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CEE 680: Water Chemistry

Lecture #43

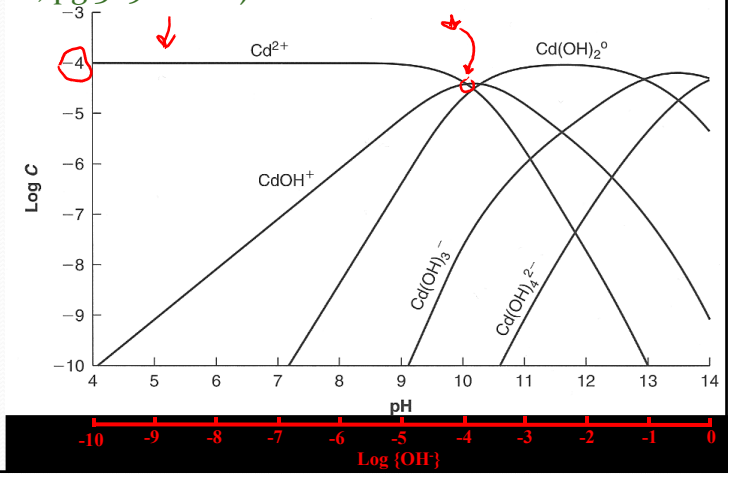
Precipitation and Dissolution: Cadmium Case Study

(Stumm & Morgan, Chapt.7)

Benjamin; Chapter 8

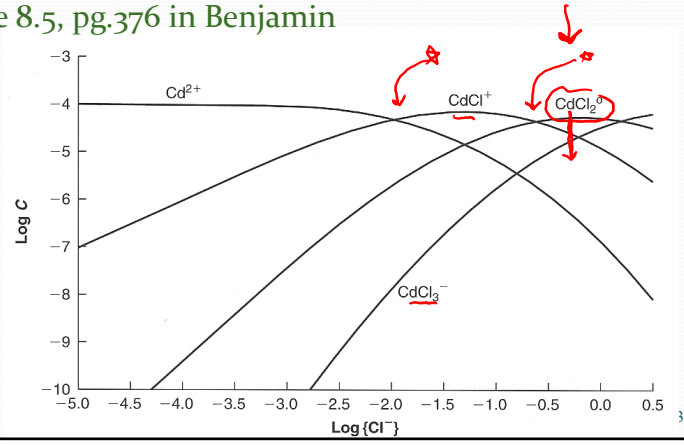
Hydroxo complexes

- 10^{-4}M Cd_T
  - Figure 8.2, pg.369 in Benjamin



Chloride Complexes

- 10^{-4}M Cd_T
- Low pH (no OH complexes)
  - Figure 8.5, pg.376 in Benjamin



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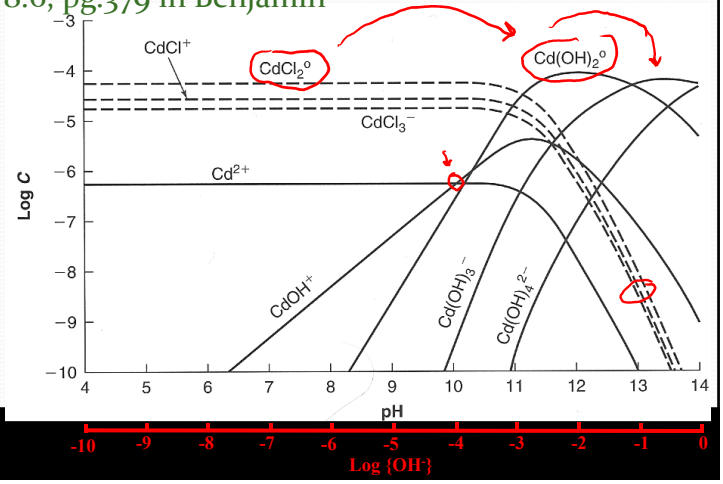
Mixed OH, Cl complexes

- 10^{-4}M Cd_T; $\{Cl^-\}$=0.5M
  - Figure 8.6, pg.379 in Benjamin



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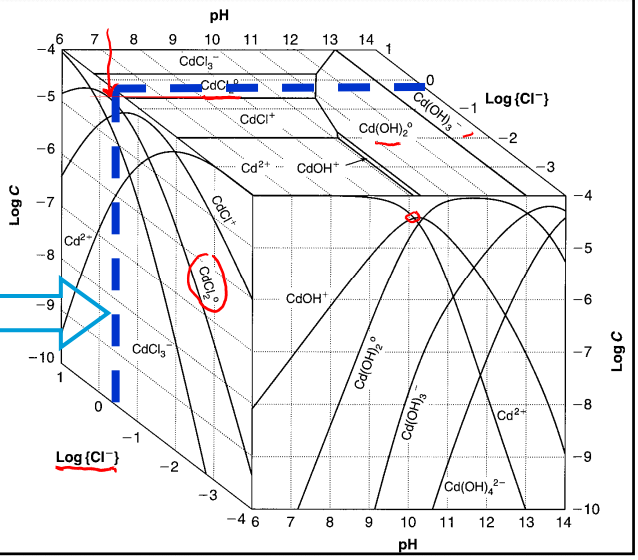
3D Surface: Cl, OH complexes

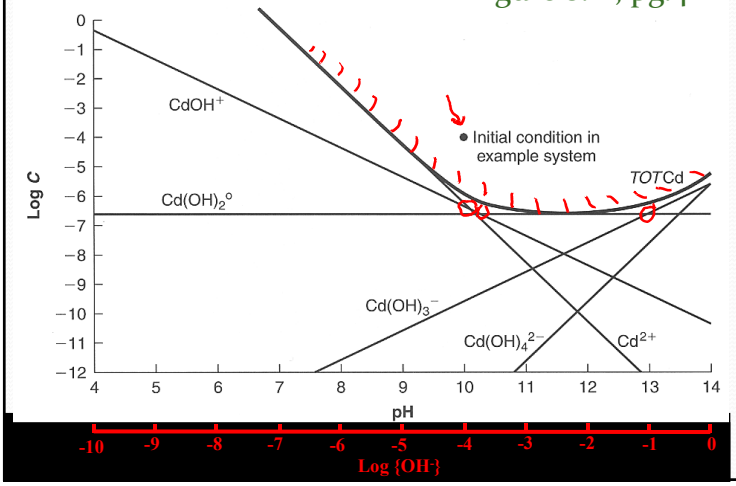
- Fig 8.7 in Benjamin

Slice shown in Fig. 8.6



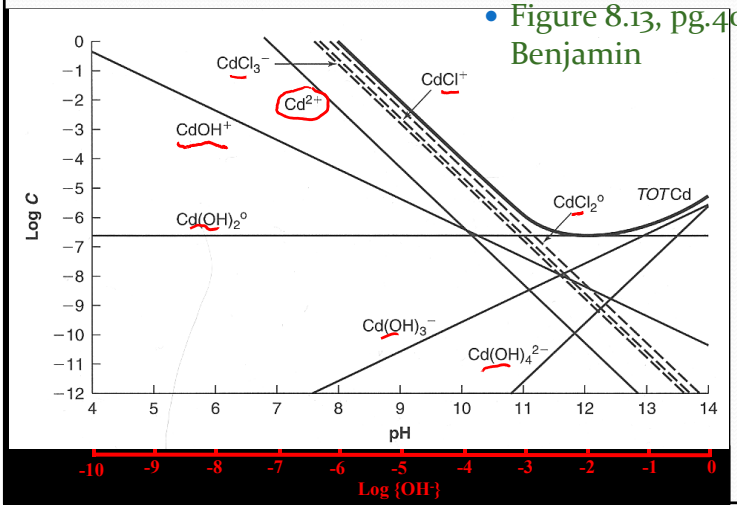
$Cd(OH)_2$ Precipitate

- no $\{Cl^-\}$
- Figure 8.12, pg.401 in Benjamin



$Cd(OH)_{2\ (s)}$ with Cl^-

- $\{Cl^-\}$=0.5M
- Figure 8.13, pg.403 in Benjamin



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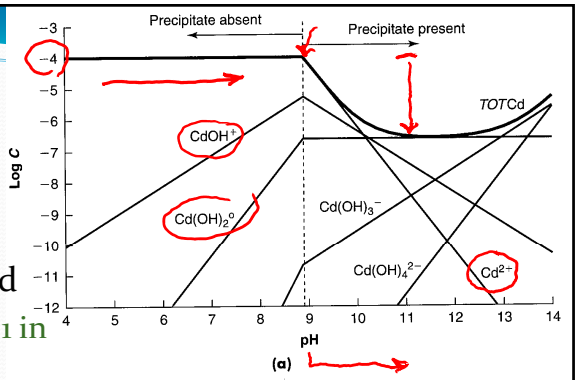
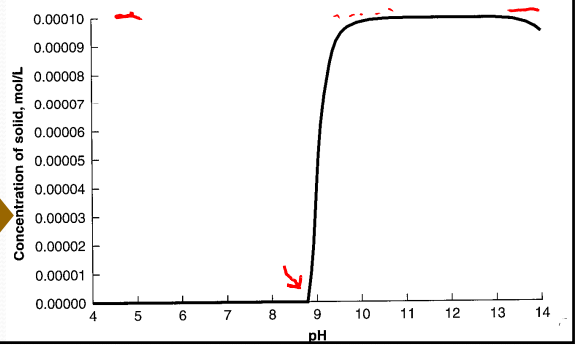
Cd limited; no Carbonate

- 10^{-4}M Cd_T
- $Cd(OH)_{2\ (s)}$ allowed
  - Figure 8.19, pg.421 in Benjamin





Not really "concentration", more accurately the mass of precipitate per L solution

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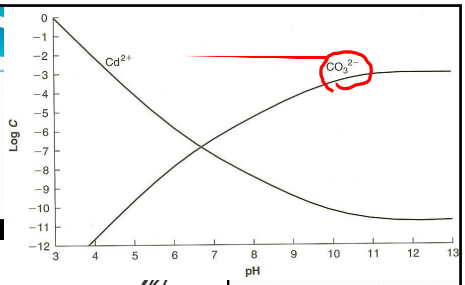
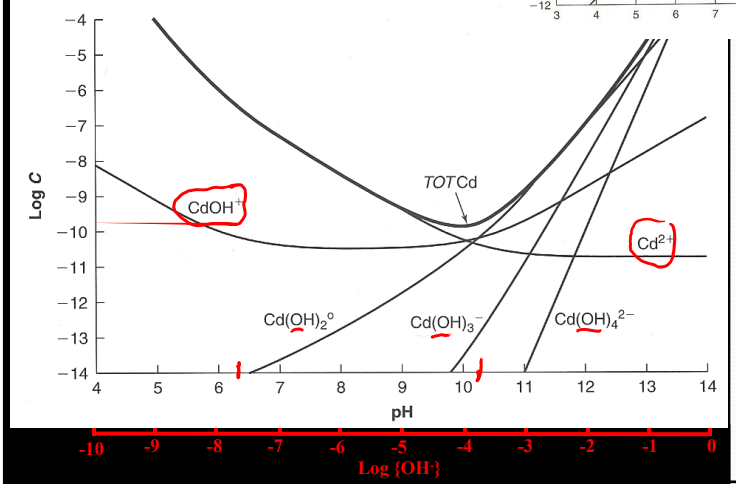
$CdCO_{3\,(s)}$ low C_T





- $C_T=10^{-3}M$
  - Figure 8.15, pg.406 in Benjamin

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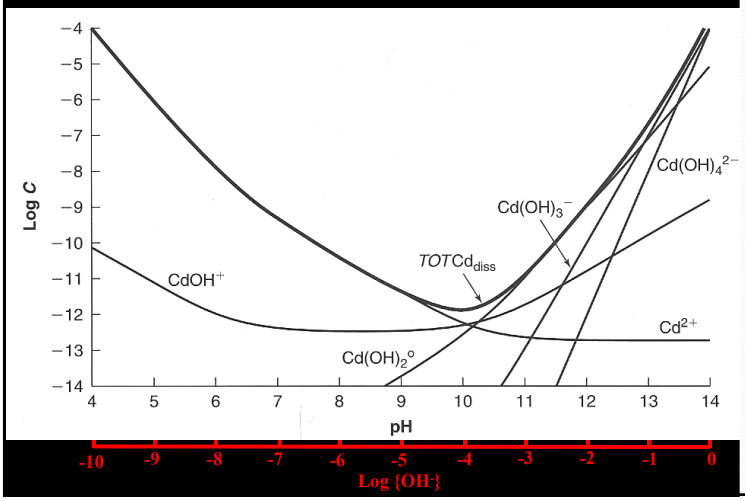
$CdCO_{3\,(s)}$ High C_T

- $C_T=10^{-1}M$
  - Figure 8.17, pg.409 in Benjamin



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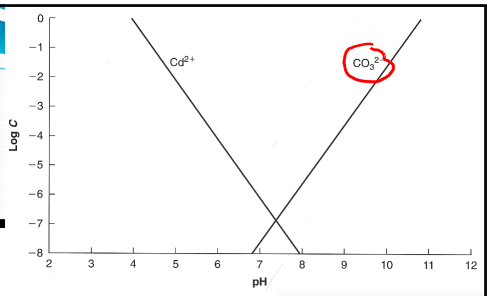
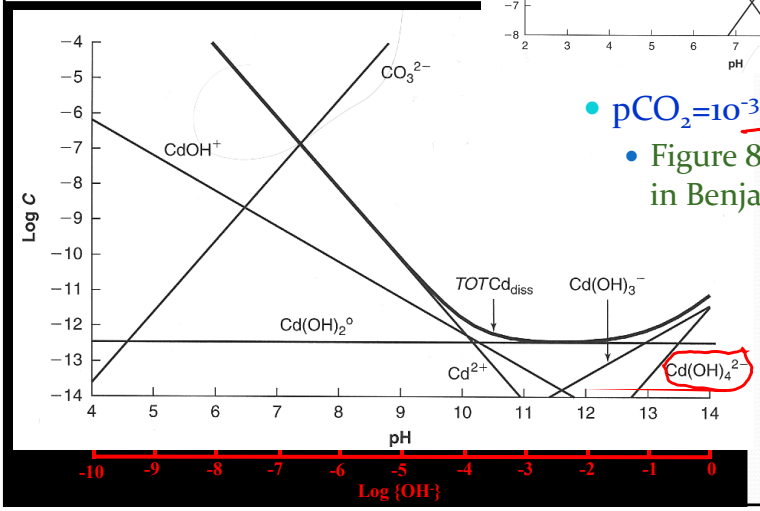
$CdCO_{3\,(s)}$ Open





- $pCO_2=10^{-3.5}$
  - Figure 8.18, pg.410 in Benjamin

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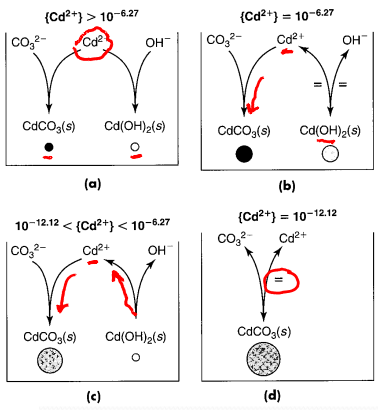
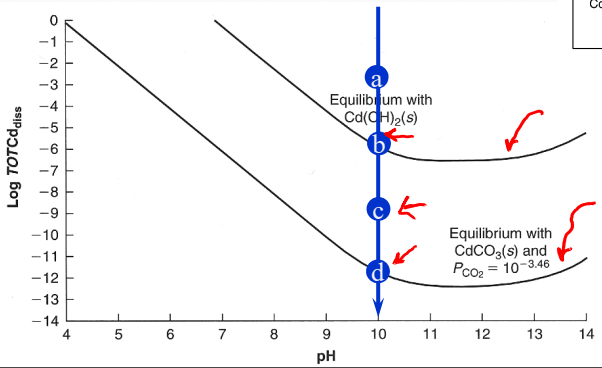
Solid formation

- Open system





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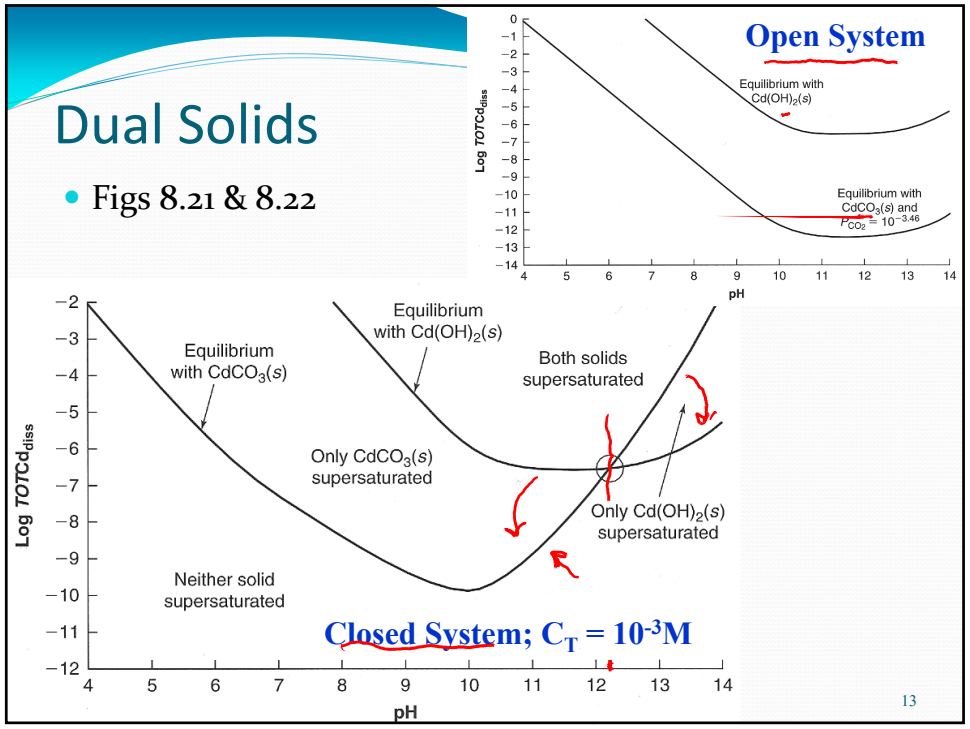
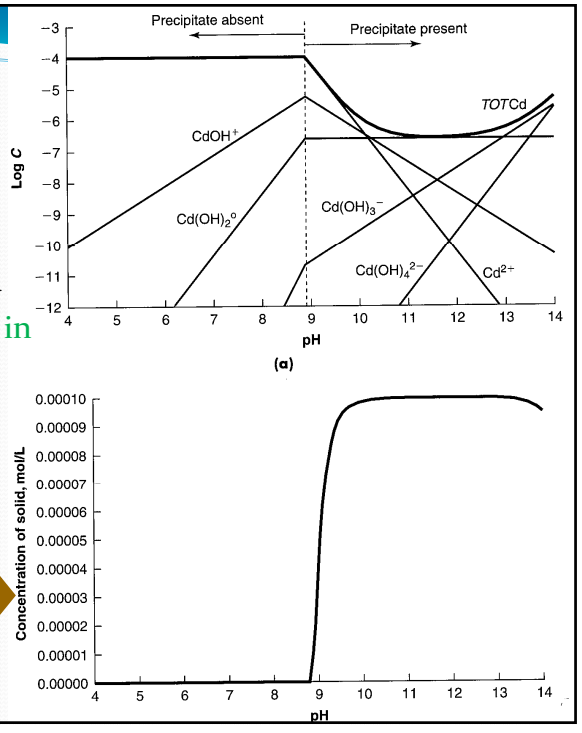
Dual Solids

- Figs 8.21 & 8.22



Cd limited; no Carbonate

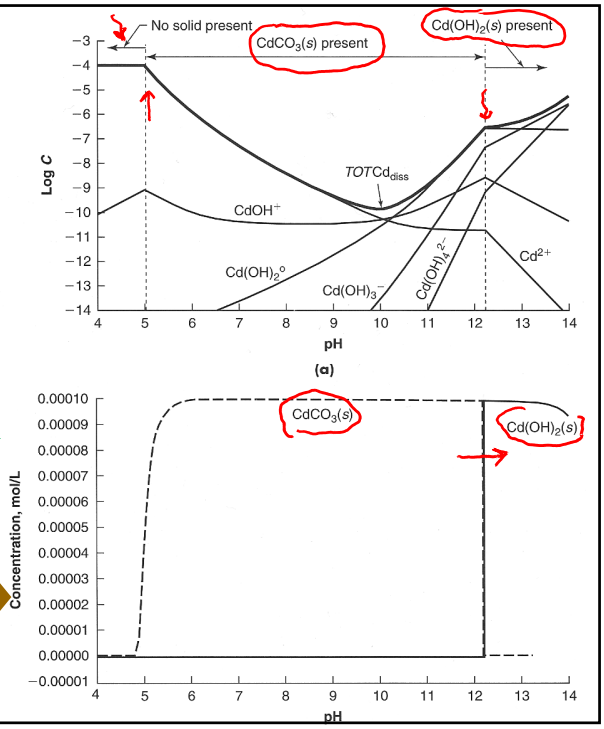
- $10^{-4}M$ Cd_T
- $Cd(OH)_{2\ (s)}$ allowed
  - Figure 8.19, pg.421 in Benjamin



Not really "concentration", more accurately the mass of precipitate per L solution

Cd limited; Closed System

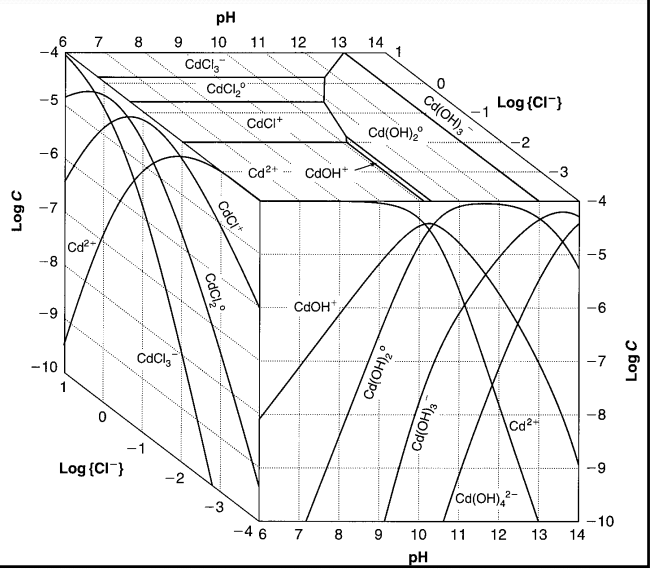
- 10^{-4}M Cd_T
- 10^{-3} $CO3_T$
- $Cd(OH)_{2\ (s)}$ & $CdCO_{3\ (s)}$ allowed
  - Figure 8.23, pg.428 in Benjamin



Not really "concentration", more accurately the mass of precipitate per L solution

3D, 4D, 5D?

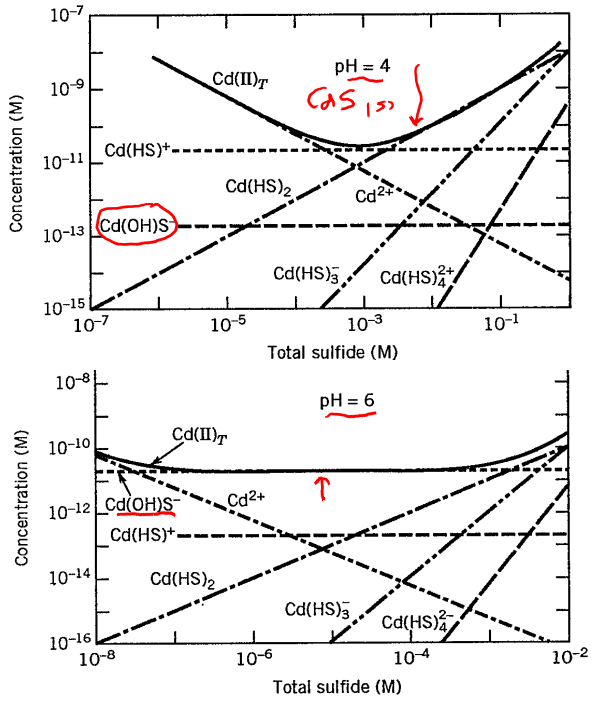
- Fig 8.7 in Benjamin



With S^{-2}, low pH

Stumm & Morgan, 1996, Figure 7.19a, pg. 405

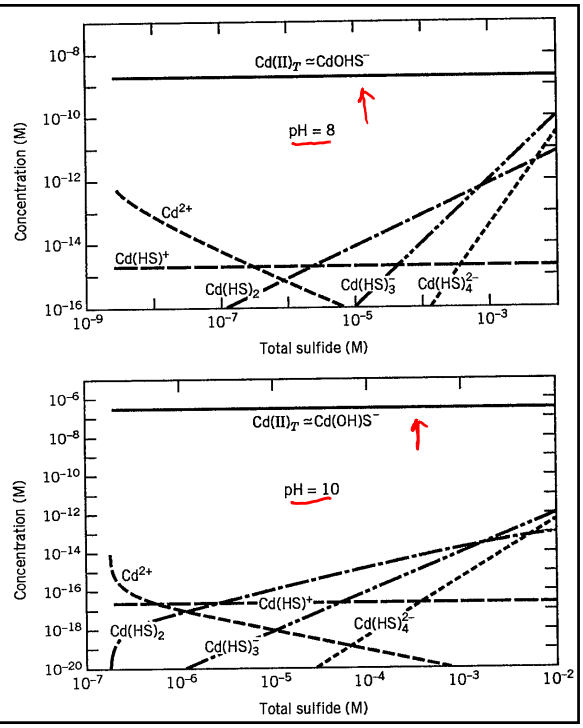
Stumm & Morgan, 1996, Figure 7.19b, pg. 405

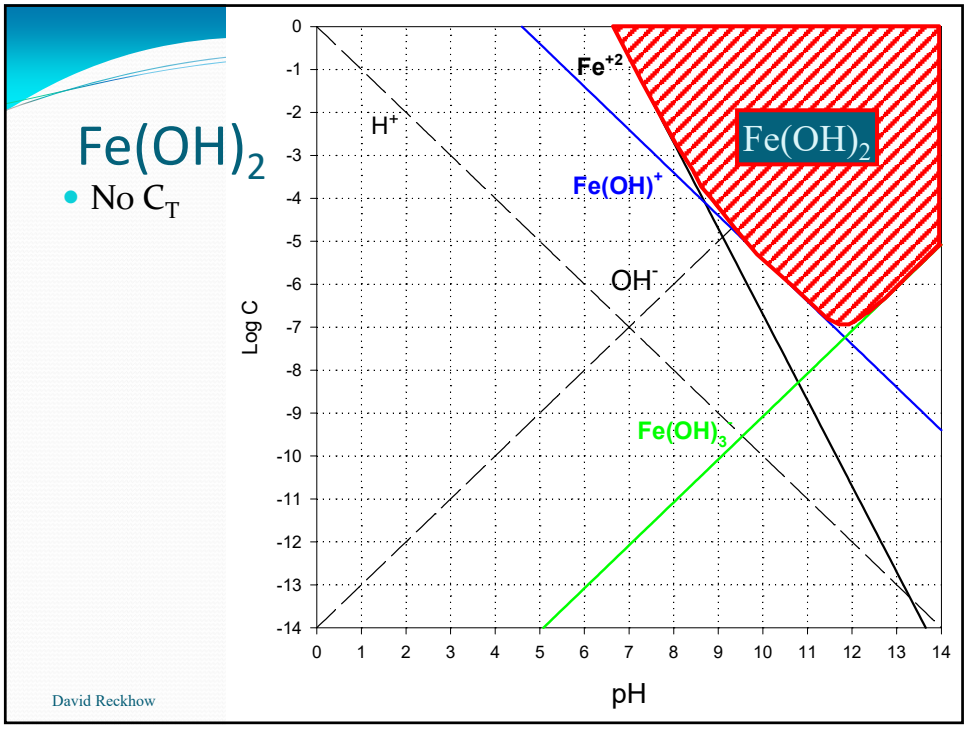


With S^{-2}, high pH

Stumm & Morgan, 1996, Figure 7.19c, pg. 406

Stumm & Morgan, 1996, Figure 7.19d, pg. 406




Fe(OH)2
No CT
Fe+2
H+
Fe(OH)2
Fe(OH)+
OH-
Fe(OH)3
Log C
pH
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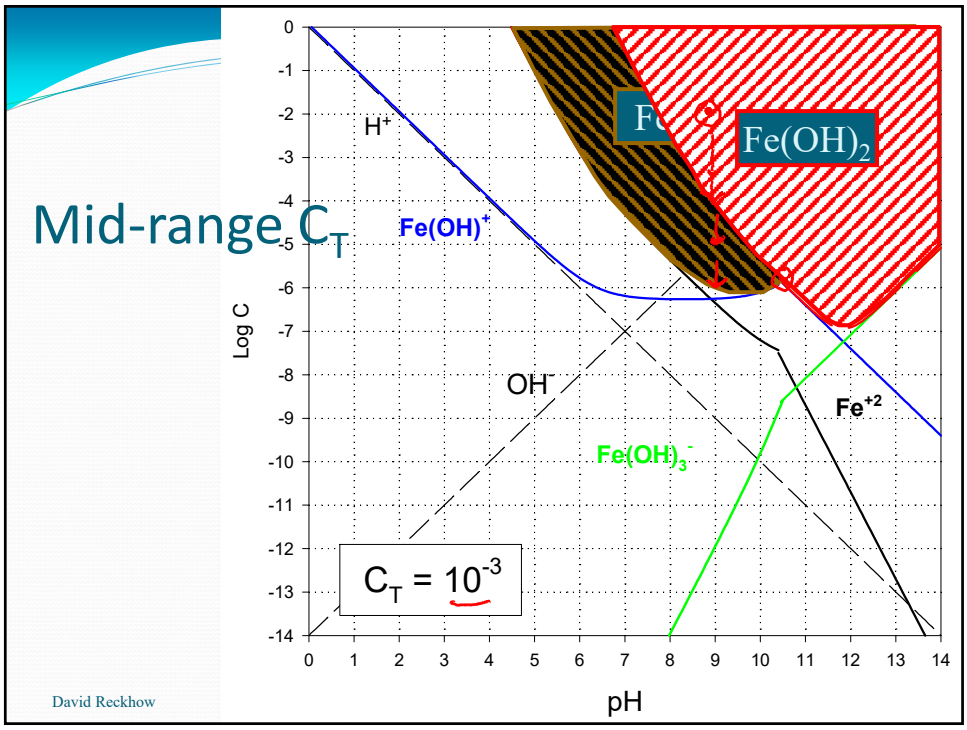
Mid-range CT
H+
Fe(OH)2
Fe(OH)+
OH-
Fe+2
Fe(OH)3-
CT = 10-3
Log C
pH
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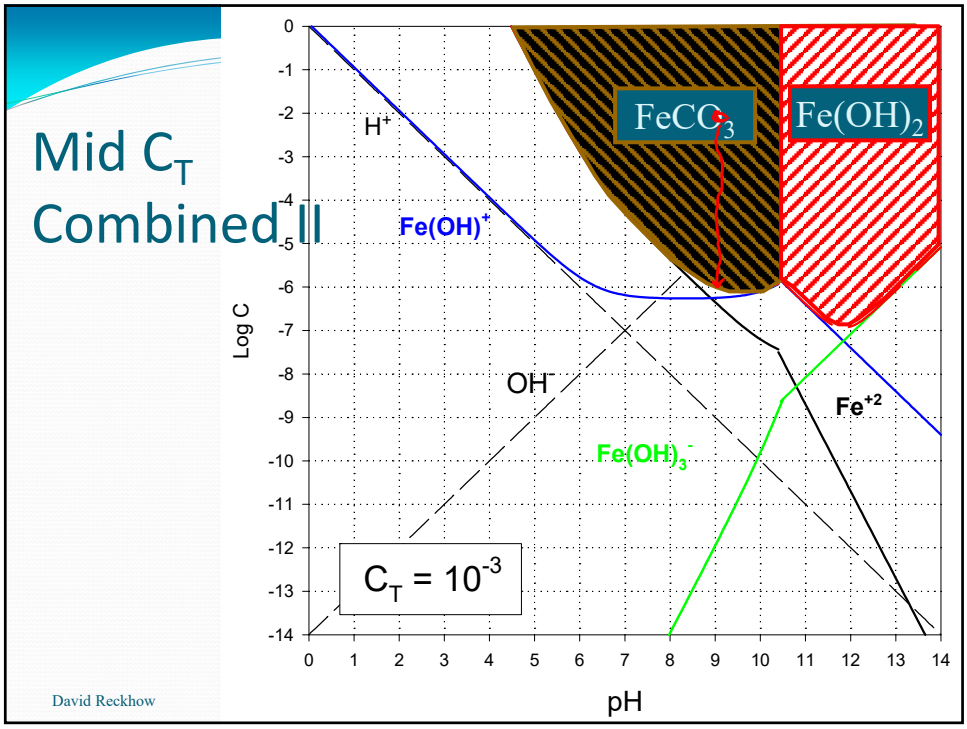
Mid C_T Combined II
$FeCO_3$
$Fe(OH)_2$
H^+
$Fe(OH)^+$
OH^-
Fe^{+2}
$Fe(OH)_3^-$
$C_T = 10^{-3}$
Log C
pH
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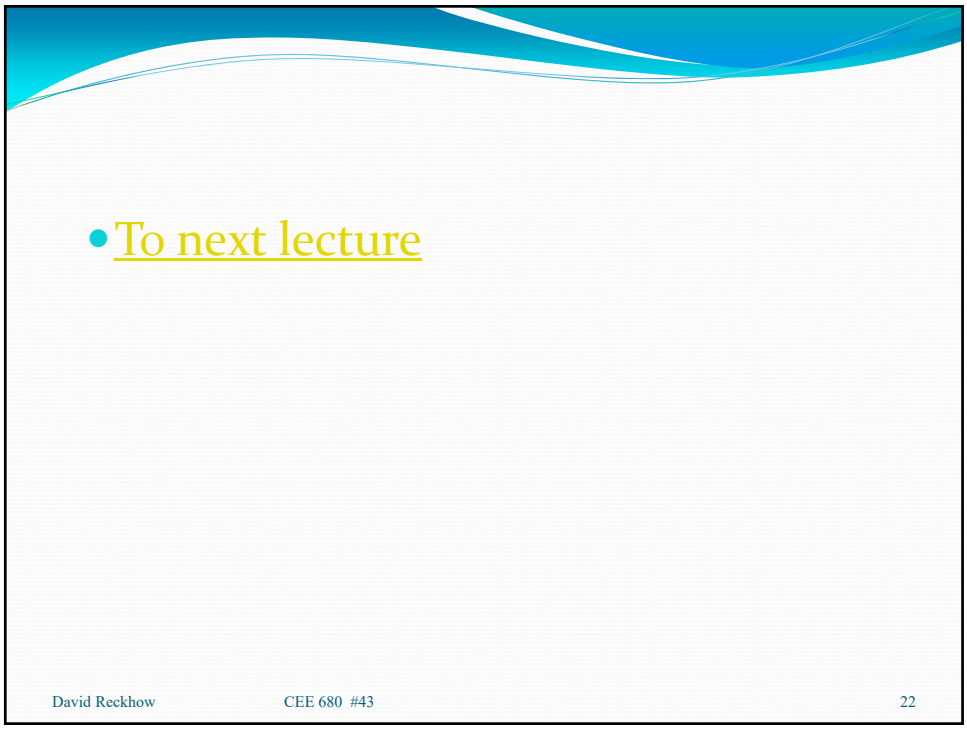
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