

QUEST: IONIC EQUILIBRIUM

NAME: _____

PROBLEMS AND DESCRIPTIVE ANSWERS.

Questions are to be answered in the space provided. For problems requiring a numerical calculation, be certain to show all the steps in your answer and the correct number of significant digits to receive full credit.

1. According to the Arrhenius theory (2 marks)

a) in a neutralization reaction, what are the products of the following reaction?

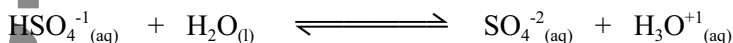


b) define: BASE:

2. According to the Bronsted- Lowry theory (1 mark)

an ACID is:

3. Given the reaction: (3 marks)



a) identify

the hydrogen ion donor _____

the hydrogen ion acceptor _____

a) identify the

acid _____ and its conjugate base _____

base _____ and its conjugate acid _____

4. Write the equation for the reaction of water with $\text{CO}_3^{-2}(\text{aq})$ a weak base. (2 marks)

5. Which of the following is the strongest acid? (1 mark)

HClO_3 HClO_2 HClO _____

6. Given that potassium hydroxide (KOH) is strong base and carbonic acid (H_2CO_3) is a weak acid, would a solution of potassium carbonate be **acidic, basic or neutral**? Circle one. Use your knowledge of hydrolysis to justify your answer. (3 marks)

7. Calculate the K_a of the ammonium ion if the K_b of ammonia NH_3 is 1.8×10^{-5} (2 marks)

8. Barbituric acid, (H-Bar), was discovered by Adolph Von Baeyer (of Baeyer aspirin fame) and named after a friend, Barbara. It is the parent compound of widely used sleeping drugs, the barbiturates. It is a weak acid with a K_a of 9.70×10^{-5} .
- a. What is the $[H^+]$ if a 0.0250 mol/L solution of H-Bar? State any assumptions you may have made. (4 marks)

b. What is the pH of barbituric acid? (1mark)

c. What is the K_b of the conjugate base of barbituric acid? (1 mark)

d. What is the pKa of barbituric acid? (1 mark)

e. Barbituric acid forms a salt with sodium called sodium barbiturate, Na Bar.

(i) **State and explain** if a 0.100 mol L⁻¹ solution will be expected to be acidic, basic or neutral? (4 marks)

(ii) Calculate the pH of a 0.100 mol L^{-1} solution of sodium barbiturate. (5 marks)

f. Barbituric acid and sodium barbiturate form a system known as a 'buffer'.

(i) Define what is meant by the term 'buffer'. (2 marks)

(ii) Explain how a solution of barbituric acid and sodium barbiturate act as a buffer. (4 marks)

(iii) Determine the pH of a system containing 1.00 mol L^{-1} barbituric acid and 0.500 mol L^{-1} sodium barbiturate. (4 marks)

9. A 0.0040 mol/L solution of $\text{Mg(OH)}_{2(\text{aq})}$ was neutralized by 15.20 mL of 0.0750 mol/L $\text{HNO}_{3(\text{aq})}$. (7 marks).
- Write the balanced equation for this reaction.
 - Write the net ionic equation for this reaction
 - What volume of Mg(OH)_2 was neutralized?
 - Explain if the reaction of $\text{Mg(OH)}_{2(\text{aq})}$ with $\text{HNO}_{3(\text{aq})}$ is expected to be an endothermic or an exothermic process. (2 marks).
10. A 0.0015 mol/L solution of acetic acid (HCH_3CO_2) is 6.50 % ionized at 40°C. Calculate the K_a for acetic acid at this temperature. (5 marks)