Chemistry / Environmental Studies L111
Environmental Concerns and Chemical Solutions
Professor Dransfield
Homework 7: Due April 19, 2007

Chapter 5:

18 a) If you add the densest layer first, it will stay on the bottom, and you'll be able to create layers which don't mix. So, you add the maple syrup first, then the dishwashing detergent, then the vegetable oil.

b) The unknown liquid must be more dense than the maple syrup.

c) The liquids which can dissolve in water will, so the maple syrup and the dishwashing detergent will dissolve in water and produce a layer with a density closer to that of water. But the vegetable oil will not dissolve in water, and will remain floating on the top.

*Note: Depending on how well you mix it, the soapy water formed **might** be enough to dissolve the vegetable oil, too, which would leave us with only one layer in the system.*

21. a) Cl forms Cl^- ions because adding one electron will complete its octet

b) Ba forms Ba^{2+}

c) S forms S^{2-}

d) Li forms Li^+

e) Ne does not form ions, as it already has a complete octet

27. a) This is potassium oxalate. All potassium compounds are soluble, so this is soluble

b) This is calcium nitrate. All nitrates are soluble.

c) This is lithium hydroxide. Most hydroxides are **in**soluble... but the exception is hydroxides of Group IA metals, which includes Li. This is soluble.

d) This is sodium sulfate. All sodium compounds are soluble.

48. a) The most likely source of the lead is the soldering material that holds the tank together.

b) If the scientists are doing their job right, they shouldn't be disposing of any lead down the drains. Even if they were polluting the drains, it's very unlikely that the drinking water source is from the lab wastewater. There's very little chance the chemists have any effect on the drinking water.

Chapter 7:

4. a) C-14 is carbon, so it has an atomic number of 6, which is also the number of protons. The mass number of 14 represents the sum of protons and neutrons, so 14 - 6 = 8 neutrons.

b) C-12 also has 6 protons, but only 12 – 6 = 6 neutrons.

c) H-3, or tritium, has 1 proton and 2 neutrons

d) Tc-99 has 43 protons, which leaves 99 - 43 = 56 neutrons.

From the 4th edition:

a) Na-23 has 11 protons and 12 neutrons

b) Cl-37 has 17 protons and 20 neutrons

c) Cu-65 has 29 protons and 36 neutrons

d) Hg-200 has 80 protons and 120 neutrons

8. $^{239}_{94}Pu + ^{4}_{2}He \rightarrow \left[^{243}_{96}Cm\right] \rightarrow ^{242}_{96}Cm + ^{1}_{0}n$

Number of protons: 94 + 2 on the left = 96 = 96 + 0 on the right

Mass number: 239 + 4 on the left = 243 = 242 + 1 on the right

10. a) $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{2}He + ^{1}_{0}n$

b) $^{238}_{92}U + ^{14}_{7}N \rightarrow ^{247}_{99}Es + 5^{1}_{0}n$

c) $^{239}_{94}Pu + ^{1}_{0}n \rightarrow ^{146}_{58}Ce + ^{91}_{36}Kr + 3^{1}_{0}n$

12. a) Mass of reactants = 2.01345 g + 3.01493 g = 5.02838 g

Mass of products = 4.00150 g + 1.00728 g = 5.00878 g

Mass difference = 0.0196 g

b) $E = mc^2 = (0.0196\text{ g})(9.0 \times 10^{16}\text{ m}^2/\text{s}^2)$

$= (0.0000196\text{ kg})(9.0 \times 10^{16}\text{ m}^2/\text{s}^2)$

$= 1.764 \times 10^{12}\text{ kg m}^2/\text{s}^2 = 1.764 \times 10^{12}$ Joules