* IF covalent molecular, i = 1

what is i for each of these in water?

C_3H_7OH i = 1 NH_4Br i = 2

$Ca(NO_3)_2$ i = 3 K_3PO_4 i = 4

$C_6H_{12}O_6$ i = 1 CH_3COOH i = between 1 & 2 (close to 1.0)

Today: 24 January 2020
- finish ch. 13 sections 1-3 of ch 14

→ Sunday 1/26:
- problem club w/ Kendall 6:30-8:00 Eppley 211

M/W/F → ch. 14

→ Thursday: Expt. 2 (lab manual)

A 1.10 g sample of an unknown hydrocarbon was dissolved in 25.0 g camphor. If the soln melts/freezes at 162.°C, what is its MM? $K_f^{camphor}$ = 37.8 deg/molal

- T_f^{normal} = 175°C
- $\Delta T_f = K_f \cdot m \cdot i$
- 13.0 deg = 37.8 deg/molal · m · 1
- $m = \frac{0.344 \text{ mol unknown}}{\text{kg camphor}}$
- $n = \frac{0.344 \text{ mol unknown}}{\text{kg camphor}} \left| \frac{0.0250 \text{ kg camphor}}{} \right. = 8.60 \times 10^{-3}$ mol
- $MM = \frac{m_{unknown}}{n_{unknown}} = \frac{1.10 \text{ g}}{8.60 \times 10^{-3} \text{ mol}}$ → MM = 127.8 g/mol

If the unknown is 93.71% C, what is the molecular formula?

100 g sample. Go moles!

		÷ smallest	× integer
93.71 g C	÷ 12.01 g/mol = 7.803 mol C	1.250 → 1 1/4	5
6.29 g H	÷ 1.008 g/mol = 6.24 mol H	1 → 1	4

empirical formula: C_5H_4 → MM = 64 g/mol

molecular formula: $C_{10}H_8$ → MM = 128 g/mol

Osmotic Pressure, Π

$\Pi = M \cdot R \cdot T \cdot i$ 0.0821 L atm/mol K

what is the osmotic pressure of 0.075 M $CaCl_2$? (@ 298 K)

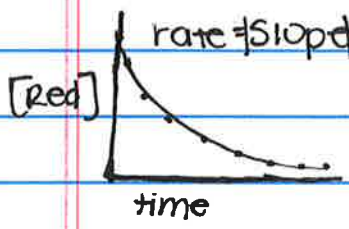
$\Pi = \frac{0.075 \text{ mol}}{\text{L}} \left| \frac{0.0821 \text{ L atm}}{\text{mol K}} \right| 298 \text{ K} \left| 3 \right. = 5.50$ atm

what is the MM of a non-electrolytic solute with mass 0.342 g dissolved in 100 g H_2O @ 298 K? (giving an osmotic pressure of 550 mmHg)

- ÷ 760 mmHg = 0.724 atm
- $\Pi = M \cdot R \cdot T \cdot i \rightarrow M = \frac{\Pi}{R \cdot T \cdot i} = \frac{0.724 \text{ atm}}{0.0821 \text{ L·atm/mol·K} \mid 298 \text{ K} \mid i} = M = 0.0296$ mol/L
- $n = \frac{0.0296 \text{ mol unk}}{\text{L soln}} \left| \frac{0.100 \text{ L soln}}{} \right. = 0.00296$ mol unk
- $MM = \frac{0.342 \text{ g}}{0.00296 \text{ mol}} = 115.9$

bleach

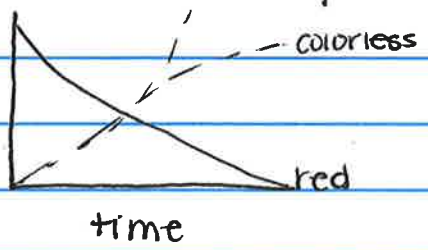
"Red" + $OCl^-_{(aq)}$ → colorless + Cl^-



rate = |slope| = $\frac{\Delta mol/L}{\Delta time}$

→ *rate slows down with time in this chemical rxn

January 24th



Chapter 13 Number 4 (13.9) (Unit 1)

24 January 2020

1. Circle the member of each pair with the higher predicted boiling point.
   A. ethane OR propane
   B. propanol OR propane
   C. methanol OR methanal
   D. propane OR propanoic acid
   E. methane OR methyl amine

2. Predict the value for i for each of these aqueous solutions.
   A. 0.20 molal potassium nitrate
   B. 0.10 M HCl(aq)
   C. $X_{glucose} = 0.220$
   D. 2.26 mass% sodium sulfate
   E. $[CH_2O] = 0.117$ M

3. What is the osmotic pressure of a 0.150 M ammonium perchlorate solution at 25 °C?

4. A solution was prepared by dissolving 20.0 g of an unknown carbohydrate ($C_xH_yO_z$) in 50.0 g water and determining the freezing point of the solution to be -2.17 °C. What is the molar mass of the unknown? Given: $K_f = 1.86$ deg/molal

5. A nitrate salt, thought to be $LiNO_3$, $NaNO_3$, KNO_3, $RbNO_3$ or $CsNO_3$, was dissolved in water. When 4.75 g of the salt was dissolved in water to make 100.0 mL solution, the osmotic pressure was determined to be 23 atm at 25 °C. What is the identity of the salt? What flame test color would you expect?

Questions in final exam format:

6. When ethylene glycol, $HOCH_2CH_2OH$, is added to the water in an automobile radiator, the effect is to
   A. lower the boiling point and lower the freezing point.
   B. lower the boiling point and raise the freezing point.
   C. raise the boiling point and lower the freezing point.
   D. raise the boiling point and raise the freezing point.

7. The coolant in automobiles is often a 50/50 % by volume mixture of ethylene glycol, $HOCH_2CH_2OH$, and water. At 20°C, the density of ethylene glycol is 1.1088 g/mL and the density of water is 0.9982 g/mL. Assuming that the volumes are additive, what is the expected freezing point of a 50/50(v/v)% ethylene glycol/water solution? K_f = 1.86°C/*m* for water.
   A. -16 °C
   B. -17 °C
   C. -30 °C
   D. -33 °C

8. Red blood cells are placed into pure water. Which of the following statements is true?
   A. Water molecules flow out of the red blood cells, causing them to collapse.
   B. Water flows into the red blood cells, causing them to swell and burst.
   C. The osmotic pressure of the cell contents increases, causing the cells to burst.
   D. The osmotic pressure inside the cells equals the osmotic pressure outside.

Now try these problems from the book:

Section 13.9. (Osmotic pressure) Problems 19, 20, 21, 22, 23, 24, 34, 118, 120, 124, 128, 140, 142.

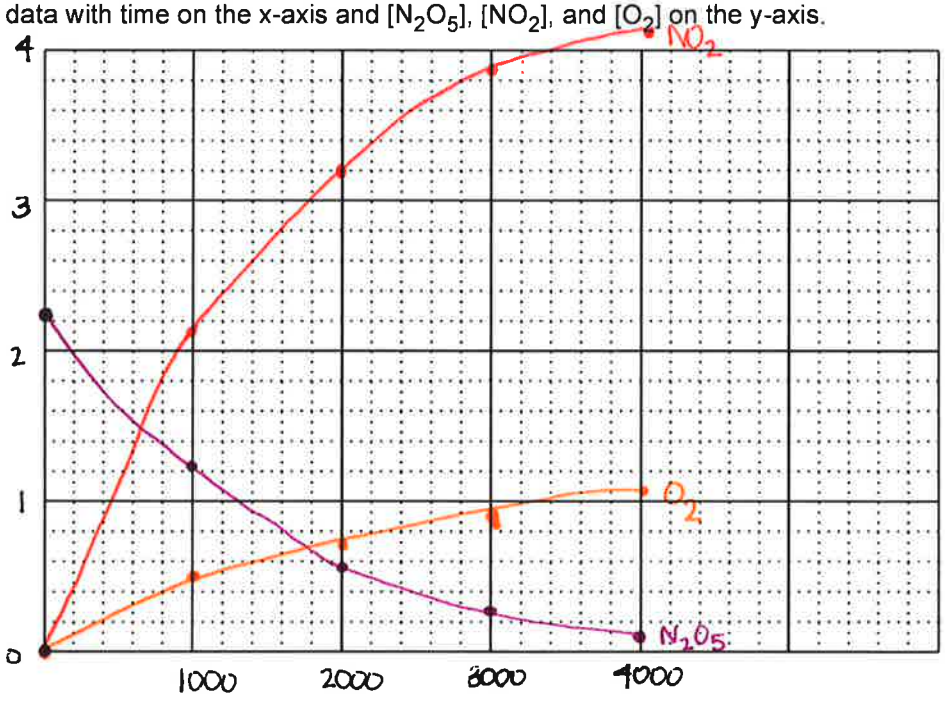
Practice Test (page 530) 14, 15

Chapter 14 Number 1 (14.1 – 14.3) (Unit 1) 24 January 2020

$$2\ N_2O_5(g) \rightarrow 4\ NO_2(g) + O_2(g)$$

time	$[N_2O_5]$	$[NO_2]$	$[O_2]$
0 s	2.330 mol/L	0	0
1000 s	1.260	2.140 mol/L	0.535 mol/L
2000 s	0.681	3.298 mol/L	0.825 mol/L
3000 s	0.369	3.922 mol/L	0.9805 mol/L
4000 s	0.199	4.202 mol/L	1.0503 mol/L

1. Graph these data with time on the x-axis and $[N_2O_5]$, $[NO_2]$, and $[O_2]$ on the y-axis.



Est. rate 0 - 1000s

rate $= -\frac{\Delta[N_2O_5]}{\Delta t}$

rate $= +\frac{\Delta[NO_2]}{\Delta t}$

↳ BIGGER RATE (2x bigger)

$+\ \frac{1.07 \times 10^{-3}\ mol\ N_2O_5}{L \cdot s}$

$\frac{1.07 \times 10^{-3}\ mol\ N_2O_5}{L \cdot s} \times \left(\frac{4\ mol\ NO_2}{2\ mol\ N_2O_5}\right) = 2.14 \times 10^{-3}\ \frac{mol\ NO_2}{L \cdot s}$

2. Is this reaction slowing down or speeding up with time? Circle: **Slowing down** or **Speeding up**

3. Sketch a tangent line on the graph and estimate the rate at t = 1000 s in terms of rate = $-\Delta[N_2O_5]/\Delta t$. Make sure to use the right units.

4. Using your value from Question 3, what is the rate in terms of rate = $\Delta[NO_2]/\Delta t$ and rate = $\Delta[O_2]/\Delta t$

5. Would the rate of the reaction increase or decrease if one started with a larger $[N_2O_5]$?

Now try these problems from the book:

Section 14.1. (Rates) Problems 1, 2, 39, 52, 54, 56 and 58
Section 14.2. (Rate Law and Order) Problems 3 and 4
Section 14.3. (Initial rate method) Problems 5, 6, 7, 8, 40, 46, 60, 62, 64, 66 and 68
Practice Test, page 587, Question 1 – 5.