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1. Calculate the pH and percent dissociation of a buffer that is 0.860 M HF and 0.770 M KF. K_a for HF = 7.20×10^{-4} (Set up the ICE table)



$$\text{pH} = \underline{\hspace{2cm}} \quad \% \text{ Dissoc} = \underline{\hspace{2cm}}$$

2. Carbonic acid dissociates in blood according to the following equation:



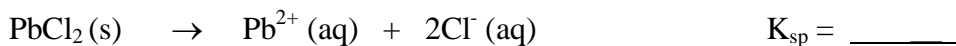
What ratio of HCO_3^- to H_2CO_3 is needed to maintain the blood pH at 7.40?

$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]} \quad \text{and} \quad \text{pH} = \text{p}K_a - \log \frac{[\text{A}^-]}{[\text{HA}]}$$

where HA = H_2CO_3 and $\text{A}^- = \text{HCO}_3^-$

$$\frac{[\text{HCO}_3^-]}{[\text{H}_2\text{CO}_3]} = \underline{\hspace{2cm}}$$

3. The molar solubility of lead chloride (PbCl_2) is 0.0162 mol/L. Set up the ICE table and calculate K_{sp} .



4. Calculate the solubility of solid $\text{Ca}_3(\text{PO}_4)_2$ ($K_{sp} = 1.3 \times 10^{-32}$) in a 0.30 M Na_3PO_4 solution. First write the equation for the dissolving of calcium phosphate and then set up the ICE table. Sodium phosphate is 100 % soluble.

$$S = \underline{\hspace{2cm}}$$

5. Given that $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$, which set of conditions would characterize a reaction that is spontaneous at low temperatures and non-spontaneous at high temperatures? ΔG° is negative for a spontaneous reaction.

a) $\frac{\Delta H^\circ}{-} \quad \frac{\Delta S^\circ}{-}$

- b) + +
 c) - +
 d) + -
 e) None of the above

6. Ethanethiol (C_2H_5SH) is an alcohol in which the oxygen has been replaced by sulfur. Having a strong offensive odor, it is injected into natural gas at the gas plant so that customers can detect leaks. If the boiling point of ethanethiol is 35.2 degrees C and its heat of vaporization is 27.4 kJ/mol, what is the entropy of vaporization for this substance?

Answer _____

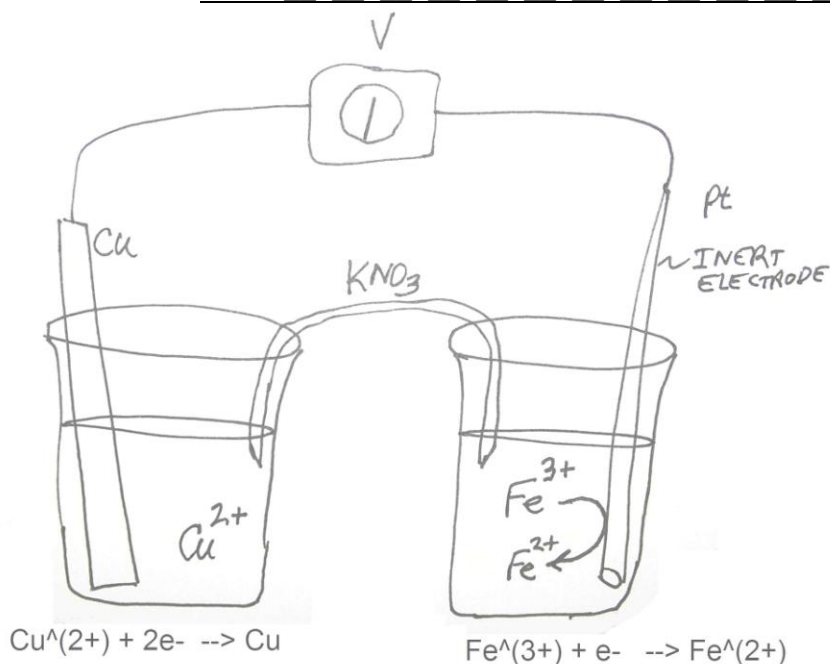
7. At what temperature will a process become spontaneous if its $\Delta H = + 16.2$ kJ and $\Delta S = + 58.0$ J/K? Is it spontaneous above or below this temperature, and how do you know?

Answer _____

8. Write the oxidation number above each atom in the equation below. Which atom is being oxidized, which atom is being reduced, and which atom is neither losing nor gaining electrons? How do you know?



Answer _____



9. Shown above is a copper/iron cell with the half-reactions written as reductions below each beaker. Questions 9 through 14 refer to this cell. Reverse the half-reaction that has the most negative potential and combine it with the other to make the overall cell reaction. Write the overall reaction and the cell potential (E°_{cell}) here.

$$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$$

Answer _____

10. What direction will electrons flow in the external circuit (through the voltmeter)?

Answer _____

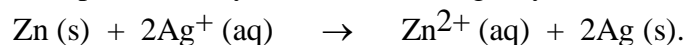
11. Which metal will be converted to its ion? Answer _____

12. Into which beaker will the K^+ ion flow? Answer _____

13. Which electrode would be labeled “+” in the diagram?
Answer _____

14. Which electrode would be labeled the anode?
Answer _____

15. Zinc reacts spontaneously with silver ion Ag^+ by the following reaction.



How many moles of electrons flow in the circuit per mole of zinc? (that is, what is n ?)

Answer _____

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