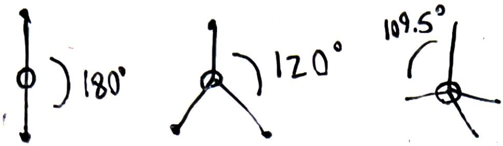
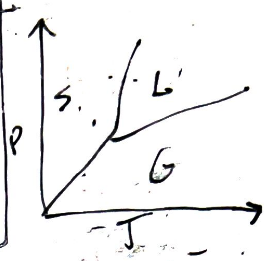
ALEKS Week 1

$a^2+b^2=160^2$ $\quad 2(a^2)=160^2$





–C– sp^3

=C– sp^2

–C≡ sp

=C= sp

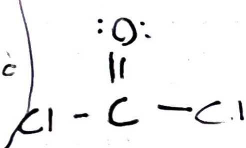
–C– sp^3

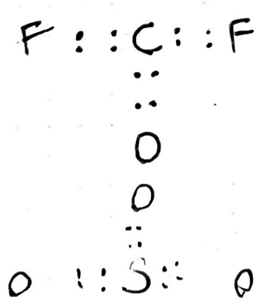
–C– sp^2

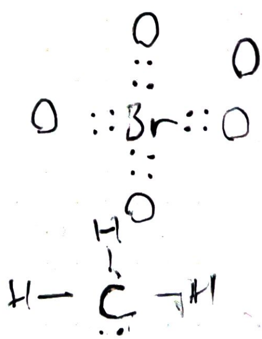
single = 1 sigma
double = 1 sigma + 1 pi
triple = 1 sigma + 2 pi

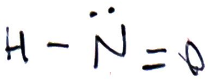
4 sigma = sp^3
3 sigma = sp^2
2 sigma = sp

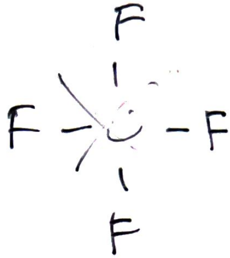
A = central atom
X = atoms bonded
E = lone pairs

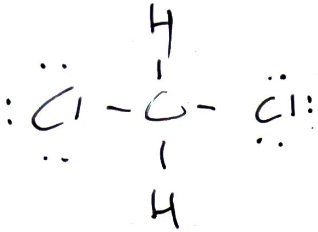




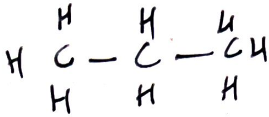


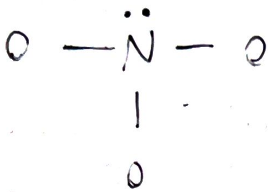


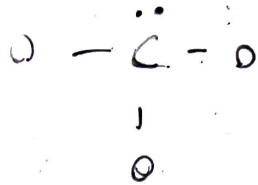


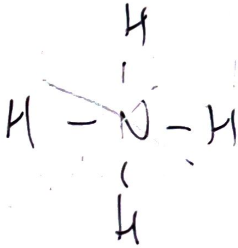


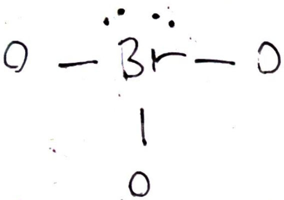
AX_4E_1

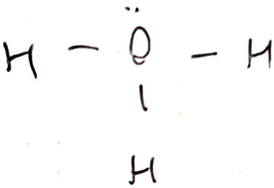


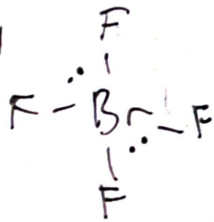


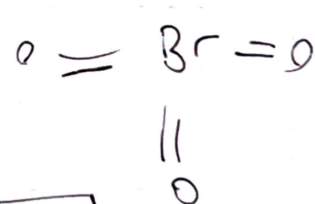








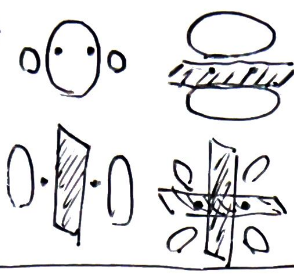




$$\boxed{N(t) = N_0\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}}$$

$$x = 100\left(\frac{1}{2}\right)^{\frac{30.8}{16.3}}$$

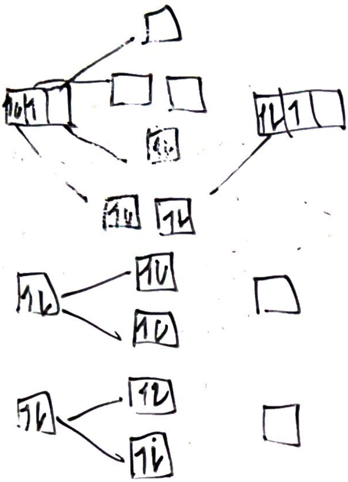
	σ	π
bond		
anti		

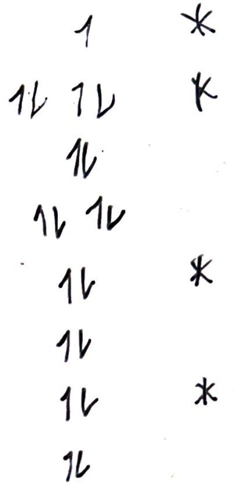


antibonding always have a node between nuclei

Pi always have a node along bond axis

antibonding > AO > bonding





15 elec

6 elec

5 elec

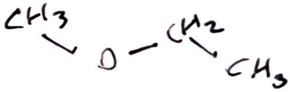
10 - 9

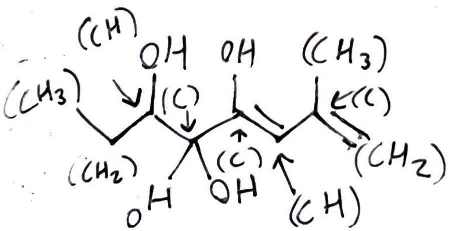
$$O = \frac{n - n^*}{2}$$

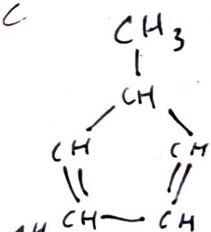
n = bonding orbit. n^* = antibonding

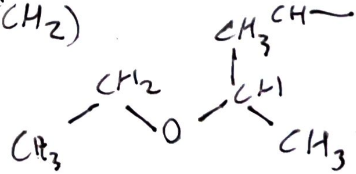
O > 0 = stable

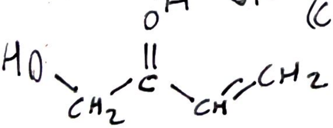
unpaired elec. = Paramagnetic

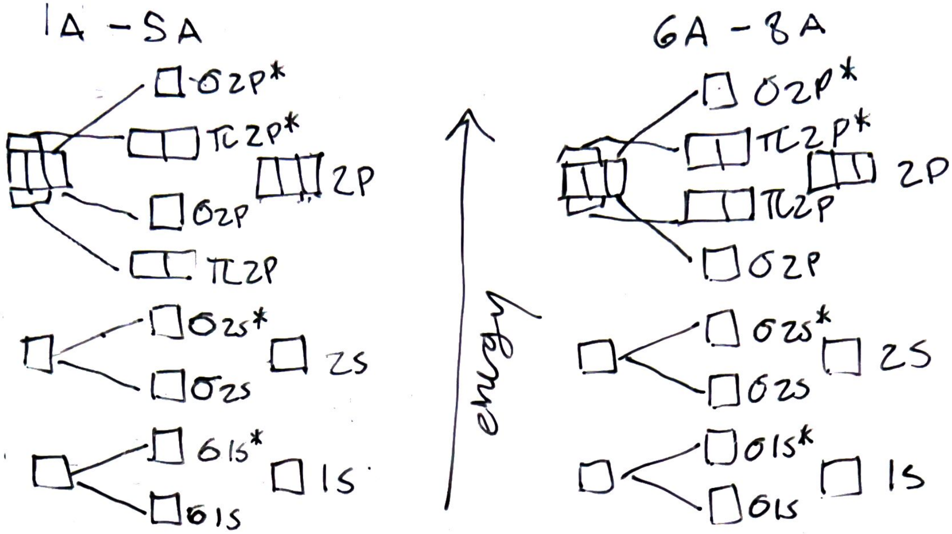






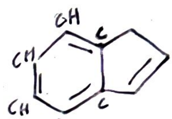


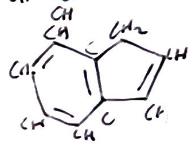




MO energy level diagram

Compound	Illustration(s)
CH_3	
CH_2	 or 
CH	 or 
C	 or  or 





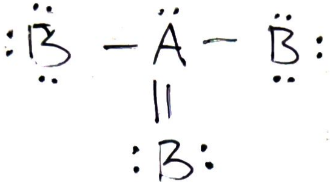
Hydrogen Bonding

1. Both molecules have O, N, or F
2. One O/N/F bonded to hydrogen, one O/N/F has 1+ lone pair

Boiling Point: T @ 1 atm / 760 torr

BP less elec < BP more elec

Chem 162 Week 2 Notes



$q = mc\Delta T$

$q = C\Delta T$

$P_1 \quad .46$

$P_2 \quad 1$

$T_1 \quad ?$

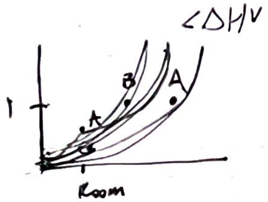
$T_2 \quad 100$

$-20 \to 0 \quad q = 15 \cdot 2.1 \cdot 20$

630 J

melt 5010

$0 \to 22 \quad 1386$



$$\frac{.46}{1} = e^{\frac{40700 \frac{J}{mol}}{8.3145 \frac{J}{mol\,K}}\left(\frac{1}{100} - \frac{1}{x}\right)}$$

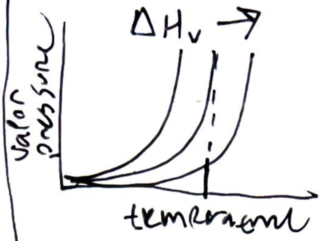
$$\ln(.46) = \frac{40700}{8.3145}\left(\frac{1}{100} - \frac{1}{x}\right)$$

$$-.7765 = 4895\left(\frac{1}{100} - \frac{1}{x}\right)$$

$$-.0001586 = \frac{1}{100} - \frac{1}{x}$$

$$\frac{1}{x} = .01015863$$

ALEKS Week 2



$$\frac{P_1}{P_2} = e^{\frac{\Delta H_v}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)}$$

$P_2 > P_1$

$R = 8.3145\ J \cdot mol^{-1} \cdot K^{-1}$

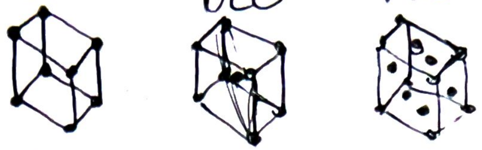
$$\frac{P_1}{1\,atm} = e^{\frac{1.4\times10^4}{8.3145}\left(\frac{1}{284.15}-\frac{1}{256.15}\right)}$$

$$\frac{.268}{.337} = e^{\frac{\Delta H_v}{8.3145}\left(\frac{1}{326.15}-\frac{1}{313.15}\right)}$$

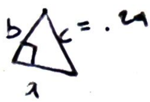
Force	Types of molecules
dispersion	all
dipole	Polar molecules
hydrogen	H−(O, N, F) & lone pairs
ion-dipole	ions & polar molecules

Boiling point:

Metal binary ionic > More molar mass > polarity or H-bond > nonpolar sc bcc fcc



simple body face



$$a^2 + 2a^2 = (.29)^2$$

$$3a^2 = .29^2$$

$$b^2 = 2(a^2)$$

$$2 = 4.1\left(\frac{1}{2}\right)^{\frac{7.03}{t_{1/2}}}$$

$$\frac{2}{4.1} = \frac{1}{2}^{\frac{7.03}{t_{1/2}}}$$

$$462^2 = a^2 + 2a^2$$

$$\ln\left(\frac{2}{4.1}\right) = \frac{7.03}{t_{1/2}} \ln\left(\frac{1}{2}\right)$$

$$-1.515 = \frac{7.03}{t_{1/2}}(-.6931)$$

$$2.18563 = \frac{7.03}{t_{1/2}}$$

in unit cell

$$\rho = \frac{n \cdot M}{V}$$ ← number of atoms × mass of atom; ← Volume of cell $= a^3$

density

$M =$ atomic mass AM. / avogadros #

$$7.874\ g/cm^3 = \frac{2 \cdot m}{V}$$

HCP = ABABAB

CCP = ABCABC

must be in the dimples of next layer

$$1\ pm = 1 \times 10^{-10}\ cm$$

$$11.34 g/cm_3 = \frac{4 \cdot M}{495^3}$$

$$P = \frac{4 \cdot (6.94/(6.022 \times 10^{23})}{(430 \times 10^{-10})^3}$$

a = width of unit cell

$$12.45 = \frac{4 \cdot M}{(388 \times 10^{-10})^3}$$

Solid	building block	Forces	Formed of
Molecular	molecules	intermolecular (weak)	Nonmetals
ionic	ions	ionic bond (v. strong)	metal + nonmetal
8A		dispersion (v. weak)	group 8A elem.
atomic not	atoms	covalent (strong)	carbon, SiO_2
metal		metal (strong	Metals

$R: 8.3145\ J mol^{-1} K^{-1}$

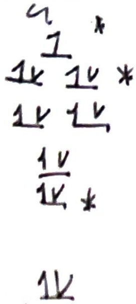
$$\frac{P_1}{P_2} = e^{\frac{\Delta HV}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)}$$

$$\frac{0.147}{0.322} = e^{\frac{\Delta HV}{8.3145\ J mol^{-1} K^{-1}}\left(\frac{1}{239.15} - \frac{1}{227.15}\right)}$$

$3(26a^2) = (4r)^2$

$(4r)^2 = 3a^2$

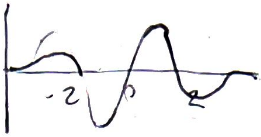
$(4r)^2 = 2a^2$



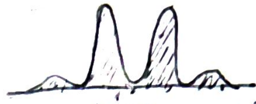
3-7

Chem 162 Midterm 1 review
WS #1

Q1 $\Psi(x)$



$|\Psi(x)|^2$



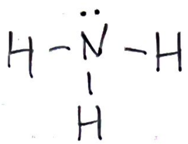
$[-2.6, -1.8]$, $[-1.6, -0.2]$, $[0.2, 1.6]$, $[1.8, 2.6]$

#2

1s

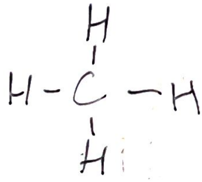
2p

#3

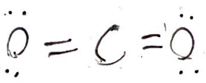


Trigonal Pyramidal

Bent

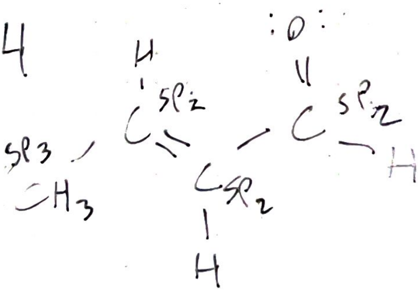


tetrahedral



~~Planar~~ linear

#4



W.S 3

Q1 $(\sigma 1s)^2$ BO = 1 , stable, higher energy than He_2^+

Q2 $\uparrow\downarrow$ $\sigma 2s$
— $\sigma 1s^*$
$\uparrow\downarrow$ $\sigma 1s$

Henrys law → $c = K_H P$
solubility → c; ↑ HL constant (K_H); partial press. (P)

$$c = (2.4\times10^{-4})(3.66) = 8.784\times10^{-4}\,M$$

$$8.784\times10^{-4}\,M \times .2\,L = 1.7568\times10^{-4}\,mol$$

solute	solvent	
Ionic	Polar	→ small hydrocarbons w electro neg atoms
Non-polar	Non polar	→ large h-carbons
polar	polar	
H-bond	H bond	→ small molec w OH, NH, NH_2

$\Delta H > 0$

solute + solvent < solution < exp and solute + exp and solvent

$\Delta H < 0$

solution < solute + solvent < exp and solute < exp and solvent

$$\frac{96.9}{x} = 2.32 \quad (\qquad \log(.588) = \frac{t}{1.26\times10^9}\log\left(\frac{1}{2}\right)$$

$$N(t) = N(0)\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

$$.588 = 1\left(\frac{1}{2}\right)^{\frac{t}{1.26\times10^9}}$$

ALEKS Week 5

$\text{molarity} = \frac{\text{moles solute}}{\text{Liters solution}}$ $\text{molality} = \frac{\text{moles solute}}{\text{Kg solvent}}$

$\frac{5.2g}{32.0419} = 0.16229$ moles

$\frac{16}{104.1491} = 0.15363$

$2.2 = 1.24 \cdot \frac{\text{mol}}{.550}$

$\frac{17}{93.1265} = 0.18255$

$E = k\frac{q_1 q_2}{r}$
small > large
high charge > low charge

Δ in boiling point

$\Delta T_b = K_b \cdot m$ ← molality (total)

$\Delta T_f = -K_f \cdot m$
← freezing

$\frac{29.8g}{60.0553} = 0.4962$ mol

$\Delta T_f = -K_f \cdot m$

$\text{molality} = \frac{0.4962 \text{ mol}}{.600 \text{ Kg}} = 0.827$

$(-9.7 - x) = -6.47 \cdot .827$

Solubility Δ

Solute	T ↑	P ↑
gas	↓	↑
l or s	↑	0

$-K_f = \frac{\Delta T_f}{m} = \frac{3.4}{.4218}$

$\frac{7}{.928}$

ox. state
+ charge on ligands

charge on complex

F^- -1 CO_3^{2-} -2
Cl^- -1 CO 0
Br^- -1 NH_3 0
CN^- -1 H_2O 0
OH^- -1

Max ox state: 3B-7B = #B 1B-2B = 2

8B = Fe Co 3
Ni 2

$\Delta T_f = -K_f m$ molality↑, bp↑ FP↓

H_2O = high FP, low BP

.1878 ↑

$-1.4 = -(6.15)\frac{x}{.4kg}$ .03885 ↓

.99 -

$\frac{x}{.4} = 0.2$ mols x = 0.20488 × 60.0553 =

.196↓ .5738

$2.3 = K_b(1.647)$ 1.048↑ .679

.807 - .537

$\Delta H = 2.24\left(\frac{.7443}{.45}\right)$

(.102 atm)(.005L) = n(.082087)(292.15)

(.0472)(.005) = n(.082057)(298.15)

$P_i = X_i P_i^0$

mole fraction

partial pressure

vapor pressure (pure)

K_2SO_4 .324 ↑bp ↓FP

$C_3H_8O_3$ .204 ligand = halogen anion, molecule w/ ONSP lone pairs

$C_3H_8O_2$ .247 7.4g .25 kg

K_2SO_4 .5096

$C_3H_8O_3$ .3214

$C_6H_{12}O_6$ .1643 electrolyte = produces ions

7.4 .25

$CaCl_2$ .800 (electrolyte)

$C_{12}H_{22}O_{11}$ .086

KI .3566

$$\Delta T_f = -i \cdot K_f \cdot \underbrace{m_e}_{\text{molality}}$$

.024 mol

$$5 = 20.3\left(\frac{x}{.1}\right)$$

$$1 = K_b(.1613)$$

$$\Delta H = -(6.03)(.4582)$$

$$\Delta H = 2.97(\quad)$$

$$4.5 = K_f\left(\frac{1.257}{1.3}\right)$$

$$K_f = 4.6535$$

$$4.2 = K_f(1.3689)$$

$$1.6 = (1.10)\frac{m}{.65}$$

$$-4.5 = -(3.12)(4.6535)\left(\frac{mol}{1.3}\right)$$

cis = same trans = opposite

$54 = K_f\left(\frac{2.138}{1.3}\right)$ $K_f = 3.2833$ $9.7 = i(3.2833)\left(\frac{2.18}{1.3}\right)$

$i = 1.7647$ $8.9 = K_f\left(\frac{2.179}{1.35}\right)$ $K_f = 5.5131$

$13.5 = i(5.5131)\left(\frac{1.0915}{1.35}\right)$ $i = 30285$ $0.7 = 6.17\left(\frac{x}{.045}\right)$

$0.97 = 4.25\left(\frac{x}{.1}\right)$ $P_i = X_i \cdot P$ $P_i = X_i \cdot P_i^\circ$

mass mol $\frac{mol}{mol}$ X mol mass %mass $2.3\times10^{-2}\,\frac{mol}{L\,atm}\times 3.8\times 1.7$

A $2.6 = K_f\left(\frac{.5036}{1.45}\right)$

B

$K_f = 7.4868$

P	25	.3465	.1755	406	.534	.534	38.5	
E	75	1.628	.8245	548	.721	.721	174.4	
C	90	1.0597	.83728					
E	10	.2171	.17					
AA	25	.416	.091	49.9	.065	3.903		
W	75	4.163	.909	710.8	.935	16.84		
CT	90	.5851	.778	79.44	.894	137.52		
AA	10	.1665	.222	80.364	.106	6.366		
P	50	1.693	.3898	560.92	.7381	53.253		
E	50	1.085	.6102	1989	.2617	12.0566		
MC	10	.1177	.0568	128.5	.169	14.35		
E	90	1.954	.4434	631.1	.830	38.25		

$6.3 = i(7.4868)\left(\frac{}{1.45}\right)$

$os.P = CRT$

$\frac{1}{84.9326}$ 337.15 .00296

$\frac{1}{46.06844}$ 270.15 .01357

$\frac{1}{60.052}$ 13.22

$\frac{1}{18.015}$ 15.72

$\frac{}{53.8227}$ 2.502

$\frac{1}{60.052}$ .00061

$\frac{1}{721.938}$ 4161.64

$\frac{1}{46.06844}$

$\frac{}{84.9326}$ $E = h\frac{c}{\lambda}$

$\frac{1}{46.06844}$ $\lambda = \frac{hc}{E}$

2.6 =

400 → 700

purple → red white

weak field: F^-, Cl^-, Br^-, H_2O - high spin

strong field: NH_3, en, CN^- - low spin

tetra = high spin ← slope

$\ln k = -\frac{E_a}{R}\,\frac{1}{T}$