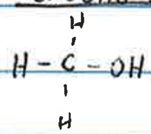
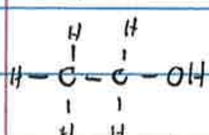
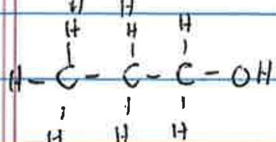
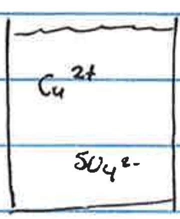
Today Jan 21: work on finishing ch 12
Tomorrow: expt 1, problem club with Ali
Wednesday: finish 12, start 13

hydrocarbons			bp	
CH_4	methane	CH_4	-164°C	increases due to more london dispersion forces
C_2H_6	ethane	CH_3CH_3	-89°C	
C_3H_8	propane	$CH_3CH_2CH_3$	-42°C	
C_4H_{10}	butane	$CH_3CH_2CH_2CH_3$	-1°C	
C_5H_{12}	pentane	$CH_3CH_2CH_2CH_2CH_3$	36°C	

alcohols			bp	
	methanol	CH_3OH	+65°C	higher due to hydrogen bonding
	ethanol	CH_3CH_2OH	+78°C	
	propanol		+83°C	
C_4H_9OH	butanol		+117°C	
$C_5H_{11}OH$	pentanol		+138°C	

$CuSO_4$ (aq)



· Cations make ion-dipole interactions in water

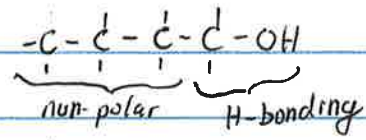
Cu^{2+} ····· :Ö(H)(H)

CH_3OH + H_2O miscible (mixes)

ethanol + H_2O miscible

propanol + H_2O miscible

butanol + H_2O 73g butanol / L H_2O (not totally miscible)



pentanol + H_2O 22g pentanol / L H_2O

· What is the vapor pressure of a solution made by dissolving 40.0g $C_{12}H_{22}O_{11}$ (MM = 342g/mol) in 100g H_2O at 23°C?

$$P_{sol'n} = X_{solvent} * P_{solvent}$$

	m	n
$C_{12}H_{22}O_{11}$	40.0g	0.117mol
H_2O	100.0g	5.55 mol

$$P_{sol'n} = \frac{5.55\,mol}{0.117mol + 5.55mol} \times 21.0\,mmHg$$

$$\boxed{P_{sol'n} = 20.57\,mmHg}$$

<u>Colligative properties</u> of solutions change physical properties based on the amount of solute present

* non-electrolyte = not ionic (does not dissociate)

urea does not dissociate
1 mol urea ≙ 1 mol particles

NaCl does dissociate
1mol NaCl ≙ 2 mols particles

Therefore for colligative properties mole fraction (X) can change...

$$X = \frac{n_{solvent}}{n_{solvent} + i\, n_{solute}}$$

↑ van hoff factor (depends on dissociation)

$i = 1$ for covalent molecules
$i = 2$ for NaCl
$i = 3$ for N_2SO_4

· What is the vapor pressure of a solution containing 0.24 mol NaCl in 5.00 mol H_2O at 21°C?

$$P_{sol'n} = \frac{5.00\,mol}{5.00 + 2 \times 0.24\,mol} \times 18.8\,mmHg$$

$$P_{sol'n} = 17.15\,mmHg$$

Vapor pressure:
- non-volatile solute (probably has very low vapor pressure):
↳ non-electrolyte: $P_{sol'n} = X_{solvent} \times P_{solvent}$

↳ electrolyte $P_{sol'n} = \frac{n_{solvent}}{n_{solvent} + i \times n_{solute}} \times P_{solvent}$

- solute with vapor pressure ($l + l$):

$$P_{sol'n} = X_{solute} \times P_{solute} + X_{solvent} \times P_{solvent}$$

Freezing point lowering

$\Delta T_f = K_f \times m \times i$

(K_f ↑ constant, m ↑ molality, i ↑ Van Hoff factor)

What is the fp/mp of a solution containing 5.7g NaCl in 55g H_2O? $K_f = 1.86 \frac{deg}{molal}$ $MM_{NaCl} = 58.5 g/mol$

$\Delta T_f = 1.86 \frac{deg}{molal} \times$ ~~0.0974 molal~~ 1.76 molal $\times 2$

$\Delta T_f =$ ~~0.36 deg~~ 6.6 deg

normal freezing point = 0°C

new freezing point = ~~-0.36°C~~ **-6.6°C**

Boiling point elevation

$\Delta T_b = K_b \times m \times i$

for H_2O, $K_b = 0.51$ deg/molal

$\Delta T_b = 0.51$ deg/molal $\times$ 1.76 molal $\times 2$

$\Delta T_b = 1.81$ deg

normal boiling point = 100°C

new boiling point = **101.81°C**

· Suppose 4.77g unknown non-electrolyte is dissolved in 50.0g H_2O. The fp/mp = -2.40 °C. What is the MM?

$\Delta T_f = K_f \times m \times i$

$2.40 \text{ deg} = 1.86 \frac{deg}{molal} \times 1 \times m$

$1.29 \text{ molal} = m$

$1.29 \text{ molal} = \frac{n_{unk}}{m_{H_2O}(kg)}$ → $1.29 = \frac{n}{0.05 \text{ kg}}$

→ $n = 0.0645$ mol

$MM = \frac{4.77 g}{0.0645 m}$

MM = 73.95 g/mol