

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 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 one of the following: Dr. Ades 107-001, 107-002
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. The day after the examination is finished, 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.

<p><u>BE SURE THAT YOUR TEST HAS 25 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER.</u> You may <u>NOT</u> use your own scratch paper during this examination. Cell phones and pagers are to be turned off and out of sight during the exams.</p>

-
1. In which of the following cases is the heat of solution **most** exothermic?
- A. when the solute-solvent interaction is stronger than the solute-solute and the solvent-solvent interactions.
 - B. when the solute-solvent interaction is the same strength as the solute-solute and the solvent-solvent interactions.
 - C. when the solute-solvent interaction is weaker than the solute-solute and the solvent-solvent interactions.
 - D. when the solute-solvent interaction is much stronger than the solute-solute and the solvent-solvent interactions.

-
2. Which will be **more** soluble in water than in CCl_4 ?

- 1. NH_3
- 2. CS_2
- 3. C_6H_{14}
- 4. H_2CO

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

-
3. Which of the following are the **major** differences between solutions and colloids? Both are in the liquid state. (Choose the best answer.)

- 1. color of the solution or colloid
- 2. particle size
- 3. interaction with light
- 4. density

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

-
4. What is the molality of a 45.0 % by mass H_3PO_4 solution?

- A. 4.59 *m*
 - B. 12.5 *m*
 - C. 8.35 *m*
 - D. 0.450 *m*
-

5. What is the molality of an aqueous 5.97 M glycerol ($C_3H_8O_3$) solution? The density of the solution is 1.10 g/mL.

A. 3.61 m

C. 7.97 m

B. 5.43 m

D. 10.8 m

6. Which of the following are true?

1. Gases are more soluble in water as the partial pressure of the gas above the liquid increases.
2. Gases are less soluble in water as the temperature increases.
3. Pressure increases greatly affect the solubility of a liquid in another liquid.
4. The solubilities of all ionic compounds in water increase with an increase in temperature.

A. 1 and 2

C. 3 and 4

B. 2 and 3

D. 1 and 4

7. The solubility of nitrogen gas in water at 25°C and a nitrogen pressure of 522 mmHg is 4.4×10^{-4} mol/L. What is the solubility of nitrogen gas in water when the nitrogen partial pressure is increased to 2.00 atm?

A. 1.7×10^{-6} mol/L

C. 0.11 mol/L

B. 1.5×10^{-4} mol/L

D. 1.3×10^{-3} mol/L

8. What is the vapor pressure, in mmHg, of a solution prepared by dissolving 3.00×10^2 g of urea ($(NH_2)_2CO$) (a nonvolatile solute) in 9.00×10^2 g of water at 63.5°C. The vapor pressure of water at 63.5°C is 175 mmHg.

A. 191 mmHg

C. 117 mmHg

B. 15.9 mmHg

D. 159 mmHg

9. A 1.35 *m* aqueous solution of compound X had a freezing point of $-6.8\text{ }^{\circ}\text{C}$. Which of the following **most likely** is compound X? The freezing point constant for water is $1.86^{\circ}\text{C}/\text{m}$.

- A. NaCl
B. MgBr₂
C. C₂H₅OH
D. FeCl₃

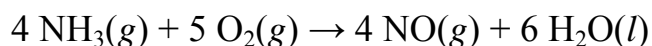
10. A 1.50×10^2 mL sample, at 25°C , of an aqueous solution contains 0.0152 g of an unknown nonelectrolyte compound. The osmotic pressure at 25°C was determined to be 8.44 mmHg. What is the molar mass of the compound?

- A. 446 g/mol
B. 345 g/mol
C. 223 g/mol
D. 72.9 g/mol

11. Which aqueous solution will have the highest boiling point?

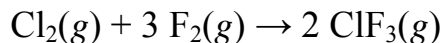
- A. 0.80 *m* C₁₂H₂₂O₁₁
B. 0.40 *m* NH₄Cl
C. 0.25 *m* FeCl₃
D. 0.30 *m* Ca(NO₃)₂

12. What is the rate at which O₂(*g*) is reacting when NH₃(*g*) is reacting at a rate of 0.20 *M*/min according to the following reaction?



- A. 0.25 *M*/min
B. 0.050 *M*/min
C. 1.0 *M*/min
D. 0.16 *M*/min

13. For the **overall** chemical reaction shown below, which of the following statements can you **rightly** assume?



1. The reaction is first-order in Cl₂ and third-order in F₂.
2. The reaction is fourth-order overall.
3. The rate law is $\text{rate} = k[\text{Cl}_2][\text{F}_2]$.
4. The rate law cannot be determined without experimental data.

- A. 1 and 2
B. 1, 2 and 3
C. 4 only
D. 3 only
-

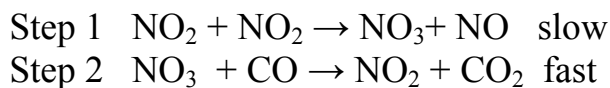
17. The radioactive decay of radon follows first-order kinetics and has a half-life of 3.823 days. How many grams of radon will remain after 12.00 days if the sample initially had a mass of 455 g?

- A. 105 g
B. 24.3 g
C. 39.2 g
D. 51.7 g

18. A reversible reaction was found to have an activation energy of 102.0 kJ/mol in the forward direction and 38.2 kJ/mol in the reverse direction. What is ΔH for the reverse reaction?

- A. 63.8 kJ/mol
B. -63.8 kJ/mol
C. 140.2 kJ/mol
D. -140.2 kJ/mol

19. The following mechanism for the gas phase reaction $\text{NO}_2 + \text{CO} \rightarrow \text{NO} + \text{CO}_2$ has been proposed:



If this is to be a valid mechanism, the experimental rate law for the overall reaction must be:

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

20. A catalyst

1. decreases the activation energy of a reaction.
2. alters the mechanism of the reaction.
3. increases the concentration of the reactants.
4. increases the temperature of the reaction.

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

21. The following mechanism has been proposed for a gas phase reaction.

1. $\text{NO}_2 + \text{SO}_2 \rightarrow \text{NO} + \text{SO}_3$
2. $\text{NO} + 1/2 \text{O}_2 \rightarrow \text{NO}_2$

Which of the following acts as the catalyst for the reaction?

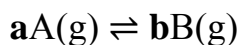
- A. NO_2
- B. SO_2
- C. NO
- D. There is no catalyst in the mechanism.

22. Which one of the following is the correct equilibrium constant expression, K_c , for



- A. $\frac{[\text{NH}_3]^2[\text{H}_2\text{Se}]}{[(\text{NH}_4)_2\text{Se}]}$
- B. $\frac{[2\text{NH}_3] + [\text{H}_2\text{Se}]}{[(\text{NH}_4)_2\text{Se}]}$
- C. $[\text{NH}_3]^2[\text{H}_2\text{Se}]$
- D. $2[\text{NH}_3] + [\text{H}_2\text{Se}] - [(\text{NH}_4)_2\text{Se}]$

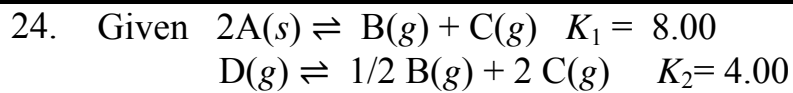
23. The entries in the table below represent equilibrium partial pressures of A and B under different initial conditions.



$P_A(\text{atm})$	$P_B(\text{atm})$
2.00	8.00
1.00	1.00
2.15	10.00

What are the coefficients **a** and **b**?

- A. **a**=1, **b**=2
 - B. **a**=3, **b**=1
 - C. **a**=2, **b**=1
 - D. **a**=1, **b**=3
-



what is K for $2 D(g) \rightleftharpoons 2 A(s) + 3C(g)$?

- A. 2.00
B. 0.00
C. 16.0
D. 8.00

25. The equilibrium constant for the following reaction is 4.34×10^{-3} at 300°C . At equilibrium

- A. products predominate.
B. reactants predominate.
C. only reactants are present.
D. only products are present.
-

CHE 107 Exam 2 October 21, 2010																									
Question	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
Correct Answer	D	D	B	C	D	A	D	D	B	C	C	A	C	A	B	C	D	B	C	A	A	C	B	A	B
Partial Credit	A	A,C	A,C	A		B,D		B	D			D			A,C	A,D	C	A		B,D		A			C
	2	2	2	2		2		1	2			2			2	1	2	2		2		1			2