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:

<table>
<thead>
<tr>
<th>NAME:</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUDENT NUMBER:</td>
<td>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 &quot;0&quot; for &quot;1&quot;).</td>
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<td>TEST FORM:</td>
<td>Fill in the &quot;1&quot; blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination I).</td>
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<tr>
<td>SPECIAL CODES:</td>
<td>Use for course and section number; in positions K-P write in one of the following:</td>
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<tr>
<td></td>
<td>Dr. Allison Soult 107001 or 107002</td>
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<tr>
<td></td>
<td>Dr. Lisa Blue 107003 or 107006</td>
</tr>
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<td></td>
<td>Dr. H. Ades 107005</td>
</tr>
<tr>
<td>SIGNATURE:</td>
<td></td>
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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. Soon after the examination is finished, an examination key will be posted on Blackboard.

Grading and Reporting:

The examination scores will be posted in Blackboard within 96 hours 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.
1. Which one of the following molecules will have only dispersion forces?

A. CH₃COOH  
B. CH₃Cl  
C. CH₄  
D. H₂O

2. Rank the following molecules in order of increasing intermolecular forces:

CH₃CH₂OH, O₂, AsH₃

A. O₂ < CH₃CH₂OH < AsH₃  
B. O₂ < AsH₃ < CH₃CH₂OH  
C. AsH₃ < O₂ < CH₃CH₂OH  
D. CH₃CH₂OH < O₂ < AsH₃

3. Which of the following has the compound with the greater viscosity listed first? All pairs are at the same temperature unless stated otherwise.

A. CHCl₃, CHBr₃  
B. H₂O at 50 °C, H₂O at 25 °C  
C. CH₃CH₂CH₂OH, (CH₃)₂CO  
D. H₂CO, H₂O

4. How much energy is needed to vaporize 75.0 g of H₂O(l) at 100. ºC?

ΔH_vap of water = 40.7 kJ/mol

A. 1.84 kJ  
B. 1.70 × 10² kJ  
C. 33.2 kJ  
D. 2.05 × 10³ kJ

5. The rate of vaporization (1) _____ with decreasing temperature and (2) _____ with increasing surface area.

A. (1) increases, (2) decreases  
B. (1) decreases, (2) increases  
C. (1) increases, (2) increases  
D. (1) decreases, (2) decreases
6. Acetone has a vapor pressure of 221 torr at 25 °C and a heat of vaporization of 32.0 kJ/mol. What is the normal boiling point of acetone?

A. 56.5 °C  C. 65.7 °C  
B. 48.5 °C  D. 32.1 °C

7. Which one of the following statements regarding the ‘critical point’ is true?

A. Solids can exist above the critical point.
B. The critical point is defined only by temperature, and the pressure has no effect.
C. Only the gas phase is present beyond the critical point.
D. Neither distinct liquid nor gas phases exist beyond the critical point.

8. Sublimation is

A. the phase transition from gas to solid.
B. the phase transition from liquid to solid.
C. the phase transition from gas to liquid.
D. the phase transition from solid to gas.

9. Benzene has the following properties:
   molar mass = 78.0 g/mol
   melting point = 5.5 °C
   boiling point = 80.1 °C
   \( \Delta H_{\text{fus}} \) (heat of fusion) = 9.92 kJ/mol
   \( \Delta H_{\text{vap}} \) (heat of vaporization) = 30.8 kJ/mol
   \( C_s \) (specific heat capacity) of \( \text{C}_6\text{H}_6(s) \) = 1.52 J/g·°C
   \( C_s \) (specific heat capacity) of \( \text{C}_6\text{H}_6(l) \) = 1.74 J/g·°C
   \( C_s \) (specific heat capacity) of \( \text{C}_6\text{H}_6(g) \) = 1.05 J/g·°C

   How much energy is needed to warm 39.0 g of \( \text{C}_6\text{H}_6(s) \), initially at 5.5 °C, to \( \text{C}_6\text{H}_6(l) \) at 55.5 °C?

A. 11.7 kJ  C. 4.49 kJ
B. 8.35 kJ  D. 9.95 kJ
10. Which one of the following expressions is true?

A. \( \Delta H_{\text{fus}} = \Delta H_{\text{vap}} \)
B. \( \Delta H_{\text{vap}} < \Delta H_{\text{fus}} \)
C. \( \Delta H_{\text{fus}} < \Delta H_{\text{sub}} \)
D. \( \Delta H_{\text{fus}} = -\Delta H_{\text{vap}} \)

11. In the heating curve for water, region D represents

A. ice melting to liquid water.
B. steam warming.
C. liquid water warming.
D. liquid water vaporizing to steam.
12. According to the phase diagram below, moving along a straight line from point _____ to point _____ would represent melting of the species?

A. from A to B  
B. from C to D  
C. from E to D  
D. from B to C

13. In a cubic unit cell, atoms on edges contribute ____ of the atom to the unit cell while atoms on the corners contribute ____.

A. 1/4, 1/2  
B. 1/8, 1/2  
C. 1/8, 1/4  
D. 1/4, 1/8

14. A crystalline unit cell contains two halide atoms, X, located completely inside the cell and eight metal atoms, M, on all the corners of the cell. Determine the correct formula for the ionic compound.

A. \(M_4X\)  
B. \(MX_2\)  
C. \(M_4X_2\)  
D. \(M_2X_2\)
15. Lead has a density of 11.35 g/cm³ and crystallizes with the face-centered cubic unit cell. What is the edge length of the unit cell?

A. 552 pm  
B. 312 pm  
C. 495 pm  
D. 326 pm

16. What type of crystalline solid has a high melting point and is composed of two or more elements?

A. Nonbonding atomic solid  
B. Molecular solid  
C. Ionic solid  
D. Metallic solid

17. Which statement about mixing a solute with a solvent is true?

A. Mixing decreases the entropy of the system.  
B. Mixing increases the order in the system.  
C. Mixing disperses energy in the system.  
D. Mixing decreases the randomization of energy in the system.

18. What is the correct arrangement of the following compounds in order of increasing solubility in water?

CH₃CH₂CH₂CH₂CH₃  HOCH₂CH₂CH₂CH₂CH₂OH  CH₃CH₂CH₂CH₂CH₂OH  CH₃CH₂CH₂CH₂CH₂Cl

A. CH₃CH₂CH₂CH₂CH₃ < CH₃CH₂CH₂CH₂CH₂Cl < CH₃CH₂CH₂CH₂CH₂OH < HOCH₂CH₂CH₂CH₂CH₂OH  
B. HOCH₂CH₂CH₂CH₂CH₂OH < CH₃CH₂CH₂CH₂CH₂OH < CH₃CH₂CH₂CH₂CH₃ < CH₃CH₂CH₂CH₂CH₂Cl  
C. CH₃CH₂CH₂CH₂CH₃ < CH₃CH₂CH₂CH₂CH₂Cl < HOCH₂CH₂CH₂CH₂CH₂OH < CH₃CH₂CH₂CH₂CH₂OH  
D. CH₃CH₂CH₂CH₂CH₂Cl < CH₃CH₂CH₂CH₂CH₃ < CH₃CH₂CH₂CH₂CH₂OH < HOCH₂CH₂CH₂CH₂CH₂OH
19. A saturated solution

A. is always unstable.
B. must have more solute than solvent.
C. has more solute dissolved than predicted by the solubility.
D. has a precipitated solute in equilibrium with the dissolved solute.

20. The solubility of potassium nitrate (KNO₃) is 37 g KNO₃ per 100 g of water. If a student adds 37 g KNO₃ with stirring to 105 g of water, what type of solution will result?

A. A supersaturated solution.
B. A supercritical solution.
C. An unsaturated solution.
D. A saturated solution.

21. The solubility of O₂(g) in water at 20 °C and 1.0 atm O₂(g) pressure is 1.3 × 10⁻³ mol/L. What minimum partial pressure of O₂(g), at 20 °C is needed to maintain a dissolved oxygen concentration of 1.4 × 10⁻⁴ mol/L, the concentration necessary to maintain fish life?

A. 0.98 atm
B. 0.21 atm
C. 0.055 atm
D. 0.11 atm

22. What is the molality of a solution prepared from 47.2 g KBr in 500.0 mL of water at 25°C? Assume the density of water is 1.00 g/mL.

A. 0.793 m
B. 1.47 m
C. 0.0944 m
D. 2.48 m
23. Find the ppm concentration when 17.7 mg sucrose is dissolved in 1.25 L of water.

A. $1.89 \times 10^3$ ppm  
B. 14.2 ppm
C. 17.7 ppm  
D. 7.06 ppm

24. What is the percent NaOCl by mass in an aqueous 5.00 $m$ NaOCl solution?

A. 35.5%  
B. 5.00%  
C. 67.4%  
D. 27.1%

25. What is the molality of an aqueous 1.25 $M$ solution of MgCl$_2$ given the density is 1.02 g/mL?

A. 1.28 $m$  
B. 1.39 $m$  
C. 1.20 $m$  
D. 1.31 $m$

26. Which one of the following concentration units is temperature dependent?

A. molality  
B. mole percent  
C. mole fraction  
D. molarity

27. The vapor pressure of benzene, C$_6$H$_6$, at 26 °C is 100.0 torr. How many moles of a nonvolatile solute need to be added to 0.500 mol of benzene to reduce the vapor pressure of the solution to 70.0 torr?

A. 0.333 mol  
B. 0.167 mol  
C. 0.214 mol  
D. 0.667 mol
28. What is the freezing point of a 2.1 \textit{m} solution of a molecular compound in chloroform? 
\textit{K}_f \text{ of chloroform} = 4.70 \degree \text{C}/\text{m} \text{ and the normal freezing point of chloroform is } -63.5 \degree \text{C}.

A. -9.00 \degree \text{C}  
B. -51.3 \degree \text{C}  
C. -73.4 \degree \text{C}  
D. 9.00 \degree \text{C}

29. Calculate the osmotic pressure of 5.27 g \text{NaCl} dissolved in enough water to make 500. mL of solution at 25.0 \degree \text{C}.

A. 0.740 atm 
B. 4.41 atm 
C. 8.82 atm 
D. 2.51 atm

30. Which one of the following aqueous solutions will have an osmotic pressure closest to that of a 0.15 M \text{NaCl} solution?

A. 0.15 M \text{C}_6\text{H}_6\text{O}_{12}  
B. 0.10 M \text{CaCl}_2  
C. 0.050 M \text{Al(NO}_3\text{)}_3  
D. 0.075 M \text{CH}_3\text{OH}
CHE 107 SPRING 2013 Exam 1 Key

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