# CHE 113 MIDTERM EXAMINATION March 1, 2012

**University of Kentucky Department of Chemistry**

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 correct 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 "1" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination I). |
| SPECIAL CODES: | Use for course and section number; in positions K-P write in your course and section:<br>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 **25 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 25 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.

1. Which one of the following does not belong in lab?

A. Lab notebook
B. Beaker
C. Gloves
D. Starbucks cup

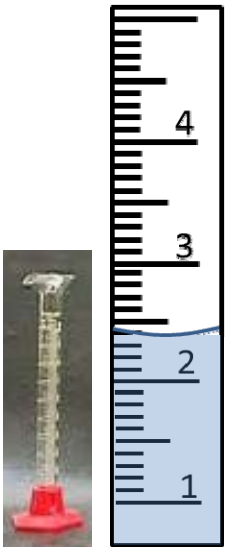
2. In the laboratory, MSDS stands for

A. Management, Storage, and Disposal of Solvents
B. Materials, Standards, Doses and Sizes
C. Modern Standards Developed in Science
D. Material Safety Data Sheet

3. What piece of laboratory equipment is best-suited for accurately measuring the volume of a liquid?

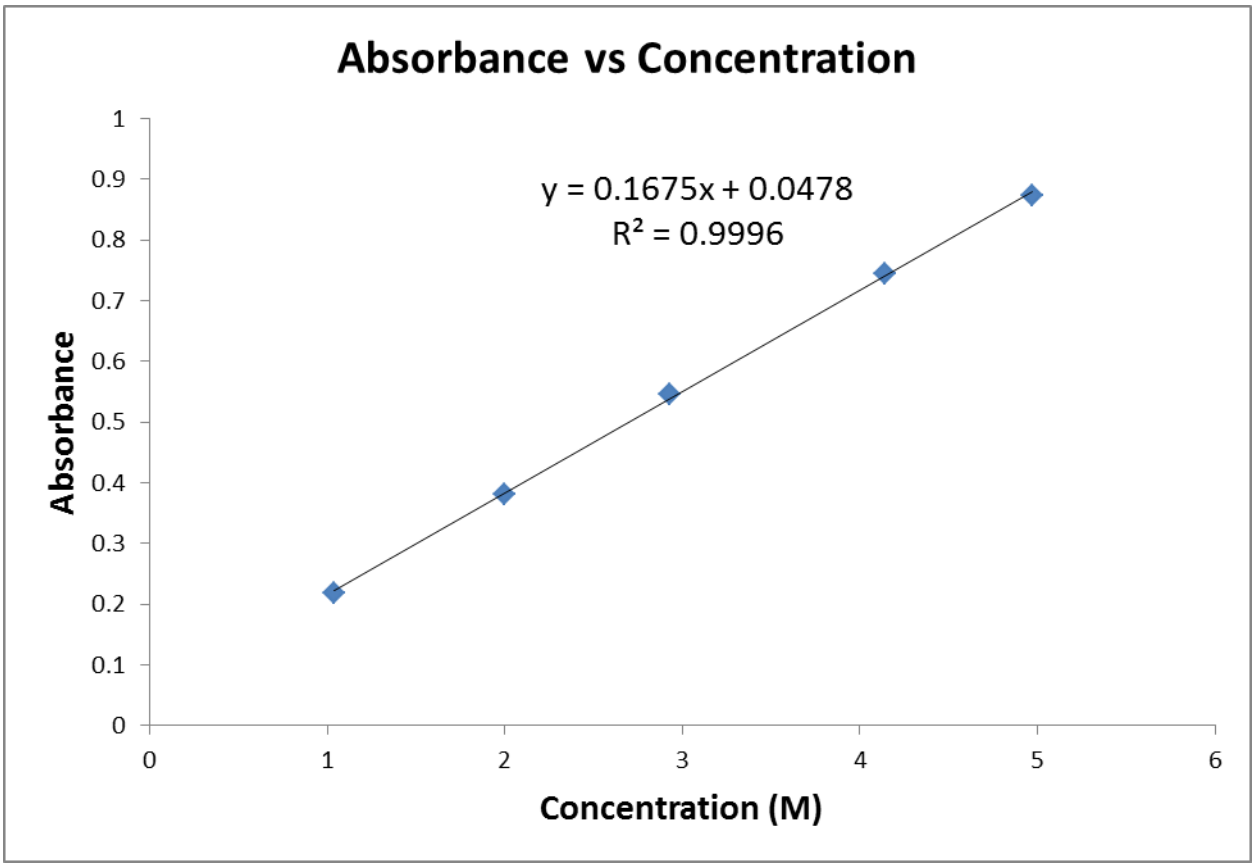
A. Graduated cylinder
B. Beaker
C. Erlenmeyer flask
D. Volumetric pipet

4. A 10-mL graduated cylinder, shown in picture, was used to measure the volume of a liquid reagent added to the reaction flask. A section of the graduated cylinder, which includes the meniscus of the solution, is enlarged for illustrative purposes. How many significant figures should be shown in this measurement?



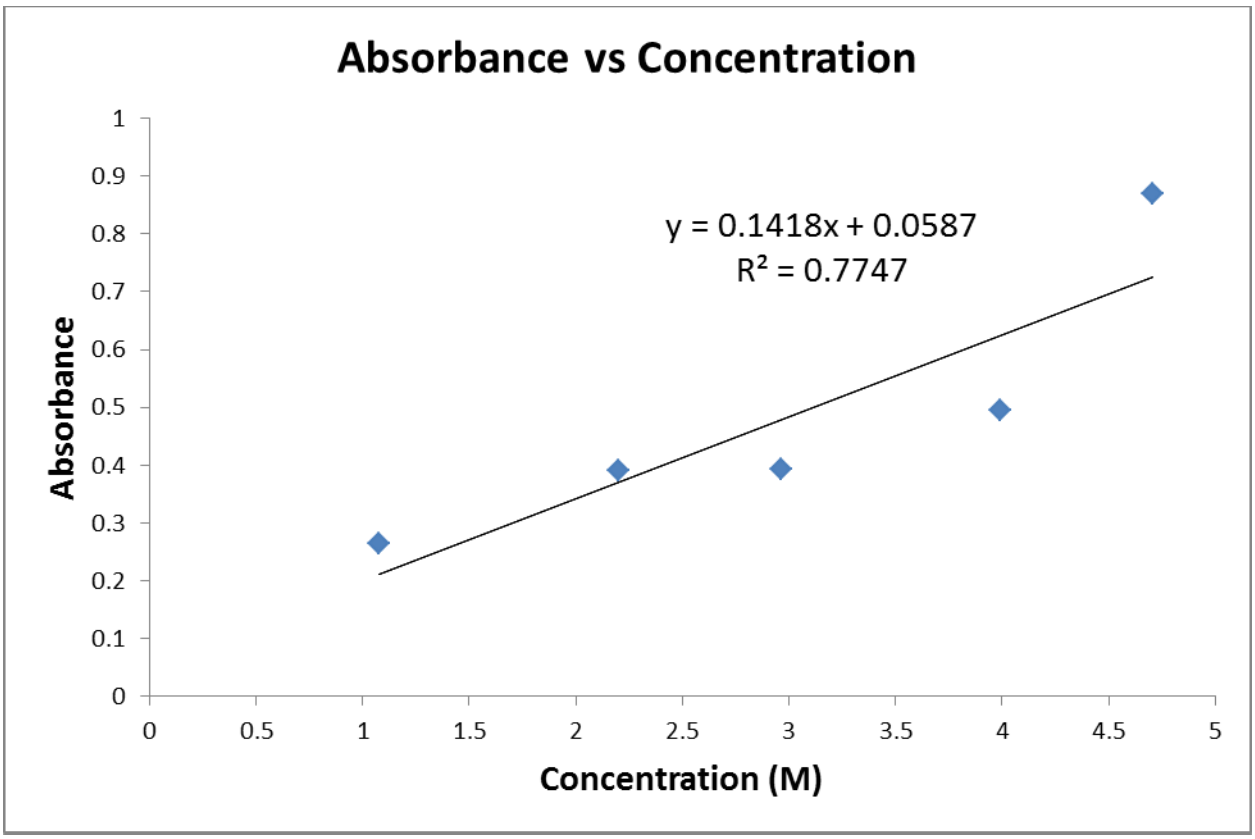

A. 1
B. 3
C. 2
D. 4

5. Using the following graph, what is the concentration of a solution whose absorbance is 0.268?




A. 1.31 M
B. 1.56 M
C. 0.0926 M
D. 0.167 M

6. In the following graph, what does the $R^2$ value of 0.7747 tell us?




A. The data points are close to the line.
B. The data points vary in distance from the line.
C. The data points vary greatly in distance from the line.
D. The data is horrible and the experiment should be done again.

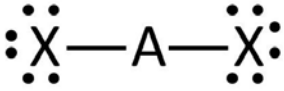
7. Which of the following compounds is paired with the wrong number of total valence electrons?

A. $PCl_3F_2$ 40 $e^-$
B. $TeCl_4$ 34 $e^-$
C. $Ba(NO_3)_2$ 26 $e^-$
D. $XeOF_2$ 28 $e^-$

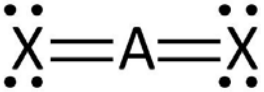
8. What is the molecular geometry of $\mathbf{ICl_4^+}$ ?

A. Trigonal bipyramidal
B. T-shaped
C. Bent
D. Seesaw

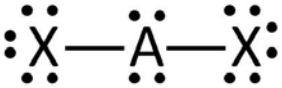
9. Which of the following should not be linear?



I



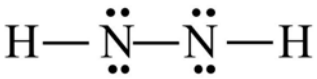
II

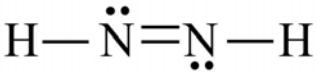


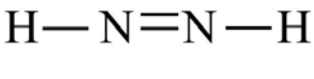
III

A. Only I
B. Only II
C. Only III
D. Both I and II

10. Which one of the following is the correct Lewis structure for $N_2H_2$?

A. 

B. 

C. 

D. 

11. Which one of the following compounds has the largest number of electron groups?

A. $IF_3$
B. $SF_2$
C. $CF_4$
D. $XeF_2$

12. How many grams of ethylene glycol, $HOC_2H_4OH$, should be added to 1.5 kg of water to prepare a 0.44 m ethylene glycol solution?

A. 18 g
B. 41 g
C. 0.66 g
D. 62 g

13. A solution was prepared by adding 6.34 grams of sucrose ($C_{12}H_{22}O_{11}$) to 250. mL of ethanol ($C_2H_6O$). What is the freezing point of this solution? The normal freezing point of ethanol is –114.1ºC and its freezing point depression constant is 1.99 ºC/m. The density of ethanol is 0.789 g/mL.

A. –114.1ºC
B. –113.9 ºC
C. –116.7 ºC
D. –114.3 ºC

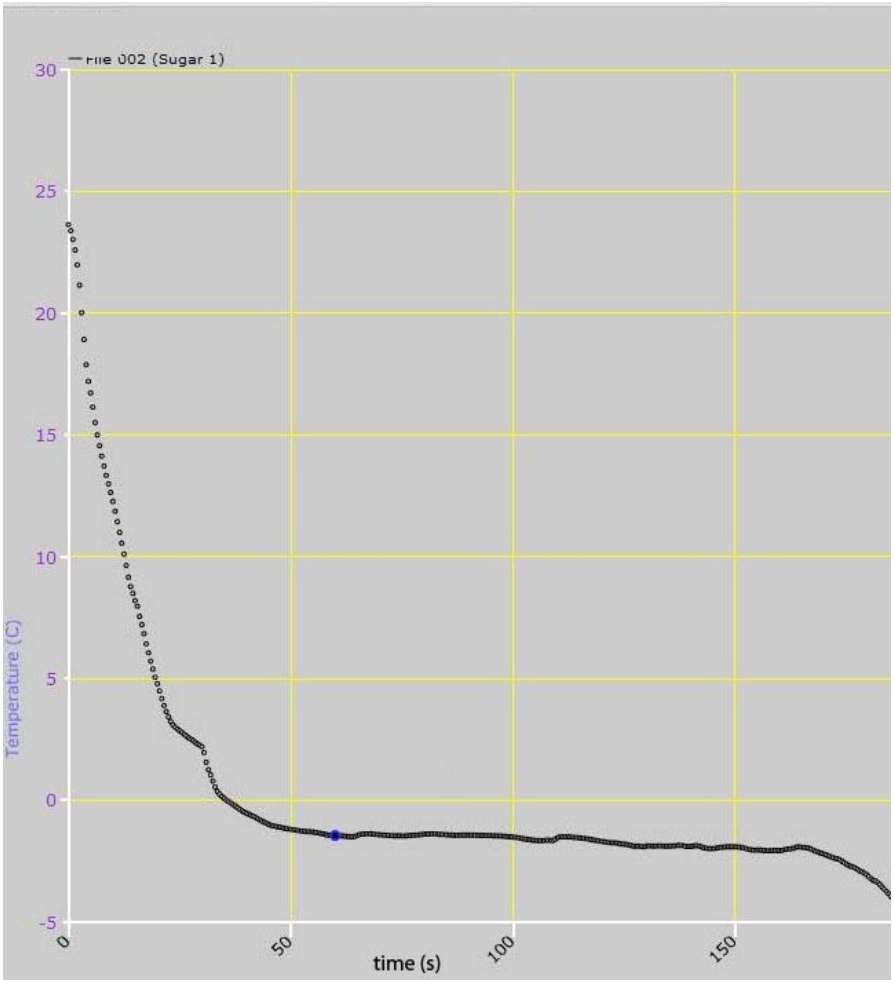
14. An aqueous solution containing 35.9 g of an unknown molecular (nonelectrolyte) compound in 150.0 g of water was found to have a freezing point of –1.3ºC. What is the molar mass of the unknown compound? The freezing point depression constant of water is 1.86 ºC/m.

A. 342 g/mol
B. 445 g/mol
C. 0.105 g/mol
D. 103 g/mol

15. Which one of the following is expected to have the largest van't Hoff factor?

A. $C_{12}H_{22}O_{11}$
B. $NaNO_3$
C. $MgF_2$
D. KCl

16. The following data was collected from a sugar solution. What is the freezing point of the solution?




A. –1.25 ºC
B. 0.00 ºC
C. –3.01 ºC
D. 2.08 ºC

17. Consider the following reaction for the decomposition of hydrogen peroxide:

$$2H_2O_2 \rightleftharpoons 2H_2O + O_2$$

If the rate of change in $H_2O_2$, $\frac{\Delta[H_2O_2]}{\Delta t}$, at a particular time is –3.0 M/s, what is the rate of change of $O_2$, $\frac{\Delta[O_2]}{\Delta t}$, at the same time?

A. +3.0 M/s
B. +1.5 M/s
C. –3.0 M/s
D. –6.0 M/s

18. The following rate data was found for the reaction of nitric oxide with hydrogen gas.

$$2NO + 2H_2 \rightarrow N_2 + 2H_2O$$

| [NO] | $[H_2]$ | rate |
|---|---|---|
| 0.420 | 0.122 | 0.136 |
| 0.210 | 0.122 | 0.0339 |
| 0.210 | 0.244 | 0.0678 |
| 0.105 | 0.488 | 0.0339 |

What is the rate law for this reaction?

A. Rate = $k[NO][H_2]^2$
B. Rate = $k[NO][H_2]$
C. Rate = $k[H_2]$
D. Rate=$k[NO]^2[H_2]$

19. A certain first order reaction has a rate constant of $1.75 \times 10^{-1}$ $s^{-1}$ at 20.0ºC. What is the value of k at 60.0ºC if $E_a$ = 55.5 kJ/mol?

Recall:

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

A. 0.0113 $s^{-1}$
B. 0.175 $s^{-1}$
C. 2.70 $s^{-1}$
D. 6.54 $s^{-1}$

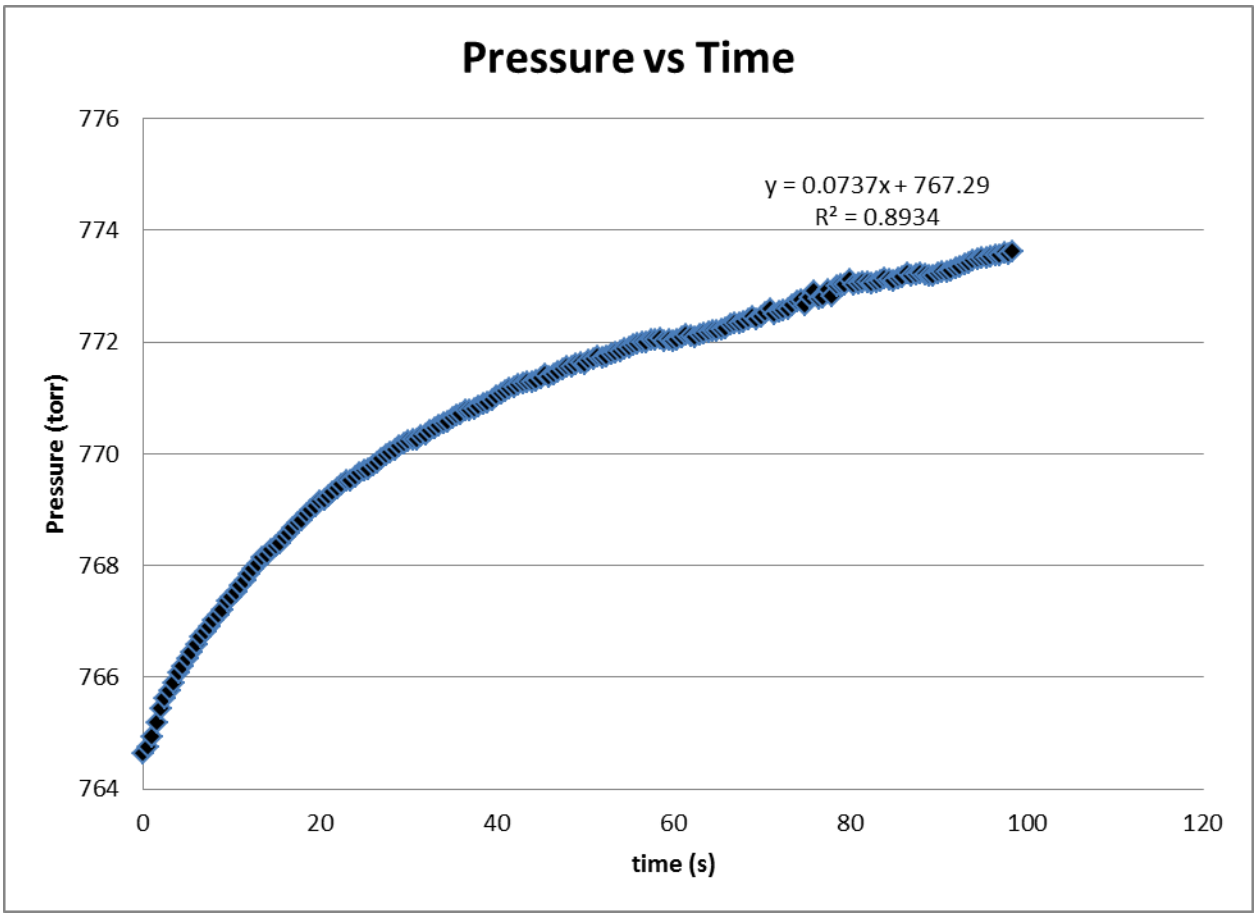
20. What happens to the activation energy when a catalyst is added to a reaction?

A. The activation energy increases.
B. The activation energy decreases.
C. The activation energy does not change.
D. The activation energy inverts.

21. The following graph was obtained during the decomposition of hydrogen peroxide at 21ºC using 4.11 mL $H_2O_2$ , 0.51 mL KI, and 0.59 mL $H_2O$.

$$2H_2O_2 \rightleftharpoons 2H_2O + O_2$$

What is the molar rate constant for the decomposition of hydrogen peroxide?




A. $4.02 \times 10^{-6}$ M/s
B. $3.05 \times 10^{-3}$ M/s
C. $2.48 \times 10^{5}$ M/s
D. $4.18 \times 10^{-2}$ M/s

22. Initially 1.50 moles of $N_2(g)$ and 3.5 moles of $H_2(g)$ were added to a 1L container at 700ºC. As a result of the reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3$$

the equilibrium concentration of $NH_3(g)$ became 0.540 M. What is the value of the equilibrium constant for this reaction at the given temperature of 700 ºC.

A. 0.163
B. 0.0122
C. 82.1
D. 0.00245

23. Consider the following equilibrium:

$$C(s) + H_2O(g) \rightleftharpoons CO\ (g) + H_2(g)$$

The contents of a 1.00 L container at equilibrium were analyzed and found to contain 0.20 mole C, 0.20 mole $H_2O$, 0.60 mole CO, and 0.60 mole $H_2$. What is the equilibrium constant?

A. 0.11
B. 0.56
C. 1.8
D. 0.0

24. In the following reaction, how does the addition of $SCN^-$ $(aq)$ change the equilibrium?

$$Fe^{+3}(aq) + SCN^-(aq) \rightleftharpoons FeSCN^{+2}(aq)$$

A. Shifts to the left
B. Shifts to the right
C. No change in the equilibrium
D. Increases pressure

25. How many grams of glucose ($C_6H_{12}O_6$) do you need to prepare 35.5 mL of a 3.52 M glucose solution?

A. 17.8 grams
B. 1.82 grams
C. 22500 grams
D. 22.5grams

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1. D
2. D
3. D (thrown out)
4. B
5. A
6. B
7. C
8. D
9. C
10. B
11. A & D
12. B
13. D
14. A
15. C
16. A
17. B
18. D
19. C
20. B
21. A
22. B
23. C
24. B
25. D