

READ THESE DIRECTIONS CAREFULLY BEFORE STARTING THE EXAMINATION!

It is *extremely* important that you fill in the answer sheet EXACTLY as indicated, otherwise your answer sheet may not be processed; ALL entries are to be made on SIDE 1 of the answer sheet. Use a #2 pencil (or softer); fill in the circles completely and firmly. Erasures must be complete. Use only the following categories:

NAME:	Print your name starting at the first space, LAST NAME first, then a space, followed by your FIRST NAME, then another space, followed by your MIDDLE INITIAL. Fill in the <u>correct</u> circles below your printed name corresponding to the letters of your name; for the spaces, fill in the top blank circle.
STUDENT NUMBER:	This is VERY IMPORTANT! Under IDENTIFICATION NUMBER, put in your 8 DIGIT STUDENT ID NUMBER (do not use the 9 at the beginning of your number) beginning in column A and continuing through column H, column I will be blank, (do NOT use column J at this time); be sure to fill in the correct circles (a common error to be avoided is mistaking "0" for "1").
TEST FORM:	Fill in the "2" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination II).
SPECIAL CODES:	Use for course and section number; in positions K-P write in your course and section: Dr. April French 113-xxx
SIGNATURE:	You MUST sign the examination answer sheet (bubble sheet) on the line directly above your printed name. Use your legal signature.

Answering Questions:

Starting with answer "1" on SIDE 1, fill in the circle indicating the one best answer for each of the **30 questions** in this examination. Your score is the sum of the appropriate credit for each response. On the day following the examination, an examination key will be posted on Blackboard.

Grading and Reporting:

The examination scores will be posted in Blackboard as soon as possible after the examination. If an error has occurred in scoring your answers, inform your instructor within 48 hours of the posting of your score.

BE SURE THAT YOUR TEST HAS 30 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may NOT use your own scratch paper during this examination. Cell phones, computer, and pagers are to be turned off and out of sight during the exam. **All** exam paper, scratch paper, and scantrons must be handed in at the end of the exam. You may **not** take any exam materials away from the exam room.

Questions 1 – 10 cover material from the Midterm Exam

1. Which of the following students is correctly dressed for lab?

Student 1: UK t-shirt, blue shorts, Nike tennis shoes

Student 2: Old Navy pull-over, denim jeans, flip-flops

Student 3: Pink halter top, white shorts, flip-flops

Student 4: tye-dye t-shirt, denim jeans, New Balance tennis shoes

A. Student 1

C. Student 3

B. Student 2

D. Student 4

2. You measured out the amount of liquid shown in the 10-mL graduated cylinder shown below. A section of the graduated cylinder, which includes the meniscus of the solution, is enlarged for illustrative purposes. Which of the following measurements should you record in your lab notebook?



A. 3.3 mL

C. 3 mL

B. 3.34 mL

D. 3.4 mL

3. In lab, you did a titration of an acid and a base. The waste disposal instructions say to dispose of a neutral solution with excess water down the drain. How do you know the solution is neutral?

A. Trust that it is a neutral pH.

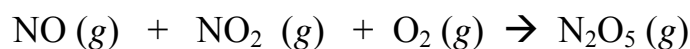
B. Ask your TA.

C. Measure the solution with a temperature probe.

D. Measure the pH with litmus paper.

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4. Which of the following does not obey the octet rule?
- A. SCN^- C. XeF_2
B. PCl_3 D. SiH_4
-
5. How many grams of diphenyl ($\text{C}_{12}\text{H}_{10}$) must be dissolved in 655 g of benzene to lower the freezing point by 3.20°C ? The normal freezing point of benzene is 5.5°C and its K_f is $5.12^\circ\text{C}/\text{m}$.
- A. 161 g C. 108 g
B. 63.1 g D. 6.31×10^4 g
-
6. What is the freezing point depression when 85.3 g of oxygen gas is dissolved in 1500 g of water? The freezing point depression constant for water is $1.86^\circ\text{C}/\text{m}$.
- A. $3.29 \times 10^{-3}^\circ\text{C}$ C. 3.31°C
B. 1.67°C D. 6.61°C
-

7. Given the following experimental data, what is the experimentally determined rate law for the following reaction?



Trial	[NO]	[NO ₂]	[O ₂]	Rate (M/s)
1	0.10	0.10	0.10	2.1×10^{-2}
2	0.20	0.10	0.10	4.2×10^{-2}
3	0.20	0.30	0.20	1.26×10^{-1}
4	0.10	0.10	0.20	2.1×10^{-2}

- A. $\text{Rate} = k[\text{NO}][\text{NO}_2][\text{O}_2]$ C. $\text{Rate} = k[\text{NO}][\text{NO}_2]$
B. $\text{Rate} = k[\text{NO}]^2[\text{NO}_2]$ D. $\text{Rate} = k[\text{NO}][\text{N}_2\text{O}_5]$
-

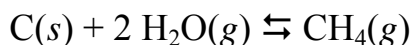
8. For the reaction $A + B \rightarrow C$, the rate constant at 215°C is 5.0×10^{-3} and at 452°C the rate constant is 1.2×10^{-1} . What is the activation energy in kJ/mol ?

- A. 10.8 kJ/mol C. -39.4 kJ/mol
B. 39.4 kJ/mol D. 0 kJ/mol

9. Consider the equilibrium, $\text{IO}_4^-(aq) + 2\text{H}_2\text{O}(l) \rightleftharpoons \text{H}_4\text{IO}_6^-(aq)$, $K_c = 3.5 \times 10^{-2}$. If you start with 20.0 mL of a 0.905 M solution of NaIO_4 , and then dilute it with water to 250.0 mL , what is the concentration of H_4IO_6^- at equilibrium?

- A. 0.00244 M C. 0.00236 M
B. 0.0724 M D. 0.0306 M

10. Coal, which is primarily carbon, can be converted to natural gas, primarily CH_4 , by the following exothermic reaction:

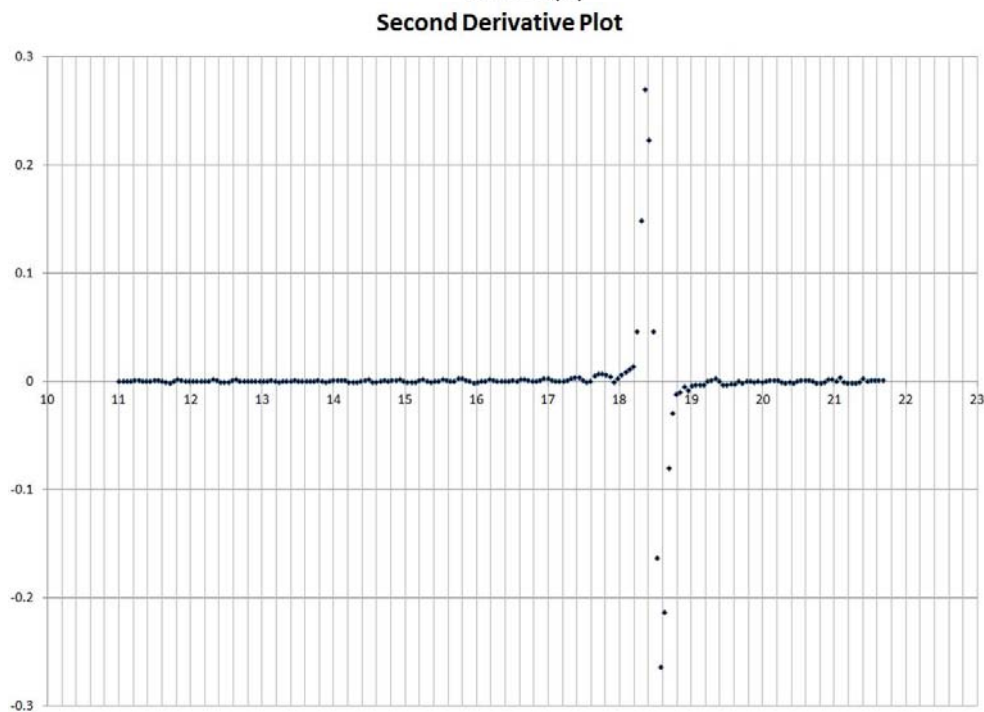
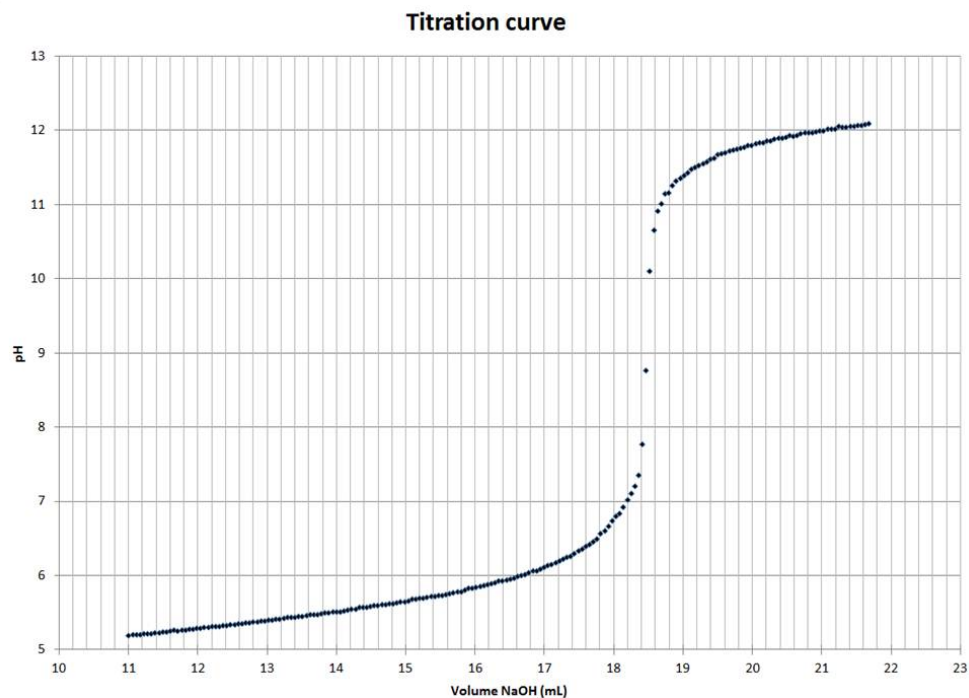


Which of the following will favor CH_4 at equilibrium?

- A. Raising the temperature of the reaction mixture.
B. Adding neon gas to the reaction mixture.
C. Lowering the volume of the reaction mixture.
D. Adding CH_4 to the reaction mixture.
-

Questions 11 – 30 cover material after the Midterm Exam

11. In lab, you measured out 0.7593g of potassium hydrogen phthalate ($\text{KHC}_8\text{H}_4\text{O}_4$) and titrated it with NaOH of unknown concentration. Plotting your data produced the following graphs:



What is the concentration of NaOH?

- A. 0.201 M C. 0.238 M
B. 0.101 M D. 0.401 M
-

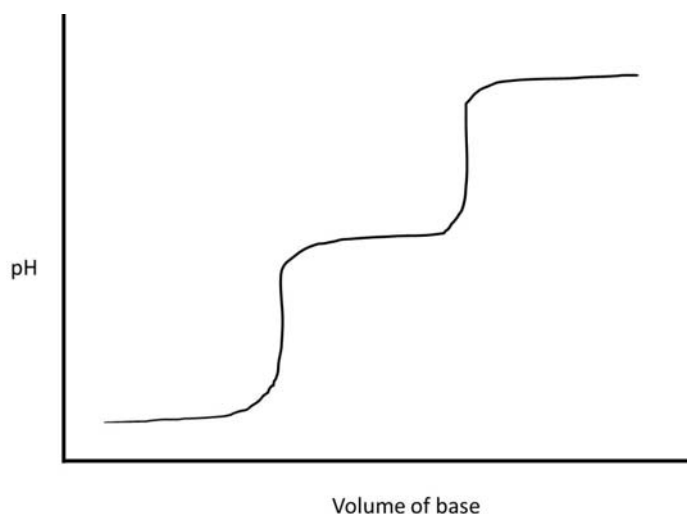
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12. In lab, you titrated three samples of sodium hydroxide that were obtained from the same container. The following molarities were determined based on the titrations performed:

0.199 M, 0.197 M, 0.198 M

The solution's known concentration was 0.2741M. How would you describe the molarities determined experimentally?

- A. Precise and accurate C. Precise, not accurate
B. Not precise, but accurate D. Not precise, not accurate

-
13. Based on the following titration curve, how would you classify the acid?



- A. Monoprotic C. Triprotic
B. Diprotic D. None of the above

-
14. Which of the following statements are true for a 0.10 M solution of the weak acid $\text{CH}_3\text{CO}_2\text{H}$ in water?

- A. $\text{pH} = 1.00$ C. $[\text{H}_3\text{O}^+] = [\text{CH}_3\text{COO}^-]$
B. $[\text{H}_3\text{O}^+] \gg [\text{CH}_3\text{COO}^-]$ D. $\text{pH} < 1.00$
-

15. Potassium hydrogen phthalate (KHP) is used as a primary standard in titrations. Why is a primary standard used in a titration?

- A. To determine the concentration of a solution that may have absorbed water.
- B. To take up time in the lab.
- C. To test your ability to titrate.
- D. To determine approximately where the equilibrium is for the reaction of interest.

16. Which of the following is NOT a conjugate acid-base pair?

- A. $\text{NH}_4^+ / \text{NH}_3$
- B. HCN / CN^-
- C. $\text{H}_3\text{O}^+ / \text{OH}^-$
- D. $\text{HNO}_3 / \text{NO}_3^-$

17. A 150.0 mL solution contains 2.94 g of sodium benzoate ($\text{NaC}_7\text{H}_5\text{O}_2$) and 4.29 g of benzoic acid ($\text{HC}_7\text{H}_5\text{O}_2$). What is the pH of the solution? The K_a of benzoic acid is 6.5×10^{-5} .

- A. 3.95
- B. 0.235
- C. 7.00
- D. 4.42

18. Consider a solution which is 0.15 M HF and 0.10 M KF. Which response contains all true statements?

- I. If NaOH is added, potassium ion reacts with hydroxide ion.
- II. If a small amount of NaOH is added, the pH increases very slightly.
- III. If HNO_3 is added, hydrogen ion reacts with fluoride ion.
- IV. If more KF is added, the pH decreases.

- A. I, III, and IV
 - B. II and III
 - C. II and IV
 - D. Another combination
-

19. The $[\text{H}_3\text{O}^+]$ is 2.0×10^{-4} M for a 0.020 M solution of a weak acid. Calculate the pK_a for this acid.

- A. 1.70
B. 4.69
C. 2.00
D. 5.70

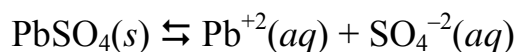
20. Which of the following acids, when paired with its conjugate base, would make the best choice for creating a buffer at a pH of 9?

- A. CH_3COOH , $K_a = 1.8 \times 10^{-5}$
B. HCOOH , $K_a = 1.8 \times 10^{-4}$
C. HOI , $K_a = 2.3 \times 10^{-11}$
D. HBO_2 , $K_a = 6.0 \times 10^{-10}$

21. In order to calculate the solubility product constant, K_{sp} , for calcium hydroxide, you prepared a saturated solution and filtered the solution the following week. Why was the solution filtered?

- A. To remove excess calcium hydroxide.
B. To remove impurities from the solution.
C. So there won't be any huge chunks of calcium hydroxide in the solution.
D. We didn't filter the solution.

22. Which of the following is the correct solubility product expression for the following reaction?



- A. $\frac{[\text{Pb}^{+2}][\text{SO}_4^{-2}]}{[\text{PbSO}_4]}$
B. $\frac{[\text{PbSO}_4]}{[\text{Pb}^{+2}][\text{SO}_4^{-2}]}$
C. $[\text{Pb}^{+2}][\text{SO}_4^{-2}]$
D. $[\text{PbSO}_4]$

23. What is the solubility product, K_{sp} , for the dissolution of strontium fluoride if the

solubility of SrF_2 in water is 8.5×10^{-4} mol/L?

- A. 8.5×10^{-4} C. 6.14×10^{-4}
B. 2.47×10^{-9} D. 1.00

24. In lab you prepared a saturated solution of calcium hydroxide. Which of the following statements are true about the amount of solute?

- A. You do not need to know the exact mass of solute because you will filter out some anyway.
B. You do not need to know the exact mass of solute because we are interested in determining the solubility product constant of the solvent.
C. You need to know the exact mass of solute in order to determine the concentration of calcium hydroxide.
D. You need to know the exact mass of solute so we can determine the equilibrium constant.

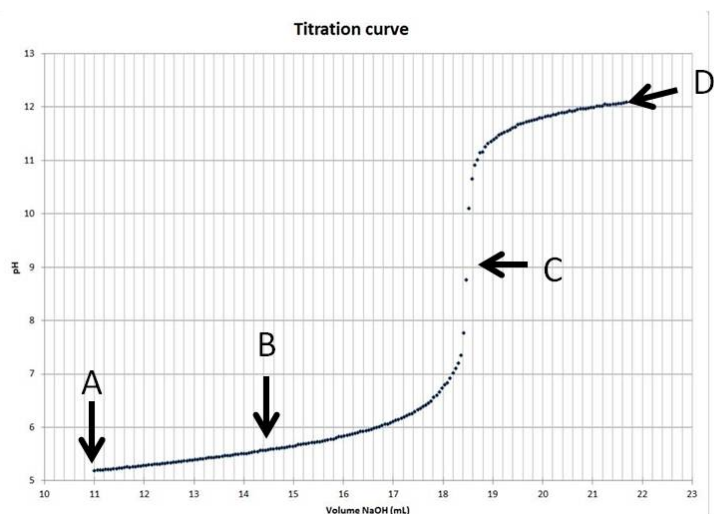
25. In lab, you conducted a vinegar test by adding 10 to 20 drops of vinegar to your unknown solids. What were you testing for in this reaction?

- A. The change in pH. C. The presence of carbonate or bicarbonate.
B. The presence of starch. D. The presence of vinegar.

26. Which of the following equations correctly represents the reaction of 2M NaOH?

- A. $\text{MgSO}_4(aq) + 2\text{NaOH}(aq) \rightarrow \text{Mg}(\text{OH})_2(s) + \text{Na}_2\text{SO}_4(aq)$
B. $\text{MgSO}_4(aq) + 2\text{NaOH}(aq) \rightarrow \text{Mg}(\text{OH})_2(aq) + \text{Na}_2\text{SO}_4(aq)$
C. $\text{CaCO}_3(aq) + 2\text{NaOH}(aq) \rightarrow \text{Na}_2\text{CO}_3(s) + \text{Ca}(\text{OH})_2(aq)$
D. $\text{CaCO}_3(aq) + 2\text{NaOH}(aq) \rightarrow \text{Na}_2\text{CO}_3(l) + \text{Ca}(\text{OH})_2(aq)$

27. Which of the following locations indicate the equivalence point within a titration curve?



- | | | | |
|----|---|----|---|
| A. | A | C. | C |
| B. | B | D. | D |

28. What is the pH of a 0.10 M $\text{Mg}(\text{OH})_2$ solution?

- | | | | |
|----|-------|----|-------|
| A. | 0.70 | C. | 14.00 |
| B. | 12.56 | D. | 13.30 |

29. What is the pH of Pepsi Cola if the concentration of the H_3O^+ ion in the solution is 0.0035 M?

- | | | | |
|----|------|----|------|
| A. | 2.45 | C. | 3.50 |
| B. | 7.00 | D. | 1.00 |

30. Which of the following will show a positive result for the iodine test?

- | | | | |
|----|-------------------|----|-----------------|
| A. | Calcium carbonate | C. | Sucrose |
| B. | Sodium hydroxide | D. | Glucose polymer |

CHE 113 Final Exam Key FA 11

1. D
2. B
3. D
4. C
5. B
6. C
7. C
8. B
9. A
10. C
11. A
12. C
13. B
14. C
15. A
16. C
17. A
18. B
19. D
20. D
21. A
22. C
23. B
24. A
25. C
26. A
27. C
28. D
29. A
30. D