Chem 112 – 2020 Practice Exam

Vining

**1.** Which of the following will create a buffer solution when equal volumes of each solution are mixed? Circle all that apply—there may be more than one correct answer.

(a) 0.20 M HNO3 + 0.10 M H2CO3

(b) 0.20 M HCO2H + 0.10 M NaHCO2

(c) 0.20 M HF + 0.20 M CaF2

(d) 0.10 M HNO3 + 0.30 M NaCH3CO2

**2.** Which of the following acids has the largest Ka value?

 H3AsO2 H3AsO3 H3AsO4

**3.** Which of the following acid-base pairs would be used to create a buffer of pH = 4.62, and which species would be present in higher concentration? **Circle** the acid-base pair used.



Circle one of these:

The conjugate acid will be in higher concentration than the conjugate base.

The conjugate base will be in higher concentration than the conjugate acid.

**4.** The value of Ka for phenol (a weak acid, C6H5OH) is 1.1 × 10-10.

What is the value of Kb, for its conjugate base, C6H5O-? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is pKa? \_\_\_\_\_\_\_\_\_\_\_\_ In what form will phenol exist at pH = 7: C6H5OH or C6H5O-

**5.** Write the chemical reaction equation described by the Ka value for H2CO3.

 Write the chemical reaction equation described by the Kb value for NaF.

**6.** Write the net-ionic equation for the acid-base reaction between HNO2 and ClO-:

 Write the net-ionic equation for the acid-base reaction between HCl and KOH:

**7.** What is the pH of a 0.60 M solution of acetic acid, CH3CO2H?

 Ka = 1.8 x 10-5

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



a. At pH = 11, which species is present in greater concentration?

HA or A- or about the same amount of each

b. What is pKa of HA? \_\_\_\_\_\_\_\_\_\_\_\_\_

c. What is Ka of HA? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**9.** a) What is the pH of a buffer composed of 1.00 L of 0.400 M HCN and 0.700 M CN-?

Ka = 4.0 x 10-10

**10.** Consider the titration curve below involving a weak acid (C2H7NH+) and a weak base (C2H7N).

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 Ka for the acid

 form (C2H7NH+) of the studied acid-base pair?

Ka = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



*For the questions below, answer with* C2H7NH+*,* C2H7NH*,* H3O+ *and/or* OH-*. More than one is allowed.*

c. What acid-base species is/are mainly in solution at point A? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. What acid-base species is/are mainly in solution at point B? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. What acid-base species is/are mainly in solution at point C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**11.** What mass of NH4Cl must be added to a 0.380 M solution of NH3 to make 1.0 L of a buffer of pH = 8.93?

Molar mass NH4Cl = 53.45 g/mol

 \_\_\_\_\_\_\_\_\_\_ g NH4Cl

**12.** You have a saturated solution of AgCl that has solid AgCl at the bottom of the solution. Some NaCl solution is added to the AgCl solution. What happens?

a) nothing

b) more AgCl precipitates

c) NaCl precipitates

d) solid AgCl dissolves

**13.** Will Cu3(PO4)2 be more soluble in pure water, or in water in which Na3PO4 has been dissolved?

 Cu3(PO4)2(s) 3 Cu2+(aq) + 2 PO43-(aq)

 a) pure water b) Na3PO4 solution

Is Fe(OH)2 more soluble in:

 a) pure water b) 0.1 M HCl c) 0.1M NaOH

**14.** Write the equilibrium reaction **and** the Ksp equilibrium expression for dissolution of:

 Al2(CO3)3

**15.** Label any species that are acting as Lewis acids (LA), Lewis bases (LB), Bronsted acids (BA), or Bronsted bases (BB).





**16.** What is the solubility of Cd3(PO4)2, in *moles per liter*? Ksp = 2.2 x 10-32

 **\_\_\_\_\_\_\_\_\_\_\_\_\_ mol/L**

**17.** What is the solubility of PbBr2 is a 0.15 M solution of NaBr, in grams per liter?

Molar mass PbBr2 = 367 g/mol. Ksp = 6.6 x 10-6

 **\_\_\_\_\_\_\_\_\_\_\_\_\_ g/L**

**18.** Cu2+ forms a complex ion with ammonia:

 Cu2+(aq) + 4 NH3(aq) ===== [Cu(NH3)4]2+(aq) Kf = 2.1 x 1013

Formation of the complex ion is: highly favored moderately favored not favored

What is the value of Kd, the dissociation constant for the complex ion, [Cu(NH3)4]2+?

 **Kd = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Equations and Constants

**Useful Information**

pH = -log[H3O+] pOH = -log[OH-] Kw = 1.0 x 10‑14 at 25 oC

[H3O+] = 10-pH[OH-] = 10-pOH 

