AP Chemistry Review Targets 1-6

Directions: Answer each of the following questions. Place your answers on the provided blanks. This is an open note quiz.

1. List the conjugate base of CH_3COOH. CH_3COO^-

2. List the conjugate acid of $H_2AsO_4^-$. H_3AsO_4

Consider the following reaction for Questions 3 and 4:

$$HCO_3^-(aq) + HPO_4^{2-}(aq) \Leftrightarrow H_2CO_3(aq) + PO_4^{3-}(aq)$$

B A CA CB

3. Identify the acid in the above reaction. HPO_4^{2-}

4. Identify the conjugate base in the above reaction. PO_4^{3-}

5. Select all correct answers. According to Arrhenius, an acid is a substance that ____.
   a) is capable of donating one or more protons ✓
   b) causes an increase in the concentration of the H^+ ions in solution ✓
   c) can accept a pair of e- to form a coordinate covalent bond not Arrhenius
   d) reacts with the solvent to form a cation formed by the autoionization of water of that solvent not Arrhenius
   e) tastes bitter

6. A substance is said to be amphoteric if it is capable of acting as both an acid and a base.

7. In an acidic solution, the $[H_3O^+]$ $>$ $[OH^-]$. Fill in the blank with <,>, or =.

8. $HSO_3^-(aq)$ is an ion which is amphoteric. In the space below, write an equation for the reaction in which $HSO_3^-(aq)$ acts as a base in $H_2O(l)$.

$$HSO_3^- + H_2O \rightleftharpoons H_2SO_3 + OH^-$$

9. In the space below, write an equation for the reaction in which $HSO_3^-(aq)$ acts as an acid in $H_2O(l)$.

$$HSO_3^- + H_2O \rightleftharpoons SO_3^{2-} + H_3O^+$$

10. Predict the products of the following reaction:

$$H_3O^+(aq) + F^-(aq) \Leftrightarrow H_2O + HF$$

11. A solution has [H+] of 0.00032 M. The [OH⁻] is 3.13×10^{-11} M and the solution is acidic. (acidic, basic, or neutral)

12. What is the value for K_w at 25°C? 1×10^{-14}

For #13-23, show your work and then circle your final answers.

13. How many times more acidic is a solution with a pH of 3.00 than a solution with a pH of 5.50?

3 → 4 → 5 →(5) 6 (10 10 10) $10 \times 10 \times 5 = 500\times$

14. If a solution has a pH of 4.52, then its [H+] is 3.02×10^{-5} M.

$10^{-4.52}$

15. If a solution has a pOH of 10.80, its [H+] is 6.31×16^{-4} M.

16. If a magnesium hydroxide solution has a [OH⁻] of 1.00×10^{-11}M, then its pH is 3.00

$Mg(OH)_2$ $[H^+] = 1.00 \times 10^{-}$ M pH = 3.00

17. Calculate the pH of a 0.0034 M solution of nitric acid.

HNO_3 is a strong acid!

$[H^+] = 0.0034M$ $pH = -\log(.0034) = \boxed{2.47}$

18. Calculate the pOH of a solution made by dissolving 2.50 grams of $HClO_3$ in enough water to make 2.50 L of solution.

$\frac{2.50g}{2.50L} \times \frac{1 mole\ HClO_3}{84.54g\ HClO_3} = 0.0118M = [H^+]$

$pH = -\log(.0118) = 1.928$

$pOH = 14 - 1.928 = \boxed{12.072}$

19. Calculate the pH of a solution made by dissolving 14.0 g of strontium hydroxide in enough water to make 3.00 L of solution.

$Sr(OH)_2$

$\frac{14.0g}{3.00L} \times \frac{1 mol\ Sr(OH)_2}{121.62g} = .0384M \times 2 = .0768M = [OH^-]$

$pOH = -\log(.0768) = 1.115$

$pH = 14 - 1.115 = \boxed{12.885}$

Limiting reactant problem!

20. Assume that you added 4.73 liters of 1.50 M HCl to 1.80 liters of 2.00 M $Ca(OH)_2$. What would be the pH of the resulting solution?

L.R. $\boxed{2\,HCl} + Ca(OH)_2 \rightarrow 2H_2O + CaCl_2$

$4.73\,L \times \frac{1.50\,mol}{L} \times \frac{2\,mol\,H_2O}{2\,mol\,HCl} = 7.095\,mol$

$1.80\,L \times \frac{2.00\,mol}{L} \times \frac{2\,mol\,H_2O}{1\,mol\,Ca(OH)_2} = 7.200\,mol$

$7.095\,mol\,HCl \times \frac{1\,mol\,Ca(OH)_2}{2\,mol\,HCl} = 3.55\,mol\,Ca(OH)_2$ used

3.60 mol original
− 3.55 mol used
.05 mol $Ca(OH)_2$ remains

× 2
.100 mol OH^-

$\frac{.100\,mol}{4.73+1.80\,L} = .0153M$

$pOH = 1.815$

$\boxed{pH = 12.19}$

21. Assume you wanted to make 50.0 L of a sodium hydroxide solution that has a pH of 10.00. How many grams of sodium hydroxide would this require?

$pH = 10.00$ so $[H^+] = 1.00\times10^{-10}M$ and $[OH^-] = 1.00\times10^{-4}M$

$50.0\,L \times \frac{1.00\times10^{-4}\,mol}{L} \times \frac{40.0\,g\,NaOH}{1\,mol\,NaOH} = \boxed{.20\,g\,NaOH}$

22. What is $[H^+]$ in a 0.10 M solution of HX, a weak acid, at 25°C?

$HX \rightleftharpoons H^+ + X^-$ $\quad K_a = \frac{[H^+][X^-]}{[HX]}$ (K_a for HX = 4.0×10^{-11})

$[H^+] = [X^-]$

So, $4.0\times10^{-11} = \frac{x^2}{.10}$

$x = 20\times10^{-6}M$

23. What is the % ionization of a 3.00 M acetic acid solution at 25°C? For acetic acid the is $K_a = 1.8 \times 10^{-5}$.

$1.8\times10^{-5} = \frac{x^2}{3.00}$

$x = .00735M$

$\%I = \frac{.00735}{3.00} \times 100$

$= .245\%$