

Name _____

Equations that you might find useful.

$$\text{pH} = \text{pK}_a + \log\left(\frac{[\text{conjugate base}]}{[\text{acid}]}\right)$$

$$\text{pOH} = \text{pK}_b + \log\left(\frac{[\text{conjugate acid}]}{[\text{base}]}\right)$$

$$E = E^\circ - \frac{0.0297}{n} \ln Q$$

1(06) Calculate the pH of a solution that is 0.25M HClO(aq) and 0.60M NaClO(aq). Show all your work.

2(05) Indicate whether or not (Y or N) the following solutions are buffers.

a) $\text{NaC}_2\text{H}_2\text{O}_2(\text{aq}) + \text{HC}_2\text{H}_3\text{O}_2(\text{aq})$ _____ b) $\text{HNO}_3(\text{aq}) + \text{HF}(\text{aq})$ _____

c) $\text{CH}_3\text{NH}_2(\text{aq}) + \text{KOH}(\text{aq})$ _____ d) $\text{HClO}_4(\text{aq}) + \text{KClO}_4(\text{aq})$ _____

e) $\text{NH}_4\text{Cl}(\text{aq}) + \text{NH}_3(\text{aq})$ _____

3(06) Write the formulas of the acid or base and salt that could be used to prepare each of the following buffer solutions having the pH listed.

<u>pH</u>	<u>acid or base</u>	<u>salt</u>
2.00	_____	_____
8.00	_____	_____
10.00	_____	_____

4(08) Sketch the titration curve for the titration of nitric acid into a beaker of $\text{NH}_3(\text{aq})$. Label each axis and indicate whether the pH at the equivalence point will be above 7, below 7, or equal to 7.

What would be the indicator of choice for this titration? _____

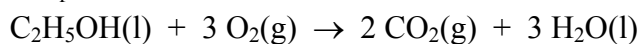
5(06) Calculate the solubility (g/L) of $\text{PbF}_2(\text{s})$ in water. Show all your work.

6(08) Indicate whether the addition of the reagent shown would increase, decrease, or have no effect on the solubility of the insoluble salt listed.

<u>Insoluble Salt</u>	<u>Reagent Added</u>	<u>Effect on Solubility</u>
$\text{CaCO}_3(\text{s})$	$\text{NaNO}_3(\text{aq})$	_____
$\text{ZnS}(\text{s})$	$\text{HCl}(\text{aq})$	_____
$\text{AgBr}(\text{s})$	ethylenediamine	_____
$\text{BaSO}_4(\text{s})$	$\text{K}_2\text{SO}_4(\text{aq})$	_____

7(08) Will a precipitate form when 50.0 mL $1.4 \times 10^{-5}\text{M}$ $\text{BaCl}_2(\text{aq})$ is added to 50.0 mL of $1.8 \times 10^{-5}\text{M}$ $\text{Na}_2\text{SO}_4(\text{aq})$? Explain your answer. If a precipitate forms, what is its formula?

8(06) Use the table of ΔG°_f to calculate the ΔG° for the reaction



9(06) Briefly discuss whether the exothermic reaction $\text{CO}(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{COCl}_2(\text{g})$ is expected to be always spontaneous, never spontaneous, spontaneous at high temperature only, or spontaneous at low temperature only.

10(03) Predict the sign of ΔS° for the following reactions.



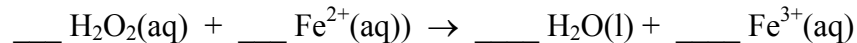
11(03) The value of ΔG at equilibrium is

- a) +100 kJ b) -100 kJ c) 0 d) 1

12(03) A large positive ΔG° suggests that the equilibrium constant is

- a) Less than 0
b) Between 0 and 1
c) Greater than 1
d) Equal to 1

13(04) Complete and balance the following equation.



14(04) List the following in order of increasing oxidizing ability (weakest on the left, strongest on the right). $Ag^+(aq)$, $Br_2(l)$, $Ca^{2+}(aq)$, and $Sn^{4+}(aq)$

15(08) For either the lead storage battery or the dry cell:

- a) Write the reaction that occurs at the anode:

b) What is the anode made of? _____

c) What is the cathode made of? _____

d) Explain whether or not the battery is rechargeable.

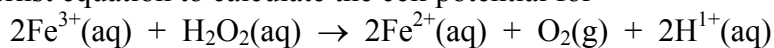
16(12) Write the cell notation for the reaction $2 \text{Ag}^+(\text{aq}) + \text{Cu}(\text{s}) \rightarrow 2 \text{Ag}(\text{s}) + \text{Cu}^{2+}(\text{aq})$

Calculate the standard cell potential for the reaction.

Is the reaction spontaneous at 25°C and standard conditions? _____ Why/why not?

Complete the sketch for this cell. Identify the anode and the cathode. Indicate what each electrode is made of. Indicate the direction of flow of electrons through the external circuit and the flow of anions through the salt bridge. Write the half-reaction that occurs at the anode and that which occurs at the cathode.

17(04) Use the Nernst equation to calculate the cell potential for



when all reagents are at standard conditions except the pH = 8.00. $E^\circ = +0.09\text{v}$. Show all your work.