Homework 1

Chapter 1: 9, 10*, 11*, 12, 26, 28 *see modifications below
Non-book problems

Chapter 1
9) List three specific examples of how chemistry is used in your major area of study in college.

10) Make a list of at least four questions you have wondered about that may involve chemistry.
Compare your list with those of your group members. Rate the questions on a scale of 1-10
(with 1 having very little to do with chemistry and 10 being very much a chemistry question.)
On your homework list the ratings, the rater, and the names of anyone's questions that you rated.

11) Make a list of at least four issues faced by our society that require scientific studies and
scientific data before a democratic society can make informed, rational decisions. (You do not
need to exchange these lists as stated in the text.)

12) Identify the information in each sentence as qualitative or quantitative.
    a) The element gallium melts at $29.8^{o}C$.
    b) A chemical compound containing cobalt and chlorine is blue
    c) Aluminum metal is a conductor of electricity
    d) The chemical compound ethanol boils at $79^{o}C$
    e) A chemical compound containing lead and sulfur forms shiny, plate-like, yellow
        crystals.

26) While camping in the mountains, you build a small fire out of tree limbs you find on the
ground near your campsite. The dry wood crackles and burns brightly and warms you. Before
slipping into your sleeping bag for the night, you put the fire out by dousing it with cold water
from a nearby stream. Steam rises when the water hits the hot coals. Describe at least three
physical and chemical changes in this scene.

28) In each case, identify the underlined property as a physical or chemical property. Give a
reason for your choice.
        a) Dry ice sublimes (changes directly from a solid to a gas) at $-78^{o}C$
        b) Methanol (methyl alcohol) burns in air with a colorless flame
        c) Sugar is soluble in water.
        d) Hydrogen peroxide, H_2O_2, decomposes to form oxygen, O_2, and water H_2O.

Non-book problems:

1) Michael L. Roukes and his colleagues at Caltech have devised a nanoelectromechanical
system device capable of "weighing" masses in the zeptogram range (zg = $1x10^{-21}g$). A carbon
atom weighs $2 x10^{-23}g$.
        a) What is the weight of a carbon atom in zeptograms?
        b) A 1 carat diamond weighs 200 mg, how many carbon atoms are in a 1 carat diamond
        c) A football weighs 15 ounces or 0.425 kg.. How many zeptograms is that?

2) Cholesterol:
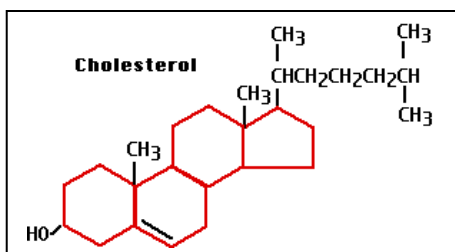
Cholesterol ($C_{27}H_{46}O$) is one of the most important steroids found in the tissues of animals. It has special importance to both the brain and spinal cord. If too much cholesterol accumulates, solid deposits may form. Gallstones, for example, may be primarily lumps of crystallized cholesterol. Cholesterol deposits in the arteries may restrict blood flow, with a resulting elevation of blood pressure. Both atherosclerosis and certain types of heart attack have been associated with excess cholesterol accumulation. It has been reported that, on the average, 1.0% of the dry weight of the human body is cholesterol.

a) Given that the longest dimension of the cholesterol molecule is 22Å, calculate the length of a chain that could be made by hooking together all the cholesterol molecules from an "average human" weighing 176 lb, if the molecules could be connected as "links" corresponding to the longest dimension of the molecule. (Hint: You will need to find out how the normal weight of a human body corresponds to the "dry weight.")

b) Assuming negligible thickness of the "cholesterol chain," calculate how many times this chain could be wound around the earth at the equator.

3)

Element	Symbol	Metal, metalloid, or nonmetal
	As	
Tungsten		
	Xe	
	Sr	
Titanium		
Iron		

4) Use the UM library website to find the following article: Wansink, B.; van Ittersum, K.; Painter, J. E. "Ice Cream Illusions: Bowls, Spoons, and Self-Served Portion Sizes" *American Journal of Preventive Medicine* **2006**, *31*(3) p 240-243.

Read the article and answer the following questions:

a) What was the driving question for the research study?

b) What was the hypothesis put forth? (What facts was it based on?)

c) The study involved both perceptive data (a survey) and objective data (weighing of the bowls). The weight data was presented in a graph, but the survey data was not. Sketch a graph that might have been included in the paper to visually represent the survey data.

d) Why did the authors choose to include the weight data in graphic form, but not the survey data?

e) Did either the perceptive data or the objective data support the hypothesis? How?

f) Were any facts, laws, or theories developed or confirmed based on this study?

g) What are some self-critiques of the study?

h) Describe one future study that the authors propose.

i) Propose an additional experiment that would expand on this study's findings.

j) How does this study relate to the *JAMA* articled from Studio 1c? What are the similarities/differences?

k) What is "new" about this study?

l) On the model for scientific inquiry draw all of the appropriate arrows for this study.

Question

Hypothesis

Data/Fact Gathering

Evaluation