AP Chemistry. Test on Aqueous Equilibrium. Name_____
NO CALCULATORS ON THIS PART OF THE EXAM!
Questions 1 to 3 are based on the following 3 acids and their Ka's

HA , Ka = 1.0×10^{-6} HX Ka = 4.0×10^{-8} HZ Ka = 1.0×10^{-10}

____1. The pH of a 1.0 molar solution of HA is A) 0 B) 3 C) 6 D) 8

____2. What is the $[H^+]$ in a solution containing 1.0 mole of HX and 2.0 mol of NaX in 500 mL of solution? A) 2.0×10^{-8} B) 4.0×10^{-8} C) 8.0×10^{-8} D) 1.0×10^{-8}

____3. Which 0.100 molar solution would have the highest pH ?
A) NaA B) NaX C) KZ D) HZ

____4. Which of the following anions has the **weakest** conjugate acid?
A) O^{2-} B) OH^- C) Cl^- D) HCO_3^-

____5. In an aqueous solution with a pH of 10.50 at 25° the molar concentration of OH^- is approximately A) 3.2×10^{-11} M B) 3.2×10^{-4} M C) 0.25 M D) 3.2×10^{10} M

Choices : A) A solution with a pH less than 7 that is not a buffer
B) A solution with a pH less than 7 that **is** a buffer
C) A solution with a pH of 7
D) A solution with a pH greater than 7 that is not a buffer
E) A solution with a pH greater than 7 that **is** a buffer.

Note: The Ka of acetic acid is 1.8×10^{-5}, the Ka of HBrO is 2.5×10^{-9} , and the K_b of NH_3 is 1.8×10^{-5}

____6. 0.10 mole of NH_3 is mixed with 0.10 mole of NH_4Cl in 1.0 L of solution

____7. 0.10 mole of NaBrO is dissolved in 250 mL of solutioni

____8. 50.0 mL of 0.20 molar HBrO is mixed with 50.0 mL of 0.10 molar NaOH

____9. 0.50 mole of $NaC_2H_3O_2$ is dissolved in 250 mL of solution

____10. 50.0 mL of 0.50 M HCl is added to 100.0 mL of 0.50 M $NaC_2H_3O_2$

____11. 50.0 mL of 0.50 M HCl is added to 100 mL of 0.25 M KOH.

_____12. What is the $[H^+]$ in an aqueous solution at 25° C that has an $[OH^-]$ of 2.0×10^{-5} ? A) 2.0×10^{-5} B) 5.0×10^{-9} C) 2.0×10^{-9} D) 5.0×10^{-10}

_____13. In the Bronsted-Lowry reaction $HNO_3(aq) + H_2O(\ell) \rightarrow H_3O^+(aq) + NO_3^-(aq)$
the **strongest acid** and **strongest base** respectively are
A) HNO_3 and H_2O B) H_3O^+ and NO_3^- C) HNO_3 and NO_3^-
D) H_2O and NO_3^-

_____14. A chemist wishing to estimate the pH of a NH_3/NH_4^+ buffer should use a pKa of approximately A) 3 B) 5 C) 7 D) 9
(the Kb of NH_3 is 1.8×10^{-5})

PROBLEMS I.

The base methyl amine, CH_3NH_2, has a Kb of 4.4×10^{-4}

A. Write the formula of the conjugate acid of CH_3NH_2

B. Write the chemical equation for the ionization of the base in water

C. 0.10 mole of CH_3NH_2 is dissolved in an aqueous solution with a volume of 200. mL
Find the pH of this solution.

D. To the solution in part C we add 50.0 mL of 1.0 molar HCl. Find the pH of the resulting mixture

II. Acetic acid, Ka 1.8×10^{-5} is titrated with potassium hydroxide.

40.0 mL of 0.200 molar acetic acid is added to a flask. The KOH is 0.100 molar.

A. What is the pH of the solution before any base is added?

B. What is the pH after the addition of 40.0 mL of KOH ?

C. What is the pH after the addition of 80.0 mL of KOH ?

D. During the titration, a pH meter at one point reads a pH of 5.00 .
At this point is $[HC_2H_3O_2]$. greater than, less than or equal to $[C_2H_3O_2^-]$. Justify your answer.