The King's Academy
Mrs. Carruthers

AP ENVIRONMENTAL SCIENCE

SYLLABUS
AN EXPERT'S GUIDE TO APES
LETTER OF INTENT
SUMMER READING AND ASSIGNMENTS

As you probably already know, success in an Advanced Placement course requires a huge commitment by you as a student. AP Environmental Science is no exception, so before you begin your summer reading and assignments, I want to make sure that you are aware of the degree of dedication and commitment that this course requires.

Please read the course syllabus that begins on page 2 in order to get a feel for the course content, goals, and elements. The syllabus will also give you an idea about the kind of teaching and learning you can expect in the class.

Next, please read *An Expert's Guide to APES* beginning on page 10. This section includes information about who should take the class (it may not be who you're expecting) and some tips for success if you do decide to take AP Environmental Science.

If after reading the syllabus and the guide, you are still interested in taking AP Environmental Science, print the letter of intent on page 16. Please read the letter and discuss it with your parent(s) or guardian before signing it. You will turn the signed letter in, along with your summer assignments, on the first day of school in August.

You can find the directions for your summer reading and assignments on page 18.

The King's Academy
AP Environmental Science
Mrs. Carruthers

SYLLABUS

COURSE OVERVIEW:

The AP Environmental Science course is designed to be the equivalent of a one-semester, introductory college course in environmental science. The AP Environmental Science course has been developed to be a rigorous science course that stresses scientific principles and analysis and includes a laboratory component. It is intended to enable students to undertake, as first-year college students, a more advanced study of topics in environmental science or, alternatively, to fulfill a basic requirement for a laboratory science and thus free time for taking other courses. In both breadth and level of detail, the content of the course reflects what is found in many introductory college courses in environmental science. The exam is representative of such a course and therefore is considered appropriate for the measurement of skills and knowledge in the field of environmental science.

This course is designed to be taken by students after successful completion of two years of high school laboratory science — one year of life science and one year of physical science (for example, a year of biology and a year of chemistry). Due to the quantitative analysis required in the course, students should also have taken at least one year of algebra. Because of the prerequisites, AP Environmental Science is usually taken in either the junior or senior year.

COURSE OBJECTIVES:

The goal of the AP Environmental Science course is to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving or preventing them.

THE CONCEPT OUTLINE:

Environmental Science is interdisciplinary, embracing topics from sociology, political science, economics, geography, biology, ecology, chemistry, and earth science. Yet there are several major unifying constructs, or themes, that cut across the many topics included in the study of environmental science. The following themes provide a foundation for the structure of the AP Environmental Science course.

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 conversions underlie 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.

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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 a vast number 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.
   • Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
   • A suitable combination of conservation and development is required.
   • Management of common resources is essential.

TOPIC OUTLINE:

The following outline of major topics serves to describe the scope of the AP Environmental Science course and exam. The percentage after each major topic heading shows the approximate proportion of multiple-choice questions on the exam that pertain to that heading; thus, the percentage also indicates the relative emphasis placed on the topics in the course.

I. Earth Systems and Resources (10–15%)
   A. Earth Science Concepts
      (Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and 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)

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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; road less 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)

-continue-

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)
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; 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)

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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

SCIENCE PRACTICES OUTLINE:

Because it is designed to be a course in environmental science rather than environmental studies, the AP Environmental Science course includes a strong laboratory and field investigation component. The goal of this component is to complement the classroom portion of the course by allowing students to learn about the environment through firsthand observation. Experiences both in the laboratory and in the field provide students with important opportunities to test concepts and principles that are introduced in the classroom, explore specific problems with a depth not easily achieved otherwise, and gain an awareness of the importance of confounding variables that exist in the "real world." In these experiences students employ alternative learning styles to reinforce fundamental concepts and principles. Competency in the science practices that follow are expected of AP Environmental students.

1. The student can critically observe environmental systems.
2. The student can develop and conduct well-designed experiments.
3. The is able to use mathematics appropriately.
4. The student is able to utilize appropriate techniques and instrumentation.
5. The student can analyze and interpret data, including appropriate statistical and graphical Presentations.
6. The student is able to think analytically and apply concepts to the solution of environmental problems and make conclusions and evaluate their quality and validity.
7. The student is able to propose further questions for study.
8. The student can communicate accurately and meaningfully about observations and conclusions.

EXAM INFORMATION:

The AP Environmental Science Exam is 3 hours long and is divided equally in time between a multiple-choice section and a free-response section. The multiple-choice section, which constitutes 60 percent of the final grade, consists of 100 multiple-choice questions that are designed to cover the breadth of the students' knowledge and understanding of environmental science. Thought-provoking problems and questions based on fundamental ideas from environmental science are included along with questions based on the recall of basic 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.

The free-response section emphasizes the application of principles in greater depth. In this section, students must organize answers to broad questions, thereby demonstrating reasoning and analytical skills, as well as the ability to synthesize material from several sources into cogent and coherent essays. Four free-response questions are included in this section, which constitutes 40 percent of the final grade: 1 data-set question, 1 document-based question, and 2 synthesis and evaluation questions.

To provide maximum information about differences in students' achievements in environmental science, the exam is designed to yield average scores of about 50 percent of the maximum possible scores for both the multiple-choice and free-response sections. Thus, students should be aware that they may find the AP Exam more difficult than most classroom exams. However, it is possible for students who have studied most but not all topics in the outline to obtain acceptable grades.

The use of calculators is not allowed on either section of the exam.

COURSE TEXTS:

William P. Cunningham and Mary Ann Cunningham. *AP Edition, Environmental Science: A Global Concern, 14th Edition* (McGraw-Hill Education, 2018).

The Staff of the Princeton Review. *Cracking the AP Environmental Science Exam, 2017 Edition* (New York: Penguin Random House LLC, 2016).

G. Tyler Miller and Scott E. Spoolman. *AP Edition, Living in the Environment, 18th Edition* (Cengage Learning, 2015).

COURSE DESCRIPTION:

Organization:

A summer assignment is provided before students leave school for the summer. This summer assignment consists of a mandatory review of basic geography, geology, biology, and chemistry concepts, as well as review and practice of basic math, graphing, data and map analysis skills. Students should be prepared to be tested on these concepts and skills during the first few days of school.

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At the beginning of the school year a schedule for the course is provided. Weekly reading assignments, tests, and exam schedules are included. Students are responsible for keeping up with reading assignments and being prepared for class discussions, labs, field investigations, tests, and exams. Class is a combination of lecture, coverage of discussion questions, laboratory and field investigations, and answering student questions. Periodically, additional homework assignments will be required.

Lab and Field Component:
Students work either individually, in pairs, or in groups to prepare and complete each hands-on investigation. Students complete teacher prepared lab reports and field studies. In addition to performing these pre-designed activities, students are frequently required to design their own experiments and investigations and then carry them out whenever possible. Pre-lab/field and post-lab/field discussions are an important aspect of this investigative component. All lab/field reports are written up in a lab notebook and submitted for grading.

Classwork/Homework:
Homework for each chapter covered includes the following exercises:

- Core Case Study - *AP Document-Based Question* found at the beginning of each chapter in the textbook (10 points)
- *Use the Math* problems found throughout each chapter in the textbook (10 points)
- *AP Connections Review* – Multiple Choice questions found at the end of each chapter in the textbook (10 points)
- *Data Analysis and Free-Response Questions* found at the end of each chapter in the textbook (20 points)

All classwork/homework assignments are worth 50 daily points and are due at the beginning of the class period on test day.

Tests
Chapter tests are composed of objective questions and free response essay questions and will be given weekly, on Fridays, whenever possible. All weekly tests are worth 20 test points. After grading, all test questions are discussed for additional reinforcement of concepts and unification of the course objectives.

Comprehensive Unit Exams
At the end of each unit, students take a comprehensive exam over materials covered since the start of the course. Each exam is formatted in a similar fashion to the actual *AP* Environmental Science exam and is scored using the scoring formula and standards used to score the actual *AP* exam. Each unit exam is worth 100 test points. One of the comprehensive unit exams is used as the first semester exam. After grading, all unit exam questions are reviewed, again for reinforcement of concepts and unification of the course objectives.

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Final Practice Exam

Approximately one week prior to the scheduled date of the *AP Environmental Science* exam, students come to school on a Saturday and take a practice exam. This exam is designed, timed and scored like the actual *AP Environmental Science* exam. Students complete a topical analysis of their exam to get an idea of areas they need to review and focus on prior to the actual exam.

Student Evaluation

Homework assignments, lab/field reports, tests, and unit exams are used to evaluate student's learning.

An Expert's Guide
What is AP Environmental Science?

by Christine Sarikas

Are you thinking about taking AP Environmental Science but want more info on the course before you decide to enroll? You've come to the right place! AP Environmental Science (AKA APES) is one of the most popular AP classes, but sometimes students don't know much about it before they enroll, which can make the class difficult and unenjoyable.

So what is AP Environmental Science? In this guide, I'll explain what topics the course covers and discuss who should take the class (it may not be who you think). I'll end with some tips for success, if you do decide to take APES. Let's get started!

What Does AP Environmental Science Cover?

What do students in APES learn and what does the exam cover? You can get an in-depth look at the class by checking out the College Board's course description for AP Environmental Science, but if you find that too wordy or too much information to look through, here's a brief, clear look at the course.

AP Environmental Science is an interdisciplinary course that focuses on ecological processes, human impacts on the Earth, and how to resolve or prevent natural and human-made environmental problems.

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The class and exam focus on seven main topics:

Earth Systems and Resources
Topics include: geology, the atmosphere, water resources, and soil science

The Living World
Ecosystems, energy flow, biogeochemical cycles

Population
Population ecology, reproductive strategies, survivorship

Land and Water Use
Agriculture, forestry, mining, fishing, global economics

Energy Resources and Consumption
Different types of energy (fossil fuels, nuclear, hydroelectric, etc.), energy consumption, and renewable energy

Pollution
Types of pollution, economic impacts of pollution, how pollution affects environmental and human health

Global Change
Global warming, loss of biodiversity, changes to the ozone

Like other AP science classes, **APES also includes a lab component,** and students who take the class will get hands-on experience. This will involve completing labs, observing the natural world, and doing field work. You might collect water and test it for certain chemicals, observe wildlife in a field or forest, track plant growth in the classroom or in the field, or one of many other hands-on opportunities.

Students who complete AP Environmental Science are expected to be able to apply scientific concepts, principles, and methodologies to real-world examples and problems. The exam questions are designed to test this knowledge.

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Who Should Take AP Environmental Science?

Environmental Science is one of the more popular AP science courses to take; however, a lot of people who take the exam don't do particularly well. In fact, based on 2016 data released by the College Board, Environmental Science had the second lowest average score of any AP Exam. Less than half (45.6%) of students who took the exam qualified for college credit (earned a score of 3, 4, or 5), only 7.6% scored a 5, and the average score students earned was 2.55, which is not considered qualifying. Yikes!

So is AP Environmental Science super hard? Actually, not really. It usually requires less work than other AP science classes, and the consensus among students is that the material isn't particularly difficult. However, many students take APES because they are trying to fill a spot in their schedule or squeeze in an extra AP class, even if they aren't very interested in the subject and don't have a lot of experience with AP classes or time to prepare for it. This lack of adequate preparation contributes to low exam scores.

Taking AP Environmental Science and doing poorly in the class and on the exam won't impress colleges or get you college credit, so definitely don't do that. Let's go over who should take the class.

You Probably Shouldn't Take AP Environmental Science If:

- **You Plan on Majoring in Science**

This may be surprising since the word "science" is actually in the course title, but, as a matter of fact, AP Environmental Science isn't the best class for future science majors. This is because the class is more interdisciplinary than solely science-based. Compared to other AP science classes like biology and chemistry, APES includes a lot more social science and cross-curricular topics.

In fact, many colleges that give college credit for AP Environmental Science give social science credits, as opposed to science credits. This is not necessarily a bad thing though since most majors require a certain number of social science credits. AP Environmental Science can also be a good option if you're deeply interested in the topic or plan on continuing to study environmental science.

- **You Don't Have Enough Time to Devote to the Class**

A lot of students take AP Environmental Science because it has a reputation for being easy and less work than other AP science classes. While the material it covers may not be as complicated or in-depth, that doesn't mean you can coast through the class and expect to pass the exam.

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As mentioned earlier, the majority of people who take the APES exam don't even qualify for college credit, let alone get a 5. AP Environmental Science still requires you to memorize certain information, make connections, and develop certain skills, and you won't be able to do this if you don't plan on putting in the time needed to do well in the class.

You May Want to Take AP Environmental Science If:

AP Environmental Science can be a good class to take for many people. You should consider taking it if one or more of the following applies to you:

- You're interested in the environment, sustainability, biodiversity, and how humans are impacting the earth.

- You want to take an AP science class but don't have the space or feel prepared to take AP biology, physics, or chemistry.

- Your school's APES class has a reputation for being interesting, teaching students a lot, and preparing them for the exam.

- Your other classes and extracurricular activities leave you with enough time and energy to spend preparing for this class.

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Tips for Success in AP Environmental Science

If you do decide to enroll in AP Environmental Science, here are a few tips to help you do well in the class:

Tip 1: Don't Expect It to Be All About Science

As I mentioned before, AP Environmental Science isn't a pure science class. It's highly interdisciplinary and will include historical information, current events, critical reading skills, and more. If you expect the class to be completely science-focused, you may struggle with some aspects of the class.

While there will be graphs and scientific questions, the AP exam will also ask you to write complete essays and interpret documents, similar to many AP history and English exams. If you struggled with these classes or exams before, make sure you feel more prepared for the AP Environmental Exam.

Tip 2: Know How to Read and Interpret Visual Data

Many exam questions, both multiple-choice and free-response, will ask you to look at a data table, map, or graph and answer questions about it. This will require you to be able to understand and analyze these types of data, so it's critical you know how to do this well before you take the AP exam.

Taking practice exams and quizzes will help you, and you can also look through your textbook and homework, and even relevant newspaper or journal articles, for more examples.

When you come across a table, map, graph, or something similar, answer the following questions to make sure you're thinking critically about the data:

- What is this data showing?
- What patterns are there?
- Does any of the data not fit the pattern? What may have caused this anomaly?
- Why is this data important?

Tip 3: Remember That Everything's Connected

Probably the most important theme of Environmental Science is that everything is related. The Earth is one interconnected system, and you need to be able to understand where and why those connections exist.

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This is not a class where memorizing isolated facts or terms will get you very far. You can know every step of, say, the nitrogen cycle, but if you can't explain why the cycle is important, how it affects plants, animals, and ecosystems, and the impact it has on Earth, you will earn very few points on the exam.

As you go through the class, always be thinking about how the topic you're currently studying is related to past topics and the world as a whole. It'll also help to think about any ways humans have impacted or been impacted by the topic, if its sustainability is in jeopardy, and how problems related to it can be resolved.

Conclusion

Having an introduction to AP Environmental Science can help you decide whether you should take the course or not and it will also help you know what to expect if you do decide to enroll.

The class covers seven main topics:
Earth Systems and Resources
The Living World
Population
Land and Water Use
Energy Resources and Consumption
Pollution
Global Change

The material the class covers isn't particularly complicated or overwhelming, but students often underestimate the work needed to do well and, as a result, many don't pass the AP exam at the end of the year. Only take AP Environmental Science if you have the time and motivation to complete the coursework and prepare for exams, including the final AP exam. Because it includes topics from many areas, APES may be of interest to many students; however, if you're looking for an AP class that will get you science credit for college and prepare you for future science classes, AP Environmental Science may not be the best choice since it's more of an interdisciplinary class than a pure science class.

If you decide to take the class, keep these three tips in mind:
1 - Don't expect the class to be all about science.
2 - Learn how to analyze and interpret visual data.
3 - Remember that everything is connected.

Dear Student and Parent,

I am looking forward to having you in my Advanced Placement Environmental Science class during the 2017/2018 school year. In order to work together toward your success, I want to make you aware of the degree of dedication and commitment this course requires.

The student that is most successful in AP Environmental Science is the student who is self-motivated and is willing to teach them self through reading the textbook and outside references. Due to the volume of material, we cannot cover all the information together in class. Our time together needs to focus on lab and field investigations, as well as, discussion of the more difficult concepts. If students are not keeping up by teaching themselves the basics, they certainly will not benefit from the instruction they receive in class. Good attendance is also critical. Students that are frequently absent or who repeatedly miss class for activities or sports will fall behind quickly. Please note that I am available for extra help outside of class. Students are encouraged to come in for extra help at the first sign of a struggle, as the curriculum is extremely integrated and unified.

The AP exam has a set date by the College Board, which cannot be changed. I plan our course schedule to ensure that students will finish the curriculum and be prepared to take the exam by the scheduled exam date. Please understand that I cannot change our course schedule because some students are falling behind. It is the student's responsibility to keep up with the schedule. Again, extra help is available, if necessary, to keep up.

All AP Environmental Science students are committed to take a practice exam on a Saturday approximately one week before the scheduled College Board exam. Since the 2018 AP Environmental Science exam is scheduled for Thursday, May 10, 2018, the practice exam will be given on Saturday, April 28, 2018. This advanced notice should avoid any scheduling conflicts with personal matters.

Parents, please be aware that students frequently complain about the amount of work and the pace we need to maintain. In all fairness, please also be aware, that I must teach the class at a college level because that is what the course is all about. Remember, students that successfully achieve a qualifying AP Environmental Science exam score may receive, from many colleges and universities, three credits for an introductory science course. Students taking the exam will also receive an honor's point added to their grade point average.

Students and Parents, please have an in depth discussion about the commitment involved in this course so that we can all have a successful year. I am praying that you have a successful year and that you will never ceased to be amazed at God's incredible design as you learn more and more about His creation.

Sincerely,

Mrs. Cherri Carruthers

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I have read and understand the AP Environmental Science letter of intent:

_____

Student's signature

_____

Parent's signature

_____

date

AP ENVIRONMENTAL SCIENCE

Summer Review and Assignments

Welcome to the world of APES! In preparation for a successful year in AP Environmental Science, you are required to do some work independently over the summer. Remember that AP Environmental Science is interdisciplinary, embracing topics from several fields of study, so this summer assignment is designed to help you build some of the necessary skills and background knowledge from some of these other disciplines that will be required throughout the course. When you return to school in August, we will spend a day or two at the most, discussing this information. You should also be prepared to be tested on this material during the first few days of school. If you do not earn at least 80% on the test, you will be required to stay after school for remediation until you can demonstrate mastery or you will be asked to withdraw from the class. Without these necessary skills and this essential background knowledge, you will fall behind in many areas.

Content area reviewed and assessed include:

- Math Skills – pp. 19 - 38
- Graphing and Data Analysis Skills – pp. 39 - 55
- Geography and Map Analysis Skills – pp. 56 - 60
- Basic Earth Science Concepts – p. 61
- Basic Chemistry Concepts – pp. 62 - 63
- Basic Biology Concepts – p. 64

You can find specific directions regarding what to review and what practice exercises to complete for each content area on the pages listed above.

All work is due the first day of school. There will be **NO EXCUSE** for incomplete work**!!!!!!!** If you do not have the work completed by the first day of class, you will be withdrawn from the course.

If you have any questions regarding this assignment or if you have any questions regarding the content that this assignment covers, contact me by email at C.Carruthers@tka.net. I will get back to you as soon as possible.

MATH SKILLS DIRECTIONS

1 – Print the answer sheet for the math review exercises located on pages 20 – 25.

2 – Read through the math reviews and complete the review exercises for each of the sections:

- Decimals 1 - 12
- Averages 13 - 15
- Percentages 16 – 27
- Metric Units 28 - 33
- Scientific Notation 34 – 39 and 40 - 55
- Dimensional Analysis 56 – 62

3 – Use the answer sheet to write out all your work as well as to record your answers.

4 – SHOW ALL STEPS NO MATTER HOW SIMPLE!!!!!

5 – BE SURE TO INCLUDE UNITS ON EACH STEP AND OBVIOUSLY AS PART OF YOUR ANSWER!!!!!

6 – EXERCISES 1 – 62 ARE DUE ON THE FIRST DAY OF SCHOOL!!!!!

APES Math Review Answer Sheet

Remember to show all your work, include units on each step. **NO CALCULATORS**!!!!

DECIMALS

1. **Answer: _____**	**2.** **Answer: _____**
3. **Answer: _____**	**4.** **Answer: _____**
5. **Answer: _____**	**6.** **Answer: _____**
7. **Answer: _____**	**8.** **Answer: _____**
9. **Answer: _____**	**10.** **Answer: _____**
11. **Answer: _____**	**12.** **Answer: _____**

AVERAGES

13. **Answer: _____**	**14.** **Answer: _____**	**15.** **Answer: _____**

PERCENTAGES

16. Answer: _____	**17.** Answer: _____
18. Answer: _____	**19.** Answer: _____
20. Answer: _____	**21.** Answer: _____
22. Answer: _____	**23.** Answer: _____

24. Answer: _____	**25.** Answer: _____
26. Answer: _____	**27.** Answer: _____

METRIC SYSTEM

28. Answer: _____	**29.** Answer: _____	**30.** Answer: _____
31. Answer: _____	**32.** Answer: _____	**33.** Answer: _____

SCIENTIFIC NOTATION

34. Answer: _____	**35.** Answer: _____
36. Answer: _____	**37.** Answer: _____
38. Answer: _____	**39.** Answer: _____
40. Answer: _____	**41.** Answer: _____

42. Answer: _____	**43.** Answer: _____
44. Answer: _____	**46.** Answer: _____
46. Answer: _____	**47.** Answer: _____
48. Answer: _____	**49.** Answer: _____
50. Answer: _____	**51.** Answer: _____

52. Answer: _____	**53.** Answer: _____
54. Answer: _____	**55.** Answer: _____

DIMENSIONAL ANALYSIS

56. Answer: _____
57. Answer: _____
58. Answer: _____

59.

Answer: _____

60.

Answer: _____

61.

Answer: _____

62.

Answer: _____

The King's Academy
AP Environmental Science
Mrs. Carruthers
Review and Review Exercises

MATH SKILLS

This year in APES you will hear the two words most dreaded by high school students… **NO CALCULATORS**! That's right, you cannot use a calculator on the AP Environmental Science exam. Since the regular tests you will take are meant to help prepare you for the APES exam, you will not be able to use calculators on regular tests all year either. The good news is that most calculations on the tests and exams are written to be fairly easy calculations and to come out in whole numbers or to only a few decimal places. The challenge is in setting up the problems correctly and knowing enough basic math to solve the problems. With practice, you will be a math expert by the time the exam rolls around. So bid your calculator a fond farewell, tuck it away so you won't be tempted, and start sharpening your math skills!

SKILLS

- decimals
- averages
- percentages
- Metric units
- scientific notation
- dimensional analysis

REMINDERS

1 - Write out all your work, even if it's something really simple. This is required on the APES exam so it will be required on all your assignments, labs, quizzes, and tests as well.
2 - Include units in each step. Your answers always need units and it's easier to keep track of them if you write them in every step.
3 - Check your work. Go back through each step to make sure you didn't make any mistakes in your calculations. Also check to see if your answer makes sense. For example, a person probably will not eat 13 million pounds of meat in a year. If you get an answer that seems unlikely, it probably is. Go back and check your work.

DIRECTIONS

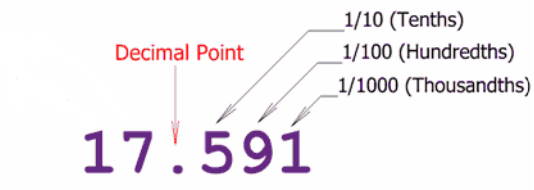
Read each section below for review. Look over the examples and use them for help on the practice problems. When you get to the practice problems, write out all your work and be sure to include units on each step. Check your work.

-continue-

Decimals

Part I - The basics

Decimals are used to show fractional numbers. The first number behind the decimal is the tenths place, the next is the hundredths place, the next is the thousandths place. Anything beyond that should be changed into scientific notation (which is addressed in another section.)



Part II - Adding or Subtracting Decimals

To add or subtract decimals, make sure you line up the decimals and then fill in any extra spots with zeros. Add or subtract just like usual. Be sure to put a decimal in the answer that is lined up with the ones in the problem.

$$\begin{array}{r} 123.0000 \\ 0.0079 \\ +43.5000 \\ \hline 166.5079 \end{array} \qquad \begin{array}{r} 27.583 \\ -\ 0.200 \\ \hline 27.383 \end{array}$$

Part III - Multiplying Decimals

Line up the numbers just as you would if there were no decimals. DO NOT line up the decimals. Write the decimals in the numbers but then ignore them while you are solving the multiplication problem just as you would if there were no decimals at all. After you have your answer, count up all the numbers behind the decimal point(s). Count the same number of places over in your answer and write in the decimal.

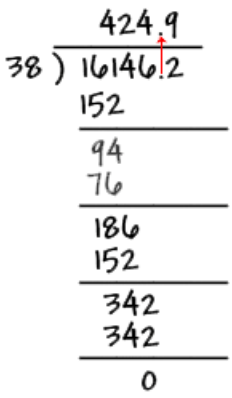
$3.77 \times 2.8 = ?$

$$\begin{array}{rl} & 3.77 \text{ (2 decimal places)} \\ \times & \underline{2.8} \text{ (1 decimal place)} \\ & 3016 \\ & +754 \\ & \hline 10.556 \text{ (3 decimal places)} \end{array}$$

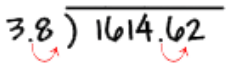
Part IV - Dividing Decimals

Scenario One - If the divisor (the number after the / or before the $\overline{)}$) does not have a decimal, set up the problems just like a regular division problem. Solve the problem just like a regular division problem. When you have your answer, put a decimal in the same place as the decimal in the dividend (the number before the / or under the $\overline{)}$).

-continue-



Scenario Two - If the divisor does have a decimal, make it a whole number before you start. Move the decimal to the end of the number, then move the decimal in the dividend the same number of places.



Then solve the problem just like a regular division problem. Put the decimal above the decimal in the dividend. (See Scenario One problem).

Practice - Remember to show all your work, include units if given, and **NO CALCULATORS**! All work and answers go on your answer sheet.

1. 1.678 + 2.456 =
2. 344.598 + 276.9 =
3. 1229.078 + .0567 =
4. 45.937 – 13.43 =
5. 199.007 – 124.553 =
6. 90.3 – 32.679 =
7. 28.4 x 9.78 =
8. 324.45 x 98.4 =
9. 1256.93 x 12.38 =
10. 64.5 / 5 =
11. 114.54 / 34.5 =
12. 3300.584 / 34.67 =

-continue-

Averages

To find an average, add all the quantities given and divide the total by the number of quantities.

Example - Find the average of 10, 20, 35, 45, and 105.

Step 1 - Add all the quantities. 10 + 20 + 35 + 45 + 105 = 215

Step 2 - Divide the total by the number of given quantities. 215 / 5 = 43

Practice - Remember to show all your work, include units if given, and **NO CALCULATORS**! All work and answers go on your answer sheet.

13. Find the average of the following numbers: 11, 12, 13, 14, 15, 23, and 29
14. Find the average of the following numbers: 124, 456, 788, and 343
15. Find the average of the following numbers: 4.56, .0078, 23.45, and .9872

Percentages

Introduction

Percents show fractions or decimals with a denominator of 100. Always move the decimal TWO places to the right go from a decimal to a percentage or TWO places to the left to go from a percent to a decimal.

Examples - .85 = 85%. .008 = .8%

Part I - Finding the Percent of a Given Number

To find the percent of a given number, change the percent to a decimal and MULTIPLY.

Example - *30% of 400*

Step 1 - 30% = .30

Step 2 -

$$\begin{array}{r} 400 \\ \times\ .30 \\ \hline 12000 \end{array}$$

Step 3 - Count the digits behind the decimal in the problem and add decimal to the answer.

12000 → 120.00 → 120

-continue-

Part II - Finding the Percentage of a Number

To find what percentage one number is of another, divide the first number by the second, then convert the decimal answer to a percentage.

Example - What percentage is 12 of 25?

Step 1 - 12/25 = .48

Step 2 - .48 = 48% (12 is 48% of 25)

Part III - Finding Percentage Increase or Decrease

To find a percentage increase or decrease, first find the percent change, then add or subtract the change to the original number.

Example - Kindles have dropped in price 18% from $139. What is the new price of a Kindle?

Step 1 - $139 x .18 = $25

Step 2 - $139 - $25 = $114

Part IV - Finding a Total Value

To find a total value, given a percentage of the value, DIVIDE the given number by the given percentage.

Example - If taxes on a new car are 8% and the taxes add up to $1600, how much is the new car?

Step 1 - 8% = .08

Step 2 - $1600 / .08 = $160,000 / 8 = $20,000 *(Remember when the divisor has a decimal, move it to the end to make it a whole number and move the decimal in the dividend the same number of places. .08 becomes 8, 1600 becomes 160000.)*

Practice - Remember to show all your work, include units if given, and **NO CALCULATORS**! All work and answers go on your answer sheet.

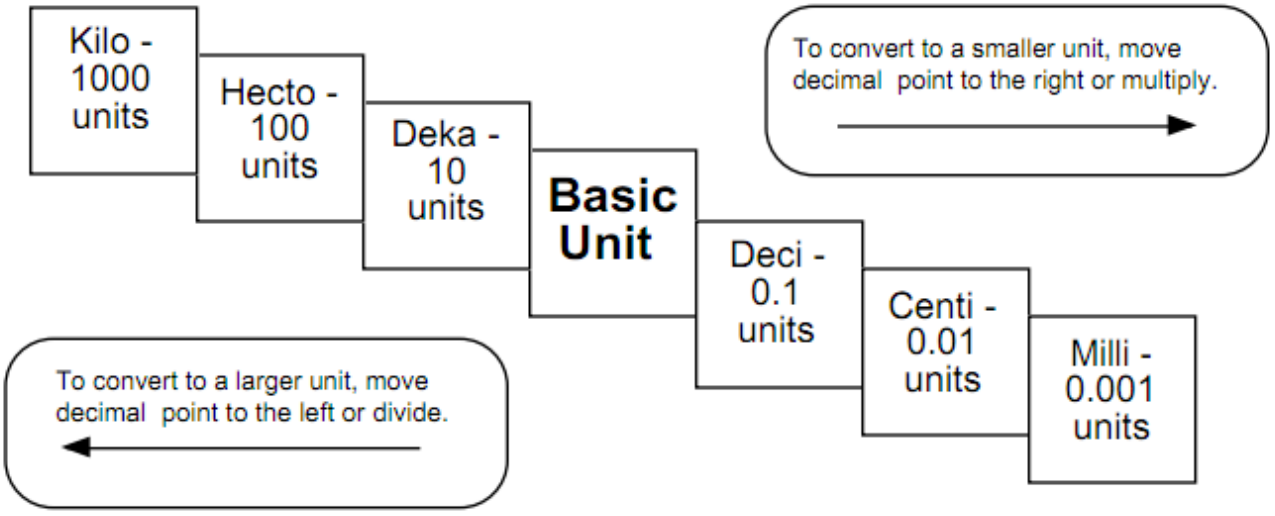
16. What is 45% of 900?
17. Thirteen percent of a 12,000 acre forest is being logged. How many acres will be logged?
18. A water heater tank holds 280 gallons. Two percent of the water is lost as steam. How many gallons remain to be used?
19. What percentage is 25 of 162.5?

-continue-

20. 35 is what percentage of 2800?
21. 14,000 acres of a 40,000 acre forest burned in a forest fire. What percentage of the forest was damaged?
22. You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?
23. Home prices have dropped 5% in the past three years. An average home in Indianapolis three years ago was $130,000. What's the average home price now?
24. The Greenland Ice Sheet contains 2,850,000 cubic kilometers of ice. It is melting at a rate of .006% per year. How many cubic kilometers are lost each year?
25. 235 acres, or 15%, of a forest is being logged. How large is the forest?
26. A teenager consumes 20% of her calories each day in the form of protein. If she is getting 700 calories a day from protein, how many calories is she consuming per day?
27. In a small oak tree, the biomass of insects makes up 3000 kilograms. This is 4% of the total biomass of the tree. What is the total biomass of the tree?

Metric Units

Kilo-, centi-, and milli- are the most frequently used prefixes of the metric system. You need to be able to go from one to another without a calculator. You can remember the order of the prefixes by using the following sentence: *King Henry Died By Drinking Chocolate Milk*. Since the multiples and divisions of the base units are all factors of ten, you just need to move the decimal to convert from one to another.



-continue-

Example - 55 centimeters = ? kilometers

Step 1 - Figure out how many places to move the decimal. King Henry Died By Drinking… – that's six places. (Count the one you are going to, but not the one you are on.)

Step 2 - Move the decimal five places to the left since you are going from smaller to larger.

55 centimeters = .00055 kilometers

Example - 19.5 kilograms = ? milligrams

Step 1 - Figure out how many places to move the decimal. … Henry Died By Drinking Chocolate Milk – that's six places. (Remember to count the one you are going to, but not the one you are on.)

Step 2 - Move the decimal six places to the right since you are going from larger to smaller. In this case you need to add zeros.

19.5 kilograms = 19,500,000 milligrams

Practice - Remember to show all your work, include units if given, and **NO CALCULATORS**! All work and answers go on your answer sheet.

28. 1200 kilograms = ? milligrams
29. 14000 millimeters = ? meters
30. 670 hectometers = ? centimeters
31. 6544 liters = ? milliliters
32. .078 kilometers = ? meters
33. 17 grams = ? kilograms

Scientific Notation

Introduction

Scientific notation is a shorthand way to express large or tiny numbers. Since you will need to do calculations throughout the year WITHOUT A CALCULATOR, we will consider anything over 1000 to be a large number. Writing these numbers in scientific notation will help you do your calculations much quicker and easier and will help prevent mistakes in conversions from one unit to another. Like the metric system, scientific notation is based on factors of 10. A large number written in scientific notation looks like this:

$$1.23 \times 10^{11}$$

The number before the x (1.23) is called the *coefficient*. The coefficient must be greater than 1 and less than 10. The number after the x is the base number and is always 10. The number in superscript (11) is the *exponent*.

Part I - Writing Numbers in Scientific Notation

To write a large number in scientific notation, put a decimal after the first digit. Count the number of digits after the decimal you just wrote in. This will be the exponent. Drop any zeros so that the coefficient contains as few digits as possible.

Example - 123,000,000,000

Step 1 - Place a decimal after the first digit. 1.23000000000

Step 2 - Count the digits after the decimal…there are 11.

Step 3 - Drop the zeros and write in the exponent. 1.23×10^{11}

Writing tiny numbers in scientific notation is similar. The only difference is the decimal is moved to the right and the exponent is a negative. A tiny number written in scientific notation looks like this:

$$4.26 \times 10^{-8}$$

To write a tiny number in scientific notation, move the decimal after the first digit that is not a zero. Count the number of digits before the decimal you just wrote in. This will be the exponent as a negative. Drop any zeros before or after the decimal.

Example - .0000000426

Step 1 - 00000004.26

Step 2 - Count the digits before the decimal…there are 8.

Step 3 - Drop the zeros and write in the exponent as a negative. 4.26×10^{-8}

Part II - Adding and Subtracting Numbers in Scientific Notation

To *add* or *subtract* two numbers with exponents, the exponents must be the same. You can do this by moving the decimal one way or another to get the exponents the same. Once the exponents are the same, add (if it's an addition problem) or subtract (if it's a subtraction problem) the coefficients just as you would any regular addition problem (review the previous section about decimals if you need to). The exponent will stay the same. Make sure your answer has only one digit before the decimal – you may need to change the exponent of the answer.

-continue-

Example - $1.35 \times 10^6 + 3.72 \times 10^5 = ?$

Step 1 - Make sure both exponents are the same. It's usually easier to go with the larger exponent so you don't have to change the exponent in your answer, so let's make both exponents 6 for this problem.

$$3.72 \times 10^5 \rightarrow .372 \times 10^6$$

Step 2 - Add the coefficients just as you would regular decimals. Remember to line up the decimals.

$$\begin{array}{r} 1.35 \\ +\ .372 \\ \hline 1.722 \end{array}$$

Step 3 - Write your answer including the exponent, which is the same as what you started with.

$$1.722 \times 10^6$$

Part III - Multiplying and Dividing Numbers in Scientific Notation

To *multiply* exponents, multiply the coefficients just as you would regular decimals. Then add the exponents to each other. The exponents DO NOT have to be the same.

Example - $1.35 \times 10^6 \quad X \quad 3.72 \times 10^5 = ?$

Step 1 - Multiply the coefficients.

$$\begin{array}{r} 1.35 \\ \times\ 3.72 \\ \hline 270 \\ 9450 \\ 40500 \\ \hline 50220 \rightarrow 5.022 \end{array}$$

Step 2 - Add the exponents.

$$5 + 6 = 11$$

Step 3 - Write your final answer.

$$5.022 \times 10^{11}$$

To *divide* exponents, divide the coefficients just as you would regular decimals, then subtract the exponents. In some cases, you may end up with a negative exponent.

-continue-

Example - $5.635 \times 10^3 \ / \ 2.45 \times 10^6 = ?$

Step 1 - Divide the coefficients.

$$5.635 / 3.45 = 2.3$$

Step 2 - Subtract the exponents.

$$3 - 6 = -3$$

Step 3 - Write your final answer.

$$2.3 \times 10^{-3}$$

Practice - Remember to show all your work, include units if given, and **NO CALCULATORS**! All work and answers go on your answer sheet.

Write the following numbers in scientific notation:

34. 145,000,000,000
35. 13 million
36. 435 billion
37. .000348
38. 135 trillion
39. 24 thousand

Complete the following calculations:

40. $3 \times 10^3 + 4 \times 10^3$
41. $4.67 \times 10^4 + 323 \times 10^3$
42. $7.89 \times 10^{-6} + 2.35 \times 10^{-8}$
43. $9.85 \times 10^4 - 6.35 \times 10^4$
44. $2.9 \times 10^{11} - 3.7 \times 10^{13}$
45. $1.278 \times 10^{-13} - 1.021 \times 10^{-10}$
46. three hundred thousand plus forty-seven thousand
47. 13 million minus 11 thousand
48. $1.32 \times 10^8 \ X \ 2.34 \times 10^4$
49. $3.78 \times 10^3 \ X \ 2.9 \times 10^2$
50. three million times eighteen thousand
51. one thousandth of seven thousand
52. eight ten-thousandths of thirty-five million
53. $3.45 \times 10^9 / 2.6 \times 10^3$
54. $1.98 \times 10^{-4} / 1.72 \times 10^{-6}$
55. twelve thousand divided by four thousand

Dimensional Analysis

Introduction

Dimensional analysis is a way to convert a quantity given in one unit to an equal quantity of another unit by lining up all the known values and multiplying. It is sometimes called factor-labeling. The best way to start a factor-labeling problem is by using what you already know. In some cases you may use more steps than a classmate to find the same answer, but it doesn't matter. Use what you know, even if the problem goes all the way across the page!

In a dimensional analysis problem, start with your given value and unit and then work toward your desired unit by writing equal values side by side. Remember you want to cancel each of the intermediate units. To cancel a unit on the top part of the problem, you have to get the unit on the bottom. Likewise, to cancel a unit that appears on the bottom part of the problem, you have to write it in on the top.

Once you have the problem written out, multiply across the top and bottom and then divide the top by the bottom.

Example - 3 years = ? seconds

Step 1 - Start with the value and unit you are given. There may or may not be a number on the bottom.

$$\left[\frac{3 \text{ years}}{\ }\right]$$

Step 2: Start writing in all the values you know, making sure you can cancel top and bottom. Since you have years on top right now, you need to put years on the bottom in the next segment. Keep going, canceling units as you go, until you end up with the unit you want (in this case seconds) on the top.

$$\left[\frac{3 \text{ years}}{\ }\right]\left[\frac{365 \text{ days}}{1 \text{ year}}\right]\left[\frac{24 \text{ hours}}{1 \text{ day}}\right]\left[\frac{60 \text{ minutes}}{1 \text{ hour}}\right]\left[\frac{60 \text{ seconds}}{1 \text{ minute}}\right]$$

Step 3: Multiply all the values across the top. Write in scientific notation if it's a large number. Write units on your answer.

$$3 \times 365 \times 24 \times 60 \times 60 = 9.46 \times 10^7 \text{ seconds}$$

-continue-

Step 4 - Multiply all the values across the bottom. Write in scientific notation if it's a large number. Write units on your answer if there are any. In this case everything was cancelled so there are no units.

$$1 \times 1 \times 1 \times 1 = 1$$

Step 5 - Divide the top number by the bottom number. Remember to include units.

$$9.46 \times 10^7 \text{ seconds} / 1 = 9.46 \times 10^7 \text{ seconds}$$

Step 6 - Review your answer to see if it makes sense. 9.46 x 10^7 is a really big number. Does it make sense for there to be a lot of seconds in three years? YES! If you had gotten a tiny number, then you would need to go back and check for mistakes.

In lots of APES problems, you will need to convert both the top and bottom unit. Don't panic! Just convert the top one first and then the bottom.

Example - 50 miles per hour = ? feet per second

Step 1 - Start with the value and units you are given. In this case there is a unit on top and on bottom.

$$\left[\frac{50 \text{ miles}}{1 \text{ hour}}\right]$$

Step 2 - Convert miles to feet first.

$$\left[\frac{50 \text{ miles}}{1 \text{ hour}}\right] \quad \left[\frac{5280 \text{ feet}}{1 \text{ mile}}\right]$$

Step 3 - Continue the problem by converting hours to seconds.

$$\left[\frac{50 \text{ miles}}{1 \text{ hour}}\right] \quad \left[\frac{5280 \text{ feet}}{1 \text{ mile}}\right] \quad \left[\frac{1 \text{ hour}}{60 \text{ minutes}}\right] \quad \left[\frac{1 \text{ minute}}{60 \text{ seconds}}\right]$$

Step 4 - Multiply across the top and bottom. Divide the top by the bottom. Be sure to include units on each step. Use scientific notation for large numbers.

$$50 \times 5280 \text{ feet} \times 1 \times 1 = 264000 \text{ feet}$$

$$1 \times 1 \times 60 \times 60 \text{ seconds} = 3600 \text{ seconds}$$

$$264000 \text{ feet} / 3600 \text{ seconds} = 73.33 \text{ feet/second}$$

-continue-

Practice - Remember to show all your work, include units if given, and NO CALCULATORS! All work and answers go on your answer sheet. Use scientific notation when appropriate.

Conversions

1 square mile = 640 acres
1 hectare (Ha) = 2.47 acres
1 kw-hr = 3,413 BTUs
1 barrel of oil = 159 liters
1 metric ton = 1000 kg

56. 134 miles = ? inches
57. 8.9×10^5 tons = ? ounces
58. 1.35 kilometers per second = ? miles per hour
59. A city that uses ten billion BTUs of energy each month is using how many kilowatt-hours of energy?
60. A 340 million square mile forest is how many hectares?
61. If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide?
62. Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?

GRAPHING AND DATA ANALYSIS SKILLS DIRECTIONS

1 – Print the answer sheet for the Graphing and Data Analysis review exercises located on pages 40 - 44.

2 – Read through The Basics of Graphs and Tables review on pages 45 – 47.

3 – Complete the Graphing and Data Analysis review exercises on pages 48 – 55.

4 - Use the answer sheet to record all answers and to make the graphs.

5 – GRAPHING AND DATA ANALYSIS REVIEW EXERCISES 1 – 10 AND PROBLEMS 1 – 3 ARE DUE ON THE FIRST DAY OF SCHOOL!!!!!

The King's Academy
AP Environmental Science
Mrs. Carruthers
Review Exercises Answer Sheet

GRAPHING AND DATA ANALYSIS

A – Interpreting Data

1. a. _____
   b. _____
   c. _____

2. a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____

3. a. _____
   b. _____
   c. _____

4. a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____

5. a. _____
   b. _____
   c. _____

6. a. _____
   b. _____
   c. _____
   d. _____

7. a. _____

b. _____

c. _____

d. _____

e. _____

8. a. _____

b. _____

c. _____

d. _____

9. a. _____

b. _____

c. _____

d. _____

e. _____

10. a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

-continue-

Problem 1

a. Create a line graph in the space given. Don't forget labels, a title, and a smooth best-fit line.

b. _____

c. _____

d. _____

e. _____

-continue-

Problem 2

a. *Create a line graph in the space given. Don't forget labels, a title, and a smooth best-fit line.*

b. _____

c. _____

d. _____

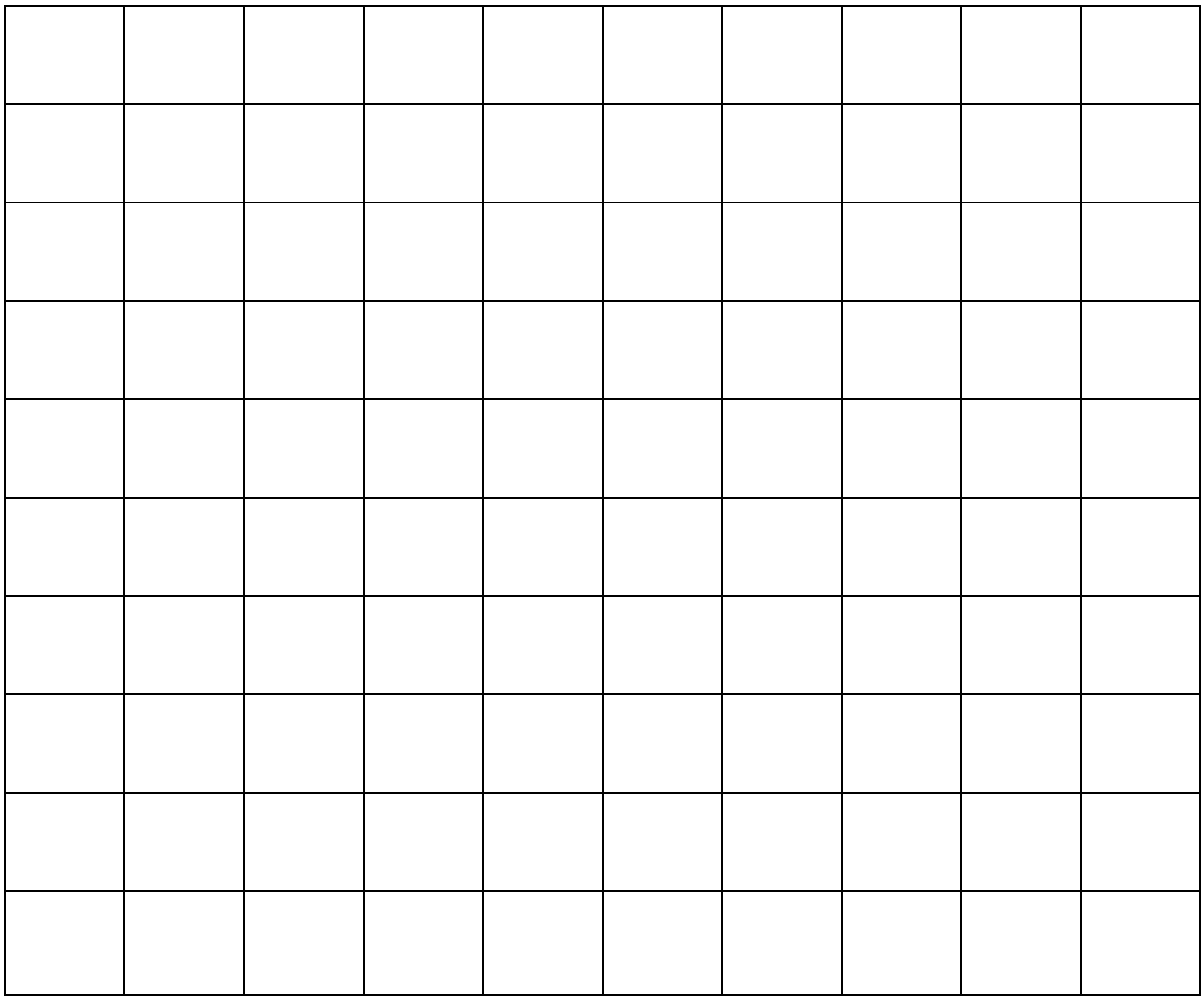
e. _____

f. _____

g. _____

h. _____

Problem 3



a. Create a line graph in the space given. Use a different color for each type of apple. Don't forget labels, a title, a smooth best-fit line, and a key.

b. _____

c. _____

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Review

The Basics of Graphs and Tables

Graphs and charts communicate information visually. They can show patterns, help scientists identify correlations, and get the point of the experiment across quickly.

- Typically, the **independent variable** is plotted on the **x-axis**
- The **dependent variable** is plotted on the **y-axis**.

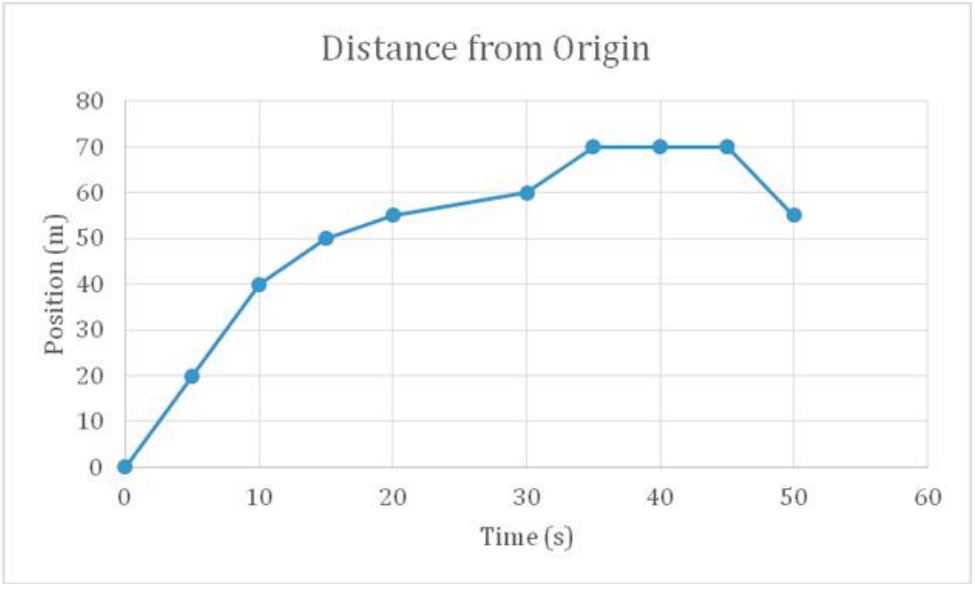
The mnemonic DRY MIX, for "dependent, responding, y-axis" and "manipulated, independent, x-axis," can help students remember this point.

Let's look at the different types of graphs and which types of data are best represented by each.

line graph

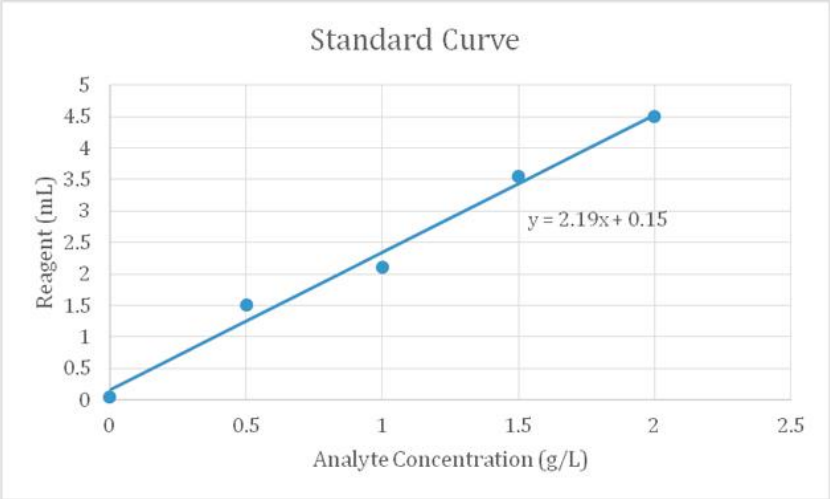
Line graphs show continuous data over periods of time. Before setting up a line graph, determine the dependent and independent variables. The independent variable may be a scalar (numeric) or ordinal (order) quantity. The independent variable always goes on the x-axis. If an experiment requires taking data points every 5 seconds for a minute, or every day for a month, it is appropriate to use a line graph.

Line graphs are similar to x-y scatter plots, except that the individual data points are connected. These graphs may be useful in circumstances when the change from point to point is of interest (as in a titration curve or absorbance spectrum). See the example below of a line graph showing the distance an object traveled from its starting point over time.



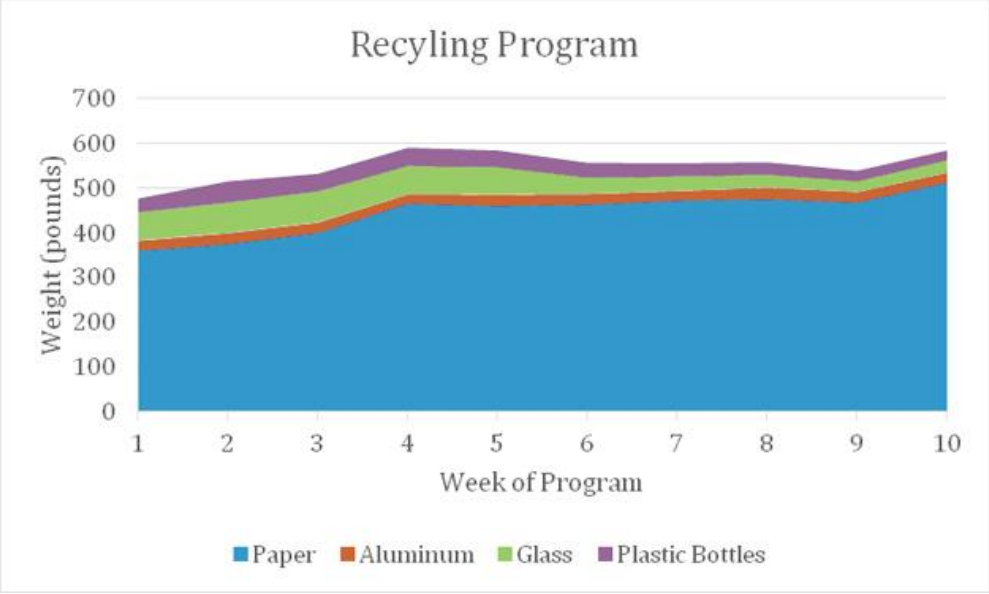
X-Y (scatter) plot

A scatter plot is often used to show relationships between independent and dependent variables. Instead of connected data points with a line, a best-fit line can be used to find a trend in data. Scatter plots are frequently used for creating a standard curve in chemistry, as is shown in the graph below. An equation for the trend line can be determined.



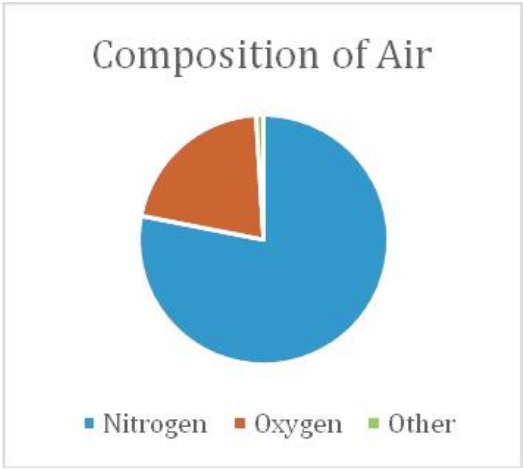
area graph

Similar to a line graph, an area graph is used to track changes over time for one or more groups. An area chart works well for data that both changes over time and indicates where the sum and the parts are important.



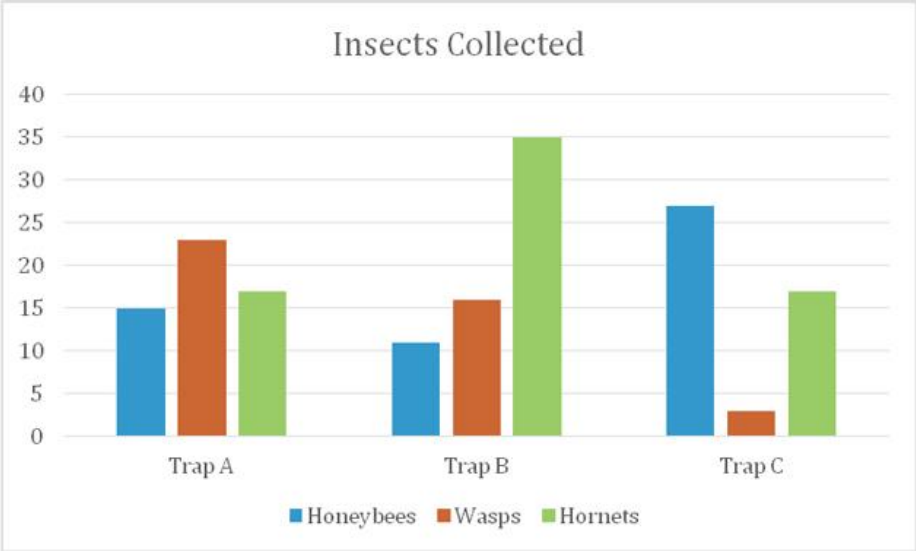
pie graph

Use pie graphs to compare parts of a whole. They depict a single point in time rather than changes over time. A pie graph can display percent composition, such as the composition of air. The area of each sector is proportional to a percentage.



bar graph

Bar graphs are used to compare different groups or to track a change over a period of time. Bar graphs compare data that do not continuously change over time, and they are helpful when you need to compare information collected by counting. A bar graph should be used if you are not looking for trends over time and when the items are not part of a whole. Bar graphs can also be used to compare values from different trials or different experimental groups, and they are ideal when the independent variable is not numerical.



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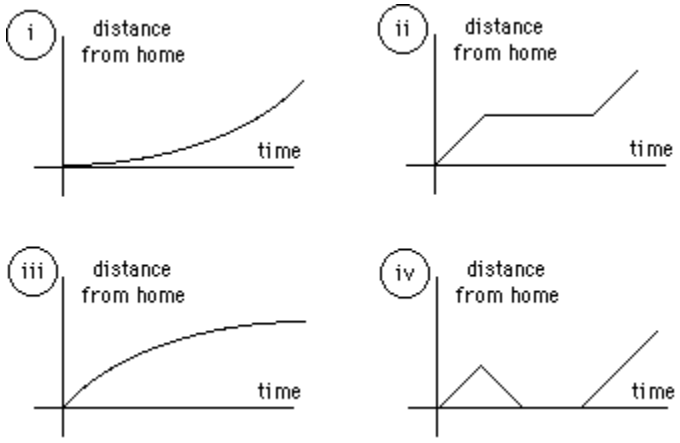
Review Exercises

GRAPHING AND DATA ANALYSIS

A – Interpreting Data

The following exercises are to help you practice reading information shown on a graph. Answer each question on the separate answer sheet.

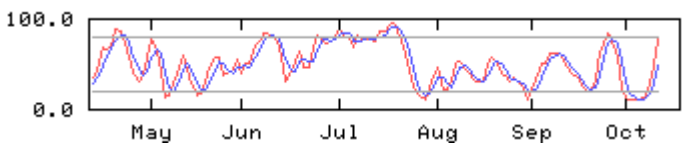
1. Identify the graph that matches each of the following stories:
   a. I had just left home when I realized I had forgotten my books so I went back to pick them up.
   b. Things went fine until I had a flat tire.
   c. I started out calmly, but sped up when I realized I was going to be late.



2. The graph at the right represents the typical day of a teenager. Answer these questions:
   a. What percent of the day is spent watching TV?
   b. How many hours are spent sleeping?
   c. What activity takes up the least amount of time?
   d. What activity takes up a quarter of the day?
   e. What two activities take up 50% of the day?
   f. What two activities take up 25% of the day?

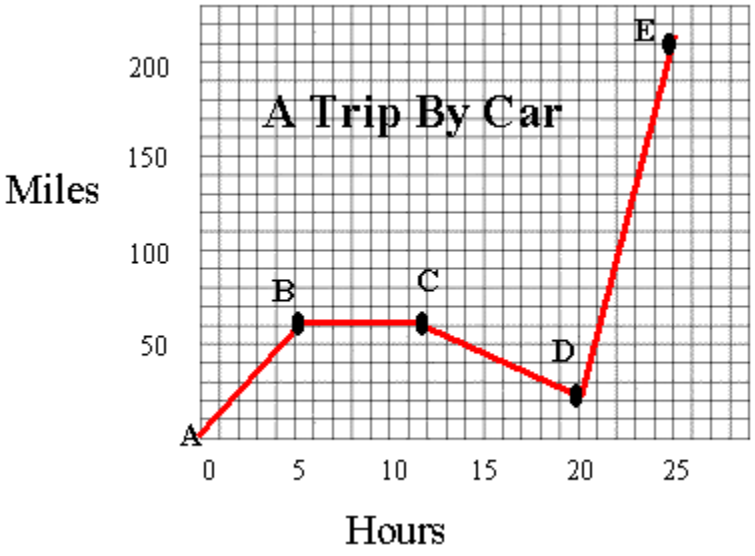
-continue-

3. Answer these questions about the graph at the right:



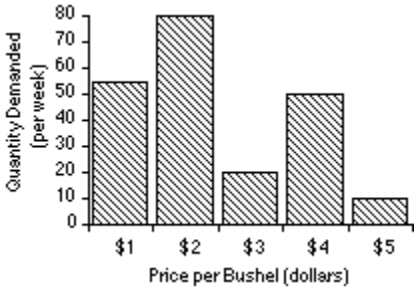
   a. How many sets of data are represented?
   b. On approximately what calendar date does the graph begin?
   c. In what month does the graph reach its highest point?

4. Answer these questions about the graph on the right:



   a. How many total miles did the car travel?
   b. What was the average speed of the car for the trip?
   c. Describe the motion of the car between hours 5 and 12?
   d. What direction is represented by line CD?
   e. How many miles were traveled in the first two hours of the trip?
   f. Which line represents the fastest speed?

5. Answer these questions about the graph at the right:

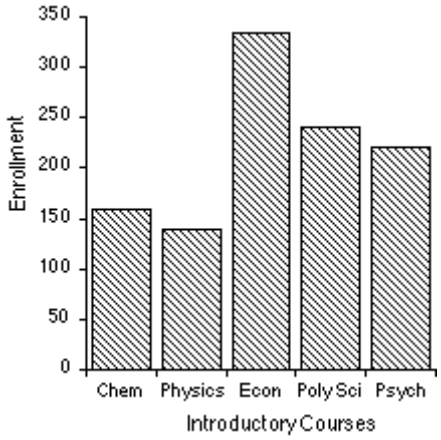


   a. What is the dependent variable on this graph?
   b. Does the price per bushel always increase with demand?
   c. What is the demand when the price is 5$ per bushel?

-continue-

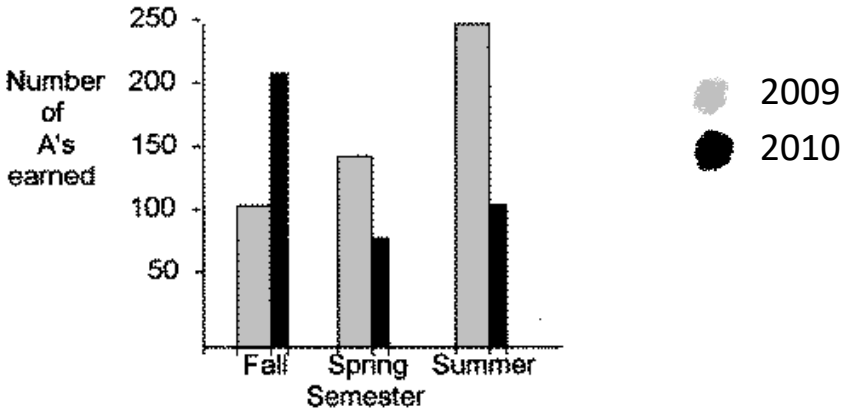
6. The bar graph below represents the declared majors of freshman enrolling at a university. Answer the following questions:

    a. What is the total freshman enrollment of the college?
    b. What percent of the students are majoring in physics?
    c. How many students are majoring in economics?
    d. How many more students major in poly sci than in psych?



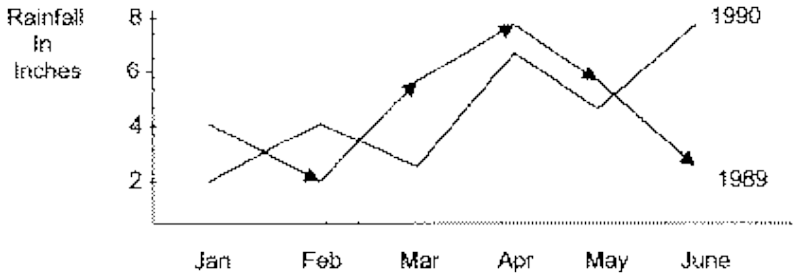
7. This graph represents the number of A's earned in a particular college algebra class. Answer the following questions:

    a. How many A's were earned during the fall and spring of 2009?
    b. How many more A's were earned in the fall of 2010 than in the spring of 2010?
    c. In which year were the most A's earned?
    d. In which semester were the most A's earned?
    e. In which semester and year were the fewest A's earned?



-continue-

8. Answer these questions about the graph below:
   a. How much rain fell in Mar of 1989?
   b. How much more rain fell in Feb of 1990 than in Feb of 1989?
   c. Which year had the most rainfall?
   d. What is the wettest month on the graph?



9. Answer these questions about the data table:
   a. What is the independent variable on this table?
   b. What is the dependent variable on this table?
   c. How many elements are represented on the table?
   d. Which element has the highest ionization energy?
   e. Describe the shape of the line graph that this data would produce?

Atomic Number	Ionization Energy (volts)
2	24.46
4	9.28
6	11.22
8	13.55
10	21.47

-continue-

10. Answer the following using the data table below:
    a. How many planets are represented?
    b. How many moons are represented?
    c. Which moon has the largest mass?
    d. Which planet has a radius closest to that of Earth?
    e. How many moons are larger than the planet Pluto?
    f. Which of Jupiter's moons orbits closest to the planet?
    g. Which planet is closest to Earth?

Solar System Data Table

Name	Orbits	Distance (000 km)	Radius (km)	Mass (kg)
Sun			697000	1.99×10^{30}
Jupiter	Sun	778000	71492	1.90×10^{27}
Saturn	Sun	1429000	60268	5.69×10^{26}
Uranus	Sun	2870990	25559	8.69×10^{25}
Neptune	Sun	4504300	24764	1.02×10^{26}
Earth	Sun	149600	6378	5.98×10^{24}
Venus	Sun	108200	6052	4.87×10^{24}
Mars	Sun	227940	3398	6.42×10^{23}
Ganymede	Jupiter	1070	2631	1.48×10^{23}
Titan	Saturn	1222	2575	1.35×10^{23}
Mercury	Sun	57910	2439	3.30×10^{23}
Callisto	Jupiter	1883	2400	1.08×10^{23}
Io	Jupiter	422	1815	8.93×10^{22}
Moon	Earth	384	1738	7.35×10^{22}
Europa	Jupiter	671	1569	4.80×10^{22}
Triton	Neptune	355	1353	2.14×10^{22}
Pluto	Sun	5913520	1160	1.32×10^{22}

-continue-

B – Making Graphs

Use the following steps to create graphs and answer questions for each of the problems below. All your work will go on the separate answer sheet.

1. *Identify the variables. The independent variable is controlled by the experimenter. The dependent variable changes as the independent variable changes. The independent variable will go on the X axis and the dependent on the Y axis.*
2. *Determine the variable range. Subtract the lowest data value from the highest data value.*
3. *Determine the scale of the graph. The graph should use as much of the available space as possible. Each line of the scale must go up in equal increments. For example, you can go 0, 5, 10, 15, 20, etc. but you cannot go 1, 3, 9, 34, 50, etc. Increments of 1, 2, 5, 10, or 100 are commonly used but you should use what works best for the given data.*
4. *Number and label each axis.*
5. *Plot the data. If there are multiple sets of data on one graph, use a different color for each.*
6. *Draw a smooth, best-fit line for each data set.*
7. *Title the graph. Titles should explain exactly what the graph is showing and are sometimes long. Don't be afraid of a long title!*
8. *Create a key to the graph if there is more than one set of data.*

-continue-

Problem 1

Age of the tree in years	Average thickness of the annual rings in cm. Forest A	Average thickness of the annual rings in cm. Forest B
10	2.0	2.2
20	2.2	2.5
30	3.5	3.6
35	3.0	3.8
50	4.5	4.0
60	4.3	4.5

The thickness of the annual rings indicate what type of environmental situation was occurring at the time of its development. A thin ring, usually indicates a rough period of development. Lack of water, forest fires, or a major insect infestation. On the other hand, a thick ring indicates just the opposite.

a. Make a line graph of the data.
b. What is the dependent variable?
c. What is the independent variable?
d. What was the average thickness of the annual rings of 40-year-old trees in Forest A?
e. Based on this data, what can you conclude about Forest A and Forest B?

Problem 2

pH of water	Number of tadpoles
8.0	45
7.5	69
7.0	78
6.5	88
6.0	43
5.5	23

a. Make a line graph of the data.
b. What is the dependent variable?
c. What is the independent variable?
d. What is the average pH in this experiment?
e. What is the average number of tadpoles per sample?
f. What is the optimum water pH for tadpole development?
g. Between what two pH readings is there the greatest change in tadpole number?
h. How many tadpoles would you expect to find in water with a pH reading of 5.0?

Problem 3

Amount of ethylene in ml/m^2	Wine sap Apples: Days to Maturity	Golden Apples: Days to Maturity	Gala Apples: Days to Maturity
10	14	14	15
15	12	12	13
20	11	9	10
25	10	7	9
30	8	7	8
35	8	7	7

Ethylene is a plant hormone that causes fruit to mature. The data above concerns the amount of time it takes for fruit to mature from the time of the first application of ethylene by spraying a field of trees.

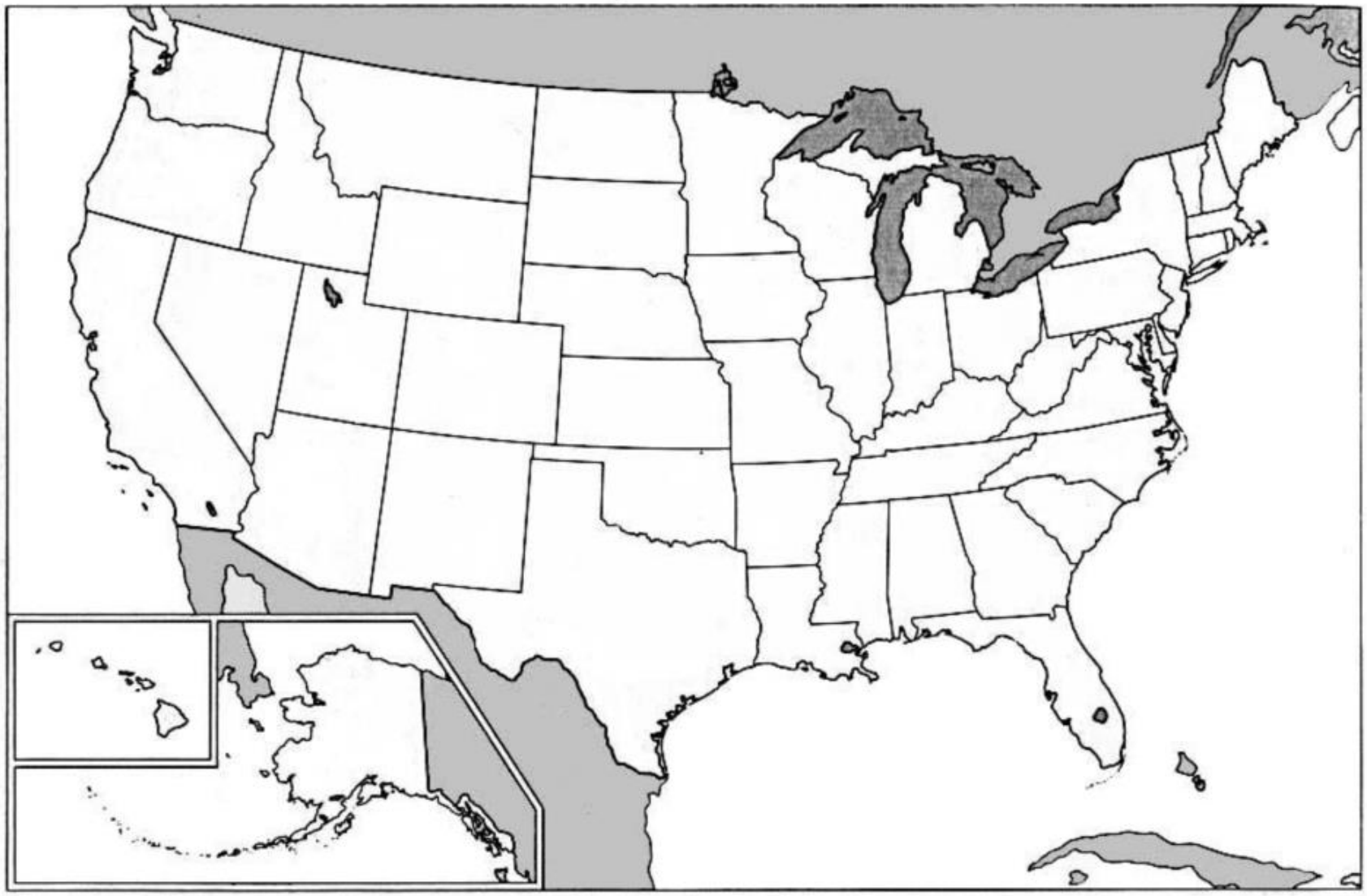
a. Make a line graph of the data.
b. What is the dependent variable?
c. What is the independent variable?

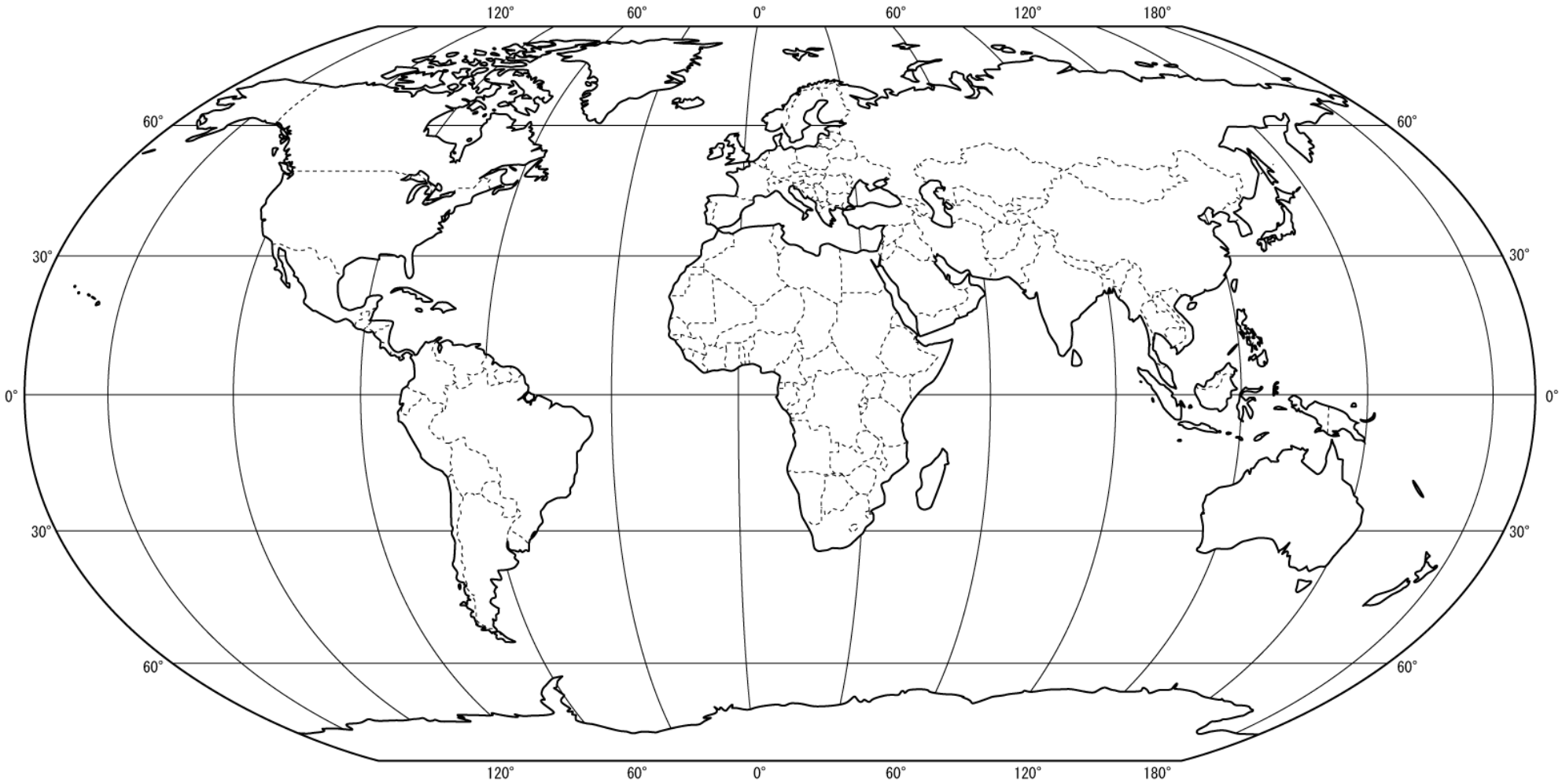
GEOGRAPHY AND MAP ANALYSIS SKILLS DIRECTIONS

1 – Print the US and world maps for the geography and maps review located on pages 57 and 58.

2 – Read through the geography and maps review and ***neatly*** label all the places listed on the appropriate map.

3 – THE NEATLY LABELED US MAP AND THE WORLD MAP ARE DUE ON THE FIRST DAY OF SCHOOL!!!!!




120°
60°
0°
60°
120°
180°
60°
30°
0°
30°
60°

GEOGRAPHY AND MAP ANALYSIS

Geographical locations are referenced frequently throughout the year in AP Environmental Science. Review your basic geography by labeling each of the places listed on the map indicated.

US MAP

each of the 50 states
Atlantic Ocean
Pacific Ocean
Gulf of Mexico
each of the 5 Great Lakes
Lake Okeechobee
Chesapeake Bay
Colorado River
Mississippi River
Missouri River
Ohio River
Rocky Mountains
Appalachian Mountains
Death Valley
Denali
Everglades
Grand Canyon
Yellowstone
Yosemite
Mojave Desert
Sonoran Desert

WORLD MAP

Geographic Coordinates

Equator
Northern Hemisphere
Southern Hemisphere
North Pole
South Pole
Tropic of Cancer
Tropic of Capricorn

Continents

North America
South America
Europe
Asia
Africa
Australia
Antarctica

Oceans and Seas

North & South Pacific Ocean
North and South Atlantic Ocean
Indian Ocean
Arctic Ocean
Southern Ocean
Hudson Bay
Sargasso Sea
Caribbean Sea
Bering Sea & Strait
Mediterranean Sea
Aral Sea

Countries

Argentina
Afghanistan
Bangladesh
Brazil
Canada
Chad
Chile
China
D.R. of Congo
Costa Rica
Ecuador
Egypt
Greenland
Haiti
Iceland
India
Indonesia
Iran
Iraq
Japan
Kenya
Madagascar
Mexico
Mongolia
New Zealand
Niger
Pakistan
Panama
Philippines
Russia
Rwanda
Saudi Arabia
Somalia
Sudan
Uganda
United Kingdom
United States

-continue-

Rivers

Amazon	Congo	Nile	Yangtze
Columbia	Ganges	St. Lawrence	

Mountains

Alps	Andes	Himalayans	Mid-Atlantic Ridge

Deserts

Arabian	Gobi	Namib	Sahara
Atacama	Kalahari	Negev	

Miscellaneous

Galapagos Islands	Great Barrier Reef	Lake Chad
Aleutian Islands	Lake Baikal	

REVIEW OF BASIC EARTH SCIENCE CONCEPTS

You should be familiar with the following background knowledge from Earth Science. Be able to define, describe, or explain all of the following terms and concepts.

Geosphere

Earth's crust, mantle, core
Plate Tectonics
Rock cycle
Weathering
Rocks/Minerals
Fossil fuels

Hydrosphere

Hydrologic cycle
Freshwater/Saltwater
Surface water/Groundwater
Ocean/Lake/River
Oceanic currents
Sea ice/Land ice

Atmosphere

Troposphere/Stratosphere
Ozone layer
Greenhouse effect
Climate/Weather
Convection cells
Rising air/sinking air/wind
High pressure air/low pressure air
Coriolis effect

REVIEW OF BASIC CHEMISTRY CONCEPTS

You should be familiar with the following background knowledge from Chemistry. Be able to define, describe, or explain all of the following terms and concepts.

Matter

Law of Conservation of Matter
Atomic structure
Atom/element/molecule/compound
Isotope/ion
Covalent bond/ionic bond/hydrogen bond
Polar covalent/nonpolar covalent
Natural substance/synthetic substance
Organic compound/inorganic compound
pH/pH scale/acid/base
physical property/physical change
chemical property/chemical change
chemical reaction/reactants/products
catalyst
high quality matter/low quality matter

Energy

1st Law of Thermodynamics/2nd Law of Thermodynamics
Kinetic energy/potential energy
Electromagnetic radiation

- Gamma radiation
- X-ray radiation
- Ultraviolet radiation
- Visible radiation
- Infrared radiation
- Microwave radiation
- Radio wave

Types of energy

- Mechanical
- Electrical
- Chemical
- Nuclear
- Solar
- Thermal

Entropy
Radioisotope/radioactive decay/half-life
Nuclear change/fission/fusion
High quality energy/low quality energy

-continue-

Know the full name of each of the following chemical abbreviations:

Al	CO	H_2SO_4	NH_3	Pb
As	CO_2	Hg	NO	PO_4^{-3}
C	Fe	HNO_3,	NO_2	Rn
$C_6H_{12}O_6$	H_2	K	NO_3^-	SO_2
Ca	HCl	Mg	NO_x	SO_3
$CaCO_3$	H_2CO_3	N_2	O_2	U
CH_4	H_2O	N_2O	O_3	Zn
Cl_2	H_2S	NaCl	P	

REVIEW OF BASIC BIOLOGY CONCEPTS

You should be familiar with the following background knowledge from Biology. Be able to define, describe, or explain all of the following terms and concepts.

Biochemistry

ATP
Carbohydrates
Lipids
Nucleic Acids
Proteins
Enzymes

Cytology

Aerobic Vs. Anaerobic
Cell
Cellular Respiration
Photosynthesis
Chemosynthesis

Genetics

Chromosome
Gene
Mutation
Trait

Ecology

Biotic/abiotic
Environment
Habitat
Niche
Organism
Species
Population
Community
Ecosystem
Biome
Biosphere
Trophic level
Food chain/food web
Producers/Autotroph
Consumers/Heterotroph
Decomposers
Detritivore/scavenger
Herbivore
Carnivore
Omnivore
Symbiosis
Mutualism
Commensalism
Parasitism

Evolution

Biodiversity
Gene Pool
Adaptation
Natural Selection
Speciation
Evolution
Extinction

Taxonomy

Domain
Kingdom
Phylum
Class
Order
Family
Genus
Species