Problem Set 1: Chemical Foundations: Uncertainty, Matter, Density, Temperature

HCHE 111L: Introduction to Elementary Inorganic Chemistry

Due Date: Friday August 25$^{\text{th}}$, 2017

Problem 1

The melting point of a solid is the temperature at which the solid undergoes a physical change to become a liquid. The following melting points are expressed on one temperature scale. Convert them to temperatures on the scale indicated.

A) Convert the following to °F: cesium, 28.5°C ; germanium, 937 °C; silver, 961.93°C; mercury, −38.36°C

B) Convert the following to °C: gold, 1948.57°F; lead, 621.37°F; ethyl alcohol, −174.1°F

Problem 2

The *furlong* is a unit used in horse racing, and the units *chain* and *link* are used in surveying land. There are 8 furlongs in 1 mi, 10 chains in 1 furlong, and 100 links in 1 chain. Calculate the length of 1 link, in inches (1 mi = 5280 ft).
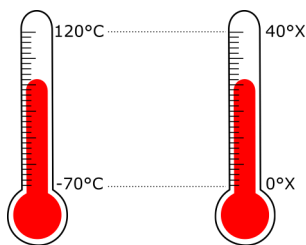
Problem 3

The container pictured below on the left is filled with water at 20°C, just to the overflow spout. A cube of wood with edges of 1.0 in. is floated on the water, and 10.8 mL of water is collected, as shown on the right.Given that the density of water is 1.0 g/mL, calculate the density of the wood in g/mL, and express your result with the maximum number of significant figures permitted in this experiment. (*Hint*: An object floating on water will displace it's **mass** in water.)
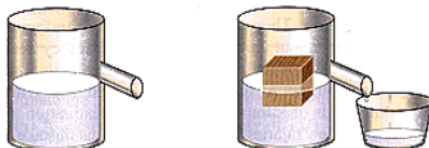
Problem 4

Use the figure below to answer the following questions

A Derive a relationship between °C and °X.

B If the temperature outside is 32°X, what is the temperature in Kelvin?

C Convert 78°X to units of °C, °F, and K.

Problem 5

Small spheres of equal mass are made of lead (density = 11.3 g/cm^3), silver (10.5 g/cm^3), and aluminum (2.70 g/cm^3). Which sphere has the largest diameter and which one has the smallest? (*Hint*: You don't need to perform any detailed calculation for this one, it can all be explained via words and/or equations.)

Problem 6

A chemist who wished to verify the density of water constructed a **cylindrical** container of aluminum 4.500 inches high, whose inside radius measured 0.875 inches. The empty cylinder had a mass of 93.054 g. When filled with water, its mass was 270.064 g. Find the density of water from these data, expressing your result in g/mL.