Chemistry 160, Spring 2007

Sample exam 1 (chapters 14, 22, 15, 16)

Closed book, open notes, exercises, homeworks, handouts, lab notebook; 50 minutes duration; answer all questions.

1. a. Phosphorus-32 decays by beta-emission. Write the balanced decay equation of ^{32}P (do not include an emitted gamma ray – this isotope does not emit one).

b. Phosphorus-32 is used as a radioactive tracer in many biological and biochemical experiments that involve the energy transport mechanism in cells (think of ATP/ADP). However, it is quite dangerous because it releases such high-energy beta particles. The half-life of ^{32}P is 14.29 days. The dose rate at the mouth of an open vial containing 1 mCi (37 MBq) of ^{32}P in 1 ml of liquid is roughly 26 rem/hour (260 mSv/hour). How long must you wait until you can safely peer down the mouth of the vial (the dose rate has dropped to 1 rem/hour (10 mSv/hour))?

2. A 30.0 mL sample of 0.300 M KOH is titrated with 0.150 M $HClO_4$ solution. Calculate the pH of the sample after the following volumes of acid have been added:

a. 30.0 mL

b. at the equivalence point

3. A 30.0 mL sample of 0.300 M KOH is titrated with 0.150 M acetic acid solution. Calculate the pH of the sample after the following volumes of acid have been added:

a. 30.0 mL

b. at the equivalence point

4. A friend of yours has performed three titrations: a strong acid with a strong base, a weak acid with a strong base and a weak base with a strong acid. He has plotted each of the sets of data on a pH versus volume added graph but has neglected to label or title the graphs. How would you tell them apart? You may draw what the graphs look like, but include labels and titles!

5. A 1.00 L solution saturated at 25°C with lead (II) iodide contains 0.54 g PbI_2. Calculate the solubility-product constant (K_{sp}) for this salt at 25°C.

6. The K_{sp} of $Ba(IO_3)_2$ at 25°C is 6.0×10^{-10}. What is the molar solubility of $Ba(IO_3)_2$?