

Questions 1 – 15 cover Midterm Exam material

1. Which of the following is considered proper footwear in the lab?

- A. sandals that allow proper ventilation to the feet
 - B. a comfortable pair of slippers
 - C. closed-toe shoes
 - D. shoes with a high heel and straps
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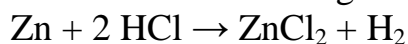
2. For your **safety**, what should you do prior to leaving the lab?

- A. wash your hands and any other area of skin that has contacted lab equipment or lab benches.
 - B. get the TA's initial on your lab notebook.
 - C. see that all equipment in the shared drawer is complete and well organized.
 - D. pour all reagents down the drain.
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3. Concentrated hydrochloric acid is about 12.1 M. What volume of concentrated HCl is required to produce 5500 mL of 0.250 M HCl?

- A. 980 mL
 - B. 1114 mL
 - C. 0.211 L
 - D. 0.114 L
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4. Consider the following reaction:



What mass of ZnCl_2 can be prepared from the reaction of 1.69 grams of zinc with 1.10 grams of HCl?

- A. 3.52 g
 - B. 2.06 g
 - C. 4.11 g
 - D. 2.30 g
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7. The carbon atom in CSe_2 will have ____ lone pair(s) and a ____ molecular geometry.

A. 0, linear

C. 4, bent

B. 2, bent

D. 4, linear

8. How many electron groups are present on the tellurium atom of TeBr_4 ?

A. 6

B. 3

C. 4

D. 5

9. The freezing point of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is $-114.6\text{ }^\circ\text{C}$. The molal freezing point depression constant for ethanol is $2.00\text{ }^\circ\text{C}/\text{m}$. What is the freezing point ($^\circ\text{C}$) of a solution prepared by dissolving 50.0 g of glycerin ($\text{C}_3\text{H}_8\text{O}_3$, a nonelectrolyte) in 200.0 g of ethanol?

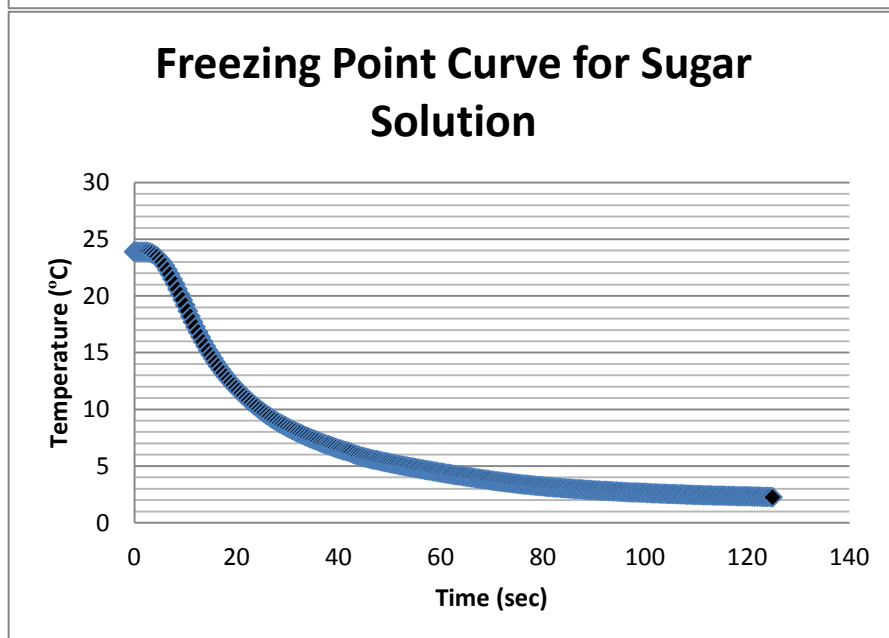
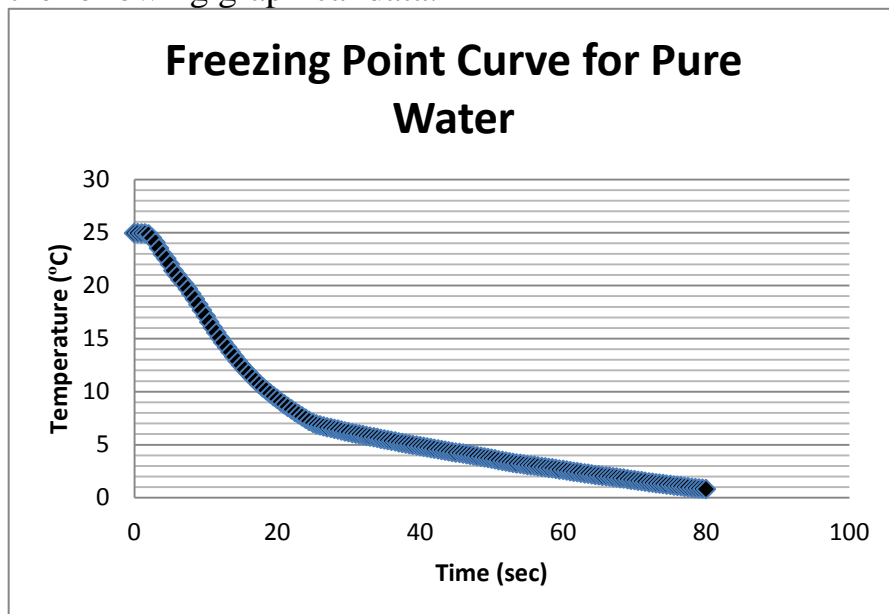
A. $-115\text{ }^\circ\text{C}$

C. $-109\text{ }^\circ\text{C}$

B. $-120\text{ }^\circ\text{C}$

D. $-5.43\text{ }^\circ\text{C}$

10. In lab, a student prepared a solution containing 0.810 g of sugar ($C_6H_{12}O_6$) in 25.21 mL of water. The student then conducted a freezing-point depression experiment and obtained the following graphical data:



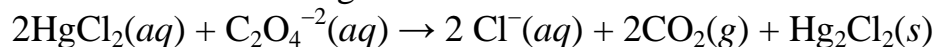
What is the freezing point depression constant, K_f , for water based upon the data the student collected?

- A. $11.2\text{ }^\circ\text{C}/\text{m}$ C. $1.86\text{ }^\circ\text{C}/\text{m}$
B. $0.0135\text{ }^\circ\text{C}/\text{m}$ D. $2.35\text{ }^\circ\text{C}/\text{m}$

11. What is the concentration of urea (MW = 60.0 g/mol) in a solution prepared by dissolving 16 g of urea in 39 g of H₂O?

- A. 96 m
B. 0.0048 m
C. 0.15 m
D. 6.8 m

12. Consider the following rate data for the reaction below:

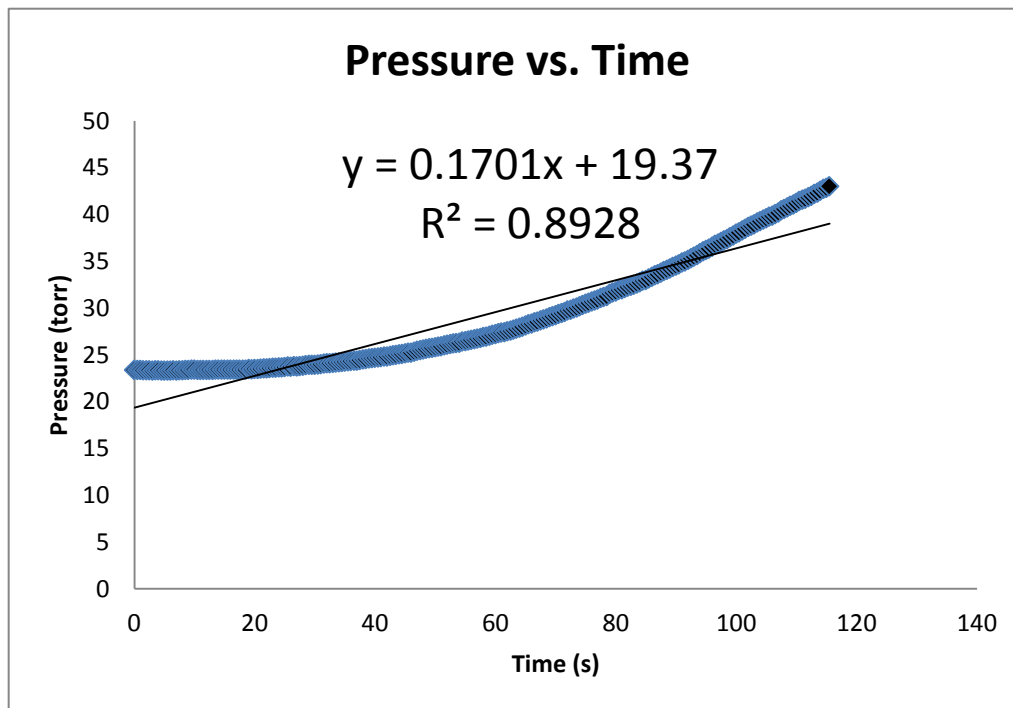


Trial	[HgCl ₂]	[C ₂ O ₄ ²⁻]	Rate, M/s
1	0.10	0.10	1.3×10^{-7}
2	0.10	0.20	5.2×10^{-7}
3	0.20	0.20	1.0×10^{-6}

What is the rate constant, k, for this reaction?

- A. $1.4 \times 10^{-8} \text{ M}^{-2} \text{ s}^{-1}$
B. $1.3 \times 10^{-7} \text{ M}^{-2} \text{ s}^{-1}$
C. $1.4 \times 10^{-5} \text{ M}^{-2} \text{ s}^{-1}$
D. $1.3 \times 10^{-4} \text{ M}^{-2} \text{ s}^{-1}$
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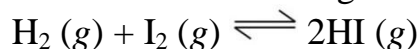
13. In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at 20 °C.



Based upon the student's data, what is the initial rate of the reaction in $\frac{\text{mol}}{\text{L}\cdot\text{s}}$?

- A. $7.07 \times 10^{-3} \frac{\text{mol}}{\text{L}\cdot\text{s}}$
- B. $\frac{\text{mol}}{\text{L}\cdot\text{s}} 9.31 \times 10^{-6}$
- C. $1.36 \times 10^{-4} \frac{\text{mol}}{\text{L}\cdot\text{s}}$
- D. $0.1701 \frac{\text{mol}}{\text{L}\cdot\text{s}}$
14. According to Le Châtelier's principle, which chemical system shifts to the right when pressure is increased?
- A. $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$
- B. $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$
- C. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
- D. $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

15. Consider the following chemical reaction:



At equilibrium in a particular experiment, the concentrations of H_2 , I_2 , and HI were 0.15 M, 0.033 M, and 0.55 M, respectively. What is the value of the equilibrium constant, K_{eq} , for this reaction?

- A. 61
B. 9.0×10^{-3}
C. 23
D. 111

Questions 16 – 35 cover material after the Midterm Exam

16. When is the endpoint of an acid/base titration reached?

- A. When the indicator changes color.
B. When you get tired of filling the buret.
C. When a buffer is formed in the solution.
D. When an excess of the titrant has been added to the solution being titrated.

17. A student titrated a solution of acetic acid four times and determined the following concentrations for the solution: 0.2356 M, 0.2319 M, 0.2469 M, and 0.2421 M. What is the standard deviation amongst her concentrations?

- A. ± 0.007
B. ± 0.005
C. ± 0.004
D. ± 0.01
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19. A 25.0 mL solution of ascorbic acid ($\text{H}_2\text{C}_6\text{H}_6\text{O}_6$) was titrated to the second equivalence point using 25.13 mL of 0.125 M sodium hydroxide. What is the concentration of the ascorbic acid?

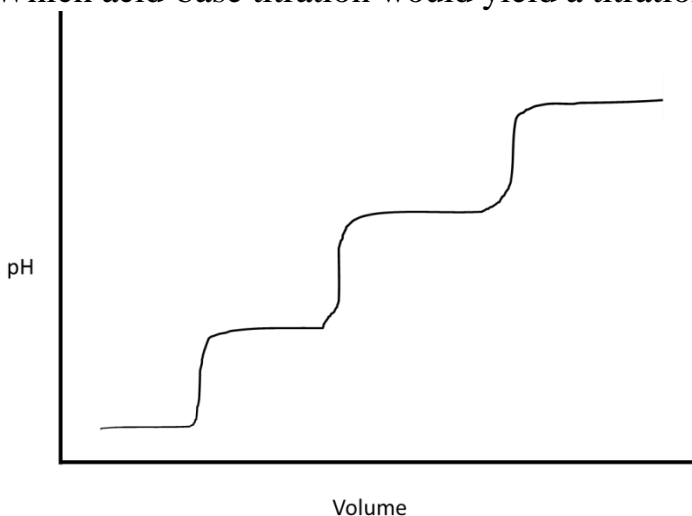
A. 3.14×10^{-3} M

C. 6.28×10^{-3} M

B. 1.26×10^{-2} M

D. 1.26×10^{-1} M

20. Which acid-base titration would yield a titration curve of the general form shown?



A. NaPO_4 titrated with HCl

C. H_3PO_4 titrated with NaOH

B. H_2CO_3 titrated with NaOH

D. NaOH titrated with H_3PO_4

21. What is the pH of a 2.36 M solution of acetic acid, CH_3COOH ? The K_a for acetic acid is 1.8×10^{-5} .

A. 0.373

B. 5.69

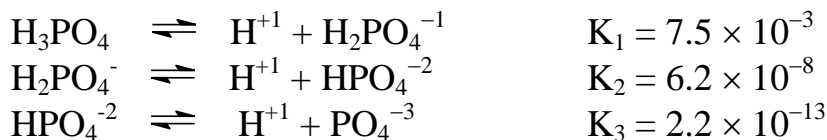
C. 3.64

D. 2.19

22. A buffer is made by dissolving 0.35 moles of acetic acid in 0.98 moles of sodium acetate in enough water to form 1.00 L of solution. The K_a for CH_3COOH is 1.8×10^{-5} . When NaOH is added to the original buffer solution, the pH slightly _____, the concentration of CH_3COOH _____, and the concentration of CH_3COO^- _____.

- A. increases, decreases, increases C. decreases, increases, increases
B. increases, increases, increases D. decreases, increases, decreases

23. Given the following information regarding the dissociation of phosphoric acid, which would be the most useful in creating a buffer system with a pH of 7.5?



- A. H_3PO_4 and $\text{H}_2\text{PO}_4^{-1}$ C. HPO_4^{-2} and PO_4^{-3}
B. $\text{H}_2\text{PO}_4^{-1}$ and HPO_4^{-2} D. H_3PO_4 and PO_4^{-3}

24. A buffer is prepared from lactic acid (HLac , $K_a = 1.41 \times 10^{-4}$) and sodium lactate (Lac^-) such that $[\text{HLac}] = [\text{Lac}^-] = 0.05 \text{ M}$. What is the pH of this buffer solution?

- A. 2.95
B. 3.50
C. 3.85
D. 4.20

25. What is the pH of a solution in which you dissolve 5.00 g of NaOH in 250 mL of water? Assume no change in volume upon addition of the salt.

- A. 0.50 C. 13.7
B. 0.30 D. 12.6
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26. What is the solubility product constant, K_{sp} , for a 0.0195 M solution of calcium hydroxide?

A. 2.96×10^{-5}

C. 7.41×10^{-6}

B. 1.95×10^{-2}

D. 1.48×10^{-5}

27. A student determined the K_{sp} of manganese(II) hydroxide to be 2.3×10^{-13} . A reference source lists the K_{sp} as 1.9×10^{-13} . What is the percent error?

A. 98%

B. 7.8%

C. 54%

D. 21%

28. Which of the following best represents the K_{sp} expression for the dissociation of aluminum sulfate?

A. $K_{sp} = [Al^{+3}]^2 \times [SO_4^{-2}]^3$

C. $K_{sp} = [Al] \times [SO_4]$

B. $K_{sp} = [Al^{+3}] \times [SO_4^{-2}]$

D. $K_{sp} = [Al^{+3}]^3 \times [SO_4^{-2}]^2$

29. What is the molar solubility of the salt AgBr? The solubility product constant, $K_{sp} = 5.0 \times 10^{-13}$.

A. 5.0×10^{-13} M

C. 1.0×10^{-12} M

B. 7.1×10^{-7} M

D. 2.5×10^{-25} M

30. Which of the following is most soluble in water at 25 °C?

- A. $\text{Co}(\text{OH})_2$, $K_{\text{sp}} = 5.92 \times 10^{-15}$
- B. MgF_2 , $K_{\text{sp}} = 5.16 \times 10^{-11}$
- C. BaF_2 , $K_{\text{sp}} = 2.45 \times 10^{-5}$
- D. Ag_2SO_4 , $K_{\text{sp}} = 1.20 \times 10^{-5}$

31. An aqueous solution of $\text{Ba}(\text{OH})_2$ is often used as a reagent in chemistry lab. What is the molar solubility? The solubility product constant, K_{sp} , of $\text{Ba}(\text{OH})_2$ in water is 5.0×10^{-3} .

- A. 0.035 M
- B. 0.0012 M
- C. 0.010 M
- D. 0.11 M

32. Which of the following best represents the reaction that occurs for a positive sodium hydroxide test?

- A. $2\text{NaOH} (aq) + \text{MgSO}_4 (aq) \rightarrow \text{Mg}(\text{OH})_2(s) + \text{Na}_2\text{SO}_4 (aq)$
- B. $2\text{NaOH} (aq) + \text{MgSO}_4 (s) \rightarrow \text{Mg}(\text{OH})_2(aq) + \text{Na}_2\text{SO}_4 (aq)$
- C. $\text{NaOH} (aq) + \text{MgSO}_4 (aq) \rightarrow \text{MgOH}(s) + \text{NaSO}_4 (aq)$
- D. $\text{NaOH} (aq) + \text{MgSO}_4 (aq) \rightarrow \text{Mg}(\text{OH})_2(s) + \text{NaSO}_4 (s)$

33. Various qualitative tests were performed on an unknown sample and the following results were obtained:

1. The unknown was soluble in water.
2. It had a pH ranging from 10-12.
3. It bubbled when mixed with vinegar

Based on this information, what is the identity of the unknown?

- A. sucrose
 - B. sodium hydroxide
 - C. sodium carbonate
 - D. magnesium sulfate
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34. Various qualitative tests were performed on an unknown sample and the following results were obtained:
1. The unknown was soluble in water.
 2. It had a pH ranging from 6-7.
 3. It was soluble in 2 M NaOH.
 4. Turned green with a flame test.

Based on this information, what is the identity of the unknown?

- A. sodium chloride
- B. boric acid
- C. sucrose
- D. calcium sulfate

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35. Which of the following would result in a positive vinegar test?

- | | |
|----------------------|-------------------------|
| A. calcium carbonate | C. potassium bitartrate |
| B. calcium sulfate | D. sodium borate |
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FA 2012

CHE 113 Final Exam	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Key	C	A	D	B	A	B	A	D	B	A	D	D	B	C	A	D	B	C	C	C	D	B	B	C	C	A	D	A	B	C	D	A	C	B	A