

\*\*\*\*If you are asked to design or describe an experiment, be sure to include the following:

1. **hypothesis** and/or predictions
2. identify the **independent variable** - what treatments will you apply
3. identify the **dependent variable** - what will you measure
4. identify several **variables to be controlled** (very important)
5. describe the **organism/materials/apparatus to be used**
6. describe what you will **actually do**
7. describe how you will actually **take and record data**
8. describe how the data will be **graphed and analyzed**
9. state how you will **draw a conclusion** (compare results to hypothesis and predictions)
10. 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.

Include a graph of the following:

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

## Things Not To Do

* 1. Do not waste time on background information or a long introduction unless the question calls for historical development or historical significance. Answer the question.
	2. Don't ramble. Get to the point; don't shoot the bull. Say what you know and go on to the next question. You can always come back later and add information if you remember something.
	3. Only use black ballpoint pens. Don't use felt tip pens -they leak through the paper and make both sides hard to read. Do not obliterate information you want to delete. One or two lines drawn through the word(s) should be sufficient. Don't write more than a very few words in the margin. Don't write sloppily. Is easier for the grader to miss an important word when he/she cannot read your handwriting.
	4. Don't panic or get angry because you are unfamiliar with the question. You probably have read or heard something about the subject - be calm and think.
	5. Don't worry about spelling every word perfectly or using exact grammar. These are not a part of the standards the graders use. It is important for you to know, however, that very poor spelling and grammar will hurt your chances.
	6. There is no need to say the same thing twice. While introductory paragraphs may be important in English class, saying, "Process A is controlled by x, y, and z" and then writing a paragraph each on A, X, Y, and Z is a waste of valuable time. This also goes for restating the question. Don't restate it, just answer it.
	7. If given a choice of two or three topics to write about, understand that only the first one(s) you write about will count. You must make a choice and stick with it. If you decide that your first choice was a bad one, then cross out that part of the answer so the reader knows clearly which part you wish to be considered for credit.
	8. Don't leave questions blank. Remember that 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!**

## Additional Comments

* Get to the point
* Be concise. Be precise.
* Don't waste time adding any additional information. Credit is only given for information requested.
* Give examples whenever you can, but still be concise.

**You cannot list items in an outline form**. Use normal sentence structure to give a list of items. Always use complete sentences and good penmanship. If they can't read it, they can't grade it.

For questions involving calculations, calculators are not allowed. You can get credit for setting up a problem correctly and showing all work including correct units. You receive no credit for the correct answer only.

**Themes & Topic Outline**

**The Themes**

The six themes, which provide a foundation for the structure of the AP Environmental Science **(APES)** course are:

1. Science is a process.
	* Science is a method of learning more about the world.
	* Science constantly changes the way we understand the world.
2. Energy conservation underlies all ecological processes.
* Energy cannot be created; it must come from somewhere.
* As energy flows through systems, at each step more of it becomes unusable.
1. The Earth itself is one interconnected system.
* Natural systems change over time and space.
* Biogeochemical systems vary in ability to recover from disturbances.
1. Humans alter natural systems.
* Humans have had an impact on the environment for millions of years.
* Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
1. Environmental problems have a cultural and social context.
* Understand the role of cultural, social, and economic factors is vital to the development of solutions.
1. Human survival depends on developing practices that will result in sustainable systems.
* A suitable combination of conservation and development is required.
* Management of common resources is essential.

**Topic Outline**

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

**A. Earth Science Concepts**

* geological time scale
* plate tectonics
* earthquakes
* volcanism
* seasons
* solar intensity
* latitude

**B. The Atmosphere**

* composition
* structure
* weather and climate
* atmospheric circulation and the Coriolis Effect
* atmosphere-ocean interactions
* ENSO (El Niño-Southern Oscillation)

**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
* ecosystem services

**D. Natural Ecosystem Changes**

* 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 Populations**

1. human population dynamics
* historical population sizes
* distribution
* fertility rates
* growth rates and doubling times
* demographic transition
* age-structure diagrams
1. population size
* strategies for sustainability
* case studies
* national policies
1. 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 needs
* types of agriculture
* Green Revolution
* genetic engineering and crop production
* deforestization
* irrigation
* sustainable agriculture
1. Controlling pest
* Types of pesticides
* cost and benefits of pesticides use
* integrated pest management (IPM)
* relevant laws

**B. Forestry**

* Tree plantations
* old growth forests
* forest fires
* forest management
* national forest

**C. rangelands**

* overgrazing
* deforestation
* desertification
* rangeland management
* federal rangelands

**D. Other Land Use**

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

**E. Mining**

* Mineral formations
* 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
* Conversions
* Laws of Thermodynamics

**B. Energy Consumption**

1. History
* Industrial Revolution
* Exponential growth
* Energy crisis
1. Present global energy use
2. 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 processes
	+ 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
	+ CAFÉ standards
	+ Hybrid electric vehicles
	+ Mass transit

**G. Renewable Energy**

* + Solar energy
	+ Solar 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
	1. Noise pollution
	+ Sources
	+ Effects
	+ Control measures
	1. 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
	1. Solid Waste
	+ Types
	+ Disposal
	+ 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 risk
2. Hazardous chemicals in the environment
	* Types of hazardous waste
	* Treatment/disposal of hazardous waste
	* Cleanup of contaminated sites
	* Biomagnification
	* Relevant laws

**C. Economics 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. Loss of Biodiversity due to:
	1. Habitat loss
	2. Overuse
	3. Pollution
	4. Introduced species
	5. Endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

**Air Pollution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Cause** | **Environmental Effect** | **Human Health Effect** |
| **PRIMARY** |  |  |  |
| Carbon Dioxide (CO2) |  |  |  |
| Carbon Monoxide (CO) |  |  |  |
| Hydrocarbons |  |  |  |
| Nitrogen Oxides(NOx)Which gases |  |  |  |
| Ozone (O3) |  |  |  |
| Particles |  |  |  |
| Sulfur Dioxide (SO2) |  |  |  |
| **Type** | **Cause** | **Environmental Effect** | **Human Health Effect** |
| **SECONDARY** |  |  |  |
| Industrial Smog |  |  |  |
| Nitric Acid (HNO3) |  |  |  |
| PANs |  |  |  |
| Photochemical Smog |  |  |  |
| Sulfur Trioxide (SO3) |  |  |  |
| Sulfuric Acid (H2SO4) |  |  |  |
| **Type** | **Cause** | **Environmental Effect** | **Human Health Effect** |
| **INDOOR AIR POLLUTANTS** |  |  |  |
| Asbestos | Insulation, ceiling and floor tiles |  | Lung cancer, lung diseases, asbestosis |
| Carbon Monoxide (CO) |  |  |  |
| Formaldehyde |  |  |  |
| Radon |  |  |  |

**Water Quality Test**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **What the test measures** | **Environmental Effect of poor/low results** | **Comments** |
| **BOD** |  |  |  |
| **Chloroform Bacteria** |  |  |  |
| **Dissolved Oxygen (DO)** |  |  |  |
| **Nitrates** |  |  |  |
| **pH** |  |  |  |
| **Phosphate** |  |  |  |
| **Salinity** |  |  |  |
| **Temperature** |  |  |  |
| **Turbidity** |  |  |  |

**Biomes of the World**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Biome**  | **Precipitation****(mm/in)** | **Temperature****Range** | **Location** | **Comments** |
| **Forest**Rain ForestTropicalTemperateDeciduousBoreal (Taiga, Coniferous) |  |  |  |  |
| **Tundra**ArticAlpine |  |  |  |  |
| **Desert**PolarTemperateTropical |  |  |  |  |
| **Mountains** |  |  |  |  |
| **Grassland**ShortTall |  |  |  |  |
| **Chaparral** |  |  |  |  |
| **Ice** |  |  |  |  |



http://www.csun.edu/science/biology/ecology/biomes/biome.2.gif

**Types of Tree Cutting**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Description** | **Environmental Effect** | **Comment** |
| **Clear-cut** | Removing all trees in the area | Loss of biodiversity of trees, loss of shelter for animals and loss of animal biodiversity, increased erosion | Increased erosion can cause increase turbidity and other issues in near-by steams |
| **Selective** |  |  |  |
| **Shelterwood** |  |  |  |
| **Seed Tree** |  |  |  |
| **Strip** |  |  |  |

**Laws**

|  |  |  |  |
| --- | --- | --- | --- |
| **Area** | **Law** | **Description** | **Effect** |
| **General** | National Environmental Policy Act (NEPA), 1969 |  |  |
| **Energy** | Energy Policy and Conservation Act, 1975 |  |  |
| **Energy** | Energy Policy Act, 1992 |  |  |
| **Water Quality** | Safe Drinking Water Act, 1974 |  |  |
| **Water Quality** | Clean Water Act, 1988 |  |  |
| **Water Quality** | Ocean Dumping Act, 1972 |  |  |
| **Air Quality** | Clean Air Act, 1990 |  |  |
| **Noise Control** | Quiet Communities Act, 1978 |  |  |
| **Resources and Solid Waste Management** | Solid Waste Disposal Act, 1965 |  |  |
| **Toxic Substances** | Nuclear Waste Policy Act, 1982 |  |  |
| **Toxic Substances** | Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), 1980 |  |  |
| **Pesticides**  | Federal Insecticide, Fungicide, and Rodenticide Control Act (FIFRA), 1972 |  |  |
| **Wildlife Conservation** | Lacy Act. 1900 |  |  |
| **Wildlife Conservation** | Migratory Bird Treaty Act, 1918 |  |  |
| **Wildlife Conservation** | Fur Seal Act, 1966 |  |  |
| **Wildlife Conservation** | Marine Mammal Protection Act, 1972 |  |  |
| **Wildlife Conservation** | Endangered Species Act, 1973 |  |  |
| **Land Use and Conservation** | Taylor Grazing Act, 1934 |  |  |
| **Land Use and Conservation** | Wilderness Act, 1964 |  |  |
| **Land Use and Conservation** | Soil and Water Conservation Act, 1977 |  |  |
| **Land Use and Conservation** | Surfacing Mining Control and Reclamation Act, 1977 |  |  |
| ***Other*** |  |  |  |
| ***Other*** |  |  |  |

**International Treaties and Protocols**

|  |  |  |  |
| --- | --- | --- | --- |
| **International Law** | **Description** | **Effect** | **Comments** |
| **Montreal Protocol** |  |  |  |
| **Kyoto Protocol** |  |  |  |
| **CITES** |  |  |  |
| **Basel Convention (movements of hazardous waste)** |  |  |  |
| **International Whaling Commission** |  |  |  |
| **Rio Earth Summit** |  |  |  |
| **Agenda 21** |  |  |  |

**Major Environmental Events**

|  |  |  |  |
| --- | --- | --- | --- |
| **Event** | **Year(s)** | **Problem** | **Environmental Impact** |
| **Bhopal, India** |  |  |  |
| **Chernobyl** |  |  |  |
| **Cuyahoga River** |  |  |  |
| **Exxon Valdez** |  |  |  |
| **Kissimmee River** |  |  |  |
| **Lake Erie** |  |  |  |
| **Love Canal** |  |  |  |
| **Santa Barbara** |  |  |  |
| **St. James Bay** |  |  |  |
| **Three Mile Island** |  |  |  |

**Symbiosis**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Description** | **Example** | **Comments** |
| **Commensalism** |  |  |  |
| **Mutualism** | Both species benefit | Bees get nectar from the flowers, they carry pollen from flower to flower. |  |
| **Parasitism**  |  |  |  |

**Related to Symbiosis**

|  |  |  |  |
| --- | --- | --- | --- |
| **Competition** |  |  |  |
| **Predator – Prey**  |  |  |  |

**Soils**

|  |  |  |  |
| --- | --- | --- | --- |
| **Horizons** |  | **Description** | **Comments** |
| **O** | Leaf Litter | Freshly fallen and partially decomposed organic material | Contains bacteria, fungi, worms, insects that help with the decomposition |
| **A** | Top soil |  |  |
| **B** | Sub soil |  |  |
| **C** | Parent Material |  |  |
| **E** | Eluviated |  |  |



**Biogeochemical Cycles**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Components** | **Cycle Flow** | **Man’s Influence** |
| **Carbon** |  |  |  |
| **Nitrogen** |  |  |  |
| **Oxygen** |  |  |  |
| **Phosphate** |  |  |  |
| **Sulfur** |  |  |  |
| **Water** |  |  |  |

**Related to Biogeochemical Cycles**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Components** | **Cycle Flow** | **Man’s Influence** |
| **Rock** |  |  |  |
| **Soil** |  |  |  |

**Appendix A: The Metric System**

**Metric Prefixes:**

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Abbreviation** | **Scientific Notation** |
| pico | p | 1 x 10-12 |
| nano | n | 1 x 10-9 |
| micro | μ | 1 x 10-6 |
| milli | m | 1 x 10-3 |
| centi | c | 1 x 10-2 |
| deci | d | 1 x 10-1 |
|  |  | 1 x 10 |
| deca1 | da | 1 x 101 |
| hecto | h | 1 x 102 |
| kilo | k2 | 1 x 103 |
| mega | M | 1 x 106 |
| giga | G | 1 x 109 |
| tera | T | 1 x 1012 |

1: in US will see deka

2: will sometimes see K

The following prefixes are not used often: deci, deca and hecto

**Distance**

The major unit of measurement for distance is the **METER**, in comparison to our system of measurement, it is approximately 1 yard. The abbreviation for the meter is **m**. Here are some common units of measurement and their conversion between the two systems.

|  |  |
| --- | --- |
| **Metric** | **United States** |
| 1 millimeter (mm) = 0.039 in | 1 inch (in) = 2.54 cm |
| 1 centimeter (cm) = 0.39 in | 1 foot (ft) = 30.48 cm |
| 1 meter (m) = 1.09 yards | 1 yard = 0.091 m |
| 1 kilometer (km) = 0.62 mile | 1 mile = 1.61 km |

**Volume**

The major unit of measurement for distance is the **LITER**, in comparison to our system of measurement, it is approximately 1 quart. The abbreviation for the liter is **l or L**, the lower case was more prevalent until the use of computers, the upper case is more common today but students need to know both. Here are some common units of measurement and their conversion between the two systems.

|  |  |
| --- | --- |
| **Metric** | **United States** |
| 1 milliliter (mL) =  | 1 ounce (oz) = |
|  | 1 cup = 8 oz = |
| 1 liter (L) = 1.06 quarts (qt) | 1 pint = 2 cups = |
| 1 kiloliter (kL) =  | 1 quart = 2 pints = 0.95 liters |

**Mass**

gram

**Area**

centimeter square

meter square

hectare

**Temperature**

Celsius (°C) = 5/9 (°F – 32 °F), by definition, water boils at 100 °C and freezes at 0 °C

Fahrenheit (°F) = (9/5 °C) + 32 °F

Kelvin (K) = absolute zero = -273.15 °C

 Room Temperature = 72 °F = 23 °C

**Appendix B: Energy Units and Terms**

The numbers here are the actual numbers, for the exam numbers are rounded for easy calculations as students can not use calculators. For example, 1 kwh = 3413 BTU’s, where as for the exam they use 3400 BTU’s.

* 1 calorie = the amount of heat it takes to raise 1 gram of water 1 degree Celsius (1.8 degree Fahrenheit)
* 1 BTU (British Thermal Unit) = the amount of heat it takes to raise one pound of water 1 degree Fahrenheit.
* 1 joule = the force of one Newton over 1 meter.
* 1 calorie = 3.968 BTU’s = 4,186 joules.
* 1 BTU = 0.254 calories = 1,055 joules
* 1 therm = 100,000 BTU’s
* 1 quad = 1 quadrillion BTU’s
* 1 watt = 1 watt of energy for one hour = 3.413 BTU’s
* 1 kilowatt (kw) = 1000 watts
* 1 kilowatt hour (kwh) = 1 kilowatt for 1 hour = 3413 Btu’s
* 1 megawatt (Mw) = 1,000,000 watts or 1,000 kilowatts
* 1 gigawatt (Gw) = 1,000,000,000 watts or 1,000,000 kilowatts or 1,000 megawatts
* 1 terawatt (Tw) = 1,000,000,000,000 watts
* 1 horsepower = 0.7457 kilowatts = 2,545 BTU’s
* 1 gallon of gasoline = 125,000 BTU’s
* 1 barrel of crude oil = 25,000,000 BTU’s
* 1 barrel of crude oil = 55 gallons of crude oil
* 1 cubic foot of natural methane gas = 1031 BTU’s
* 1 short of coal = 25,000,000 BTU’s

**Appendix C: Computer Terms**

* 1 byte
* 1 kilobyte (kb) = 1,000 bytes
* 1 megabyte (Mb) = 1,000,000 bytes
* 1 gigawatt (Gb) = 1,000,000,000 bytes
* 1 terawatt (Tb) = 1,000,000,000,000 bytes