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1.) The pH of a weak BASE dissolved in water is 9.14. The concentration of the base is 0.408 M. In addition, to make things worse, we are not necessarily at 25°C and $pK_w = 14.17$. Calculate pK_b for this base.

2.) Calculate the pH of a 0.641M solution of barium hydroxide. Assume that $pK_w = 14.31$ for the conditions under which the solution was prepared.

3.) Which one of the following sets of compounds cannot form a buffer solution?

- (a) Sodium dihydrogen phosphate with sodium hydrogen phosphate
- (b) Ammonia with ammonium chloride
- (c) Acetic acid with sodium acetate
- (d) Nitric acid with sodium nitrate
- (e) All these form buffers!

4.) What is the pH of a solution made by mixing 30.00 mL of 0.100 M acetic acid with 30.00 mL of 0.100 M KOH? $K_a = 0.000018$ for acetic acid.

- (a) 5.28 (b) 7.00 (c) 8.72 (d) 9.28

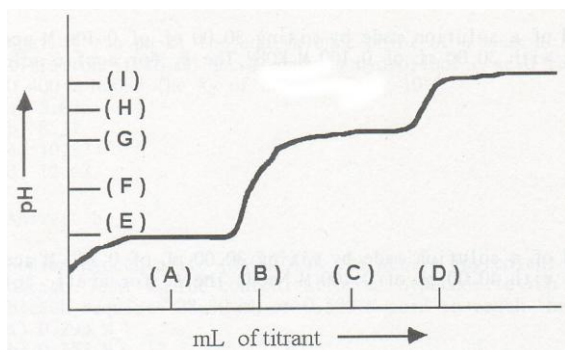
5.) What is the pH of a solution prepared by mixing 25.00 mL of 0.10 M methylamine with 25.00 mL of 0.10 M methylammonium chloride? Assume that volumes are additive and that $K_b = 3.70 \times 10^{-4}$ for CH_3NH_2 .

- (a) 8.97 (b) 9.57 (c) 10.57 (d) 11.78 (e) 12.28

6.) Which set of metal ions can all be precipitated out of solution as chlorides?

- (a) Ag^+ , Hg^{2+} , Co^{2+} (b) Cu^{2+} , Cd^{2+} , Bi^{3+} (c) Ag^+ , Hg_2^{2+} , Pb^{2+} (d) Na^+ , K^+ , Mg^{2+}

7.) Using the following graph for the titration of the weak acid, H_2X , determine the HX^-/X^{2-} buffer region.



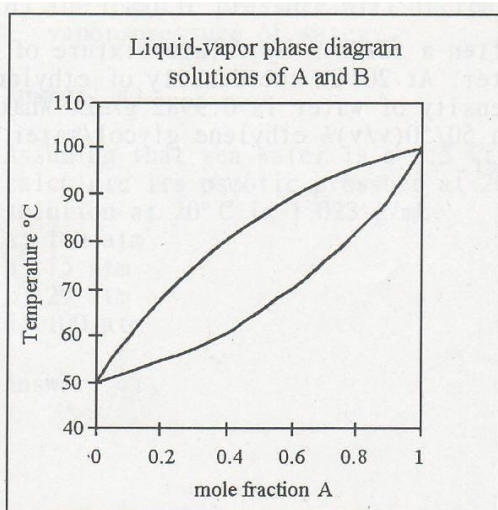
- (a) Between A and B
- (b) Between B and D
- (c) Between G and I

(d) Around G

8.) Place a check mark by all ions which may be precipitated as sulfides. Assume neutral aqueous solution ($\text{pH} = 7$).

- Silver(I) ion
- Sodium ion
- Calcium ion
- Lead(II) ion
- Manganese(II) ion
- Ammonium ion

9.) At 80°C , pure liquid A has a vapor pressure of 700 mm Hg and pure liquid B has a vapor pressure of 940 mm Hg. What is X_A for a solution of A and B with a normal boiling point of 80°C ? Consult the following diagram if you get stuck.



- (a) 0.25 (b) 0.50 (c) 0.75
(d) A solution of A and B cannot boil at 80°C

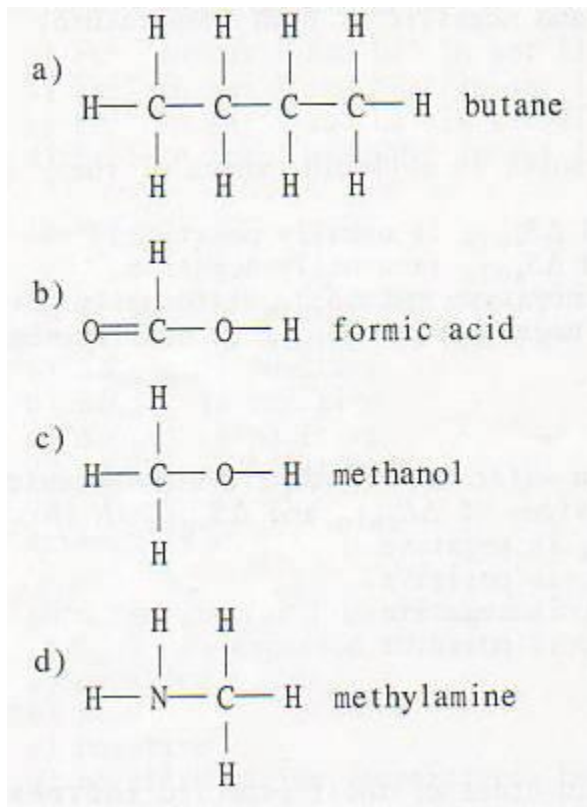
10.) We give a special name to solutions where water is the solvent, namely, "aqueous." The only other type of solution for which the solvent receives special recognition are those where _____ is the solvent.

- (a) xenon (b) chloroform (c) copper (d) mercury

11.) When two similar liquids mix to form a solution, the entropy of solution is expected to be:

- (a) negative. (b) zero. (c) positive.
(d) negative at low T and positive at high T.

12.) Which of the following should be LEAST soluble in water?



13.) The solubility of argon in water at 25°C is 0.0150 M. What is the Henry's Law constant for Ar if the partial pressure of argon in air is 0.00934 atm?

- (a) 0.000140 M/atm
- (b) 0.623 M/atm
- (c) 1.61 M/atm
- (d) 4.10 M/atm

14.) In the process of dissolving ionic compounds, the cations and anions are separated from the crystal lattice and surrounded by an ordered shell of solvent molecules. If the solvent be water, the dissolved ions are said to be:

- (a) halogenated.
- (b) homogenized.
- (c) hydrated.
- (d) hybridized.
- (e) macerated.
- (f) indicted or insulted.
- (g) liquidated.

15.) Consider an acid, HA, with $pK_a = 7.67$. What is the pH of a buffer solution made up by mixing a 0.938M solution of the acid with an equal volume of a 0.262M solution of its salt?

16.) For ferrous hydroxide, $pK_{sp} = 15.097$. What is the *base-10 logarithm* of the molar solubility of this compound when $pH = 5.096$?

17.) At a temperature of 43.466°C , a solution gives an osmotic pressure of 90.725atm . What is the solution concentration in mol/L? Assume a nonionic compound here.

18.) 418.659mg of a substance at 21.823°C dissolved in 58.179mL of solvent give an osmotic pressure of 34.934 torr . What is the molecular weight of the substance (in g/mol)?

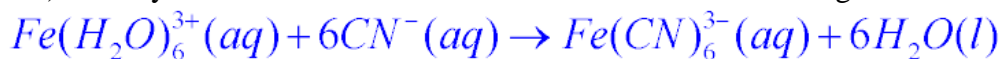
19.) Which one of the following species acts as an acid in water?

- (a) NaH
- (b) NH_4^+
- (c) CH_3NH_2
- (d) C_6H_6

20.) A tablet containing 500.0 mg of aspirin was dissolved in enough water to make 100mL of solution. Aspirin is a monoprotic acid with a dissociation constant of 0.00030 . What is the pH of the solution? (Formula: $\text{HC}_9\text{H}_7\text{O}_4$)

- (a) 1.57
- (b) 2.54
- (c) 3.52
- (d) 5.08
- (e) None of these.

21.) Identify the Lewis acid that acts as a reactant in the following reaction:



- (a) Fe^{3+}
- (b) H_2O
- (c) CN^-
- (d) $\text{Fe}(\text{H}_2\text{O})_6^{3+}$

22.) What is the relationship between K_a and K_b at 25°C for a conjugate acid/conjugate base pair?

- (a) $K_a \times K_b = 1 \times 10^{-14}$
- (b) $K_a/K_b = 1 \times 10^{-14}$
- (c) $K_b/K_a = 1 \times 10^{-14}$
- (d) $K_a + K_b = 1 \times 10^{-14}$

23.)

30. What is the hydroxide ion concentration for a solution that is 3.50×10^{-3} M in hydronium ion?
- a. 2.86×10^{-4} M
 - b. 2.86×10^{-11} M
 - c. 2.86×10^{-12} M
 - d. 3.50×10^{-12} M

24.) Which of the following is least able to act as a Lewis base?

- (a) Water
- (b) Ammonia
- (c) Ammonium ion
- (d) Chloride ion

25.) A Texas Aggie buys 12 cans of dehydrated water. The cans weigh an average of 121.53g each before the dehydrated water is removed. If the density of pure distilled water is 0.9979 g/mL and each can has a volume of 9.813L, what is the total mass of the cans AFTER the removal of the dehydrated water?