

Name \_\_\_\_\_  
PHYS 0111 (Gen Chem II)

Test 1  
Spring 2005

Equations:

$$\Delta T = imK_f$$

$$\Delta T = imK_b$$

$$\Pi = iMRT$$

Constants:

for 95% H<sub>2</sub>SO<sub>4</sub>

$$d_{25} = 1.840 \text{ g/cm}^3$$

$$760 \text{ torr} = 1 \text{ atm}$$

$$0 \text{ }^\circ\text{C} = 273.15 \text{ K}$$

More Constants:

for H<sub>2</sub>O

$$d_{25} = 1.000 \text{ g/cm}^3$$

$$K_f = 1.86 \text{ }^\circ\text{C}/m$$

for benzene

$$K_f = 5.12 \text{ }^\circ\text{C}/m$$

$$\text{FP} = 5.50 \text{ }^\circ\text{C}$$

$$\text{BP} = 80.0 \text{ }^\circ\text{C}$$

$$d_{25} = 0.874 \text{ g/cm}^3$$

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

1. Assuming that the following chemicals are dissolved in water, predict the vant Hoff number for each chemical. Hint: Writing a dissolution reaction for each chemical might help.

5. \_\_\_\_\_

a. NaCl

b. C<sub>3</sub>H<sub>8</sub>O (rubbing alcohol)

6. \_\_\_\_\_

c. Ca(NO<sub>3</sub>)<sub>2</sub>

d. HCl (an acid)

7. \_\_\_\_\_

8. \_\_\_\_\_

2. The concentration of ethanol (C<sub>2</sub>H<sub>6</sub>O) in some wines is as high as 13% by mass. At what temperature will this 3.2 *m* ethanol solution freeze?

9. \_\_\_\_\_

10. \_\_\_\_\_

3. How many grams of KNO<sub>3</sub> would be needed to make 250.0 mL of a 0.3450 M KNO<sub>3</sub> solution?

4. In the following reaction was monitored over time, and the concentration of  $\text{CO}_2$  was measured after 30.0 s. The data is tabulated below.

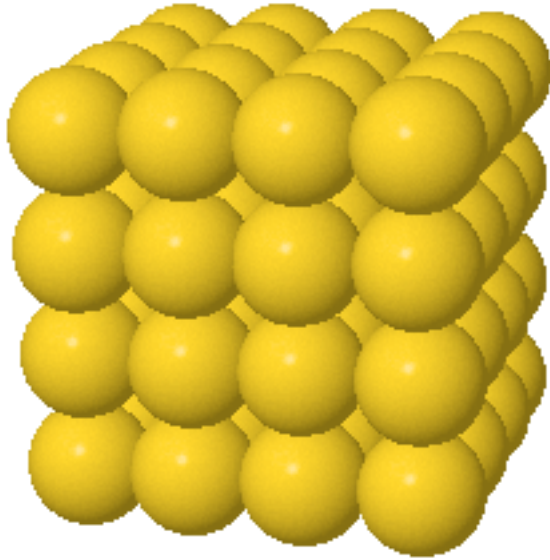


Time (s)	Concentration $\text{CO}_2$ (M)
0	4.50
30.0	1.33

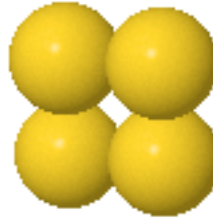
- a. Determine the average rate of consumption of  $\text{CO}_2$ .
- b. Determine the average rate at which  $\text{CH}_2\text{O}$  is being produced during the reaction.
- c. Determine the average rate of the reaction.
5. An experiment was performed to determine the molar mass of an unknown solid. A solution of 2.016 g of the unknown solid dissolved in 50.00 g of the nonpolar solvent benzene was prepared, and the freezing point of the resulting solution was determined to be  $4.35^\circ\text{C}$ . What is the molar mass of the unknown solid?

6. Sulfuric acid is sold commercially as a 95% solution of sulfuric acid in water. Determine the molarity of the  $\text{H}_2\text{SO}_4$  solution.
7. At high concentrations ionic compounds tend to form ion pairs in solution. How does the formation of ion pairs affect the vant Hoff number of the solution?
8. The osmotic pressure of a solution of 20.00 g NaOH ( $\text{MM}_{\text{NaOH}} = 40.0 \text{ g/mol}$ ) dissolved in a total volume of 500.0 mL was compared to the osmotic pressure of a solution of 14.61 g of NaCl ( $\text{MM}_{\text{NaCl}} = 58.44 \text{ g/mol}$ ) dissolved in a total volume of 250.0 mL. Is the osmotic pressure of the NaOH solution higher, lower, or the same as the osmotic pressure of the NaCl solution? Explain.

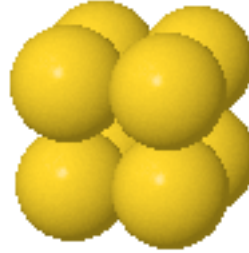
9. A crystal is pictured to the left. From the selection of pictures on the right, choose the structure that is the unit cell for the crystal on the left.



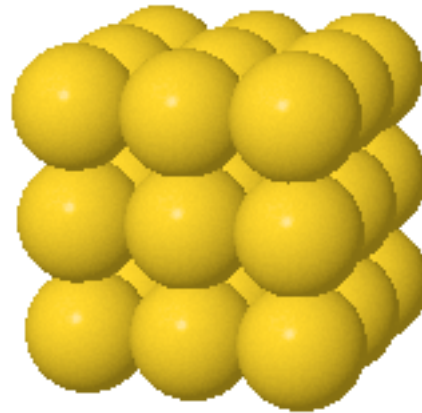
a.



b.



c.



d.



10. What kind of crystal is pictured in the previous question, a simple cubic cell, a face-centered cubic cell, or a body-centered cubic cell.