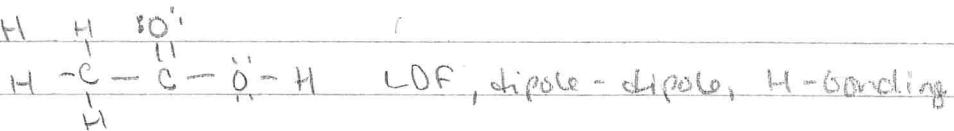


### Unit 3 Review for Midterms

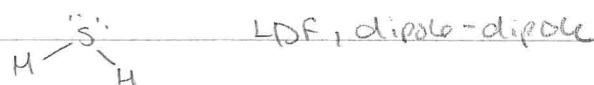
① a)  $\text{SO}_2$



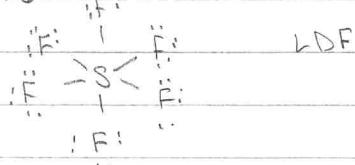
b)  $\text{CH}_3\text{COOH}$



c)  $\text{H}_2\text{S}$



d)  $\text{SF}_6$



② a)  $\text{CH}_3\text{OH}$  can H-bond w/ other  $\text{CH}_3\text{OH}$  molecules (also has LDF)

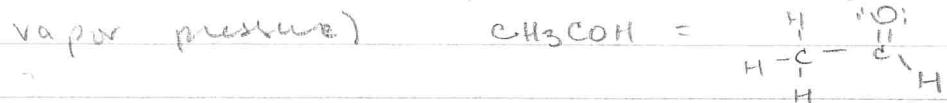
$\text{CH}_3\text{SH}$  interacts w/ dipole-dipole + LDF, which are weaker than H-bonding

b) Xe has more  $e^-$  and is more polarizable than He  
+ has stronger LDF

c)  $\text{Cl}_2$  is more polarizable than Kr w/ stronger LDF

d) water can H-bond w/ other water molecules.

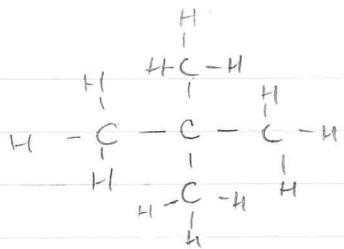
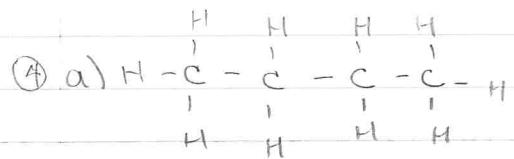
$\text{CH}_3\text{COH}$  cannot H-bond + has weaker IMFs. Weaker IMFs mean molecules are not as attracted to each other + can vaporize more easily (higher vapor pressure)



③ a) I<sub>2</sub> - more polarizable, stronger LDF

b)  $\text{H}_2\text{O}$  - can H-bond while  $\text{H}_2\text{S}$  cannot (only dipole-dipole + LDF)

c) hexane - larger molecule + more polarizable



b) the pentane isomer w/ the long chain org C will have the highest BP. It is more polarizable.

⑤ a)  $\text{Na}^+$  &  $\text{Cl}^-$  are attracted to the dipoles of  $\text{H}_2\text{O}$  (ion-dipole interaction)

b)  $\text{C}_2\text{H}_5\text{OH}$  can H-bond w/ water molecules

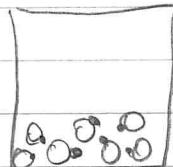
c)  $\text{CCl}_4$  is non polar & only has LDF intermolecular interactions.  $\text{H}_2\text{O}$  will H-bond w/ other  $\text{H}_2\text{O}$  molecules

⑥ a)  $\text{CH}_2\text{Cl}_2$  - not soluble. It is polar but will not H-bond w/  $\text{H}_2\text{O}$

b)  $\text{CH}_3\text{OH}$  - soluble, can H-bond w/  $\text{H}_2\text{O}$

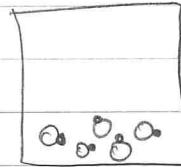
c)  $\text{F}_2$  - not soluble, non polar molec w/ only LDF

⑦



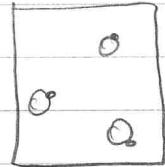
S

closely packed  
wiggles, vibrates



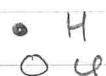
l

still packed  
can slide past  
rotate

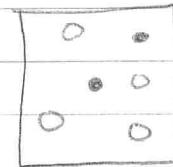


g

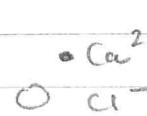
not packed  
moving in straight line until collide  
can move freely



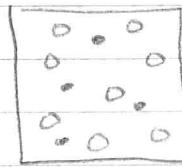
⑧



1.0M



2.0M



should be 1:2  $\text{Ca}^{2+} : \text{Cl}^-$   
2.0M should have  
twice as many  $\text{Ca}^{2+}$  &  
 $\text{Cl}^-$  as 1.0M

- ⑨ a)  $\text{NaNO}_3$  - conduct electricity when dissolved / dissociated + melted. When ions can move freely  
 b)  $\text{I}_2$  - no, no moving ions or  $e^-$   
 c) C - no " "  
 d) Cu - yes in solid, l state. In Metallic bonding, valence  $e^-$  can flow freely between metal cations. Moving  $e^-$  means electricity conducted

$$\textcircled{10} \text{ a) } \frac{24.5 \text{ g N}_2}{28.02 \text{ g}} \mid \frac{1 \text{ mol}}{\text{mol N}_2} = .874 \quad \frac{28.0 \text{ g O}_2}{32.00 \text{ g}} \mid \frac{1 \text{ mol}}{\text{mol O}_2} = .875 \text{ mol O}_2$$

$$\text{total mol} = .874 + .875 = 1.749 \text{ mol}$$

$$PV = nRT$$

$$P = \frac{nRT}{V} = \frac{(1.749 \text{ mol})(.08206 \frac{\text{L atm}}{\text{mol k}})(298 \text{ K})}{5.00 \text{ L}} = 8.55 \text{ atm}$$

$$\text{bi) mole fraction} = \frac{\text{mol N}_2}{\text{total mol}} = \frac{.874 \text{ mol N}_2}{1.749 \text{ mol total}} = .500$$

$$\text{ii) } P = \frac{nRT}{V} = \frac{(.874 \text{ mol N}_2)(.08206 \frac{\text{L atm}}{\text{mol k}})(298 \text{ K})}{5.00 \text{ L}} = P_{\text{N}_2} = 4.0 \text{ atm}$$

(there are several ways to get the correct answer)

c) decrease.  $\text{N}_2$  molecules have smaller molar mass + would escape faster



e) .176 mol NO reacts w/  $\frac{.176}{2}$  mol  $\text{O}_2$  to produce .176 mol  $\text{NO}_2$ .  
 $\frac{.176}{2}$  mol  $\text{O}_2$  is left unreacted.

$$\text{Total gases left in cylinder} = .176 + \frac{.176}{2} = .264 \text{ mol}$$

$$P = \frac{nRT}{V} = \frac{(.264 \text{ mol})(.08206 \frac{\text{L atm}}{\text{mol k}})(298 \text{ K})}{5.00 \text{ L}} = 1.29 \text{ atm}$$

(11) CH<sub>4</sub>

$$P_1 = 1.5 \text{ atm}$$

$$V_1 = 3.5 \text{ L}$$

$$P_2 = ? =$$

$$V_2 = 3.5 + .75 = 4.3 \text{ L}$$

$$P_1 V_1 = P_2 V_2$$

$$(1.5)(3.5) = (P_2)(4.3)$$

$$P_2 = 1.2 \text{ atm}$$

C<sub>2</sub>H<sub>6</sub>

$$P_1 = 4.5 \text{ atm}$$

$$V_1 = .75 \text{ L}$$

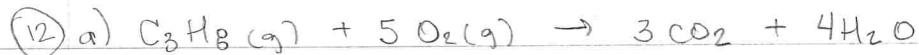
$$P_2 = ?$$

$$V_2 = 4.3 \text{ L}$$

$$(4.5)(.75) = (P_2)(4.3)$$

$$P_2 = .79 \text{ atm}$$

$$P_{\text{total}} = 1.2 \text{ atm} + .79 \text{ atm} = 2.0 \text{ atm}$$



b)  $\frac{10.0 \text{ g C}_3\text{H}_8}{44.09 \text{ g}} \left| \begin{array}{c} 1 \text{ mol C}_3\text{H}_8 \\ \hline 1 \text{ mol C}_3\text{H}_8 \end{array} \right| \frac{5 \text{ mol O}_2}{1 \text{ mol C}_3\text{H}_8} = 1.13 \text{ mol O}_2$

$$PV = nRT$$

$$30.09 + 273.15 = 303.2 \text{ K}$$

$$V = \frac{nRT}{P} = \frac{(1.13 \text{ mol O}_2)(.08206 \frac{\text{L atm}}{\text{mol K}})(303.2 \text{ K})}{(1.00 \text{ atm})} = 28.2 \text{ L O}_2$$

$$\frac{28.2 \text{ L O}_2}{21.0 \text{ L O}_2} \left| \begin{array}{c} 100 \text{ L air} \\ \hline 1 \text{ mol O}_2 \end{array} \right| = 134 \text{ L air}$$

(13) a)  $P_{\text{H}_2} = 624.2 \text{ mmHg} - 19.8 \text{ mmHg} = 604.4 \text{ mmHg}$

$$405.4 \text{ mL} = .4054 \text{ L}$$

$$PV = nRT$$

$$24.19 + 273.15 = 297.3 \text{ K}$$

$$PV = \frac{mRT}{M}$$

$$M = \frac{\text{molar mass}}{\frac{m}{n}} = \frac{m}{n}$$

$$n = \frac{m}{M}$$

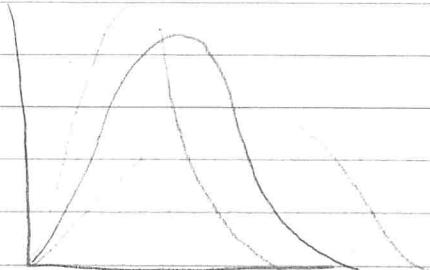
$$M = \frac{mRT}{PV} = \frac{(.0907 \text{ g})(62.36)(297.3)}{(604.4)(.4054)}$$

$$= 6.862 \text{ g/mol}$$

b) % error =  $\left| \frac{\text{exp-actual}}{\text{actual}} \right| = \left| \frac{6.862 - 2.016}{2.016} \right| \cdot 100 = 240\%$

c) H-F would interact w/ H<sub>2</sub>O molecules + mix. It would not bubble up through H<sub>2</sub>O

(14) a)



- O<sub>2</sub> at 298 K (Shapes + y values approx)
- Cl<sub>2</sub> at 298 K
- O<sub>2</sub> at 398 K

(15) Ideal gases have no attractive forces (no IMFs)

The gas particles have no volume + move randomly in straight lines until they collide w/ something (particle or wall)

- (16) a) Too high P indicates that the Xe particle volumes are not negligible. The particles themselves are taking up room  
b) Too low P indicates that the particles are attracting other particles,

(17) a) Microwaves cause Rotational motion

b) IR cause vibrational motion

c) UV/VIS cause electrons to change energy levels

(18) a) chromatography - see the dyes separate on paper

b) evaporation (or distillation) - H<sub>2</sub>O evaporate (or boils off) leaving NaCl(s) behind (can condense H<sub>2</sub>O(g) in distillation)

c) filtration - solid CaCO<sub>3</sub> would be left in filter paper, while filtrate would contain dissolved + dissociated NaNO<sub>3</sub> (which would conduct electricity)

d) distillation - heat mix to methanol BP (but below BP of H<sub>2</sub>O), methanol will boil (vapors can be collected + condensed) leaving H<sub>2</sub>O behind

(19) a) cuvet could have contained H<sub>2</sub>O, decreasing concentration of sample

b) .063 M (or close)

AP (2) a) O<sub>2</sub> balloon contains most mass. All balloons have same V (+ same # moles) so gas w/ highest molar mass would have highest mass

b) All gas molecules have same average KE @/C at the same T

c) CO<sub>2</sub> - has the most e<sup>-</sup> + is most polarizable + :. Strongest IMFs

d) He would be smallest. He atoms are the smallest particles + would escape fastest

(2) c) Dichloromethane is a polar molecule. Dipoles of dichloromethane can interact w/ dipoles of H<sub>2</sub>O molecules.

CCl<sub>4</sub> is non polar + only has London dispersion forces. The dipole-induced dipole forces that could form between H<sub>2</sub>O + CCl<sub>4</sub> are much weaker.

d) CH<sub>2</sub>Cl<sub>2</sub> has dipole-dipole + LDF attracting the molecules, which are stronger than LDF of CCl<sub>4</sub>

(3) c) IBr would have higher ΔH<sub>trap</sub> because it is polar w/ dipole-dipole → LDF forces, while Br<sub>2</sub> only has LDF

d) Both I<sub>2</sub> and hexane are non polar w/ LDF. Hexane (in) therefore dissolves I<sub>2</sub>. The LDF interactions b/w I<sub>2</sub> + C<sub>6</sub>H<sub>6</sub> are stronger than possible dipole-induced dipole interaction of I<sub>2</sub> and H<sub>2</sub>O. H<sub>2</sub>O molecules H-bond stronger w/ each other + will not be disrupted by I<sub>2</sub>