

Name: _____
Chemistry 114
Fourth Hour Exam

Remember- Show all work for partial credit

All questions are worth 12 points

1. Trichloroacetic acid (CCl_3COOH) is a weak acid. Write the equilibrium expression for the dissociation of this acid.

If the initial concentration of this acid is .1M show me the ICE table that you would use to find the concentration of H^+ as this system reaches equilibrium:

I

C

E

The K_a for this acid is .22. Using the information from the ICE table above, write (but do NOT solve) the equation you would use to solve for the concentration of H^+ at equilibrium.

Do you think you can use the usual assumption that $.1-x \sim .1$ to solve this equation? Why or why not?

2. The reaction $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ has a ΔH of 556 kJ/mol.

If the system is at equilibrium and the following changes occur, which way will the equilibrium shift? (Circle one)

Temperature is increased	shift left	remain unchanged	shift right
Volume of container increased	shift left	remain unchanged	shift right
N_2 gas is added to the container	shift left	remain unchanged	shift right
Some, but not all, CaCO_3 is removed	shift left	remain unchanged	shift right
CO_2 is added	shift left	remain unchanged	shift right
All the CaO is removed	shift left	remain unchanged	shift right

3. Calculate the following:

What is the pH of .005M HCl

If the pOH is 11.5, what is the H⁺ concentration?

What is the pH of 1.5M KOH

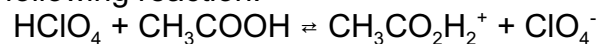
What is the pOH of .00003M Fe(OH)₃

4. Definitions of acids and bases

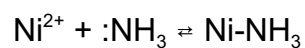
A. What is the Arrhenius definition of an acid?

B. and a base?

C. What are the Bronsted-Lowry acid, base, conjugate acid and conjugate base in the following reaction:



D. What is the Lewis acid and Lewis base in the coordination reaction of Ni²⁺ and ammonia:

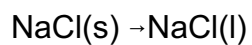
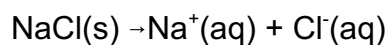
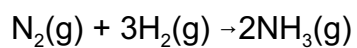
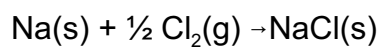


5. Given that the K_a of Benzoic acid ($\text{HC}_7\text{H}_5\text{O}_2$) is 1.8×10^{-5}
What is the pH of .1M Benzoic ($\text{HC}_7\text{H}_5\text{O}_2$)?

What is the pH of .1M Potassium Benzoate ($\text{KC}_7\text{H}_5\text{O}_2$)?

What is the pH of a mixture of .1M Benzoic acid and .1M Potassium Benzoate?

6. Predict the sign of ΔS for the following changes

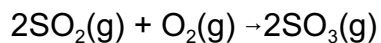


7. The reaction: $\text{Sb}_4\text{O}_6(\text{s}) + 6\text{C}(\text{s}) \rightarrow 4\text{Sb}(\text{s}) + 6\text{CO}_2(\text{g})$ has a ΔH of 778 kJ.
Calculate $\Delta S_{\text{surroundings}}$ for this reaction at 0°C .

8. Given the following data:

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S° (J/K·mol)
$\text{SO}_2(\text{g})$	-297	-300	248
$\text{SO}_3(\text{g})$	-396	-371	257
$\text{SO}_3^{2-}(\text{aq})$	-909	-745	20
$\text{O}_2(\text{g})$	0	0	205
$\text{O}(\text{g})$	249	232	161

A. Calculate ΔG for the reaction:



B. Is the above reaction spontaneous or non-spontaneous under standard state conditions?

C. What is K for the above reaction?