2015/2016
Smiths Station High School
Pre-AP Chemistry Summer Assignment

Due Date: First day of school – August 10, 2016
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Rationale: Pre-AP Chemistry is a course designed to introduce students to the structure of substances as well as the changes that they undergo at a faster and more rigorous format. Also my goal is to prepare students for the rigor and material taught in Advanced Placement science courses that can be taken in Junior or Senior years. Many students find my course extremely challenging, but at the same time are able to do very well in the course as long as they study and apply themselves.

Prior to entering the classroom, this course requires basic understanding of a few science and math concepts taught in already taken science and math courses. To ensure you are best prepared for the rigor of this course, you need to make sure you know the following information and can answer questions regarding it. Below is information you should know. Following the information are the problems you are required to turn in. I will not accept just answers for the problems portion. You are required to show work.

While there is no way for me to know whether you copied this assignment or not, please remember a very important point: I expect that you know how to do this. **IF** I spend any time on the topics listed, it will be brief. You are treading in dangerous territory if you just assume you know the material and therefore not spending the time working through it.

Scientific Method:
Students should know the steps of the scientific method as well as the terminology. An assumption is made that you can pick out the different parts and understand how labs are designed around the scientific method. There is a "scientific method test" as part of this assignment. There are plenty of online sources where you can refresh your knowledge of the scientific method.

http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml#overviewofthescientificmethod is a good website the details these steps.

Units of Measurement
Units play an extremely important role in chemistry. Almost all of our mathematically answers will require a unit. The unit signifies exactly what we are solving for. It is assumed that you should be able to convert between metric prefixes. You will need to learn how to use dimensional analysis or the factor-label method eventually, but it is acceptable to just move the decimal right now.

You should know the following common prefixes:

Prefix	**Numerical meaning**
mega- (M__)	1,000,000 (which is 10^6)
kilo- (k__)	1000 (which is 10^3)
deca- (D__ /da__)	10 (which is 10^1)

BASE UNIT	Main metric unit (meter (m), liter (l), gram (g), etc.)
deci- (d___)	0.1 (which is 10^{-1})
centi- (c___)	0.01 (which is 10^{-2})
milli- (m___)	0.001 (which is 10^{-3})
micro- (µ___)	0.000001 (which is 10^{-6})
nano- (n__)	0.000000001 (which is 10^{-9})

Math Skills
A good working understanding of basic Algebra is required for this course. You should be able to rearrange equations to solve for one unknown variable without difficulty. Below are some basic algebra problems that you need to solve.

Scientific Notation
In chemistry we use very large and very small numbers to represent amounts and masses. In order to effectively communicate these numbers without using lots of zeroes, we employ scientific notation. Each value is written as the product of two numbers, one of which is a power of 10. The first number is always a single digit number, which may or may not have any number of decimal places. Numbers greater than 1 have a positive exponent. Numbers that are less than 1 have a negative exponent.

For example:

- Converting to scientific notation:
    - 36,000 would be written as 3.6×10^{4}
    - 23.67 would be written as 2.367×10^{1} 3
    - 5069032 would be written as 3.5068032×10^{7}
    - 0.003 would be written as 3×10^{-3} 0
    - .23999 would be written as 2.3999×10^{-1}
    - 0.000000000000000000000007 would be written as 7×10^{-24}

- Converting from scientific notation to equivalent decimal numbers:
    - 3.55×10^{3} would be written as 3550 .
    - 6.887×10^{-6} would be written as 0.000006887

Class Supply List:

- Binder
- Scientific calculator (one that does logs and exponents. Costs $10-$15. You don't need a graphing calculator.)
- Loose leaf paper
- Pen/pencil

Problems:

1. How many liters are there in 145,000,000 milliliters?
2. How many grams are there in 123 kg?
3. How many centigrams are there in 921 mg?
4. What is the mass in kilograms of something that has a mass of 1926532 dg?
5. An atom of has a diameter of approximately 0.0010 µm. How many meters is this?
6. A piece of metal has a mass of 27.9 grams. How many kg is this?
7. How many µg are in 0.050 cg?
8. How many mL are in 10 cL?

Solve for x. Each answer should be expressed as a whole number.

9. $6/x = 3$
10. $4x = 16/x$
11. $x^2/2 = 8$
12. $3x + 5 = 14$
13. $5x/20 = 10$
14. $x^2 = 4x$
15. $\frac{(3.5\ atm)(2.4\ L)}{298\ K} = \frac{(4.6\ atm)x}{325\ K}$ (also solve for the unit)

Convert the following in scientific notation:

16. 45
17. 699
18. 2884
19. 28395
20. 0.344
21. 45.83
22. 302.555
23. 0.00043502

Convert the following from scientific notation to their equivalent decimal numbers:

24. 3.692×10^{6}
25. 4.9×10^{-2}
26. 1.9734×10^{5}
27. 5.55050×10^{-9}
28. 7×10^{-3}
29. 9.97×10^{-1}

Scientific Method Test

Multiple Choice

1. Examples of the skills used in science include ____ and ____.
   A. cholera, *E. coli* outbreaks
   B. clues, detectives
   C. facts, inferences
   D. observations, measurements

2. After scientists analyze the results of their experiments, they ____.
   A. form hypotheses
   B. include a control
   C. communicate those results to other people
   D. choose the variables they want to test

3. Which of the following steps to solve a problem must be completed *first*?
   A. analyzing data
   B. recognizing and identifying the problem
   C. forming a hypothesis
   D. testing a hypothesis

4. Which of the following steps to solve a problem is completed *last*?
   A. analyzing data
   B. recognizing and identifying the problem
   C. drawing conclusions
   D. testing a hypothesis

5. A prediction or statement that can be tested is a(n)____.
   A. conclusion
   B. observation
   C. control
   D. hypothesis

6. A factor in an experiment that can change is a(n)____.
   A. observation
   B. variable
   C. control
   D. hypothesis

7. A sample that is treated exactly like the other experimental groups except that the variable is not applied to it is a(n) ____.
   A. observation
   B. variable
   C. control
   D. hypothesis

8. One tool that can be used to display your data is a ____.
   A. balance
   B. spring scale
   C. microscope
   D. computer

9. One way to reduce bias in an experiment is to ____.
   A. ask only girls a question about a school topic
   B. take numerical measurements of the results
   C. use descriptive phrases as your data
   D. make sure that the results come out the way you want them

10. A good way to *organize* and *record* your results and observations is ____.
   A. in a data table
   B. by using a calculator
   C. with a balance or spring scale
   D. by having a hypothesis before you begin your experiment

11. Which skill are you using when you use your five senses to gather information?
   A. posing questions
   B. observing
   C. developing hypotheses
   D. designing experiments

12. Facts, figures, and other evidence learned through observation are called
   A. variables.
   B. experiments.
   C. questions.
   D. data.

13. What characteristic must be true of a good hypothesis?
   A. It must be correct.
   B. It must have been observed many times.
   C. It must involve quantitative data.
   D. It must be testable by observation or experiment.

14. In a controlled experiment, a scientist is studying how long it takes parachutes of different sizes to fall to the ground. What is the manipulated variable?
   A. the size of the parachute
   B. the height from which the parachute is dropped
   C. the size of the object carried by the parachute
   D. the time it takes for the parachute to drop

15. A statement that describes what scientists expect to happen every time under a given set of conditions is called a scientific
   A. observation.
   B. hypothesis.
   C. inference.
   D. law.

16. Which sentence best describes a scientific theory?
   A. It can never change.
   B. It can change every time it is tested.
   C. It can be proven conclusively.
   D. It is well-tested and explains a wide range of observations.

17. What skill is a scientist using when she listens to the sounds that whales make?
    A. interpreting data
    B. developing hypotheses
    C. making observations
    D. drawing conclusions

18. Measurements of the heights of various plants in an experiment are called
    A. data.
    B. inquiries.
    C. theories.
    D. inferences.

19. Your friends return from a canoe trip on the lake and they are dripping wet. What inference might you make?
    A. Their clothes are wet.
    B. They are tired.
    C. Their canoe tipped over.
    D. They are skillful at canoeing.

20. A possible explanation for a set of observations is known as a (n)
    A. variable.
    B. hypothesis.
    C. theory.
    D. conclusion.

21. When you decide whether or not the data support the original hypothesis, you are
    A. making an inference.
    B. making an observation.
    C. drawing a conclusion.
    D. posing a question.

22. When a scientist shares his or her findings with other scientists, the scientist is
    A. communicating.
    B. experimenting.
    C. hypothesizing.
    D. theorizing.

23. What is a well-tested concept that explains a wide range of observations?
    A. scientific observation
    B. scientific inquiry
    C. scientific theory
    D. scientific inference

24. A controlled experiment is designed to test a(n)
    A. conclusion.
    B. hypothesis.
    C. data.
    D. measurement.

25. A chart showing the amount of rain each month in a region is an example of a scientist's
    A. variables.
    B. inferences.
    C. data.
    D. conclusions.

26. A weather map is an example of a
   A. theory.
   B. model.
   C. conclusion.
   D. variable.

27. According to the scientific method, how does a physicist formulate and objectively test hypotheses?
   A. by defending an opinion
   B. by interpreting graphs
   C. by experiments
   D. by stating conclusions

28. In the steps of the scientific method, what is the next step after formulating and objectively testing hypotheses?
   A. interpreting results
   B. stating conclusions
   C. conducting experiments
   D. making observations and collecting data

29. According to the scientific method, how should conclusions be stated?
   A. so that no one can refute the conclusion
   B. so that it works with only one set of data
   C. so that it is completely correct, with no mistakes
   D. in a form that can be evaluated by others

30. A scientific theory is an explanation that
   A. has been published in a journal or book.
   B. predicts what will happen.
   C. has been tested by many observations.
   D. a scientist has tested with an experiment.

31. For a scientific theory to be valid, it must allow you to
   A. perform experiments.
   B. obtain new results each time.
   C. find a new, more complex explanation.
   D. make predictions.

32. A series of logical steps that is followed in order to solve a problem is called the
   A. experimental process.
   B. scientific theory.
   C. scientific method.
   D. model method.

33. Scientists test a hypothesis by
   A. formulating questions.
   B. designing models.
   C. doing experiments.
   D. drawing conclusions.