Chapter 9 HW: #2(c-e), 3(c-e), 4(d,e), 8, 9, 12(a-e, g), 15a, 19, 26

2.

c) *cis*- and *trans*-carbonylchlorobis(triphenylphosphane)iridium(I)
d) pentaammineazidocobalt(III) sulfate
e) diamminesilver(I) tetrafluoroborate **or** diamminesilver(I) tetrafluoroborate(III)
["Tetrafluoroborate" is a common name for BF_4^-, so the oxidation state of boron may or may not be specified.]

3.

c) carbonatobis(ethylenediamine)cobalt(III) chloride
d) tris(2,2'-bipyridine)nickel(II) nitrate
e) hexacarbonylmolybdenum(0)

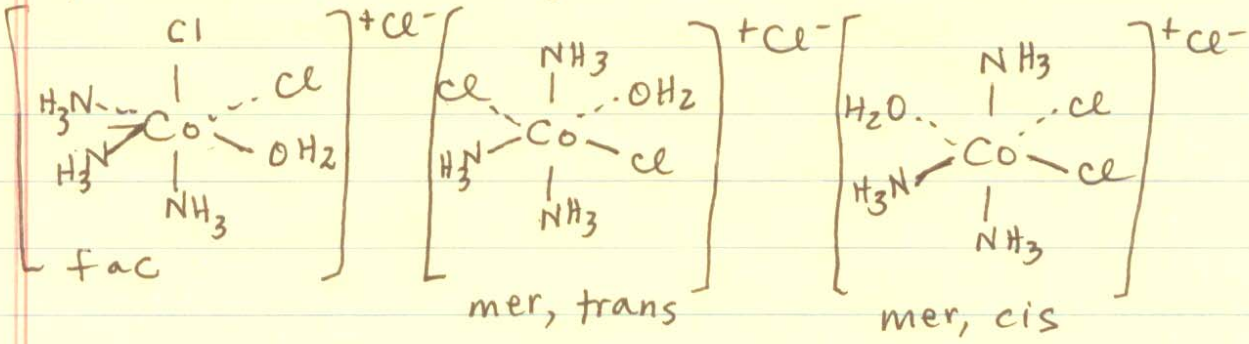
4.

d) hexacyanomanganate(II)
e) nonahydridorhenate(VII)

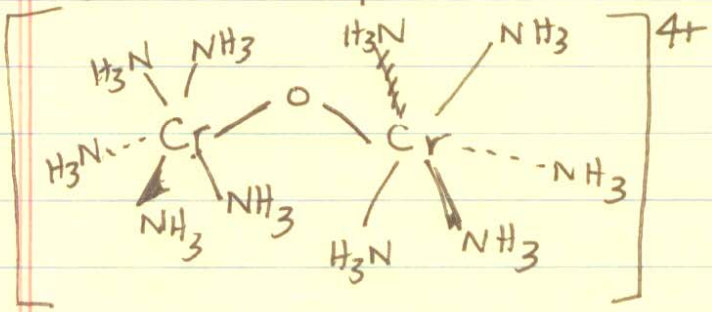
Continued on next page . . .

8. a) $[Co(NH_3)_3(H_2O)Cl_2]Cl$

ammines: fac or mer
Cl's: cis or trans



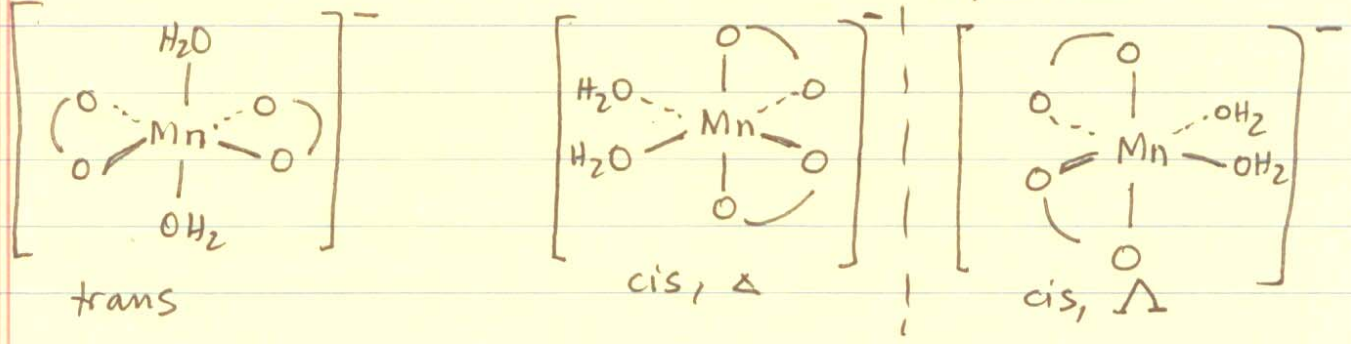
b) μ-oxo-bis[pentaamminechromium (III)]



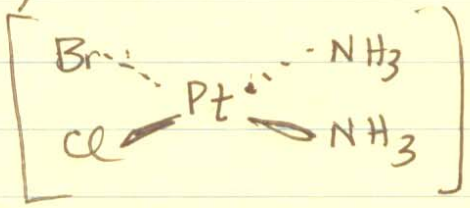
c) $K[Mn(H_2O)_2(C_2O_4)_2]$

H_2O trans; H_2O cis

Λ, Δ enantiomers



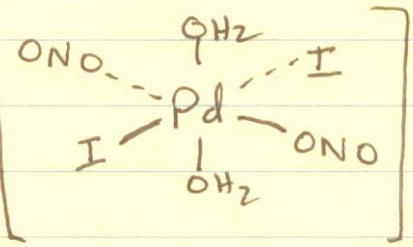
9. a) cis-Diamminebromochloroplatinum (II)



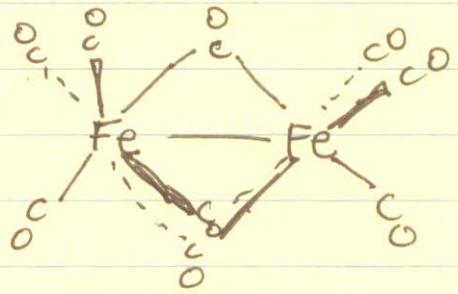
9 cont.

b) all trans-Diaquadiiododinitritopalladium(IV)

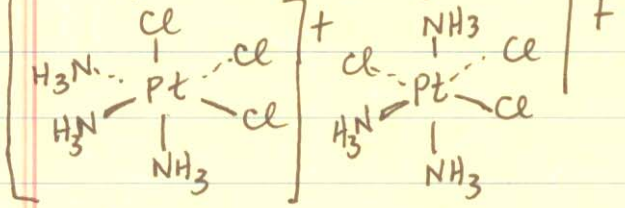
Note: When ~~the~~ "nitrito" is used without specifying the atom that bonds to M, older nomenclature is in use. Then, nitro = $\underline{N}O_2^-$ (M–N) and nitrito = $\underline{O}\text{-}NO^-$ (M–O)



c)

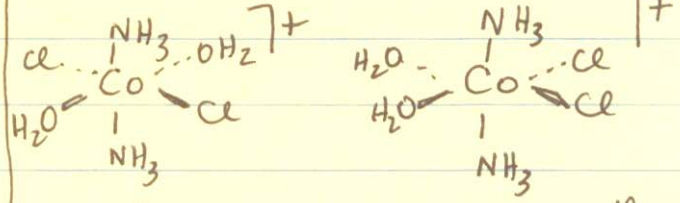


12. a) $[Pt(NH_3)_3Cl_3]^+$



fac mer

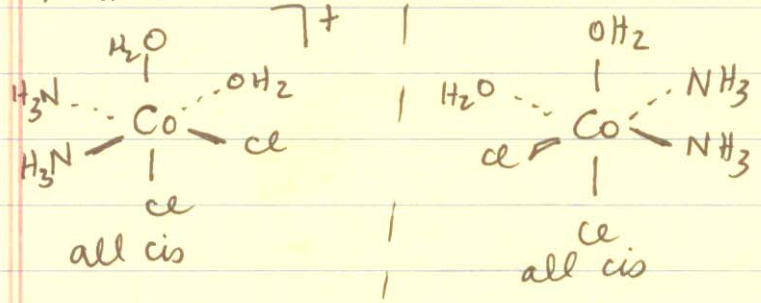
b) $[Co(NH_3)_2(H_2O)_2Cl_2]^+$



all trans NH_3 trans, other c

(+2 other isomers:
$-H_2O$ trans
-Cl trans

b) cont'd



all cis Enantiomers all cis

6 total isomers for 12(b)

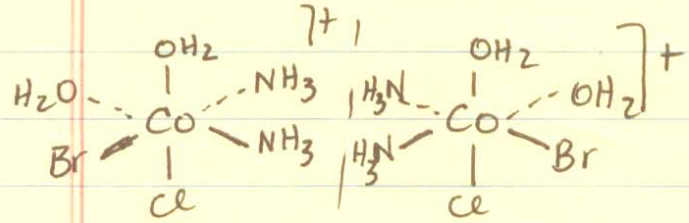
12 c) $[Co(NH_3)_2(H_2O)_2BrCl]^+$

Similar to 12(b), but 8 total isomers

1) all trans 2) Br, Cl trans; others cis 3) NH_3 trans, others cis

4) H_2O trans, others cis

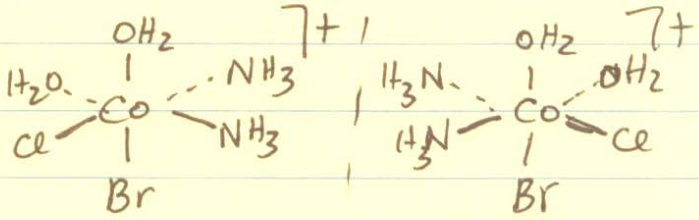
For "all cis," there are 2 pairs of enantiomers:



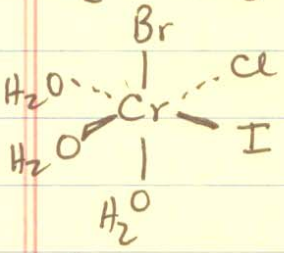
Br trans to NH_3
Cl trans to H_2O

AND

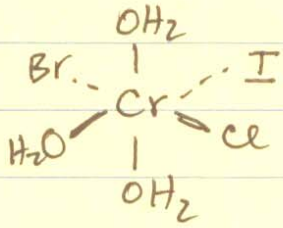
Cl trans to NH_3
Br trans to H_2O



d) $[Cr(H_2O)_3BrClI]$



fac



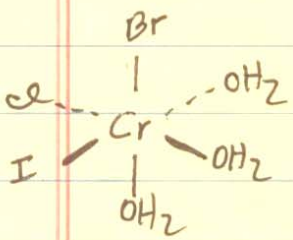
mer
Br, Cl trans

Also 2 more
mer Br, I trans
mer Cl, I trans

5 total isomers

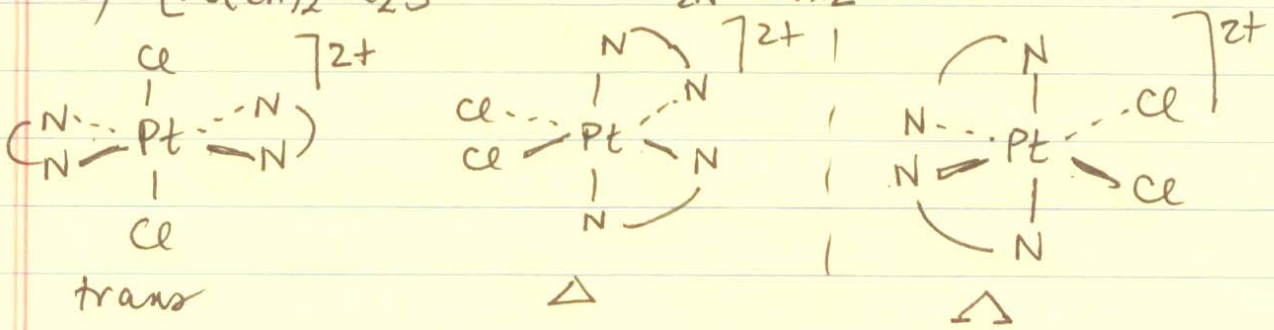
↕

and enantiomer



12 cont

e) $[Pt(en)_2Cl_2]^{2+}$ en = H_2N NH_2 ≈ N N

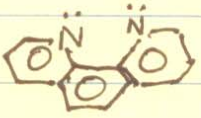


trans

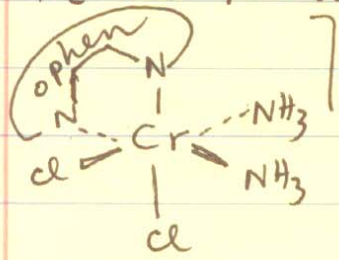
Δ

Δ

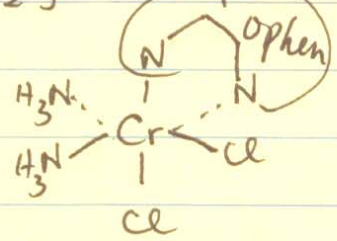
f) $[Cr(o\text{-phen})(NH_3)_2Cl_2]^+$ o-phen =



N's must be only 90° apart when coordinated



+



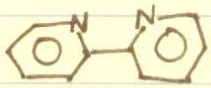
enantiomers

NH_3's + Cl's cis

4 isomers total

2 other isomers:

- NH_3's trans, Cl's cis
- NH_3's cis, Cl's trans

g) bipy =  similar to 12(e) - 3 isomers

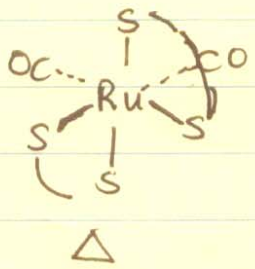
1) bipy's trans

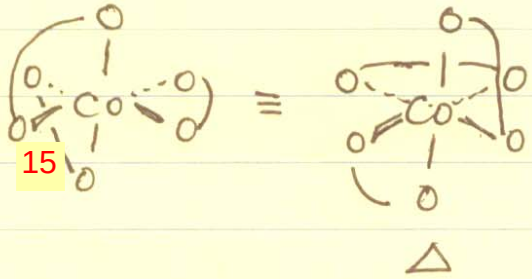
2) bipy's cis - Δ and Λ stereochem.

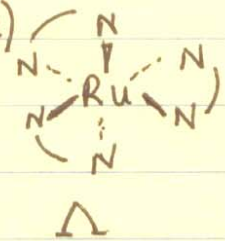
15

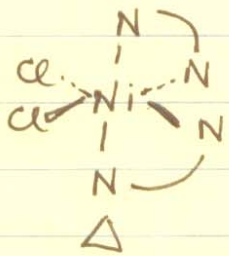
a) Pd is a soft acid, so it makes sense that the ligand would bind through the softer base, PRH_2.

19.

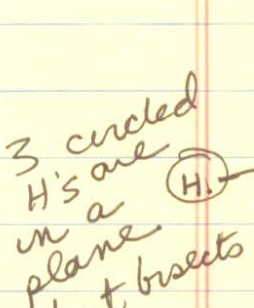
a) 

b) 

c) 

d) 

26.



3 circled H's are in a plane that bisects the molecule (the σ_h plane)

See Fig. 9.33b, p. 355

D_{3h} symmetry.

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$	
Γ_R	9	0	1	3	0	3	Σ 9 1s orbitals

Γ_R decomposes to: $2A_1' + 2E' + A_2'' + E''$

Looking at the character table, the symmetries of the Re orbitals are:

6s: A_1'

5d: $x^2-y^2, xy: e'$ $\quad xz, yz: e''$ $\quad z^2: a_1'$

6p: $x, y: e'$ $\quad z: a_2''$

All of these metal orbitals match the symmetries of the 9 ligand SALCs (from Γ_R above), so all of these Re orbitals have the correct symmetry to interact with the H's.