

Chemistry 140

Sample exam 2 (Chapters 4, 5 and 6)

Closed book; open homework, handouts, lab book, notes and calculators; no collaboration, including using other people's materials. You have **thirty-five minutes** to complete the quiz; there are 50 points possible.

1. Quick ones (2 points each):

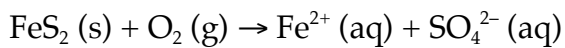
a. How many total **moles** of ions result when 1 mole of potassium sulfate dissolves?

b. Write the **products** (and balance the equation) of:



c. What is the **net ionic equation** of the reaction in part b?

3. The problem of acidic runoff from old mines is the result of the reaction of sulfide minerals like pyrite (FeS_2) in water with various reactants. One example is shown below:



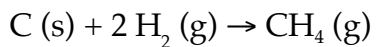
a. (2 points) Pyrite is iron (II) sulfide. Give the oxidation numbers of each of the elements in pyrite.

b. (4 points) **Balance** the reaction, using any means.

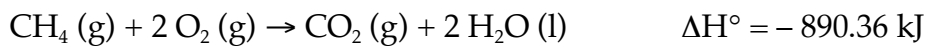
c. (2 points) If one mole of pyrite reacts, how many moles of electrons are transferred between chemical species?

5. (8 points) In the reaction between 50.00 mL of 1.25 M sodium sulfide and 50.00 mL of 1.25 M iron (II) chloride (which you previously balanced in question 1b), your yield is 5.66 g of solid product. What is your **percent yield**? You may use the molar mass of NaCl as 58.45 g/mol and the molar mass of FeS as 87.91 g/mol.

6. (10 points) The reaction which defines the formation of methane gas is:



Using the following thermochemical equations, calculate ΔH°_f for methane. You may use some or all of these equations.



7. a. (5 points) You react 0.102 g of magnesium oxide with 25.666 g of 0.500 M hydrochloric acid. The density of the HCl solution is 1.020 g/mL. You quickly turn a beaker full of water upside down above the reacting magnesium. Given that the solution temperature was 22.4°C and the pressure was 765.0 torr, what is the **volume** of water vapor that you expect to collect? Assume ideal gas behavior, and ignore the vapor pressure of the water in the beaker.

b. (3 points) Of course, we assumed ideal gas behavior for the question above. In reality, water molecules are tiny, but they exhibit “sticking” behavior – that is, they are attracted to each other. How would this affect the actual volume of water vapor you collect?