

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 test 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 <b>VERY IMPORTANT!</b> Under IDENTIFICATION NUMBER, put in your <b>8 DIGIT STUDENT ID NUMBER</b> (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 one of the following:  <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Dr. Woodrum</td> <td>107-001, 107-002</td> </tr> <tr> <td>Mr. Harris</td> <td>107-003, 107-004</td> </tr> <tr> <td>Dr. Ades</td> <td>107-401</td> </tr> </table>	Dr. Woodrum	107-001, 107-002	Mr. Harris	107-003, 107-004	Dr. Ades	107-401
Dr. Woodrum	107-001, 107-002						
Mr. Harris	107-003, 107-004						
Dr. Ades	107-401						
SIGNATURE:	You <b>MUST</b> 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. The day after 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 been made in scoring your answers, tell 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 and pagers are to be turned off and out of sight during the exams.



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6. Which of the following is **false** concerning sublimation?

- A. The reverse process of sublimation is deposition.
- B. At pressures below the triple point, substances can sublime.
- C. Dry ice (frozen  $\text{CO}_2$ ) can be liquefied at pressures above the triple point pressure.
- D. Ice cannot sublime.

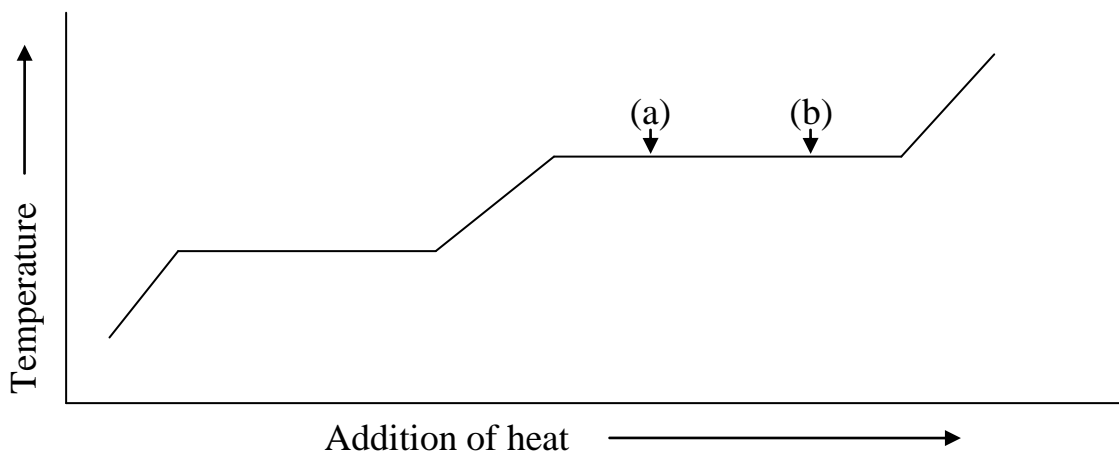
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7. How much ice would have to melt to lower the temperature of  $3.00 \times 10^2$  g of water from  $50.0^\circ\text{C}$  to  $0.0^\circ\text{C}$ ? The water will be a liquid at  $0.0^\circ\text{C}$ ? The specific heat capacity of water is  $4.18 \text{ J/g}^\circ\text{C}$  and the heat of fusion of ice is  $6.02 \text{ kJ/mol}$ .

- A.  $1.10 \times 10^3$  g
- B. 337 g
- C. 187 g
- D. 104 g

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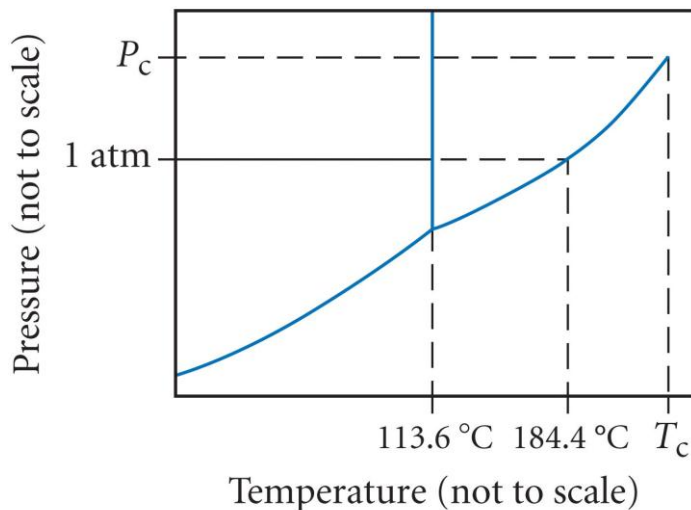
8. As heat is added to the system, what occurs from point (a) to point (b)?



- A. A solid is melting.
  - B. A liquid is boiling.
  - C. A liquid is increasing in temperature.
  - D. A gas is decreasing in temperature.
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9.



Above is the phase diagram for iodine. What state is present at room temperature and normal atmospheric pressure?

- A. Liquid
- B. Solid
- C. Gas
- D. Both solid and liquid in equilibrium

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10. A metal that crystallizes with a face-centered cubic structure has a density of  $22.67 \text{ g/cm}^3$  and an edge length of 383.3 pm. What is the molar mass of the metal?

- A. 175.0 g/mol
- B. 95.94 g/mol
- C. 39.10 g/mol
- D. 192.2 g/mol

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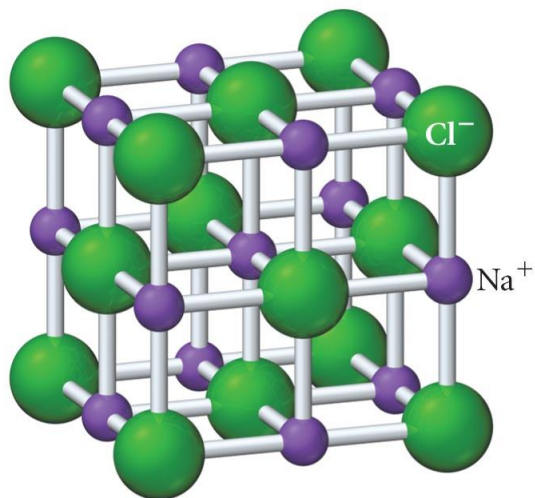
11. What type of crystalline solid is soft with a relatively low melting point and does not conduct electricity?

- A. Metallic solid
  - B. Ionic solid
  - C. Molecular solid
  - D. Network covalent solid
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12.

Sodium chloride (NaCl)



A unit cell of NaCl is shown above. How many Na<sup>+</sup> ions are in the cell?

- A. One  
B. Two  
C. Three  
D. Four

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13. Which of the following solutes would you expect to be **most** soluble in C<sub>6</sub>H<sub>14</sub> (hexane)?

- A. HCl  
B. Br<sub>2</sub>  
C. NH<sub>3</sub>  
D. SO<sub>2</sub>

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14. Gases are more soluble in water at \_\_\_\_\_ temperature and \_\_\_\_\_ partial pressure of the gas above the water and most solids are more soluble in water at \_\_\_\_\_ temperature.

- A. low temperature, high partial pressure, high temperature  
B. low temperature, low pressure, low temperature  
C. high temperature, low pressure, low temperature  
D. high temperature, high partial pressure, high temperature
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15. Determine the number of grams of oxygen dissolved in 250. mL of water at 25°C if the pressure of oxygen above the water is 0.21 atm. For O<sub>2</sub> at 25°C,  $k_H = 1.3 \times 10^{-3}$  M/atm.

A.  $2.9 \times 10^{-4}$  g

C.  $2.2 \times 10^{-3}$  g

B.  $4.4 \times 10^{-3}$  g

D.  $1.2 \times 10^{-4}$  g

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16. What is the molality of a 5.83 M aqueous sulfuric acid, H<sub>2</sub>SO<sub>4</sub>, solution? The density of the solution is 1.33 g/mL

A. 4.38 *m*

C. 18.3 *m*

B. 5.83 *m*

D. 7.69 *m*

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17. What is the mass % of a solution prepared by dissolving 98.6 g of NaCl in enough water to form 875 mL. The density of the solution is 1.06 g/mL.

A. 11.3%

C. 10.6%

B. 12.7%

D. 9.4%

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18. A certain hard water sample contains 0.00075% Ca by mass (in the form of Ca<sup>2+</sup>) ions. How many grams of calcium are in a 15.0 L sample of water? The density of water is 1.00 g/mL.

A. 11 g

C. 2.0 g

B. 0.11 g

D. 20. g

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19. What is the vapor pressure, at 25°C, of a solution containing  $4.00 \times 10^2$  g of sucrose, C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>, in  $5.00 \times 10^2$  g of water? The vapor pressure of water at 25°C is 23.76 mmHg, and sucrose is a nonvolatile, nonelectrolyte.

A. 22.8 mmHg

C. 9.60 mmHg

B. 20.8 mmHg

D. 13.2 mmHg

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20. Determine the freezing point of a solution that contains 30.7 g glycerin ( $C_3H_8O_3$ , molar mass = 92.09 g/mol) in 376 mL of water.  $K_f = 1.86^\circ C/m$  for water.

- A.  $-0.887^\circ C$                       C.  $-3.33^\circ C$   
B.  $-0.152^\circ C$                       D.  $-1.65^\circ C$

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21. A solution containing 37.25 mg of an unknown protein per 25.0 mL solution was found to have an osmotic pressure of 4.55 torr at  $25^\circ C$ . What is the molar mass of the protein?

- A.  $1.10 \times 10^2$  g/mol                      C.  $2.23 \times 10^2$  g/mol  
B.  $6.09 \times 10^3$  g/mol                      D.  $4.52 \times 10^3$  g/mol

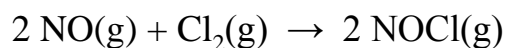
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22. Which one of the following aqueous solutions has the highest boiling point?

- A. 1.0 *m*  $CH_3CH_2OH$                       C. 0.30 *m*  $Ca(NO_3)_2$   
B. 0.70 *m*  $KCl$                               D. 0.20 *m*  $FeCl_3$

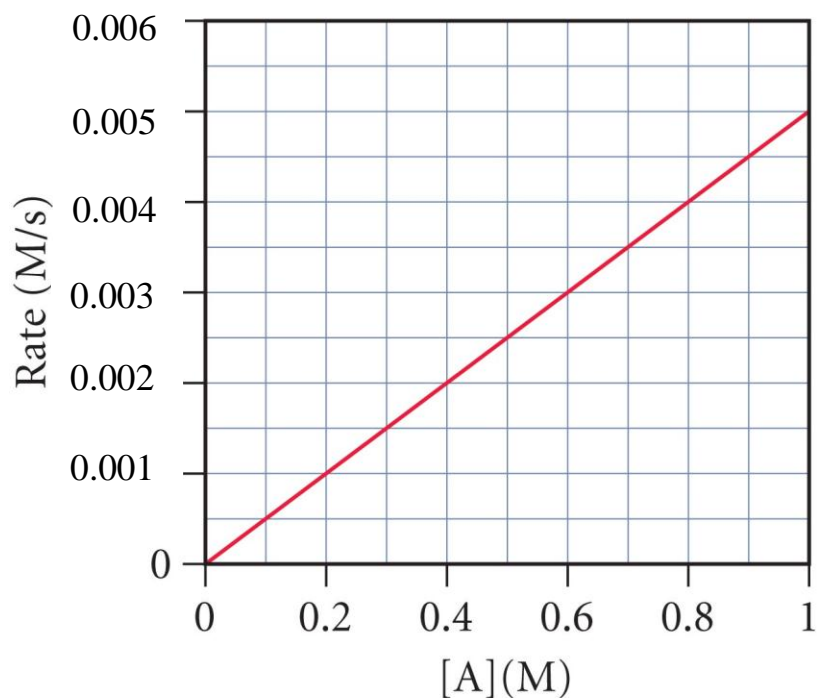
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23. What is the rate of formation of  $NOCl$  at the time that  $Cl_2$  is reacting at a rate of  $4.84 \times 10^{-2}$  M/s in the following reaction?



- A.  $4.84 \times 10^{-2}$  M/s                      C.  $1.45 \times 10^{-1}$  M/s  
B.  $2.42 \times 10^{-2}$  M/s                      D.  $9.68 \times 10^{-2}$  M/s
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24. The graph below shows a plot of the rate of a reaction versus the concentration of the reactant A for the reaction  $A \rightarrow \text{products}$ .



What is the rate law (including value of  $k$ ) for the reaction?

- A. Rate =  $0.005 \text{ s}^{-1} [\text{A}]$                       C. Rate =  $0.001 \text{ M}^{-1}\text{s}^{-1}[\text{A}]^2$   
B. Rate =  $0.005 \text{ M}^{-1}\text{s}^{-1}[\text{A}]^2$                       D. Rate =  $0.001 \text{ s}^{-1}[\text{A}]$
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28. In an Arrhenius plot of the  $\ln k$  versus  $1/\text{temperature}$  in K, the slope of the straight line is  $-5.25 \times 10^3 \text{ K}$  and the y-intercept was 35.5. What is the activation energy of the reaction?

A. 37.8 kJ/mol

C. 295 kJ/mol

B. 43.6 kJ/mol

D. 63.1 kJ/mol

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29. What is the rate law for the reaction  $A_2 + BC \rightarrow AB + AC$  if the following mechanism is an acceptable mechanism for the reaction?

Step 1:  $A_2 \rightleftharpoons 2A$  fast

Step 2:  $A + BC \rightarrow AB + C$  slow

Step 3:  $A + C \rightarrow AC$  fast

A. Rate =  $k[A][BC]$

C. Rate =  $k[A_2][BC]^{1/2}$

B. Rate =  $k[A_2][BC]$

D. Rate =  $k[A_2]^{1/2}[BC]$

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30. A catalyst...

A. increases the rate of a reaction by increasing the activation energy.

B. decreases the rate of a reaction by lowering the activation energy.

C. increases the rate of a reaction by lowering the activation energy.

D. decreases the rate of a reaction by increasing the activation energy.

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CHE 107 SPRING 2011 Exam 1 Key

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