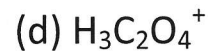
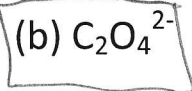
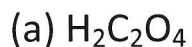
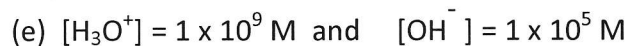
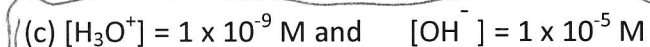


Questions 1-12 = 3 points each

1. What is the conjugate base of HC_2O_4^- ?2. What are $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ for a solution that has a pH of 9.0?

3. What is the pH of a 0.000483 M solution of NaOH?

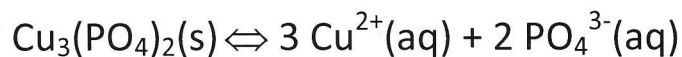
(a) 4.83×10^{-4}

(b) 2.07×10^{-11}

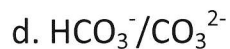
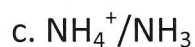
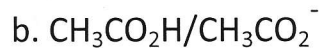
(c) 10.68

(d) 3.31

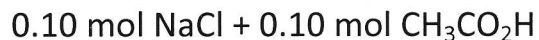
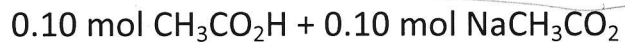
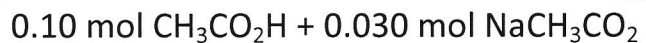
(e) 7.00

4. Will $\text{Cu}_3(\text{PO}_4)_2$ be more soluble in pure water, or in water in which Na_3PO_4 has been dissolved?Circle answer: pure water or Na_3PO_4 solution

5. Which acid base pair would be best to use for creating a buffer of pH = 3. Circle one.



6. Which of the following mixtures will form a buffer solution (in 1 L water). Circle all correct choices.



7. Indicate the pH range of a solution of **each** of the following: Circle one on each line.

a) NH_4NO_3

acidic

neutral

basic

b) KNO_3

acidic

neutral

basic

c) KCN

acidic

neutral

basic

8. What types of chemical systems do K_{sp} constants describe? Choose one.

a) weak acids

b) weak bases

c) buffer solutions

d) soluble salts

e) insoluble salts

9. What is the solubility of AgBr , in grams per liter? Molar mass = 187.8 g/mol.

a) 1.38×10^{-4} g/L

b) 1.01×10^{-10} g/L

c) 5.07×10^{-11} g/L

d) 7.35×10^{-7} g/L

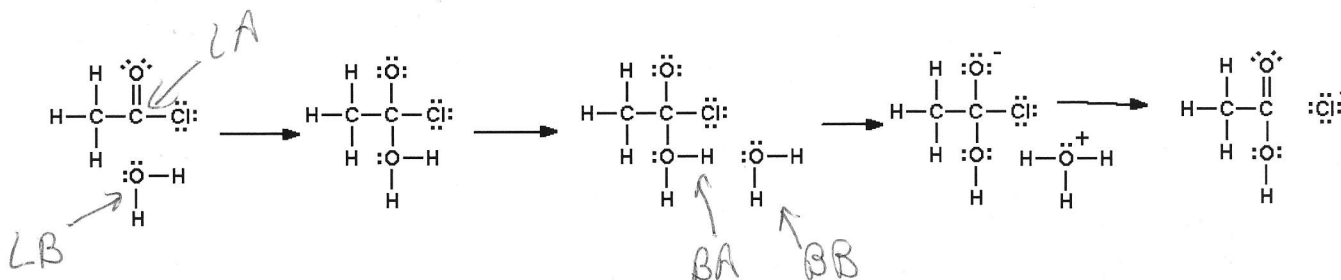
e) ~~1.38×10^{-4}~~ g/L

2.75×10^{-11} g/L

10. Consider the following set of reaction steps. Add the following labels to the species they represent. Point to the species and add the label. You label four things in total. If something is both Lewis and Bronsted, label it Bronsted. For example, find something that is acting as a Lewis Acid and draw an arrow to it labeled with "LA."

BA = Bronsted Acid
BB = Bronsted Base

LA = Lewis Acid
LB = Lewis Base



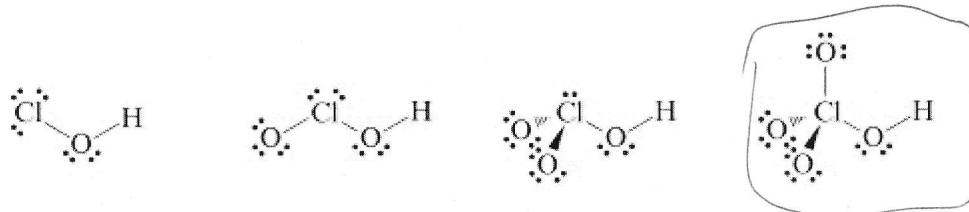
11. For each of the following, circle the one that will have the higher pH (or circle they are the same):

a. 0.1 M $\text{CH}_3\text{CO}_2\text{H}$ or 0.1 M NaCH_3CO_2 or same

b. 0.1 M HCl or 0.1 NaOH or same

c. 0.1 M HCl or 0.1 M HNO_3 or same

12. Which of the following acids has the largest K_a value? Circle it.



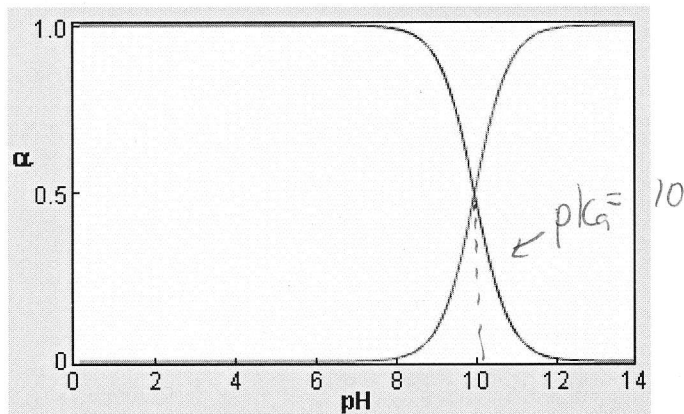
13. Write the net-ionic equation for the acid-base reaction occurring between HClO and KOH .

4 pts



14. Consider the alpha plot below, which is for an acid-base system HA/A⁻.

8 pts.



a. which species is mainly prevalent at pH = 8?

HA or A⁻ or about the same amount of each

b. What is pK_a of HA? 10

c. What is K_a of HA? 1 × 10⁻¹⁰

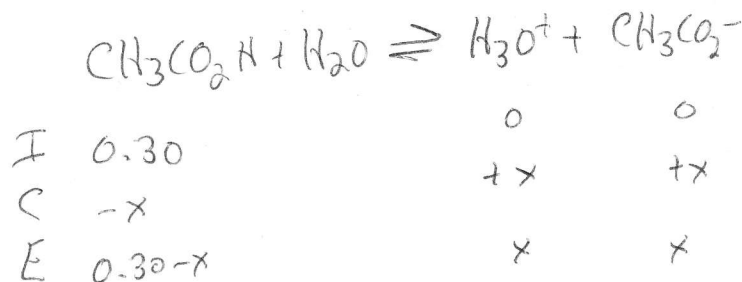
d. If this acid-base pair were a pH indicator, would it be suitable for the titration of NH₄⁺ with NaOH?

Yes or No

15. What is the pH of a 0.30 M solution of CH₃CO₂H?

12 pts

Show your work, the ICE method must be used and presented correctly.



$$K_a = 1.8 \times 10^{-5} = \frac{x \cdot x}{0.30 - x} \approx \frac{x^2}{0.30}$$

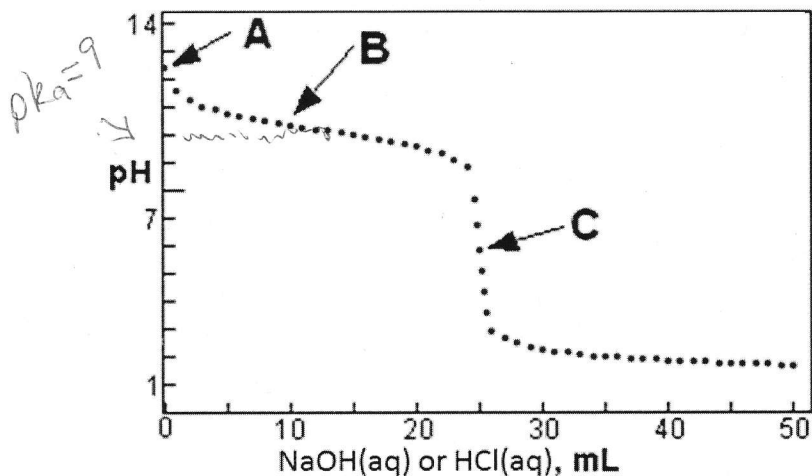
$$\text{pH} = -\log(0.00232) = 2.63$$

$$x = \sqrt{1.8 \times 10^{-5} \times 0.30} = 0.00232 \text{ M} = [\text{H}_3\text{O}^+]$$

pH = 2.63

16.

Consider the titration curve below involving a weak acid (HA) and a weak base (A⁻). 8 pts



a. Which does this titration represent? Circle it.

weak acid being titrated with NaOH or

weak base being titrated with HCl

b. What is the approximate value of K_a for the acid form of the studied acid-base pair?

K_a = 1 × 10⁻⁹

c. What acid-base species is/are mainly in solution at point A? A⁻ (weak base)

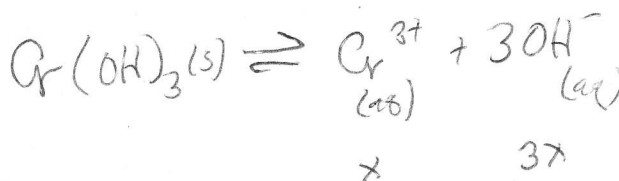
d. What acid-base species is/are mainly in solution at point B? HA + A⁻ (buffer)

e. What acid-base species is/are mainly in solution at point C? HA (weak acid)

17. A saturated solution of chromium(III) hydroxide, Cr(OH)₃, is found to have a pH of 10.63.

What is K_{sp} for Cr(OH)₃ dissolution?

12 pts



$$K_{sp} = [\text{Cr}^{3+}][\text{OH}^-]^3$$

$$[\text{Cr}^{3+}] = \frac{[\text{OH}^-]}{3} = 1.42 \times 10^{-4} \text{ M}$$

$$K_{sp} = (1.42 \times 10^{-4})(4.27 \times 10^{-4})^3 = \underline{\underline{6.11 \times 10^{-14}}}$$

pH = 10.63

pOH = 3.37

[OH⁻] = 10^{-3.37} = 4.27 × 10⁻⁴ M

18. Part a:

acid
↓

10 pts

What is the pH of a buffer solution made by mixing 100 mL of a 0.14 M H_2PO_4^- and 100 mL of a 0.55 M HPO_4^{2-} ?

base ↗

$$\begin{aligned} \text{pH} &= \text{pK}_a + \log \frac{[\text{base}]}{[\text{acid}]} & K_a &= 6.2 \times 10^{-8} \\ &= 7.208 + \log \left(\frac{0.55}{0.14} \right) & \text{pK}_a &= 7.208 \\ &= \underline{7.80} \end{aligned}$$

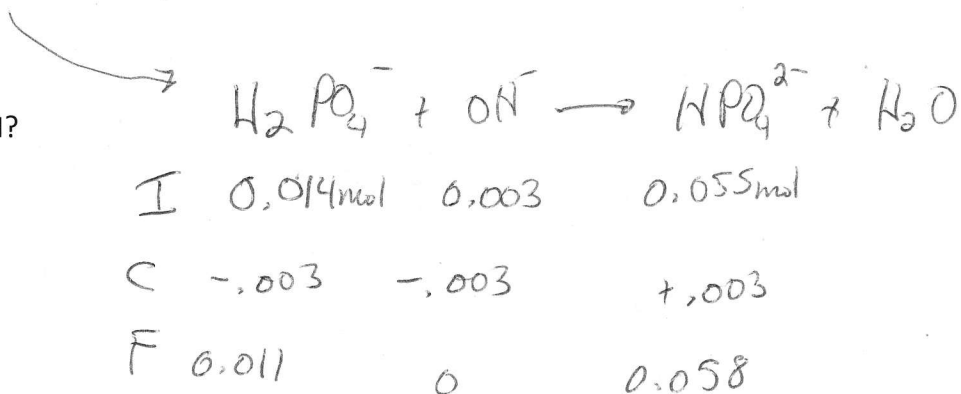
pH = 7.80

Part b: 15 mL of 0.20 M NaOH is added to this buffer

10 pts

Write the reaction that occurs:

What will be the resulting pH?



$$\text{pH} = 7.208 + \log \left(\frac{0.058}{0.011} \right) = \underline{\underline{7.93}}$$