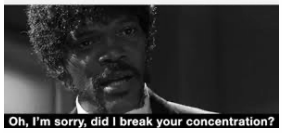
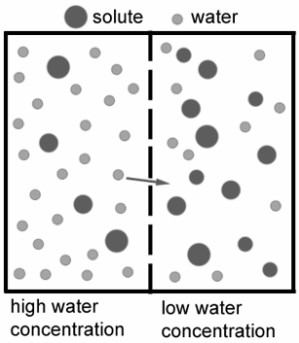
Chemistry 222 Exam II Review
Chapters 10 and 11

When you dilute a solution:





Chemistry 222
Professor Michael Russell
MAR

Last update: 4/27/26

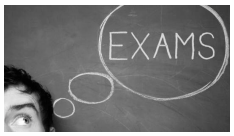
Midterm II

Chapters 10 and 11

- *Bring:* **calculator**, pencil, **"Freezing Point Depression" lab**, **Exam Prep Worksheet II, "Kinetics I" printed lab**
- 12 multiple choice questions, 4 short answer questions, ~90 minutes in length
- Returned following lab period with "summary sheet" ***Good luck with your studying!***

Let's start the review!

MAR



L1: Wed, 7/15 8:30 AM, AC 2507

Check with instructor to ensure correct dates and times!

Using intermolecular forces, the predicted order of decreasing boiling points for the following substances is

A. $CH_3OH > CH_4 > H_2$
B. $CH_3OH > H_2 > CH_4$
C. $CH_4 > CH_3OH > H_2$
D. $CH_4 > H_2 > CH_3OH$
E. $H_2 > CH_4 > CH_3OH$

MAR

When KCl dissolves in water, what types of intermolecular bonds are formed?

A. ion-ion
B. ion-dipole
C. hydrogen bonds
D. ion-ion forces and H-bonds
E. matrimony bonds

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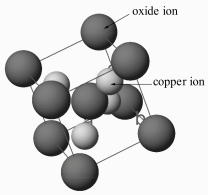
Which of the following should have the highest ΔH_{vap}?

A. F_2
B. CH_3OH
C. H_2O
D. NH_3
E. all have the same ΔH_{vap} value

MAR

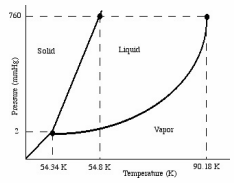
The unit cell for a compound of copper and oxygen is illustrated here. All the grey copper atoms are within the unit cell. Determine the empirical formula of the compound.



A. CuO
B. Cu_2O
C. CuO_2
D. Cu_2O_3
E. Cu_4O_9

MAR

Below is a phase diagram for O_2. What is the name of the point at P = 2 mm Hg and T = 54.34 K?



A. normal freezing point
B. triple point
C. normal boiling point
D. critical point
E. freak out point

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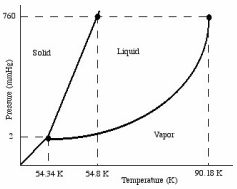
At right is a phase diagram for O_2. Which statement is correct regarding the densities of solid and liquid O_2 at the same temperature?



A. The density of liquid O_2 is 1.426 g/cm^3 whereas the density of solid O_2 is 1.149 g/cm^3.
B. The density of solid O_2 is 1.426 g/cm^3 whereas the density of liquid O_2 is 1.149 g/cm^3.
C. The densities of solid and liquid O_2 are the same.

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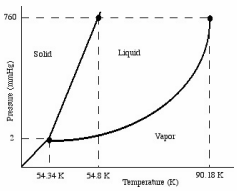
Below is a phase diagram for O_2. In what phase is oxygen found at a pressure of 1 mmHg and a temperature of 55 K?

A. solid
B. liquid
C. vapor
D. plasma



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Calculate the energy required to convert 1.00 L of liquid ethanol at 25.0 °C to a gas at 78.3 °C.
Constants for ethanol:
- density = 0.7849 g/mL
- molar mass = 46.08 g/mol
- boiling point = 78.3 °C
- heat capacity = 2.44 J/g·K
- heat of vaporization = 38.56 kJ/mol

A. -329 kJ
B. 329 kJ
C. -759 kJ
D. 759 kJ
E. 0 KJ

MAR

You dissolve 92.0 grams of CH_3CH_2OH, ethanol, in 270 g of water. What is the mole fraction of ethanol in the solution?

A. 2.0
B. 0.12
C. 0.067
D. 0.0083
E. 0

MAR

You dissolve 92.0 grams of CH_3CH_2OH, ethanol, in 270. g of water. What is the mass percent of ethanol in the solution?

A. 34.1 %
B. 17.0 %
C. 25.4 %
D. 74.8 %
E. 100. %

MAR

You dissolve 92.0 grams of CH_3CH_2OH, ethanol, in 270. g of water. What is the molality of ethanol in the solution?

A. 341 *m*
B. 170. *m*
C. 0.341 *m*
D. 7.41 *m*
E. 18.0 *m*

MAR

You dissolve 92.0 grams of CH_3CH_2OH, ethanol, in 270. g of water, and the density of the solution is 0.9780 g/mL. What is the molarity of ethanol in the solution?

A. 0.370 M
B. 2.00 M
C. 7.42 M
D. 3.05 M
E. 5.41 M

MAR

An aqueous solution of ethanol (CH_3CH_2OH) has a solution density of 0.9163 g/mL and a concentration of 0.801 M. What is the mole fraction of ethanol in the solution?

A. 0.911
B. 1.1111
C. 0.9839
D. 0.0161
E. 4.03

MAR

The Henry's Law constant for N_2 in water at 53 °C is 8.4×10^{-7} M/mm Hg, and the vapor pressure of water at 53 °C is 107 torr. Find the equilibrium concentration of N_2 in water if the total pressure equals 1 atm.

A. 5.5×10^{-4} M
B. 9.0×10^{-5} M
C. 6.4×10^{-4} M
D. 3.2×10^{-5} M
E. 42 M

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0.0400 mol of I_2 (10.1 g) is dissolved in 1.96 mol of CCl_4 (300 g) at 65 °C. Given that the vapor pressure of pure CCl_4 is 504 mm Hg at this temperature, what is the vapor pressure of the CCl_4 over this solution?

A. 504 mm Hg
B. 514 mm Hg
C. 494 mm Hg
D. 10.1 mm Hg
E. Too much pressure!

MAR

What mass of ethylene glycol (HOC_2H_4OH, molar mass = 62.0 g/mol) must be added to 125 g of water to raise the boiling point by 1.00 °C? ($k_{bp}(H_2O) = +0.512$ °C/m)

A. 1.95 g
B. 0.244 g
C. 15.1 g
D. 31.0 g
E. 0 g

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Which water-based solution is expected to have the higher boiling point?

A. 0.10 molal NaCl
B. 0.15 molal sugar
C. both the same
D. not enough information

MAR

29.3 g of NaCl (molar mass = 58.5 g/mol) is dissolved in 500. grams water. What is the boiling point of this solution? ($k_{bp}(H_2O)$ = +0.512 °C/m)

A. 100.512 °C
B. 98.976 °C
C. 101.02 °C
D. 1.024 °C
E. 10^4 °K

MAR

Erythritol occurs naturally in algae and fungi. A solution of 2.50 g of erythritol in 50.0 g of water freezes at -0.762 °C. What is the molar mass of the compound? ($k_{fp}(H_2O)$ = 1.86 °C/m)

A. 26.9 g/mol
B. 35.5 g/mol
C. 122 g/mol
D. 224 g/mol
E. 0.0100 g/mol

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Insulin (20.0 mg) dissolved in 5.00 mL of water at 300. K provides an osmotic pressure of 12.5 mm Hg. What is the molar mass of insulin?

A. 18.0 g/mol
B. 42.0 g/mol
C. 3980 g/mol
D. 6010 g/mol
E. 12,100 g/mol

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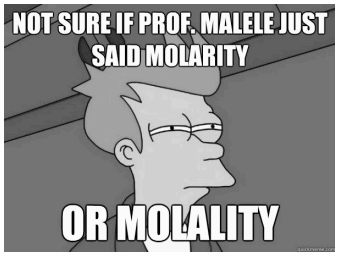
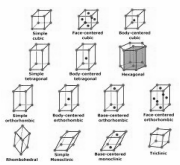
End of Review - *good luck with your studying!*



Need more practice?

- *Practice Problem Sets (Companion and online)*
- *Concept Guides (Companion and online)*
- *Chapter Guides (online)*
- *End of Chapter Problems in Textbook (every other question has answer at end)*

Good luck with your studying!



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