

**CHEM-1212**  
**Second Examination**  
**Form A**

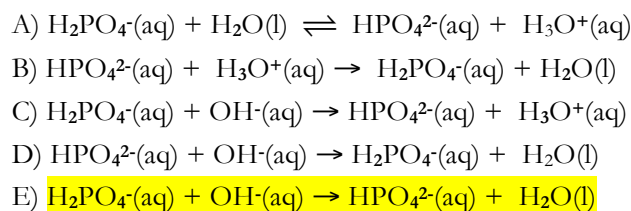
**Multiple Choice - Choose the BEST Answer**

1. What is the pH of a 0.318 *M* solution of potassium cyanide, KCN? The  $K_a$  for HCN is  $4.9 \times 10^{-10}$  and the  $K_b$  for its conjugate is  $2.04 \times 10^{-5}$ .
- A) pH = 2.60  
B) pH = 4.40  
C) pH = 11.40  
D) pH = 12.35  
E) pH = 4.65
2. 0.050 mol of an unknown salt is dissolved in water to form 0.500 L of solution. The pH of the resulting solution is 8.08. Which of the following salt is the unknown salt described above?
- A)  $\text{NH}_4\text{Cl}$   
B)  $\text{NaCl}$   
C)  $\text{NaClO}_4$   
D)  $\text{NaOCl}$   
E) None of the above salts fit the description.
3. You are asked in lab to make a buffer with a pH = 5.00. You have 0.10 *M* of the following solutions available:  $\text{HCOOH}$ ,  $\text{HCOONa}$ ,  $\text{HCl}$ ,  $\text{NaCl}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{NaCH}_3\text{COO}$ ,  $\text{HCN}$  and  $\text{NaCN}$ . Which of the following would you use to start making the buffer? Use the following table if needed.

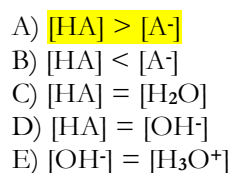
Formula	$K_a$
$\text{HCOOH}$	$1.8 \times 10^{-4}$
$\text{CH}_3\text{COOH}$	$1.8 \times 10^{-5}$
$\text{HCN}$	$4.9 \times 10^{-10}$

- A)  $\text{HCOOH}$  and  $\text{NaHCOO}$   
B)  $\text{HCl}$  and  $\text{NaCl}$   
C)  $\text{CH}_3\text{COOH}$  and  $\text{NaCH}_3\text{COO}$   
D)  $\text{HCN}$  and  $\text{NaCN}$   
E) There is not enough information.

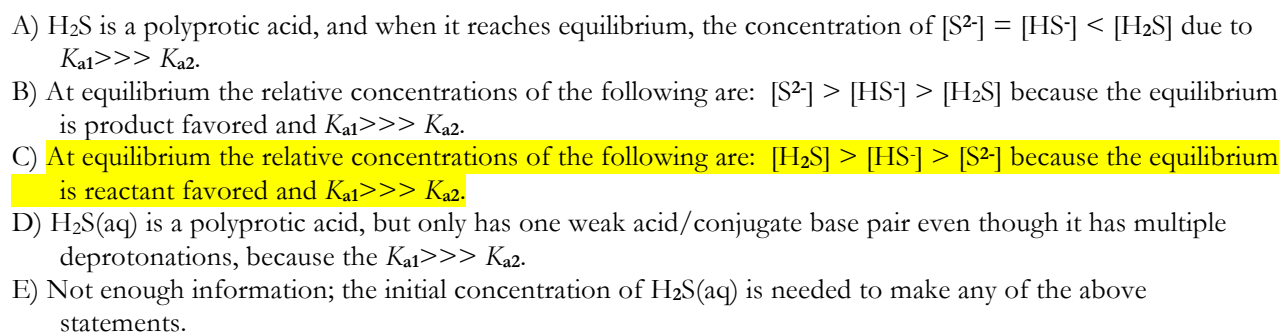
4. A buffer system consists of  $\text{H}_2\text{PO}_4^-(\text{aq})$  and  $\text{HPO}_4^{2-}(\text{aq})$ . A strong base is then added to the buffer. Which of the following equations demonstrates the strong base reacting with the buffer?



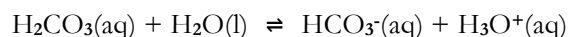
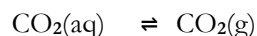
5. A buffer contains a weak acid, HA and its conjugate base,  $\text{A}^-$ . The weak acid has a  $\text{p}K_{\text{a}} = 4.82$ , and the buffer currently has a  $\text{pH} = 4.25$ . Which of the following statement(s) is(are) true?



6.  $\text{H}_2\text{S}(\text{aq})$  has an  $K_{\text{a}1} = 1.3 \times 10^{-7}$  and an  $K_{\text{a}2} = 7.1 \times 10^{-15}$ . Which of the following are true about  $\text{H}_2\text{S}(\text{aq})$  at equilibrium?



7. When respiration is restricted, which of the following statements are true? Use the following equations as needed to answer the question.



- A) The amount of  $\text{H}_2\text{O}(\text{l})$  increases to decrease the  $\text{CO}_2(\text{aq})$  present.  
B) There is an increase in carbonic acid in the blood stream; this will in turn increase the pH  
C) The amount of  $\text{CO}_2(\text{aq})$  decreases in order to increase  $\text{CO}_2(\text{g})$   
D) The carbonic acid decreases in order to form more  $\text{CO}_2(\text{aq})$  and then increases the  $\text{CO}_2(\text{g})$   
E) There is an increase in carbonic acid in the blood stream; this will in turn decrease the pH

8. When the following aqueous solutions are mixed, which combination results in a buffer if the initial concentration of each component is 1.0 *M*?

- A) HCN + NaOH
- B) HBr + LiBr
- C) HCl + KOH
- D) HCN + KCN
- E) HCl + NaCl

9. When calculating the pH, pOH, [H<sup>+</sup>] or [OH<sup>-</sup>] of a 2.5 x 10<sup>-9</sup> *M* solution of NaOH, which of the following is(are) necessary to take into account for your calculation?

- A) The hydronium and hydroxide ion concentration formed from the base.
- B) The hydronium ion and hydroxide ion concentration from the autoionization of H<sub>2</sub>O.
- C) The basicity constant of the base and the acidity constant of its conjugate acid.
- D) A and B
- E) All of the above.

10. Approximately how many moles of HCl must be added to 1.00 liter of 0.250 *M* ammonia to make the pH of the solution 9.000? Assume no change in volume. The *K<sub>b</sub>* of ammonia = 1.8 x 10<sup>-5</sup> and the *K<sub>a</sub>* of its conjugate acid = 5.6 x 10<sup>-10</sup>.

- A) 0.45 mol HCl
- B) 0.16 mol HCl
- C) 0.89 mol HCl
- D) 0.21 mol HCl
- E) Not enough information is given.

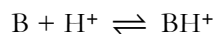
11. The following samples are both titrated with 0.100 *M* solution of NaOH(aq) :

- I. 25.0 mL of a 0.100 *M* HNO<sub>3</sub> (aq)
- II. 25.0 mL of a 0.100 *M* CH<sub>3</sub>COOH (aq)

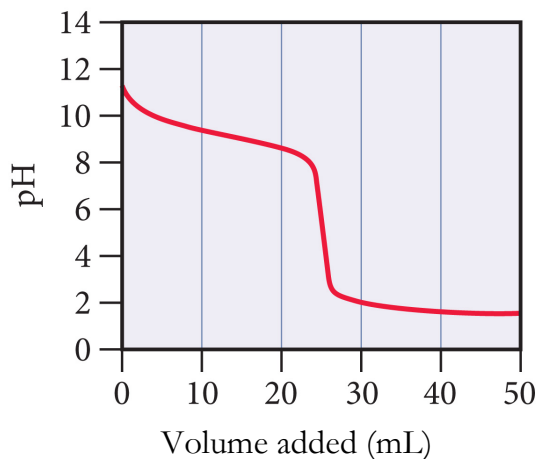
Which of the following statements are correct?

- A) A larger volume of NaOH is needed to reach the equivalence point in titration I than in titration II.
- B) At the equivalence point, the solution formed from titration II will have a higher pH than the solution formed from titration I.
- C) The pH before any NaOH is added will be the same for titration I and titration II.
- D) B and C are correct
- E) None of the above statements are correct.

12. The titration curve for the titration of a weak base, B, with a strong acid, H<sup>+</sup>, is shown below. The reaction is:

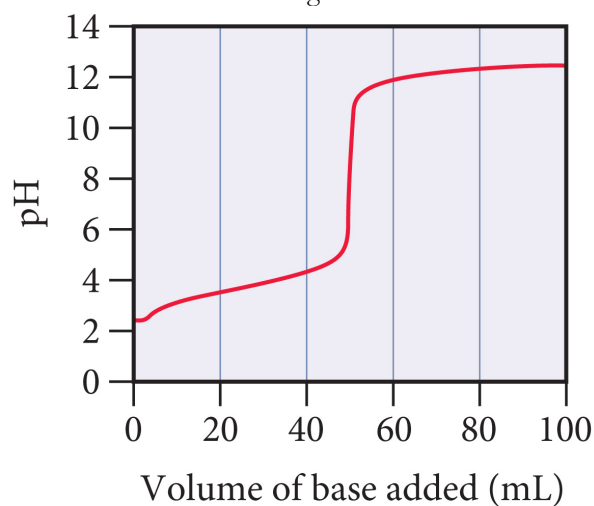


Which of the following statements is(are) true about the graph?



- A) At the equivalence point, the pH depends only on [B].  
B) After acid has been added, but before the equivalence point, a buffer is formed.  
C) After the equivalence point, the pH depends on the [BH<sup>+</sup>].  
D) At ½ the equivalence point, the pH = pK<sub>b</sub>.  
E) After the equivalence point, the pH depends on the [B].
13. Which of the following reactions will result in a pH = 7.00?
- A) The reaction of 15.0 mL of 0.15 M HBr(aq) with 10.0 mL of 0.15 M KOH(aq).  
B) The reaction of 15.0 mL of 0.15 M NH<sub>3</sub>(aq) with 10.0 mL of 0.15 M HCl(aq).  
C) The reaction of 10.0 mL of 0.15 M NaOH(aq) with 10.0 mL of 0.15 M HCl(aq).  
D) The reaction of 10.0 mL of 0.15 M CH<sub>3</sub>COOH(aq) with 10.0 mL of 0.15 M NaOH(aq).  
E) The reaction of 10.0 mL of 0.15 M HClO(aq) with 10.0 mL of 0.15 M KClO(aq).
14. Consider the titration of 25.0 mL of 0.200 M acetic acid with 0.250 M NaOH. What is the pH after 10.0 mL of NaOH has been added? The pK<sub>a</sub> of acetic acid = 4.74.
- A) pH = 3.92  
B) pH = 4.56  
C) pH = 4.74  
D) pH = 5.56  
E) pH = 7.00

15. A titration curve is shown below. Which of the following is true about the curve?



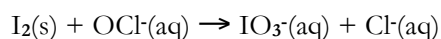
- I. At the equivalence point, the pH is determined by the  $[\text{OH}^-]$  of excess titrant
- II. The  $\text{pH} > 7$  at the equivalence point.
- III. After 20 mL of base is added; the  $\text{H}_3\text{O}^+$  ions are in excess compared to the  $\text{OH}^-$  ions

- A) Only I
- B) Only II
- C) Both II and III
- D) Both I and II
- E) I, II and III

16. A solution contains  $1.0 \times 10^{-2} \text{ M Ag}^+$ . Chloride ions are added to the solution. What concentration is necessary to precipitate  $\text{AgCl}$  at  $25^\circ\text{C}$ ? ( $K_{\text{sp}} = 1.8 \times 10^{-10}$ )

- A) a concentration less than  $1.8 \times 10^{-8} \text{ mol/L}$
- B) a concentration equal to  $1.8 \times 10^{-8} \text{ mol/L}$
- C) a concentration greater than  $1.8 \times 10^{-8} \text{ mol/L}$
- D) Not enough information is given; I need the solubility product constant.
- E) A precipitate will never form between silver and chlorine ions.

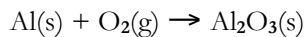
17. Balance the following reaction in acidic solution.



What is the coefficient in front of  $\text{H}^+(\text{aq})$  and which side of the equation is it on in the overall, balanced reaction?

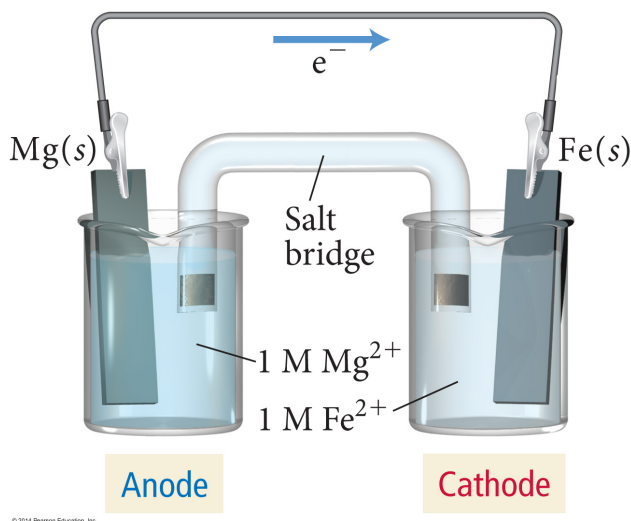
- A) 4, left side of the equation
- B) 6, right side of the equation
- C) 8, right side of the equation
- D) 2, right side of the equation
- E) 3, left side of the equation

18. In the following reaction, what is oxidized?



- A) Al
- B) O
- C)  $\text{Al}_2\text{O}_3$
- D)  $\text{Al}^{+2}$
- E) The reaction is not a redox reaction.

\*\*\*\*\*Use the following image of a galvanic cell to answer the next **two** questions.\*\*\*\*\*



19. Which of the following statement(s) is(are) true about the galvanic cell above?

- A) At the cathode, iron is reduced from an oxidation state of +2 to 0.
- B) At the anode, magnesium is oxidized from an oxidation state of 0 to +2.
- C) Electrons travel from the electrode to the cathode.
- D) Two electrons are transferred per mole of reaction.
- E) All of the previous statements are true.

20. Which of the following statement(s) is(are) true concerning a salt bridge in a galvanic cell?

- A) Cations from the salt in the salt bridge travel to the cathode to keep it electrochemically balanced.
- B) Anions from the salt in the salt bridge travel to the cathode to neutralize the  $\text{Fe}^{2+}$  and keep it electrochemically balanced.
- C) Cations from the salt in the salt bridge travel to the anode to neutralize the  $\text{Mg}^{2+}$  ions and keep it electrochemically balanced.
- D) A and B
- E) None of the above.

21. Which form of the exam do you have?

- A) A
- B) B