Advanced Placement Environmental Science Study Guide

APES Exam: May 7, 2012

Developed for Bainbridge High School APES Class by Jason Uitvlugt with support and materials from Kevin Bryan - Woodrow Wilson High School, LAUSD

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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%. Bring a small clock or wrist watch to carefully monitor your time. You may not use a calculator for this exam.

The multiple choice questions are scored by a machine soon after the exam in mid May. Three years of multiple choice questions have been released, 1998 (the first year), 2003 and 2008. There was a huge change in the difficulty between the 1998 and the 2003 exam, from looking at the 2008 released test, it is similar to 2003.

In early June, the free response questions are scored by college professors and highly qualified high school teachers at the AP Reading. These test are posted to the College Board website, where teachers and students can down load the questions and the scoring guides.

Succeeding on the Multiple Choice Questions

The multiple choice questions cover a broad range of topics, therefore to succeed you will need a solid background in Environmental Science. The **Themes and Topics** are in this document. There are six underlying themes and seven major topics. The topics have a percentage which is a general guide for the number of questions out of the 100 multiple choice questions. 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. **It is important to at least read every question,** this will help ensure that you get the maximum number correct Some of the questions at the end of the test might be very easy for you to answer. 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.
3. 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. Time saved here can be used later to answer the questions that are more difficult. **Be very careful** that your responses on the answer sheet match the number of the question you are answering, that is you are bubbling the correct number.
    a. 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. 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 (write it down) so you remember how to answer that question later, don't try to hunt for the question now. **Some students prefer using Y and N instead of + and – .**
4. Now go back and answer skipped questions that you marked with a plus (+) or a Y. Go through the whole test again doing this. Finally go through the test again, now concentrating on the questions that you are not totally sure of (the minus or N questions).
5. Remember 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**.

Free Response Questions Hints

Overview of the types of questions
There are three types of questions. An **Analysis of a Data Set** question similar to the "dishwasher" (FRQ 1998 #1) or "fossil fuel plant" questions (FRQ 2000 #1), remember calculators are not allowed. One **Document Based** question, you will have to read a document and answer questions based on that information as well as your general knowledge. There are two **Synthesis and Evaluation** 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. In 1999, 2001 and 2003, there was an experimental design question.

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.

Things To Do
The questions are in two different books. The answer booklet will be the one shipped back and graded. The question booklet will be returned to you 48 hours after the exam. The question booklet is a great place to organize your notes, outline your answer and make some calculations. Only answers written on the answer booklet will be graded.

Read all four 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. 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. 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 is better than none.

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. Thinking ahead helps to avoid scratch outs, asterisks, skipping around and rambling. Just remember only the one book is turned in for a score. If it ask for two things, 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.

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. 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. 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. **Also be sure to show all units.** If asked to draw a diagram, be sure to label the components carefully and correctly.

Below are some helpful hints.

- 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.
- Get to the point.
- Be concise. Be precise. This is a science test not an English test.
- Don't waste time adding any additional information. Credit is only given for information requested.
- Give examples whenever you can, but still be concise.
- Bring a watch to the exam so you can pace yourself. You have four essays to answer with about 22.5 minutes for each. I recommend you practice with 20 minute limits as this will provide you time to read the questions first and may provide you with needed minutes for that hard question.
- 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.

Experimental Design

There have been three years (1999, 2001 and 2003) where there has been an experimental design question. 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 organism/materials/apparatus to be used
- describe what you will actually do
- 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 (compare results to hypothesis and predictions)
- 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 first book, write it backwards, then write it in the typical experimental design method (hypothesis → results).

1. **expected results:** what is your conclusion, compare to your hypothesis.
2. **analysis:** how are you going to analyze the results (graph, calculations)
3. **procedure:** a brief outline of how you are going to conduct the test, this is a great place to discuss your control (independent variable) and experimental (dependent variable) groups, what data you will collect and how it will be collected.
4. **hypothesis:** this is a testable outcome to the problem, a prediction of what you think will happen. You can use the null hypothesis, that is you expect nothing to happen.

What to include on your graph!

Below are some steps to follow when including a graph on the FRQ exam. Two years have included graphing as part of the answer to the FRQ, 2002 (LD_{50}) and 2003 (population). Interpreting graphs was included in 4 years, 1999, 2000, 2005, 2006 (2 graphs). One of the best way to read graphs is to be able to draw them.

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

- Do not waste time on background information or a long introduction unless the question calls for historical development or historical significance. Answer the question.
- 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.
- Only use black ballpoint pens. Don't use felt tip pens. Do not obliterate information you want to delete. One or two lines drawn through the word(s) should be sufficient.
- Don't write sloppily. It is easier for the grader to miss an important word when he/she cannot read your handwriting.
- 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.
- 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.
- 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.
- 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.
- 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!**
- **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.

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.
3) The Earth itself is one interconnected system.
   - Natural systems change over time and space.
   - Biogeochemical systems vary in ability to recover from disturbances.
4) 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.
5) Environmental problems have a cultural and social context.
   - Understand the role of cultural, social, and economic factors is vital to the development of solutions.
6) 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
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 needs
    - types of agriculture
    - Green Revolution
    - genetic engineering and crop production
    - deforestization
    - irrigation
    - sustainable agriculture
2. 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
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 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
1. Industrial Revolution

2. Exponential growth
3. 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 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
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
   - 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

4. Formation of stratospheric ozone
5. Ultraviolet radiation
6. Causes of ozone depletion
7. Effects of ozone depletion
8. Strategies for reducing ozone depletion
9. Relevant laws and treaties

B. Global Warming

10. Greenhouse gases and the greenhouse effect
11. Impacts and consequences of global warming
12. Reducing climate change

13. Relevant laws and treaties

C. Loss of Biodiversity

1. Loss of Biodiversity due to:
    a. Habitat loss
    b. Overuse
    c. Pollution
    d. Introduced species
    e. Endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

Vocabulary

Below are 593 vocabulary words that you should know for the exam.

1. abiotic
2. acid
3. acid deposition
4. acid rain
5. acidic solution
6. adaptation
7. adaptive radiation
8. advanced sewage treatment
9. aerobic respiration
10. affluenza
11. age structure
12. agricultural revolution
13. agroforestry
14. air pollution
15. albedo
16. alley cropping
17. altitude
18. anaerobic respiration
19. ancient forest
20. anthropocentric
21. aquaculture
22. aquatic life zone
23. aquifer
24. arable land
25. area strip mining
26. arid
27. artificial selection
28. atmosphere
29. atmospheric pressure
30. autotroph
31. background extinction
32. bacteria
33. barrier islands
34. benthos
35. biocentric
36. biodegradable
37. biodiversity
38. biogeochemical cycle
39. biological community
40. biological diversity
41. biological evolution
42. biological oxygen demand (BOD)
43. biomass
44. biome
45. biosphere
46. biotic
47. biotic pollution
48. biotic potential
49. birth rate
50. bitumen
51. breeder nuclear fission reactor
52. broadleaf deciduous plants
53. broadleaf evergreen plants
54. buffer
55. calorie
56. carbon cycle
57. carbon oxides
58. carnivore
59. carrying capacity (K)
60. chain reaction
61. chemical evolution
62. chemosynthesis
63. chronic undernutrition
64. clear-cutting
65. climate
66. coal
67. coal gasification
68. coal liquefaction
69. coastal wetland
70. coastal zone
71. coevolution
72. cold front
73. commercial extinction
74. commercial inorganic fertilizer
75. community
76. compost
77. condensation nuclei
78. coniferous evergreen plants
79. coniferous trees
80. conservation
81. conservation biology
82. conservationist
83. conservation-tillage farming
84. consumer
85. contour farming
86. contour strip mining
87. controlled burning
88. conventional-tillage farming
89. coral reef
90. core
91. cost-benefit analysis (CBA)
92. crop rotation
93. crown fire
94. crude birth rate
95. crude death rate
96. crude oil
97. cultural eutrophication
98. death rate
99. debt-for-nature swap
100. deciduous plants
101. decomposer
102. deductive reasoning
103. deep ecology environmental worldview
104. deforestation
105. degradable pollutant
106. degree of urbanization
107. demographic transition
108. depletion time
109. desalination
110. desert
111. desertification
112. detritivore

113. detritus
114. detritus feeder
115. deuterium (D; hydrogen-2)
116. developed country
117. developing country
118. dieback
119. differential reproduction
120. discount rate
121. dissolved oxygen (DO) content
122. distribution
123. domesticated species
124. doubling time
125. drainage basin
126. dredging
127. drift-net fishing
128. drought
129. durability
130. earth-centered environmental worldview
131. ecofeminist environmental worldview
132. ecological diversity
133. ecological efficiency
134. ecological footprint
135. ecological niche
136. ecological restoration
137. ecologist
138. ecology
139. economic depletion
140. economic development
141. economic growth
142. economic resources
143. economic system
144. economy
145. ecosphere
146. ecosystem
147. electromagnetic radiation
148. elevation
149. emigration
150. endangered species
151. endemic species
152. energy
153. energy efficiency
154. energy productivity
155. energy quality
156. environment
157. environmental degradation
158. environmental ethics
159. environmental movement
160. environmental resistance
161. environmental revolution
162. environmental science
163. environmental wisdom worldview
164. environmental worldview
165. environmentalism
166. environmentalist
167. environmentally sustainable economic development
168. environmentally sustainable society
169. Environmental Protection Agency (EPA)
170. estuary
171. euphotic zone
172. eutrophic lake
173. eutrophication
174. evaporation
175. even-aged management
176. evergreen plants
177. evolution
178. exhaustible resource
179. exponential growth
180. external benefit
181. external cost
182. externalities
183. extinction
184. family planning
185. famine
186. feedback loop
187. feedlot
188. fermentation
189. fertility
190. fertilizer
191. first law of thermodynamics
192. fish farming
193. fish ranching
194. fishery
195. floodplain
196. flyway
197. food chain
198. food web
199. forest
200. fossil fuel
201. free-access resource
202. freshwater life zones
203. front
204. frontier environmental worldview
205. frontier science
206. full cost
207. functional diversity
208. fundamental niche
209. fungicide
210. game species
211. gangue
212. gene mutation
213. gene pool
214. gene splicing
215. generalist species
216. genes
217. genetic adaptation
218. genetic diversity
219. genetic engineering
220. genetically modified organism (GMO)
221. geographic isolation
222. globalization
223. grassland
224. green manure
225. green revolution
226. greenhouse effect
227. greenhouse gases
228. gross domestic product (GDP)
229. gross primary productivity (GPP)
230. ground fire
231. groundwater
232. gully erosion
233. habitat
234. half-life
235. heat

236. herbicide
237. herbivore
238. heterotroph
239. high-input agriculture
240. high-quality energy
241. high-quality matter
242. high-throughput economy
243. high-waste economy
244. HIPPO (**H**abitat destruction, **I**nvasive species, **P**ollution, **P**opulation, and **O**verharvesting)
245. human capital
246. human resources
247. human-centered environmental worldviews
248. humus
249. Hunter-gatherers
250. hydrocarbon
251. hydrologic cycle
252. hydrosphere
253. identified resources
254. immigration
255. inductive reasoning
256. industrial smog
257. industrialized agriculture
258. infant mortality rate
259. infiltration
260. information and globalization revolution
261. inherent value
262. inland wetland
263. inorganic compounds
264. inorganic fertilizer
265. input pollution control
266. insecticide
267. instrumental value
268. integrated pest management (IPM)
269. intercropping
270. internal cost
271. interplanting
272. intertidal zone
273. intrinsic rate of increase (r)
274. intrinsic value
275. inversion
276. ionizing radiation
277. isotopes
278. J-shaped curve
279. kerogen
280. kilocalorie (kcal)
281. kinetic energy
282. K-selected species
283. K-strategists
284. land degradation
285. land-use planning
286. latitude
287. law of conservation of energy
288. law of conservation of matter
289. leaching
290. less developed country (LDC)
291. life cycle cost
292. life expectancy
293. life-centered environmental worldview
294. limiting factor
295. limiting factor principle
296. linear growth
297. lipids
298. liquefied natural gas (LNG)
299. liquefied petroleum gas (LPG)
300. lithosphere
301. loams
302. logistic growth
303. low-input agriculture
304. low-quality energy
305. low-quality matter
306. low-throughput economy
307. low-waste economy
308. macroevolution
309. malnutrition
310. mangrove swamps
311. manufactured capital
312. manufactured resources
313. marginal benefit
314. marginal cost
315. mass depletion
316. mass extinction
317. mass transit
318. material efficiency
319. matter-recycling economy
320. maximum sustainable yield
321. megacity
322. meltdown
323. mesotrophic lake
324. metabolism
325. metropolitan area
326. microevolution
327. micronutrients
328. microorganisms
329. migration
330. mineral resource
331. minimum viable population (MVP)
332. minimum-tillage farming
333. model
334. monoculture
335. monsoons
336. more developed country (MDC)
337. mountaintop removal
338. multiple use
339. mutation
340. natural capital
341. natural gas
342. natural greenhouse effect
343. natural law
344. natural rate of extinction
345. natural recharge
346. natural resources
347. natural selection
348. negative feedback loop
349. nekton
350. net energy
351. net primary productivity (NPP)
352. niche
353. nitric acid (HNO_3)
354. nitrogen cycle
355. nitrogen fixation
356. nitrogen oxides (NO_x)
357. noise pollution
358. nondegradable pollutant

359. nonionizing radiation
360. nonpersistent pollutant
361. nonpoint source
362. nonrenewable resource
363. no-till farming
364. nuclear change
365. nuclear energy
366. nuclear fission
367. nuclear fusion
368. nutrient
369. nutrient cycle
370. oil
371. oil shale
372. old-growth forest
373. oligotrophic lake
374. omnivore
375. open sea
376. open-pit mining
377. ore
378. organic compounds
379. organic farming
380. organic fertilizer
381. organism
382. output pollution control
383. overfishing
384. overgrazing
385. overnutrition
386. oxygen-demanding wastes
387. ozone (O_3)
388. ozone depletion
389. ozone layer
390. PANs
391. paradigm shifts
392. particulates
393. parts per billion (ppb)
394. parts per million (ppm)
395. parts per trillion (ppt)
396. pasture
397. per capita ecological footprint
398. per capita GDP
399. percolation
400. permafrost
401. permeability
402. perpetual resource
403. persistence
404. persistent pollutant
405. pest
406. pesticide
407. petrochemicals
408. petroleum
409. pH
410. phosphorus cycle
411. photochemical smog
412. photosynthesis
413. phytoplankton
414. planetary management worldview
415. plankton
416. plantation agriculture
417. point source
418. pollutant
419. pollution
420. pollution cleanup
421. pollution prevention
422. polyculture
423. polyvarietal cultivation
424. population
425. population change
426. population density
427. population dispersion
428. population distribution
429. population dynamics
430. population size
431. porosity
432. positive feedback loop
433. potential energy
434. poverty
435. prairies
436. precipitation
437. primary consumer
438. primary pollutant
439. primary productivity
440. primary sewage treatment
441. producer
442. pure free-market economic system
443. pyramid of energy flow
444. Quagga Mussel
445. radiation
446. radioactive decay
447. radioactivity
448. radioisotope
449. radon (Rn)
450. rain shadow effect
451. range
452. range of tolerance
453. rangeland
454. rare species
455. realized niche
456. recharge area
457. recombinant DNA
458. reconciliation ecology
459. recycling
460. reforestation
461. reliable runoff
462. renewable resource
463. replacement-level fertility
464. reproduction
465. reproductive isolation
466. reproductive potential
467. reserves
468. resource
469. resource productivity
470. respiration
471. restoration ecology
472. reuse
473. riparian zones
474. r-selected species
475. r-strategists
476. rule of 70
477. runoff
478. salinity
479. salinization
480. saltwater intrusion
481. scavenger
482. scientific law

483. second law of energy
484. second law of thermodynamics
485. secondary consumer
486. secondary pollutant
487. secondary sewage treatment
488. second-growth forest
489. selective cutting
490. septic tank
491. shale oil
492. sheet erosion
493. shelterbelt
494. shifting cultivation
495. slash-and-burn cultivation
496. sludge
497. smart growth
498. smelting
499. smog
500. social capital
501. soil
502. soil conservation
503. soil erosion
504. soil horizons
505. soil permeability
506. soil porosity
507. soil profile
508. soil structure
509. soil texture
510. solar capital
511. solar energy
512. spaceship-earth worldview
513. specialist species
514. speciation
515. species
516. species diversity
517. spoils
518. stewardship worldview
519. stratosphere
520. strip cropping
521. strip cutting
522. strip mining
523. subsidence
524. subsistence farming
525. subsurface mining
526. succulent plants
527. sulfur cycle
528. sulfur dioxide (SO_2)
529. sulfuric acid (H_2SO_4)
530. surface mining
531. surface runoff
532. surface water
533. survivorship curve
534. sustainability
535. sustainable agriculture
536. sustainable development
537. sustainable living
538. sustainable society
539. sustainable yield (sustained yield)
540. synergistic interaction
541. synergy
542. synfuels
543. synthetic natural gas (SNG)
544. tailings
545. tar sand
546. temperature inversion
547. terracing
548. terrestrial
549. tertiary (higher-level) consumers
550. tertiary sewage treatment
551. theory of evolution
552. thermal inversion
553. threatened species
554. throughput
555. throwaway society
556. total fertility rate (TFR)
557. traditional intensive agriculture
558. traditional subsistence agriculture
559. tragedy of the commons
560. transgenic organisms
561. transpiration
562. tree farm
563. tree plantation
564. trophic level
565. troposphere
566. true cost
567. undernutrition
568. undiscovered resources
569. uneven-aged management
570. upwelling
571. urban area
572. urban growth
573. urban sprawl
574. urbanization
575. volatile organic compounds (VOCs)
576. warm front
577. water cycle
578. water pollution
579. water table
580. waterlogging
581. watershed
582. weather
583. weathering
584. wetland
585. wild species
586. wilderness
587. wildlife
588. wildlife resources
589. windbreak
590. worldview
591. xeriscaping
592. Zebra mussel
593. zone of aeration
594. zone of saturation
595. zoning
596. zooplankton

Air Pollution

PRIMARY

Type	**Cause/Source**	**Environmental Effect**	**Human Health Effect**
Carbon Dioxide (CO_2)			
Carbon Monoxide (CO)			
Sulfur Dioxide (SO_2)			
Nitrogen Oxide (NO)			
Nitrogen Dioxide (NO_2)			
NO_x			
Hydrocarbons			
suspended particles			
VOCs			
SO_x			

SECONDARY

Type	**Cause/Sources/ Chemical Reaction**	**Environmental Effect**	**Human Health Effect**
Ozone (O_3)			

Sulfur trioxide (SO_3)			
HNO_3			
H_2SO_4			
H_2O_2			
PANs			

Water Quality Test

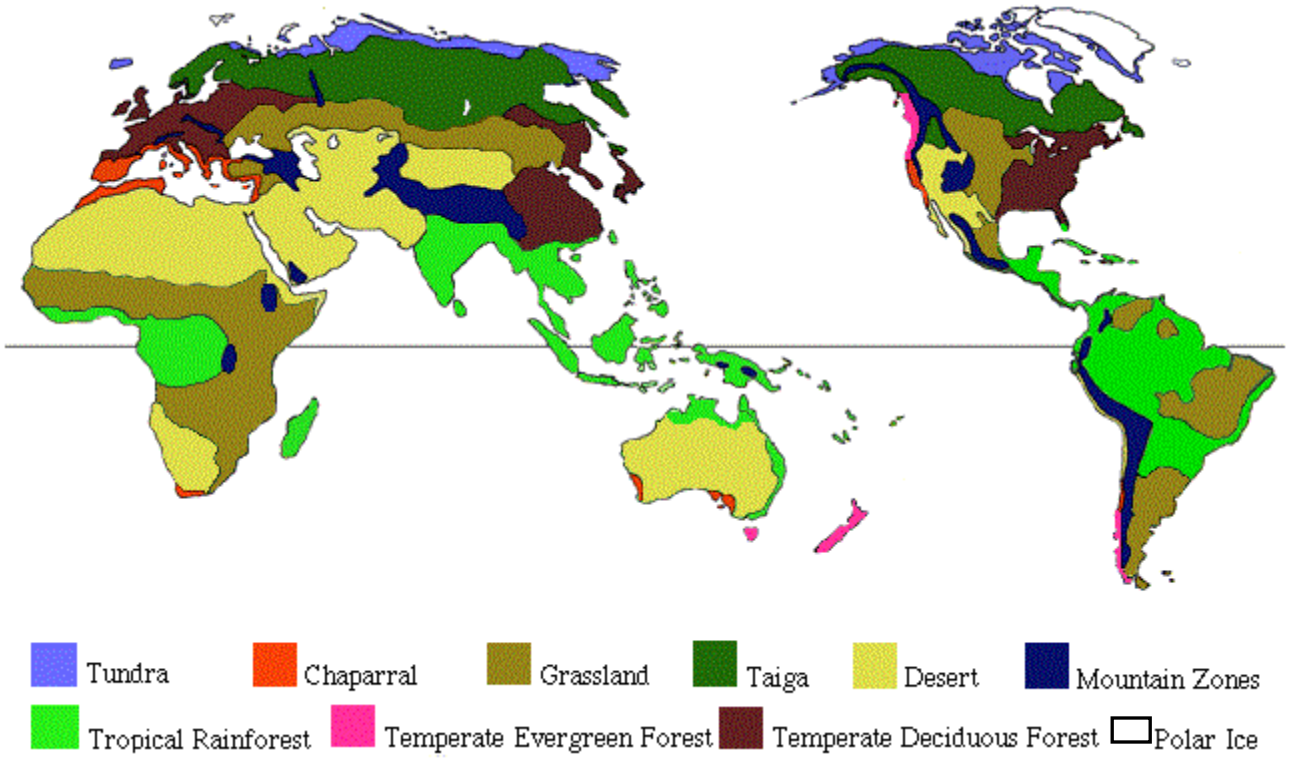
Type	**What the test measures**	**Environmental Effect of poor/low results**	**Comments**
BOD			
Chloroform Bacteria			
Dissolved Oxygen (DO)			
Heavy Metals			
Nitrates			
pH			
Phosphate			
Salinity			

Temperature			
Turbidity			

Biomes of the World

Biome	**Precipitation (mm/in)**	**Temperature Range**	**Location**	**Comments**
Forest Rain Forest Tropical Temperate Deciduous Tropical Temperate Boreal (Taiga, Coniferous)				
Tundra Artic Alpine	Usually less than 10 inches annually in both.	Winters – long, below freezing. Summers – short, usually not above 65°C	Artic – northern hemisphere around 75° Alpine – high mountains ~ 9,000 feet	Tundra is facing issues from global warming, permafrost (artic) is melting, carbon sink is breaking down into more CO_2
Desert Polar Temperate				

Tropical				
Mountains				
Grassland Short Tall				
Temperate Shrubland/ Chaparral/Mediterranean				
Ice				
Freshwater				
Marine Water				



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			

United States Laws

Area	Law	Description	Effect
	Federal Water Pollution Act		
	Oil Spill Prevention and Liability Act		
	Coastal Zone Management Act		
	Federal Environmental Pesticides Control Act		
	Food Quality Protection Act		
	Healthy Forest Initiative		
	National Forest Management Act		
	Multiple Use and Sustained Yield Act		
	National Park Service Act		
	National Trails Systems Act		
	Wild and Scenic River Act		
	General Mining Law		
	Convention on Persistent Organic Pollutants		
Air Quality	Clean Air Act, 1990		

Conservation	Soil and Water Conservation Act		
Energy	National Energy Act		
Energy	Energy Policy Act		
Energy	Energy Policy and Conservation Act, 1975		
Land	Surface Mining Control and Reclamation Act		
Land	Taylor Grazing Act		
Land	Wilderness Act, 1964		
Noise Control	Noise Control Act		
Pesticides	**FIFRA** (Federal Insecticide, Fungicide, and Rodenticide Act)		
Policy	NEPA 1970 (National Environmental Policy Act)		
Toxic Substances	Nuclear Waste Policy Act, 1982		
Toxic Waste	Superfund Act (Comprehensive Environmental Response, Compensation, and Liability Act)		
Waste Management	Solid Waste Disposal Act, 1965		
Waste Management	Resource Conservation and Recovery Act (RCRA)		
Waste Management	Ocean Dumping Act 1972		

Waste Management	Waste Reduction Act		
Waste Management	Medical Tracking Act		
Waste Management	Hazardous Materials Transportation Act (HAZMAT)		
Waste Management	Nuclear Waster Policy Act		
Water Quality	Water Quality Act		
Water Quality	Clean Water Act, 1977		
Water Quality	Safe Drinking Water Act		
Wildlife	Endangered Species Act		
Wildlife	Lacey Act		
Wildlife	Marine Mammal Protection Act		
Wildlife	Migratory Bird Treaty Act		
Wildlife	National Wildlife Refuge System Act		
Wildlife	Fish and Wildlife Act		
Wildlife	Fur Seal Act		

Species Relationships
Symbiosis

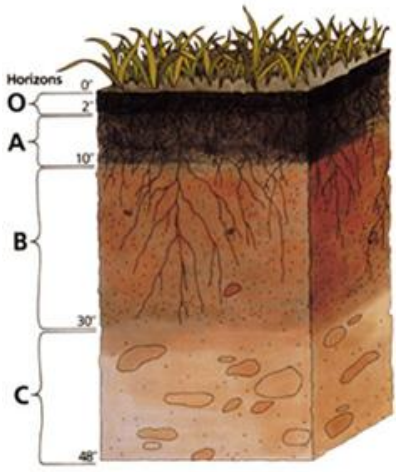
Type	Description	Example	Comments
Amensalism			
Commensalism			
Mutualism	Both species benefit	Bees get nectar from the flowers, they carry pollen from flower to flower.	
Parasitism			

Other Species Relationships

Competition			
Predator – Prey			
Saprotrophism			

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		



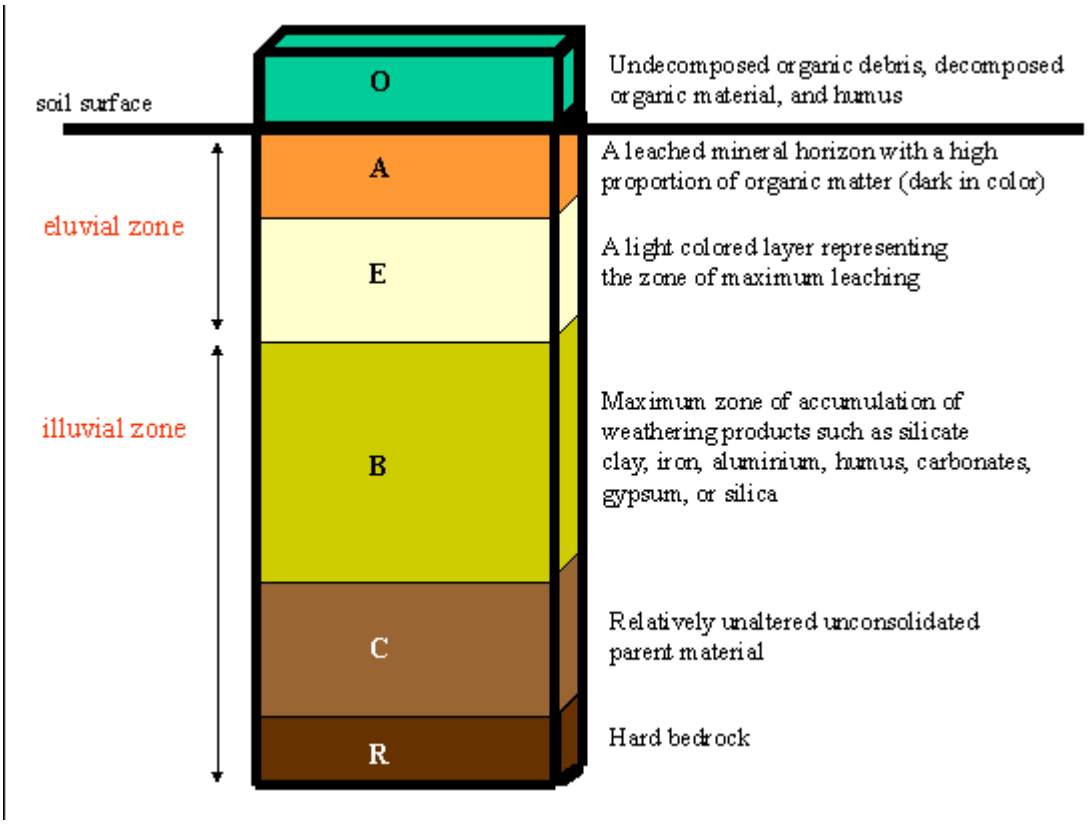
O Horizon

A Horizon: This layer eluviates (is depleted of) iron, clay, aluminum, organic compounds, and other soluble constituents.

E Horizon: When eluviation is pronounced, a lighter colored "E" subsurface soil horizon is apparent at the base of the "A" horizon.

B Horizon

C Horizon



Earth Cycles
Biogeochemical Cycles

Name	Components/Vocabulary	Cycle Flow	Man's Influence
Carbon			
Nitrogen			

Oxygen			
Phosphate			
Sulfur			
Water			

Earth's Other Cycles

Name	Components/Vocabulary	Cycle Flow	Man's Influence
Rock			

Soil			

Events

Event	**Year(s)**	**Problem**	**Environmental Impact/ Human Health**
Bhopal, India			
Chernobyl			
Cuyahoga River			
Exxon Valdez			
Kissimmee River			
Lake Erie			
Love Canal			
Santa Barbara			
St. James Bay			
Three Mile Island			
London Smog	1952		

International Treaties and Protocols

International Treaties & Protocols	**Description**	**Effect**	**Comments**
Agenda 21			
Basel Convention (movements of hazardous waste)			
CITES (Convention on International Trade in Endangered Species)			
Copenhagen Protocols			
International Whaling Commission (IWC)			
Kyoto Protocol			
Montreal Protocol			
POPs (persistent organic pollutants)			

Public Lands Management

Government Agency	**Description**	**Use**	**Comments**
National Park Service (NPS)	**58** major projects **331** national recreation areas, monuments, memorials, battlefields, historic sites, trails, parkways, seashores, rivers and lakeshores.	Only camping, hiking, sport fishing and boating in the national parks. Sport hunting, mining, oil and gas drilling **<u>may be allowed</u>** in the recreation areas.	
US Forest Service (USFS)	155 national forest 22 national grasslands	Managed for logging, mining, livestock grazing, farming, oil and gas extraction, recreation, and conservation of watersheds, soil, and wildlife resources	*"land of many uses"*

Bureau of Land Management (BLM)			
US Fish & Wildlife Services (USFWS)			
National Wilderness System			

Sewage Treatment

Type of Treatment	Description	Removes	Comment
Primary			
Secondary			
Tertiary			

Atmosphere

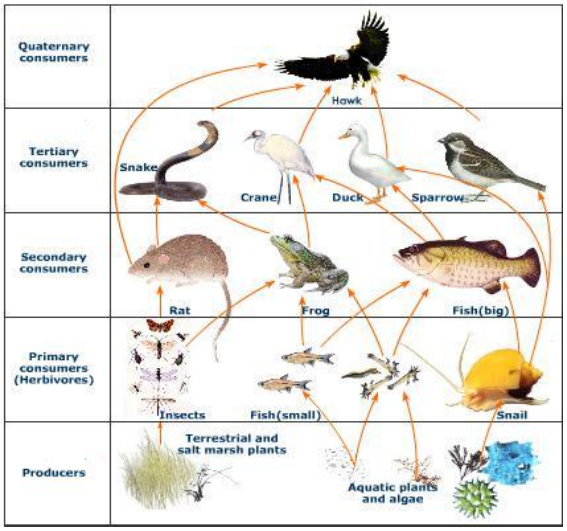
Name	Altitude (km & miles)	Temperature (ºC & ºF)	Components
Troposphere			
Stratosphere			
Mesosphere			
Thermosphere			

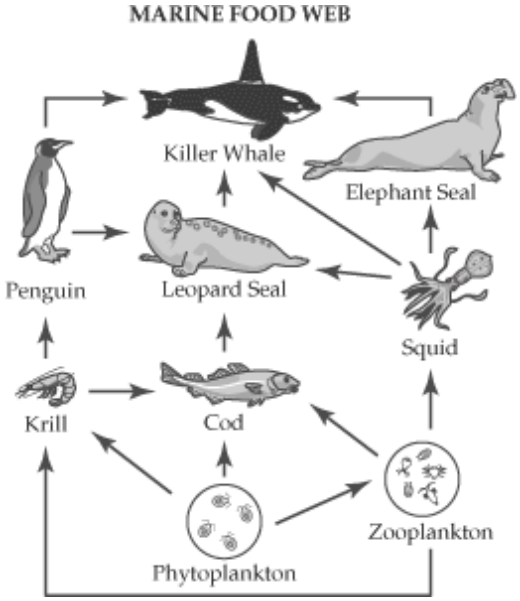
Food Chains & Food Webs

What is a food chain?

What is a food web?

Terrestrial Food Web





How to draw a food chain or food web:

1) Place the species in order from producer to the different levels of consumers.
   a. Consumers: Primary, Secondary, Tertiary, Quaternary
   b. You can use the name of the species instead of a picture/drawing.
2) Connect the species with lines that represent who is eat each other.
3) Add the arrows to show the flow of energy, from lower to higher on the trophic level.

Draw the following simple food chain.

a) the producer is grass
b) a grasshopper eats the grass
c) the toad eats the grasshopper
d) the snake eats the toad
e) the hawk eats the snake

Now add more species to make this a food web, do some research online and in your text book.

Integrated Pest Management (IPM)

Definition of IPM:

What is the goal of IPM?

Type	Description	Examples	Comments
Biological			
Chemical			
Physical			

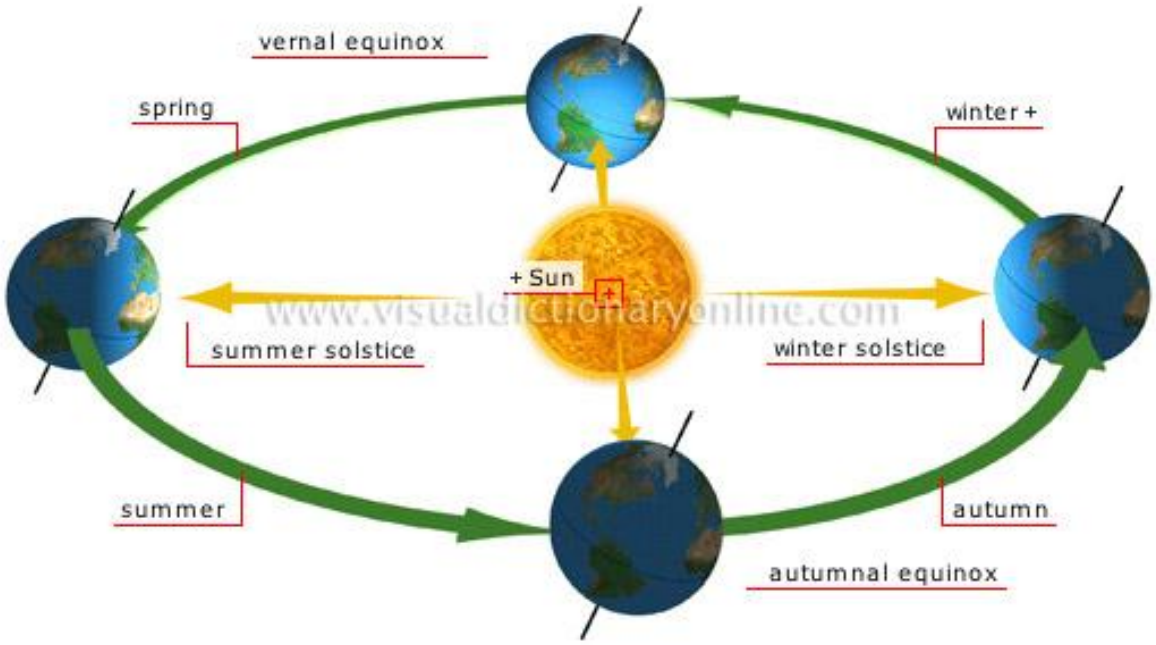
Environmental Worldviews

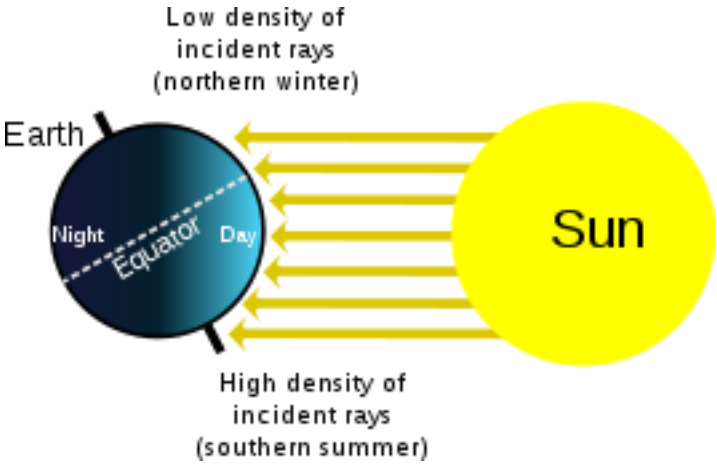
Name	Description	Beliefs	Comments
Human-Centered Environmental Worldviews			
Planetary Management			
Stewardship			
Life Centered/Earth-Centered Environmental Worldviews			
Environmental Wisdom			
Deep Ecology			
Ecofeminist			

Realm of Ecology

Description	Definition	Example
Organisms		
Population		
Community		
Ecosystem		
Biosphere		

Seasons





Definitions:

The Seasons

- Fall
- Winter
- Spring
- Summer

Astronomical Event

- Equinox
- Solstice

Geographic Locators

- Latitude
- Longitude

Circle of Latitude

- Equator
- Artic Circle
- Antarctic Circle
- Tropic of Cancer
- Tropic of Capricorn

Climate Zones

- Polar Region
- Temperate Region
- Tropic Region

Complete the Table

Hemisphere	**The Seasons**			
Northern				
Southern				
Astronomical Event				
Approximate date	March 20	June 21	September 22	December 21

Names the continent in each part of the Northern or Southern Hemisphere, several are in both hemispheres make sure to note them as well.

Northern Hemisphere:

Southern Hemisphere:

To Add:

1) Biodiversity land and aquatic
   a. Ecosystem approach
   b. Species approach
2) Climate change, ozone depletion
3) Dimensional analysis
4) Economics, per cap, developed countries
5) Energy renewable and nonrenewable
6) Food, 1st and 2nd green revolutions, organic, food labeling
7) Graphing
8) Hazards
9) How to Score
10) Land use, soil conservation
11) Minerals
12) Populations, rule of 70
13) Species
14) Human
15) Solid Waste, hazardous
16) Sustainability
17) US government, how laws are enacted
18) Wetlands
19) Time Line
20) GNP, etc.

Appendix A: The Metric System

The metric system was first adopted by France in 1791 and is the most common system of measurement in use in the world today. Only three nations, United States, Burma and Liberia do not use the metric system. Some countries use mostly the metric system but still hold on to some of their older measuring systems, these include the United Kingdom and Hong Kong. Even in the United States, the metric system is used in science and commerce. Look at our 2 L bottles of soda, medicines are sold in mg and most products sold today such as cars use metrics tools.

Metric Prefixes:

Prefix	Abbreviation	Scientific Notation
pico	p	1×10^{-12}
nano	n	1×10^{-9}
micro	μ	1×10^{-6}
milli	m	1×10^{-3}
centi	c	1×10^{-2}
deci	d	1×10^{-1}
		1×10
deca[1]	da	1×10^{1}
hecto	h	1×10^{2}
kilo	k[2]	1×10^{3}
mega	M	1×10^{6}
giga	G	1×10^{9}
tera	T	1×10^{12}

1: in US will see deka
2: will sometimes see K

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

Distance, Length
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
	3 teaspoons = 1 tablespoon
	2 tablespoons = 2 ounce
1 milliliter (mL) = 0.0338 oz	1 ounce (oz) = 29.574 mL
	1 cup = 8 oz = 236.592 mL
1 liter (L) = 1.06 quarts (qt)	1 pint = 2 cups = 16 oz = 0.473 L
	1 quart = 2 pints = 0.95 liters
1 kiloliter (kL) = 220 gallon	1 gallon = 3.785 L

Mass

The major unit of measurement for mass is the **GRAM**, for humans, we usually talk in terms of **kilogram,** in comparison to our system of measurement, it is approximately 2 pounds. The abbreviation for the gram is **g**. Here are some common units of measurement and their conversion between the two systems.

Metric	United States
1 gram (g) = 0.035 oz	1 ounce = 28.35 g
1 kilogram (kg) = 2.22 pound	1 pound (lb) = 0.45 kg

Area

hectare: the symbol is ha, is used for measuring land area, one hectare is 10,000 m^2, or one square hectometer, that is 100 meters that is squared (100 m on each side)

Temperature

Celsius

The **Celsius** temperature scale was previously known as the **centigrade scale**. From 1744 until 1954, 0 °C on the Celsius scale was defined as the freezing point of water and 100 °C was defined as the boiling point of water under a pressure of one standard atmosphere. However, the unit "degree Celsius" and the Celsius scale are currently, by international agreement, defined by two different points: absolute zero, and the triple point of Vienna Standard Mean Ocean Water **(VSMOW)** (specially prepared water). This definition also precisely relates the Celsius scale to the **Kelvin** (K) scale, which is the SI (**International System of Units)** of temperature. Absolute zero—the temperature at which no energy remains in a substance—is defined as being precisely 0 K and −273.15 °C. The triple point of water is defined as being precisely 273.16 K *and* 0.01 °C.

Fahrenheit

In this scale, the freezing point of water is 32 degrees Fahrenheit (32 °F), the boiling point is 212 degrees Fahrenheit (212 °F), placing the boiling and freezing points of water exactly 180 degrees apart. On the Celsius scale, the freezing and boiling points of water are exactly 100 degrees apart, thus the unit of this scale, a degree Fahrenheit, is $^5/_9$ of a degree Celsius. The Fahrenheit scale coincides with the Celsius scale at -40 °F, which is the same temperature as -40 °C.

Kelvin

The Kelvin unit and its scale, by international agreement, are defined by two points: absolute zero, and the triple point of VSMOW. This definition also precisely relates the Kelvin scale to the Celsius scale. Absolute zero – the temperature at which nothing could be colder and no heat energy remains in a substance – is defined as being precisely 0 K and -273.15 °C. The triple point of water is defined as being precisely 273.16 K and 0.01 °C. This definition does three things:

1. It fixes the magnitude of the Kelvin unit as being precisely 1 part in 273.16 parts the difference between absolute zero and the triple point of water;
2. It establishes that one Kelvin has precisely the same magnitude as a one-degree increment on the Celsius scale; and
3. It establishes the difference between the two scales' null points as being precisely 273.15 Kelvin (0 K = -273.15 °C and 273.16 K = 0.01 °C). Temperatures in Kelvin can be converted to other units per the table at top right.

Metric	**United States**
1° C = 33.8° F	1° F = -17.222° C
0° C = 32° F (freezing)	32° F (freezing) = 0° C
100° C = 212° F (boiling)	212° F (boiling) = 100° C

Temperature Conversions

- ° **F** = ((C - 32) · 5) / 9
- ° **C** = ((F · 9) / 5) + 32
- ° **C** = K – 273.15
- ° **F** = K × $^{9}\!/_{5}$ − 459.67

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 = 42 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 gigabyte (Gb) = 1,000,000,000 bytes
- 1 terabyte (Tb) = 1,000,000,000,000 bytes

You can change the byte to the basic metric units (meter, gram, liter).