(27) **Today**

Chap 6 Acid-Base and Donor-Acceptor Chemistry

Next Class (28)

Chap 9.1 Introduction to Coordination Chemistry

(29) **Second Class from Today**

~~Test 3~~ Nov 2~~4~~ Dec 6

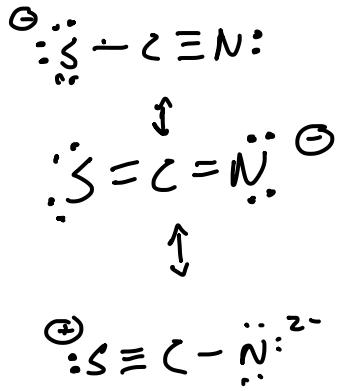
Chap 9.1 Introduction to Coordination Chemistry

Third Class from Today (30)

Chap 9.1 Introduction to Coordination Chemistry

AgF	$K_{sp} = 205$
AgCl	$K_{sp} = 1.8 \times 10^{-10}$
AgBr	$K_{sp} = 5.2 \times 10^{-13}$
AgI	$K_{sp} = 8.3 \times 10^{-17}$

why is this more soluble in H_2O



+2 -4 = -2 +2 -4 = -2

$[Hg(SCN)_4]^{2-}$ vs $[Zn(NCS)_4]^{2-}$

$[CH_3Hg(H_2O)]^+ + HCl \longrightarrow CH_3HgCl + H_3O^+ \quad K = 1.8 \times 10^{12}$

$[CH_3Hg(H_2O)]^+ + HF \rightleftharpoons CH_3HgF + H_3O^+ \quad K = 4.5 \times 10^{-2}$

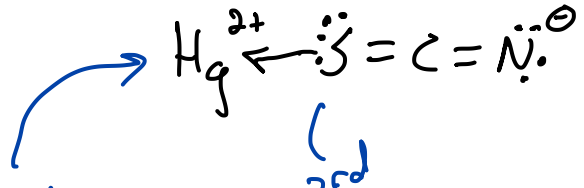
these are a Lewis acid base adduct

$[Hg(SCN)_4]^{2-}$ vs $[Zn(NCS)_4]^{2-}$

(+2) (-1)4

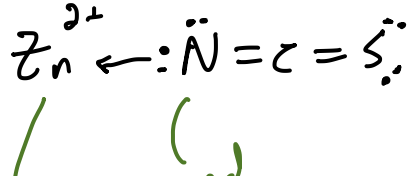
polarizable e^- density makes the atoms/molecules "soft"

more concentrated charges not as polarizable "hard"



6th row of periodic table

3rd row



4th row off p. table

2nd row

Lewis acid + Lewis base } soft

Larger acid + larger base

smaller Lewis acid

smaller Lewis base

large atoms are more polarizable since the e^-'s are farther away from the nucleus

Hard Lewis acids interact more strongly with Hard Lewis bases

Soft Lewis acids interact more strongly with soft Lewis bases

HOMO + LUMO are farther appart in Hard-soft interactions so they don't interact as well

Hard + Soft acids e^- pair acceptors

atoms not appearing in the table are considered Hard acids

1. the higher the oxidation state the harder the acid
2. can be soft or hard depending on their oxidation state

weak, but hard Lewis acid

H^+

Li^+

Na^+

Fe^{2+} soft

Fe^{3+} hard

Cu^+ Cu^{2+}

Hg_2^{2+} weak, soft acid

Hg^{2+} stronger, soft acid

													B	C			
						Mn	Fe	Co	Ni	Cu							
					Mo	Tc	Ru	Rh	Pd	Ag	Cd				Te		
					W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po		

soft Lewis acids

O as the lone pair donor makes these all hard bases ... but remember hard ≠ strong

H_2O is a weak base & O^{2-} is a very strong base

H with it's +1 nucleus is not particularly good at attracting both e^-... so they are more polarizable than you would expect

very large

3rd row

Hard Bases	Borderline Bases	Soft Bases
		H^-
F^-, Cl^-	Br^-	I^-
H_2O, OH^-, O^{2-}		H_2S, SH^-, S^{2-}
ROH, RO^-, R_2O, CH_3COO^-		RSH, RS^-, R_2S
NO_3^-, ClO_4^-	NO_2^-, N_3^-	SCN^-, CN^-, RNC, CO
CO_3^{2-}, SO_4^{2-}, PO_4^{3-}	SO_3^{2-}	$S_2O_3^{2-}$
NH_3, RNH_2, N_2H_4	$C_6H_5NH_2$, C_5H_5N, N_2	PR_3, $P(OR)_3$, AsR_3, C_2H_4, C_6H_6

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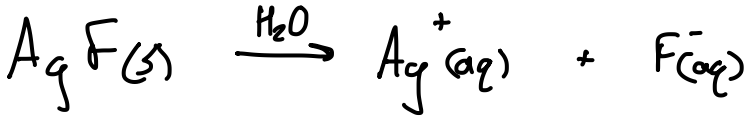
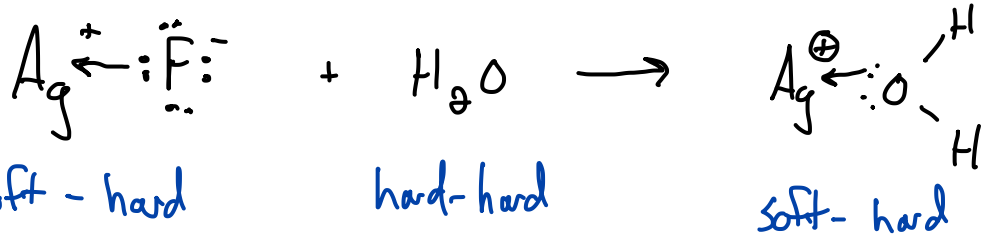
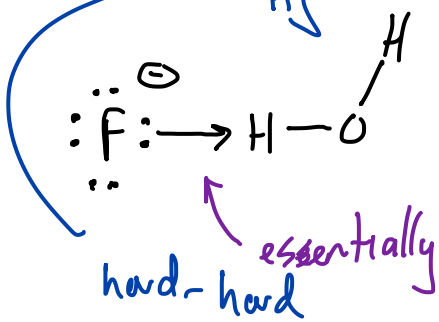




because the base interacting with Ag^+ interacts more strongly with the hard H_2O acid the F^- can be dragged into solution



soft - soft hard - hard soft - hard soft - hard

two good interactions traded for two "bad" interactions

soft hard hard hard hard

$$[CH_3Hg(H_2O)]^+ + HCl \longrightarrow CH_3HgCl + H_3O^+ \quad K = 1.8 \times 10^{12}$$

H^+ from HCl is now on harder O atom

softer than the O of H_2O

soft hard

$$[CH_3Hg(H_2O)]^+ + HF \rightleftharpoons CH_3HgF + H_3O^+ \quad K = 4.5 \times 10^{-2}$$

hard

F^- is a hard base like an O atom so it isn't a better interaction... no driving force to push rxn to completion

$$\eta = \frac{I - A}{2}$$

ionization E.

e⁻ affinity