Updated: 13 April 2020

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CEE 680: Water Chemistry

Lecture #43

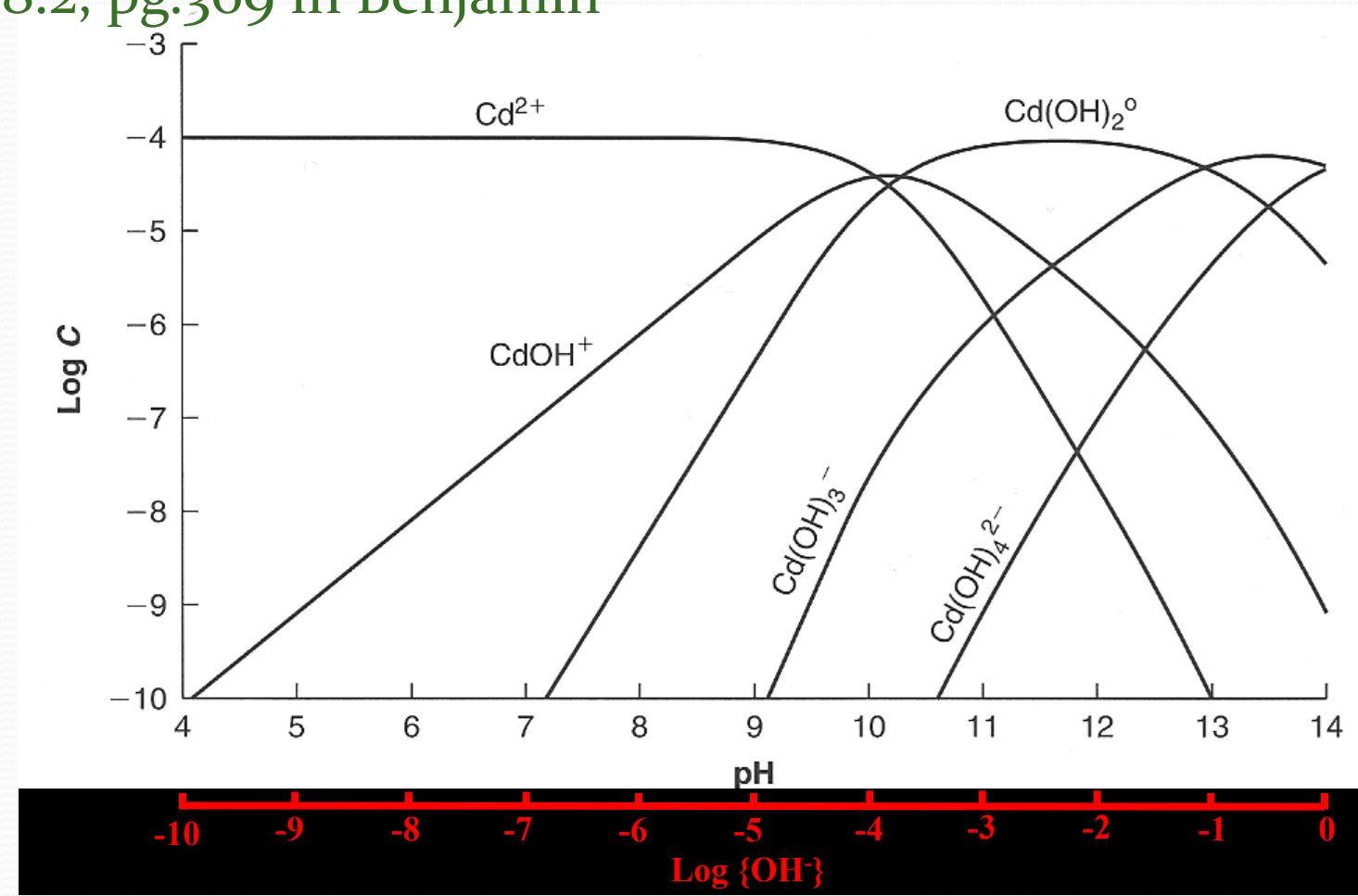
Precipitation and Dissolution: Cadmium Case Study

(Stumm & Morgan, Chapt.7)

Benjamin; Chapter 8

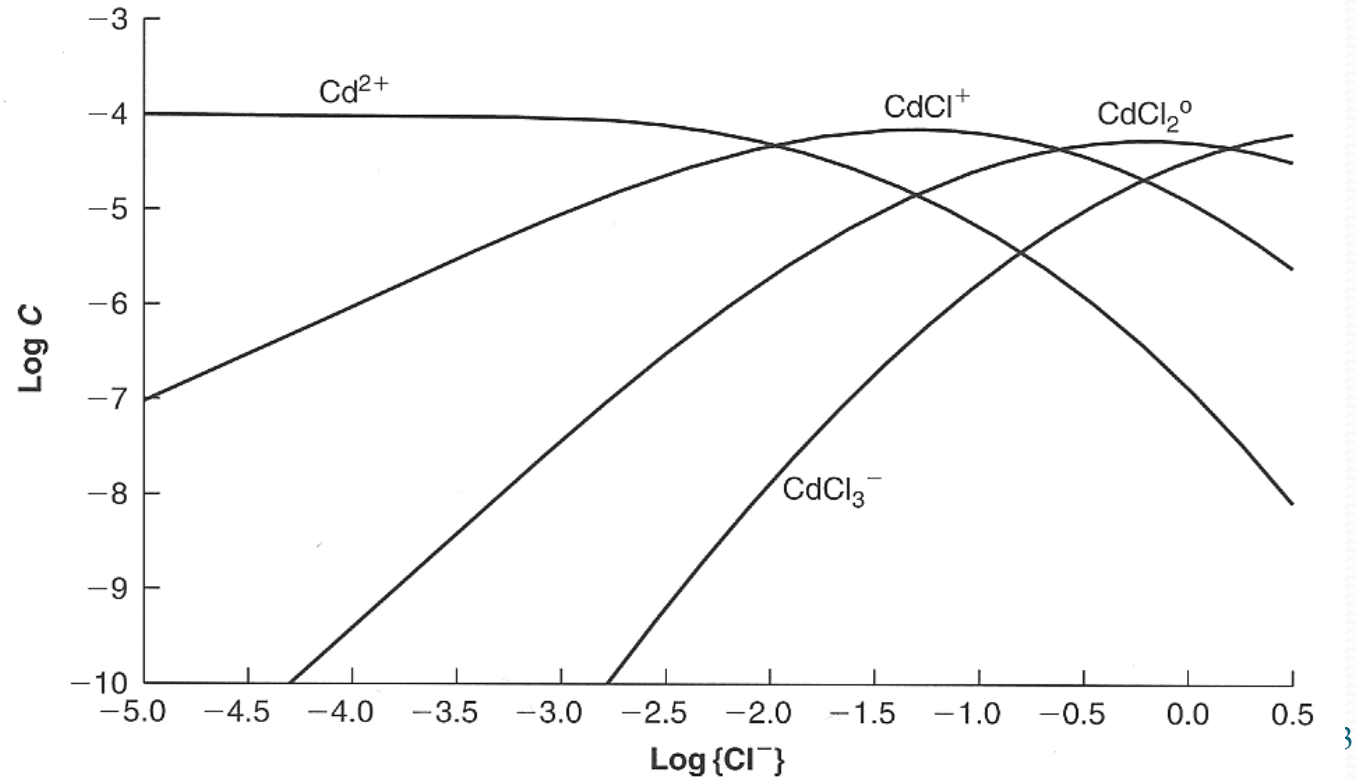
Hydroxo complexes

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



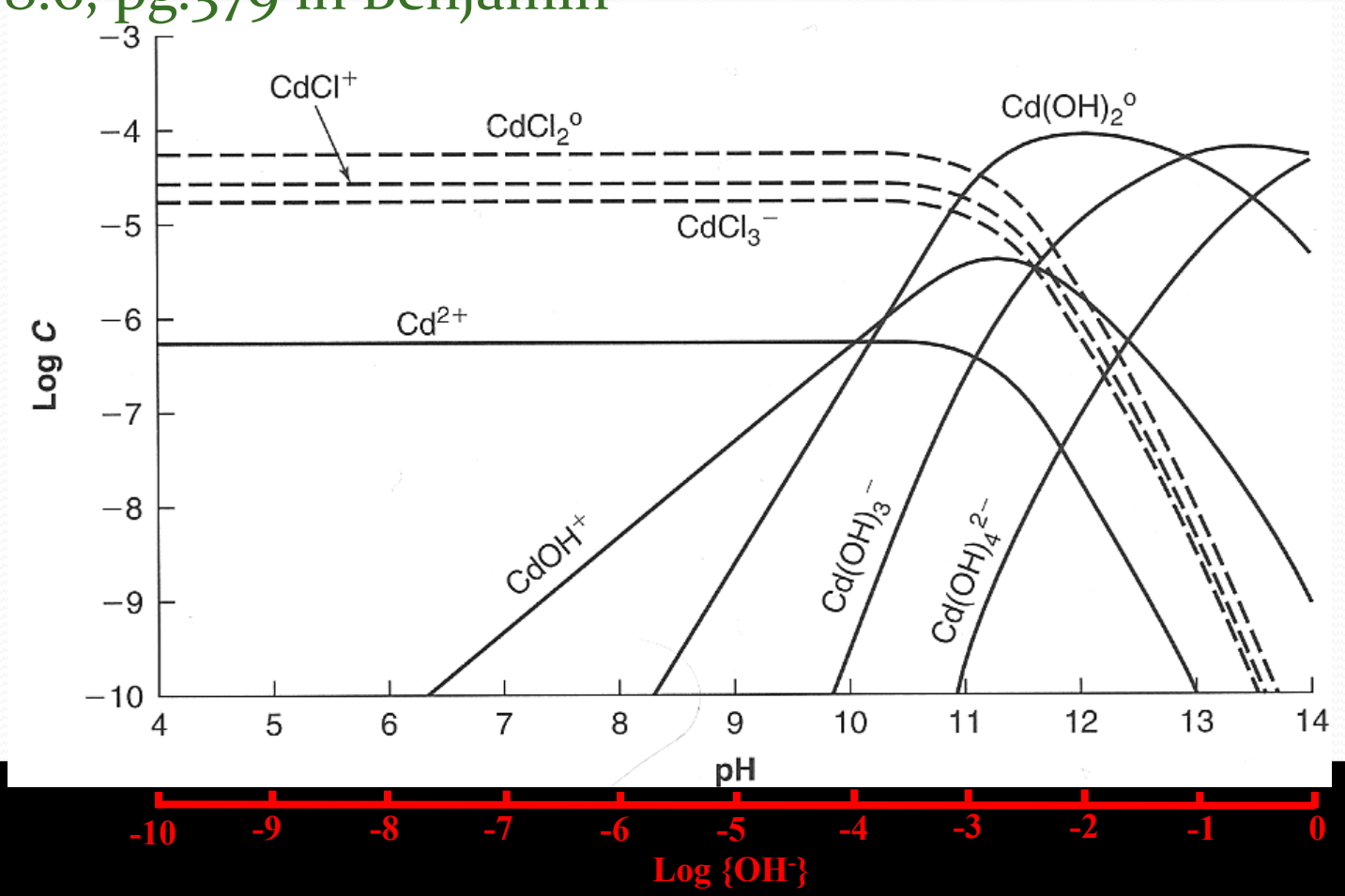
Chloride Complexes

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



Mixed OH, Cl complexes

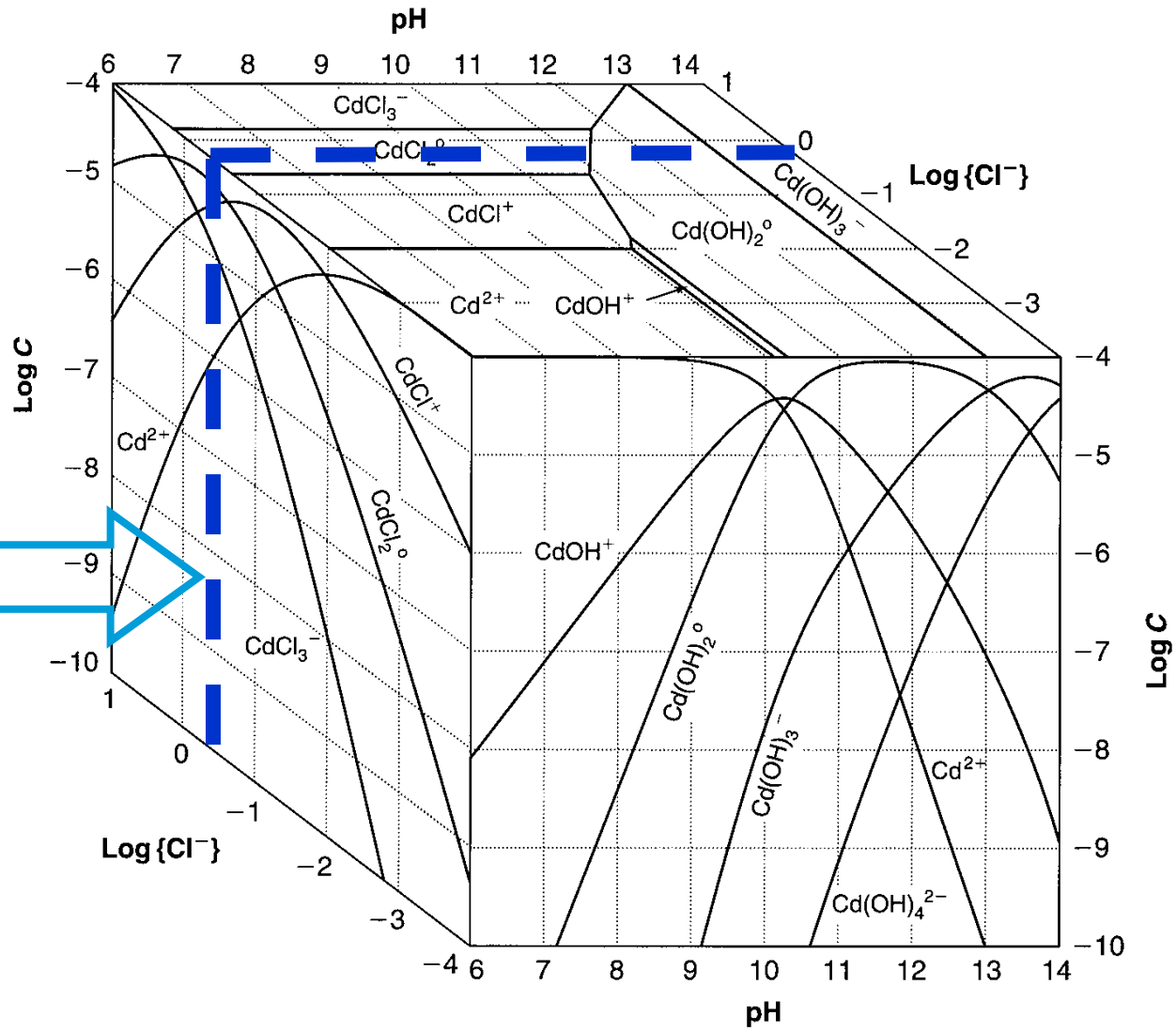
- 10^{-4}M Cd_T; $\{Cl^-\}$=0.5M
  - Figure 8.6, pg.379 in Benjamin



3D Surface: Cl, OH complexes

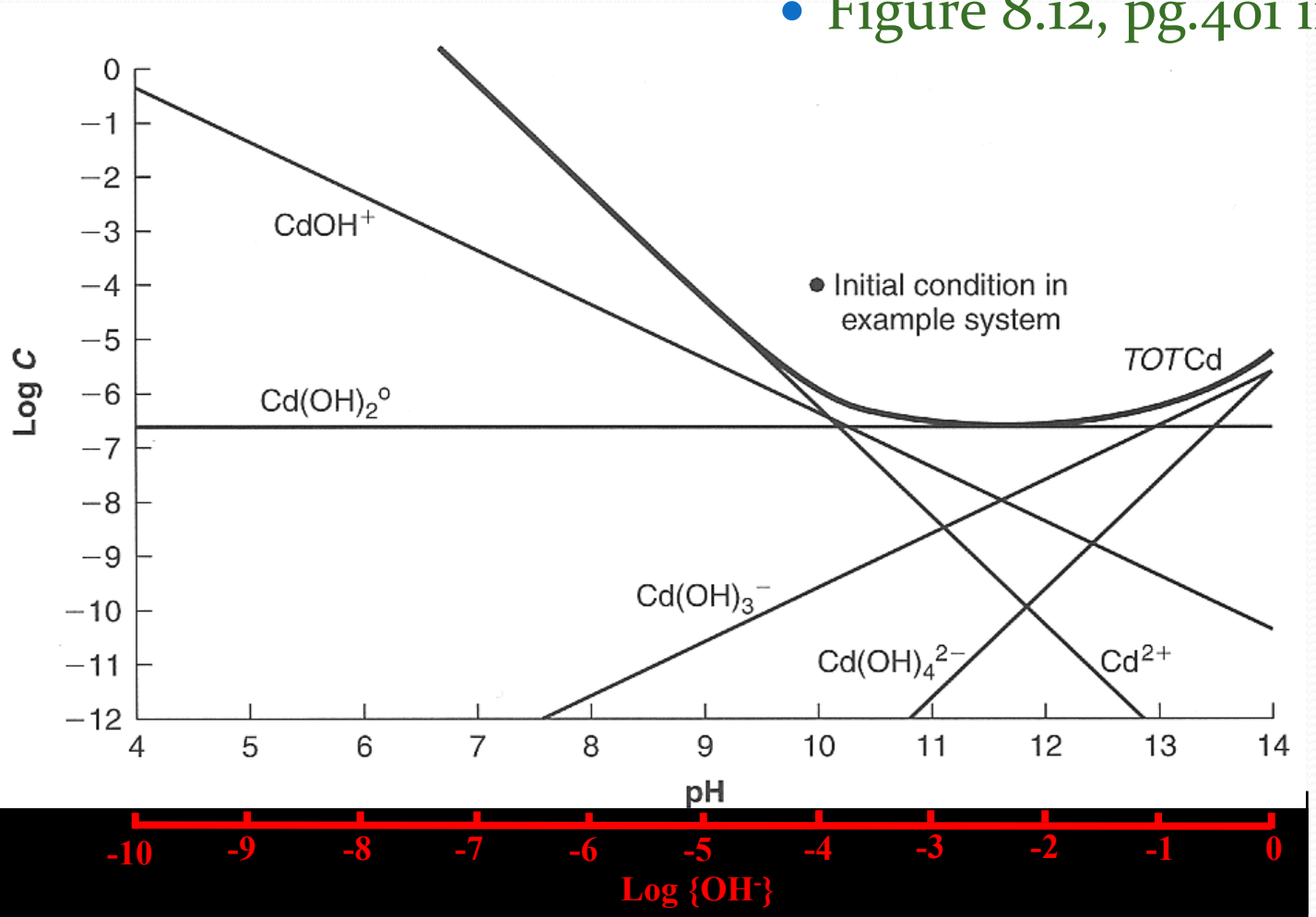
- Fig 8.7 in Benjamin

Slice shown in Fig. 8.6



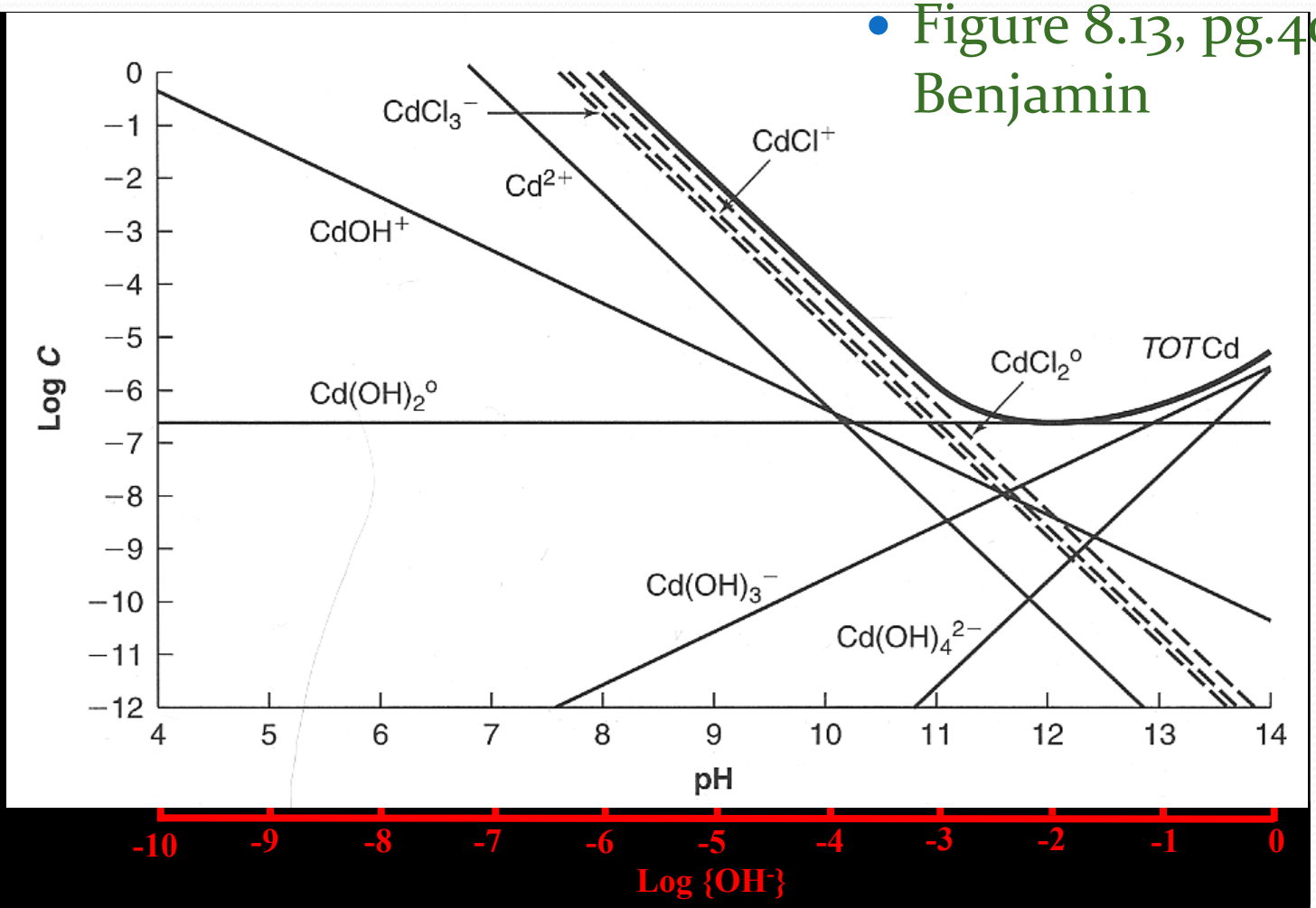
$Cd(OH)_2$ Precipitate

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



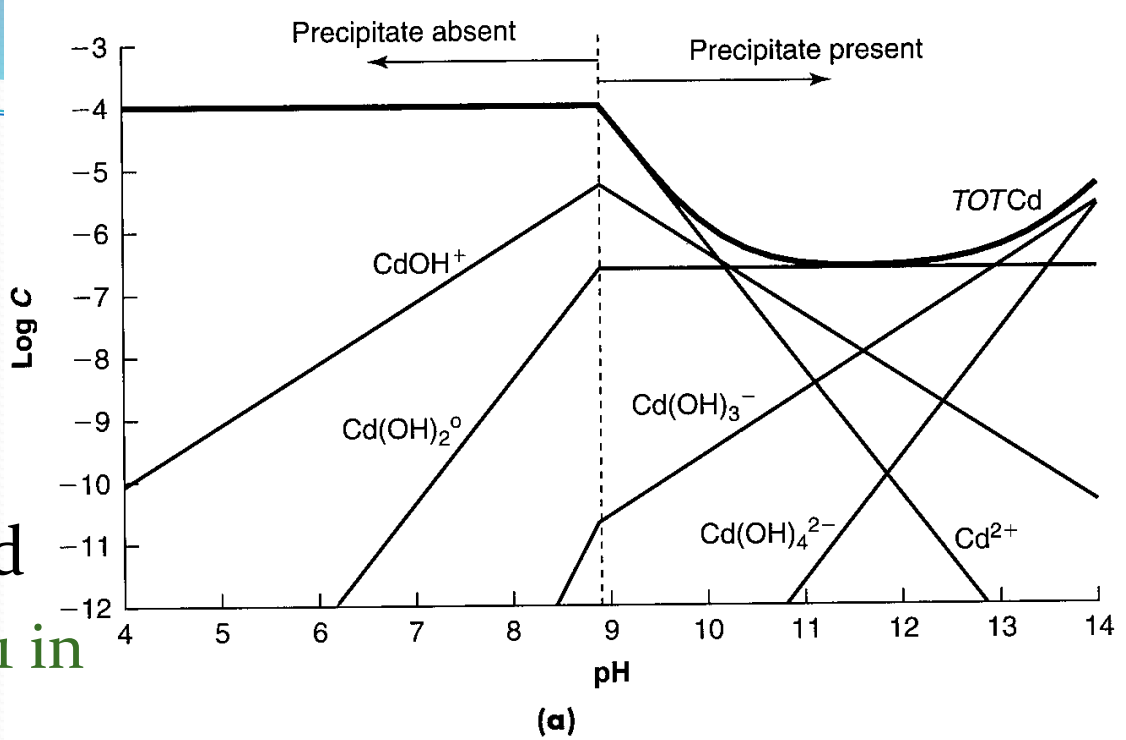
$Cd(OH)_{2\ (s)}$ with Cl^-

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

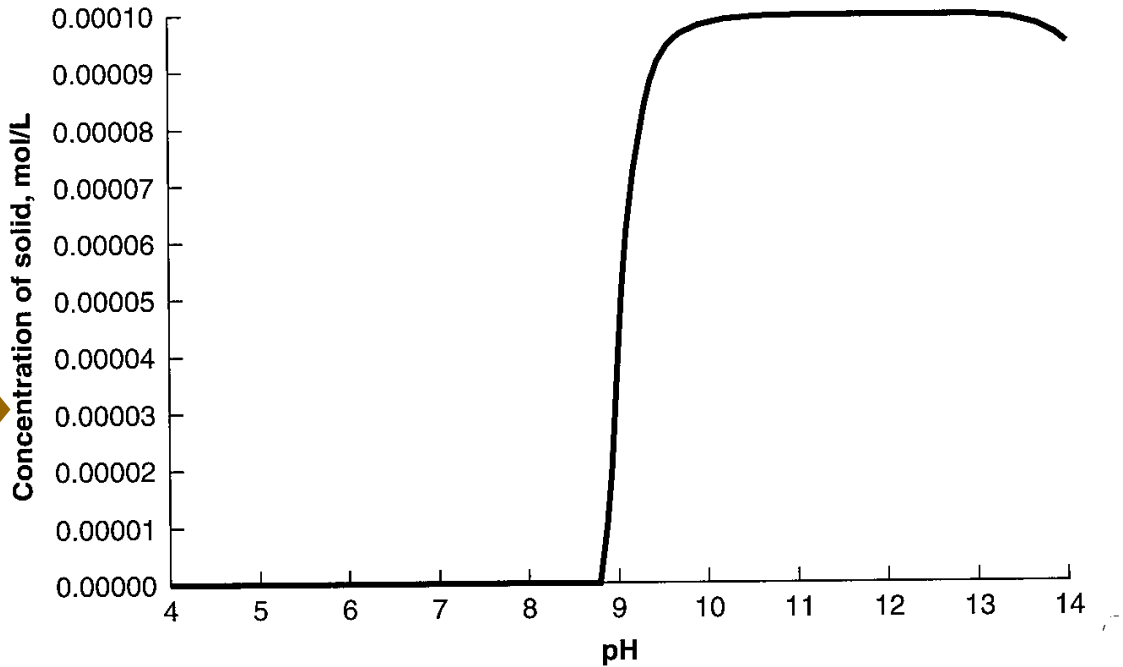


Cd limited; no Carbonate

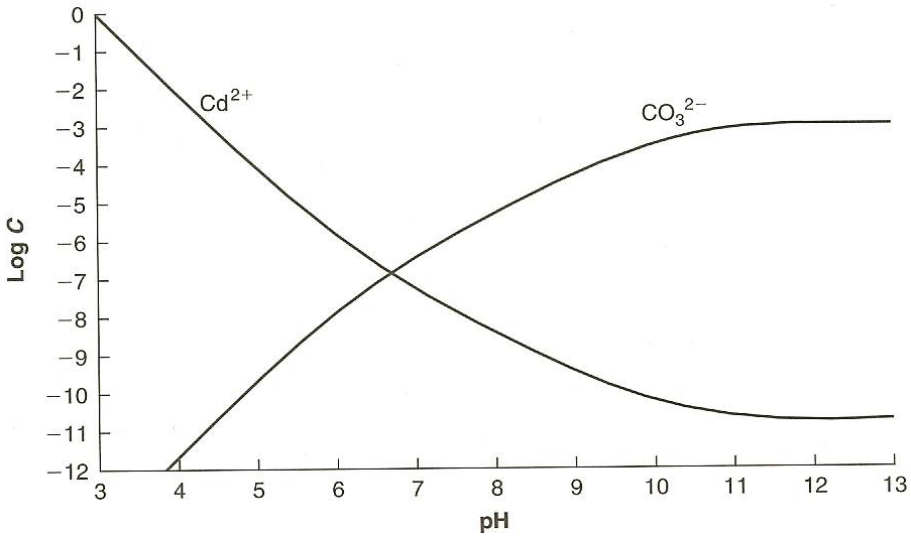
- 10^{-4}M Cd_T
- $Cd(OH)_{2\ (s)}$ allowed
  - Figure 8.19, pg.421 in Benjamin

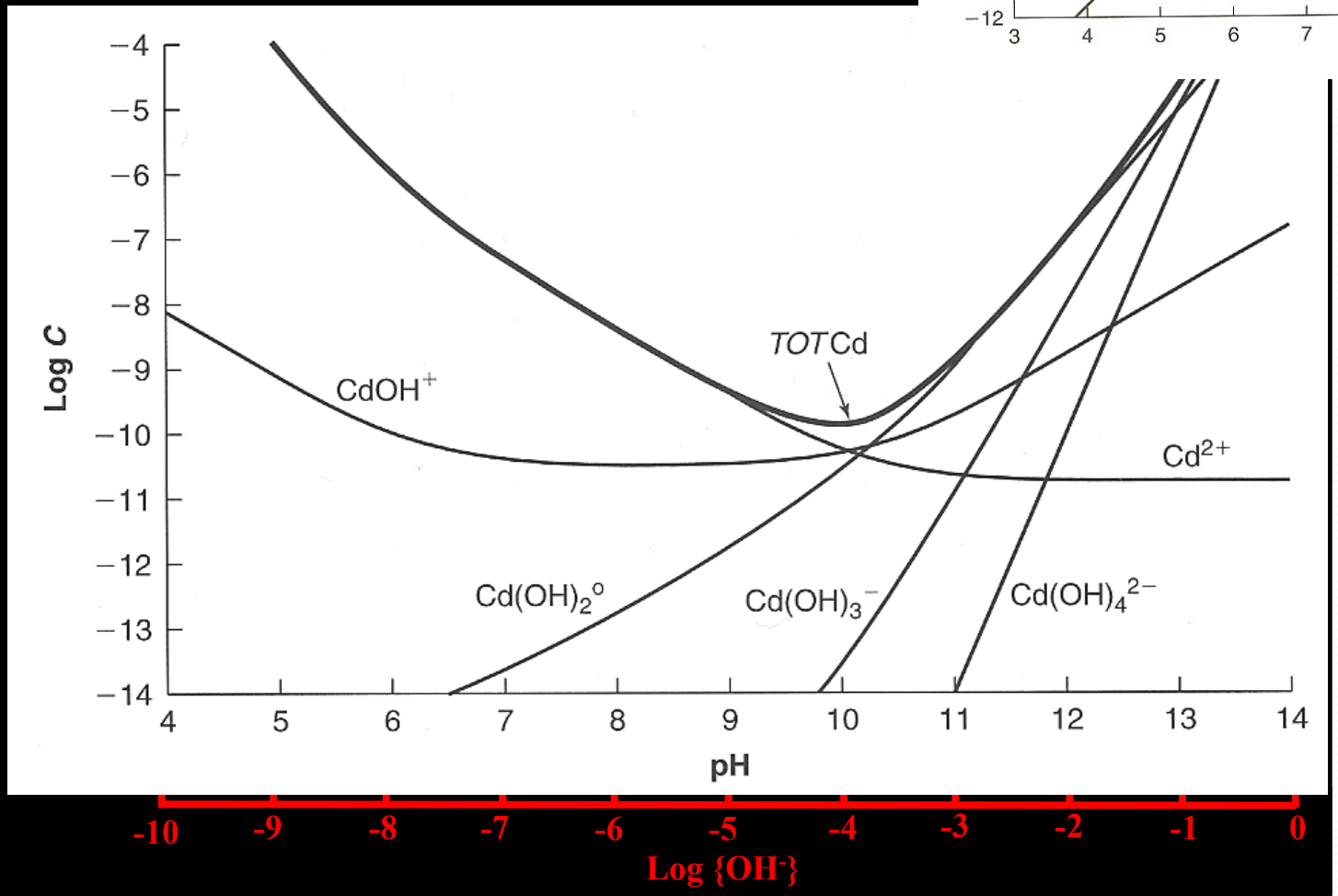


Not really "concentration", more accurately the mass of precipitate per L solution



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

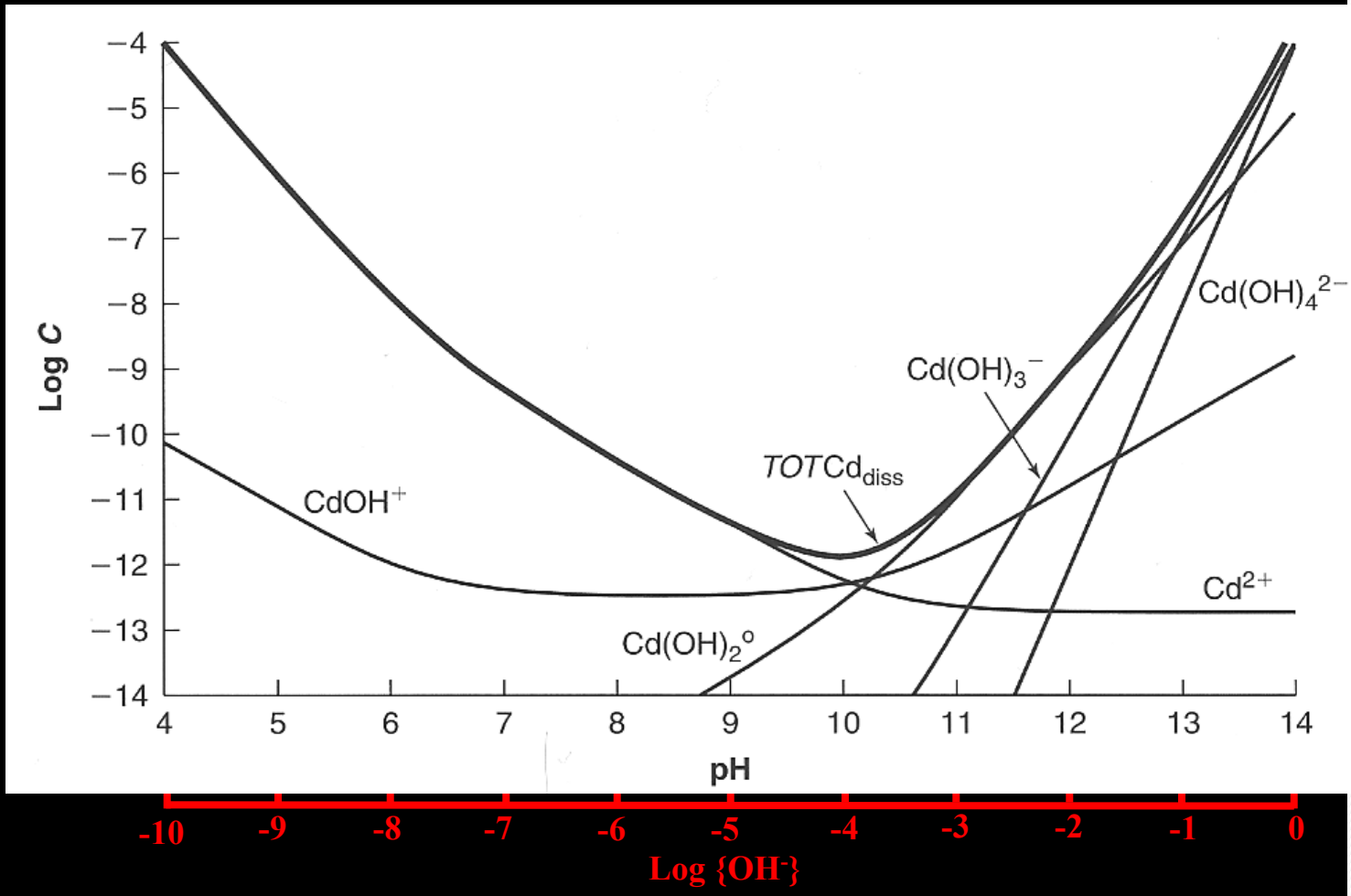




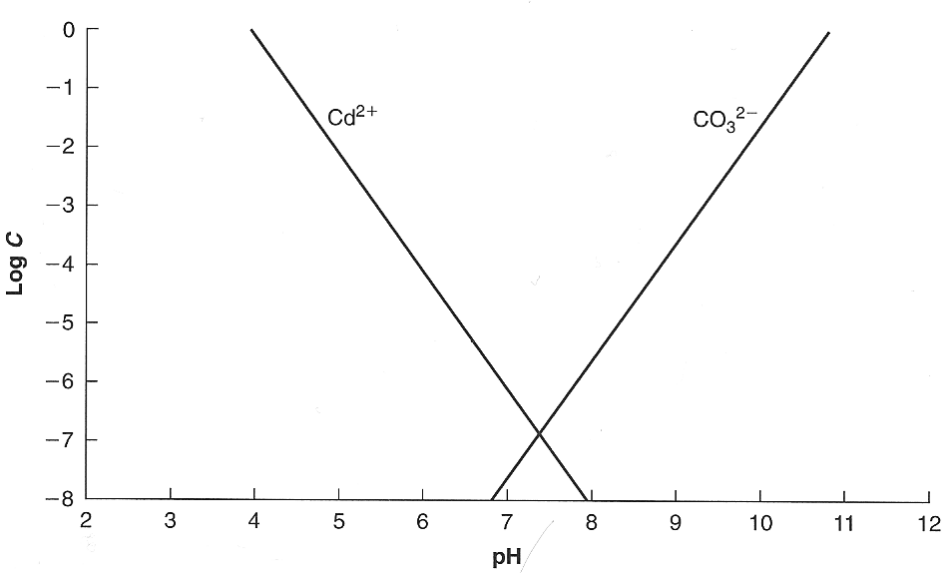
- $C_T=10^{-3}M$
  - Figure 8.15, pg.406 in Benjamin

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

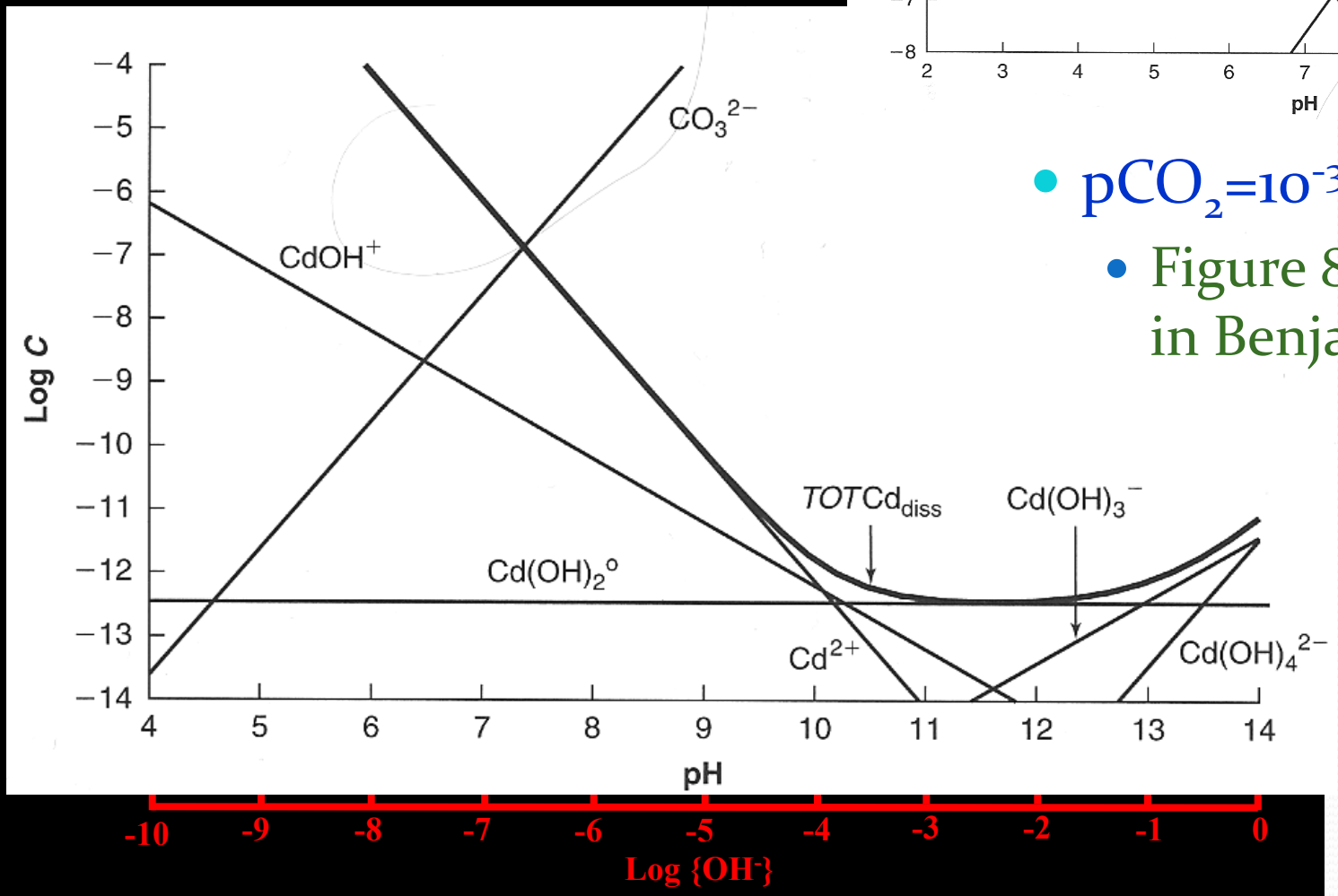
- $C_T=10^{-1}M$
  - Figure 8.17, pg.409 in Benjamin



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

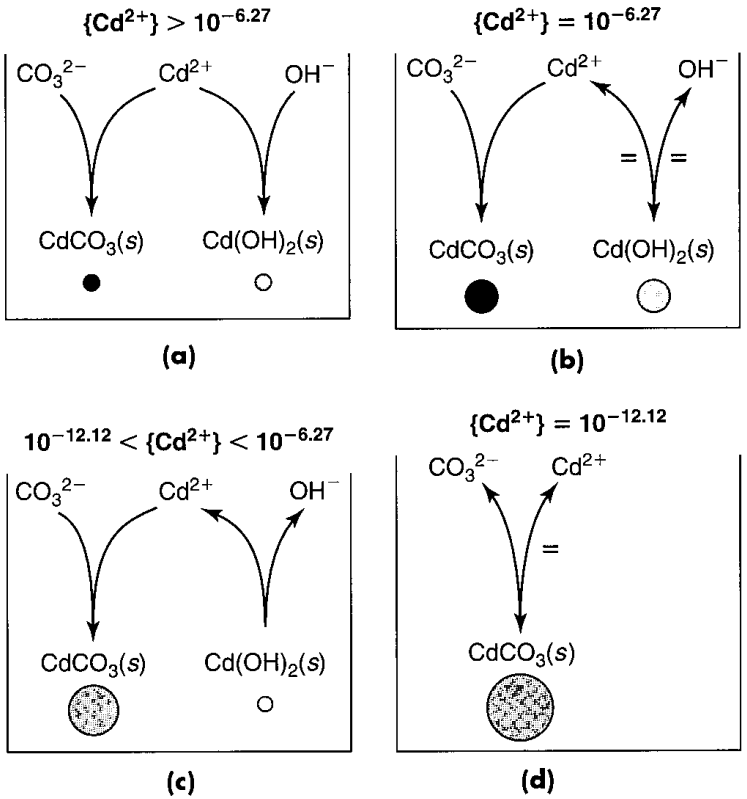


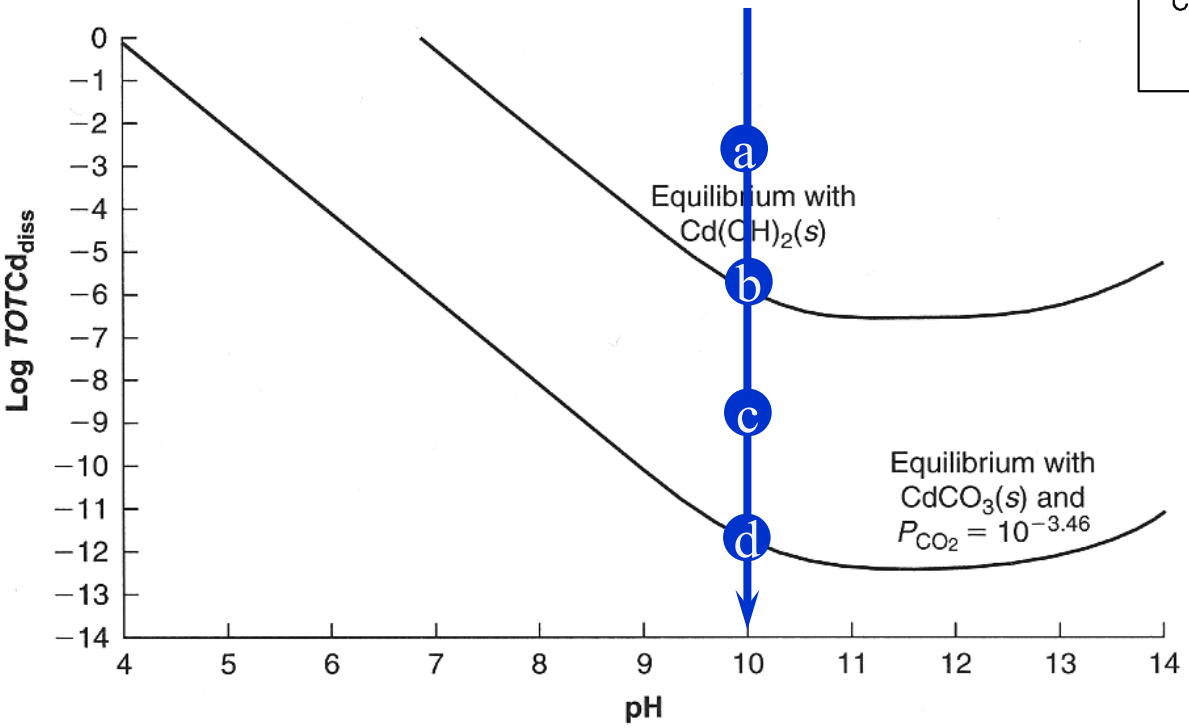
- $pCO_2=10^{-3.5}$
  - Figure 8.18, pg.410 in Benjamin



Solid formation

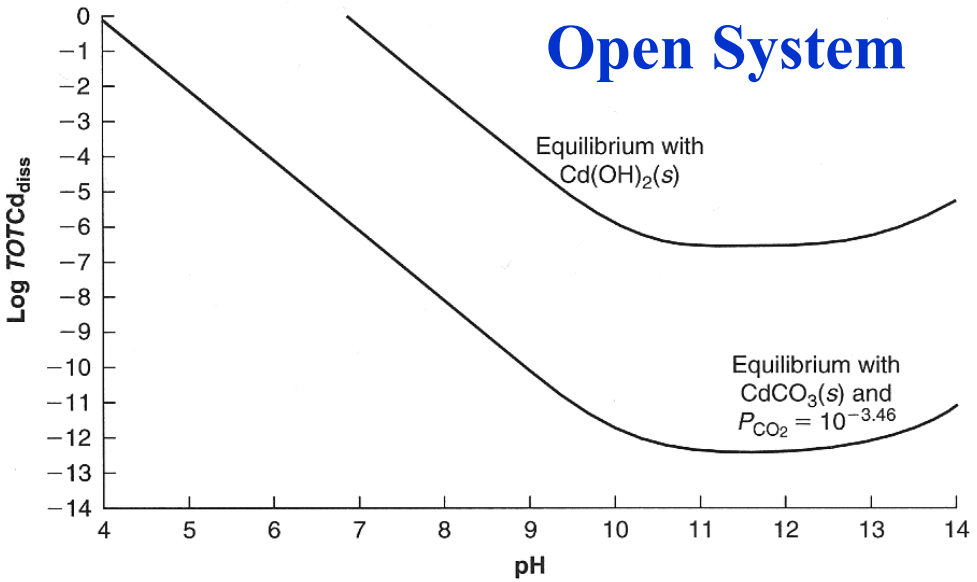
- Open system

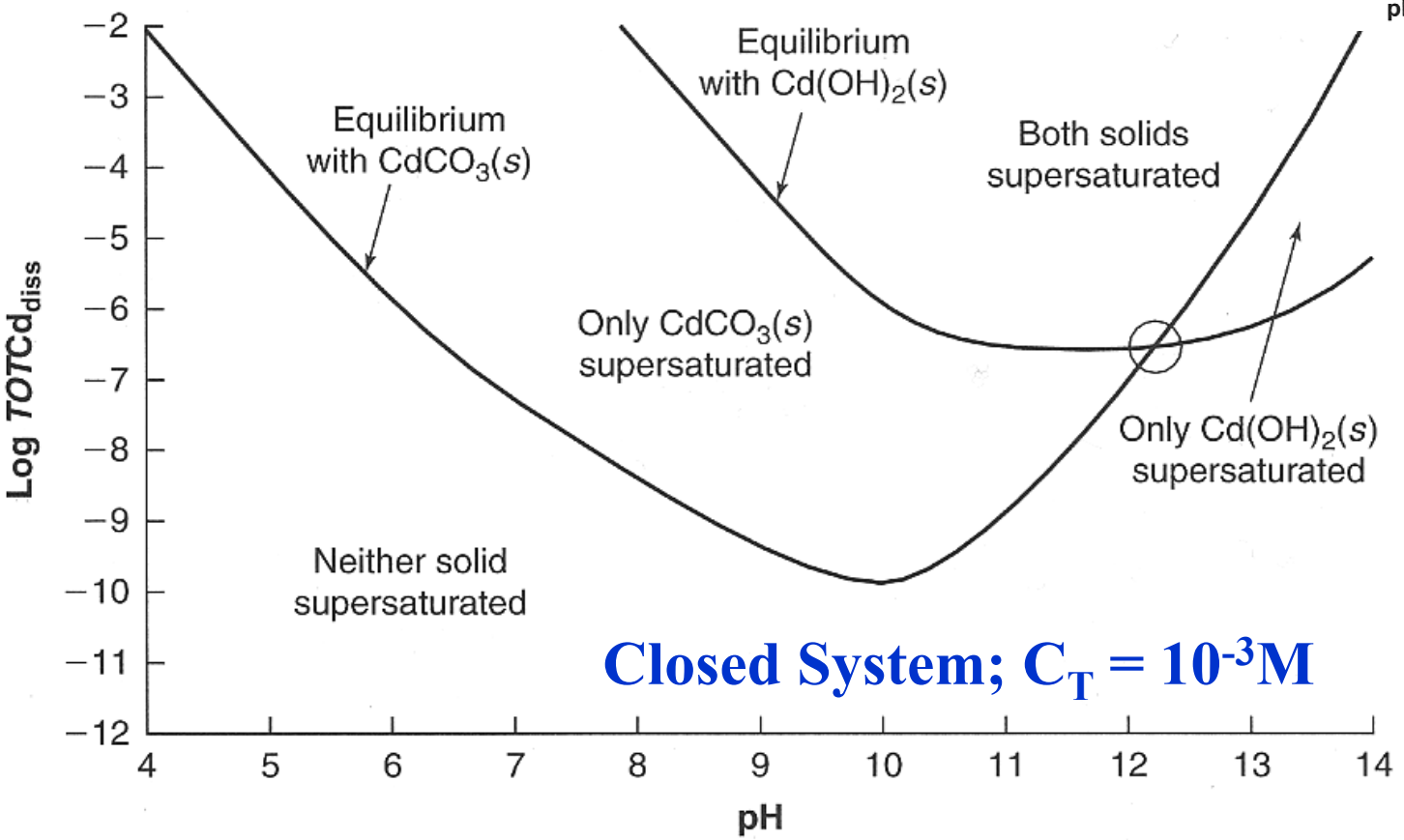




Dual Solids

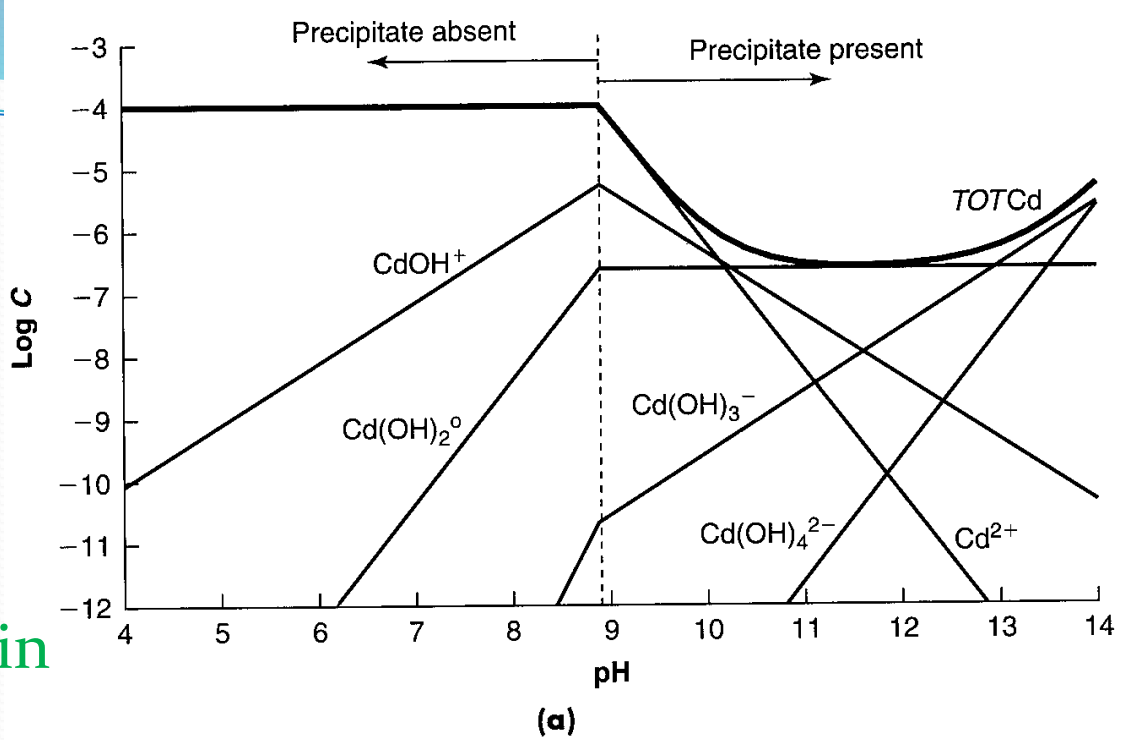
- Figs 8.21 & 8.22



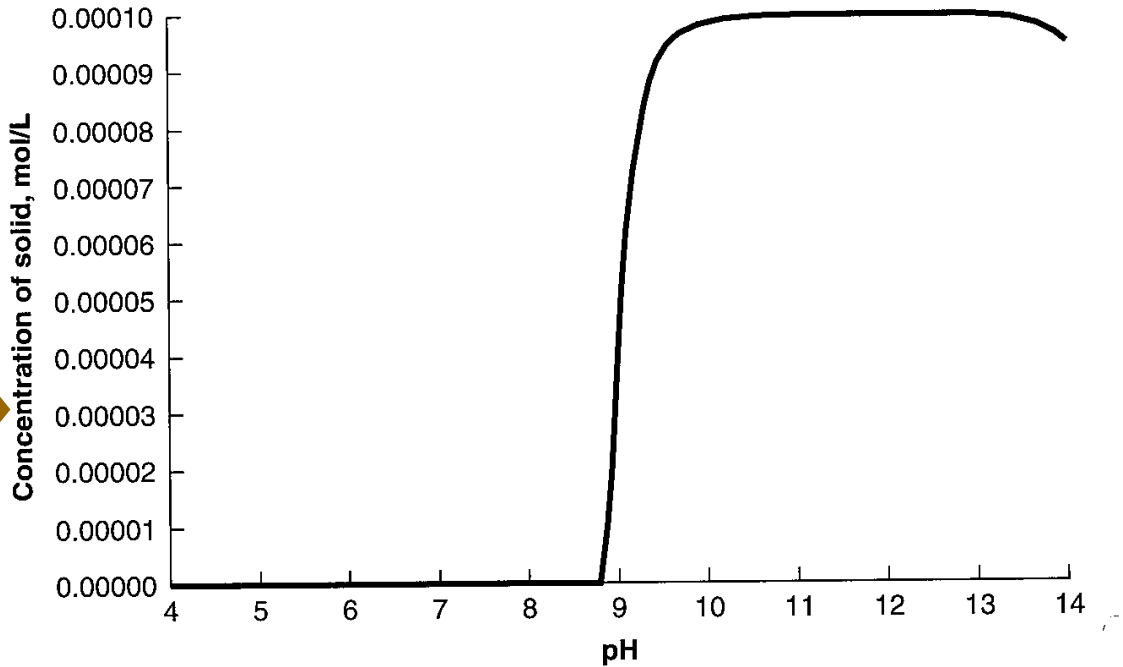


Cd limited; no Carbonate

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

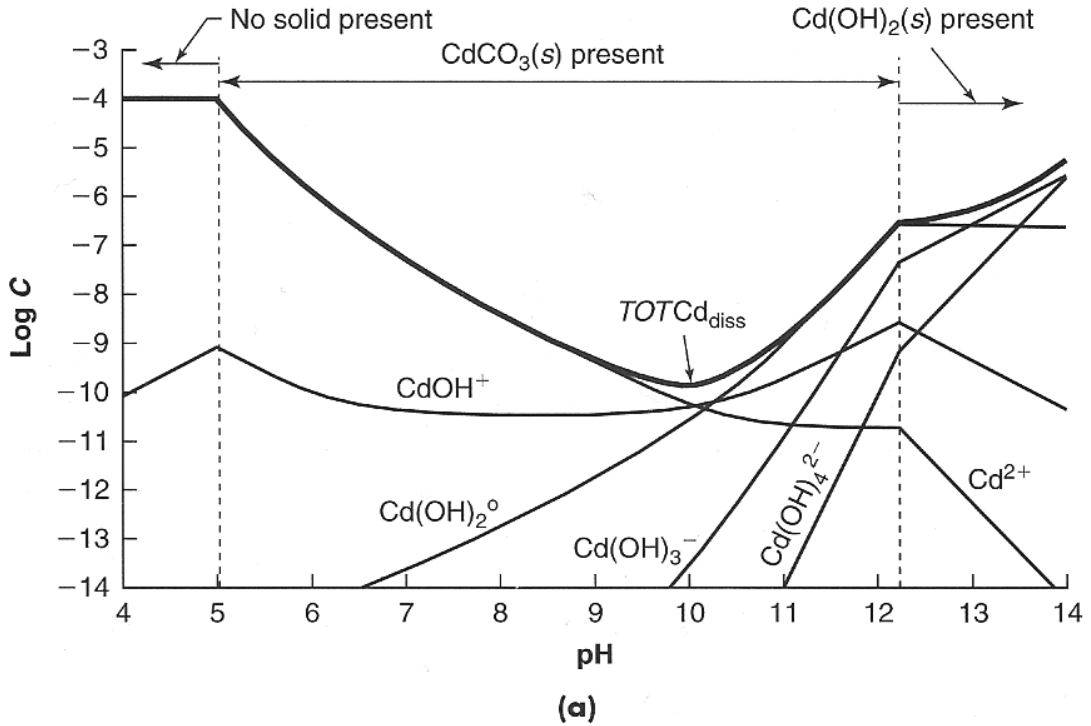


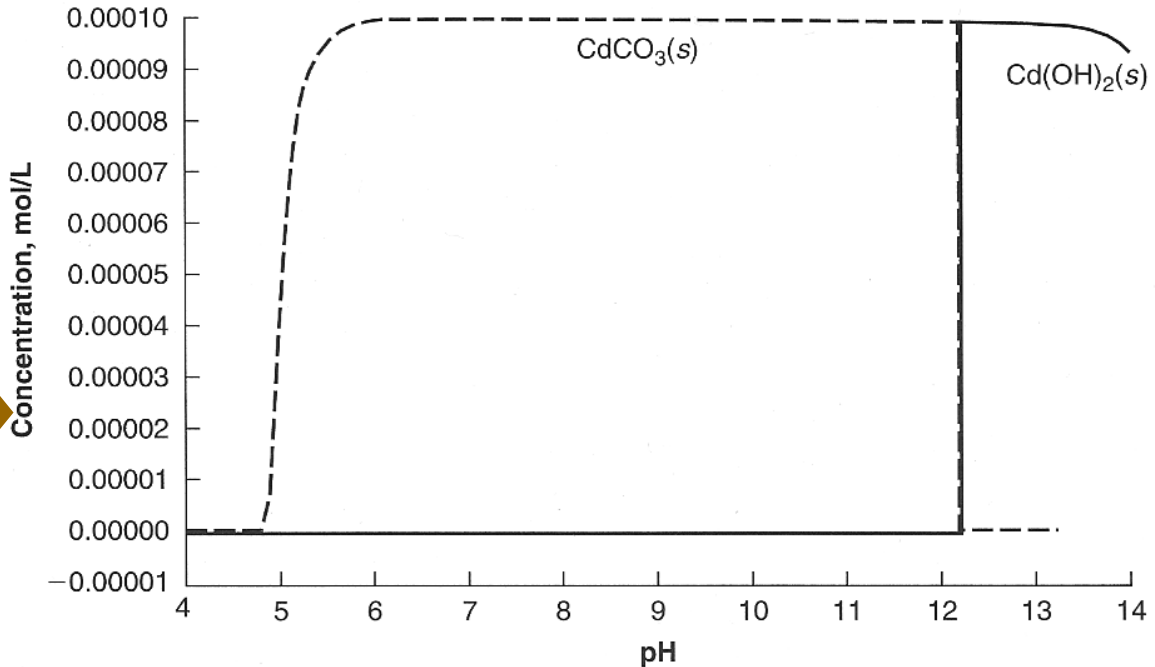
Not really "concentration", more accurately the mass of precipitate per L solution



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

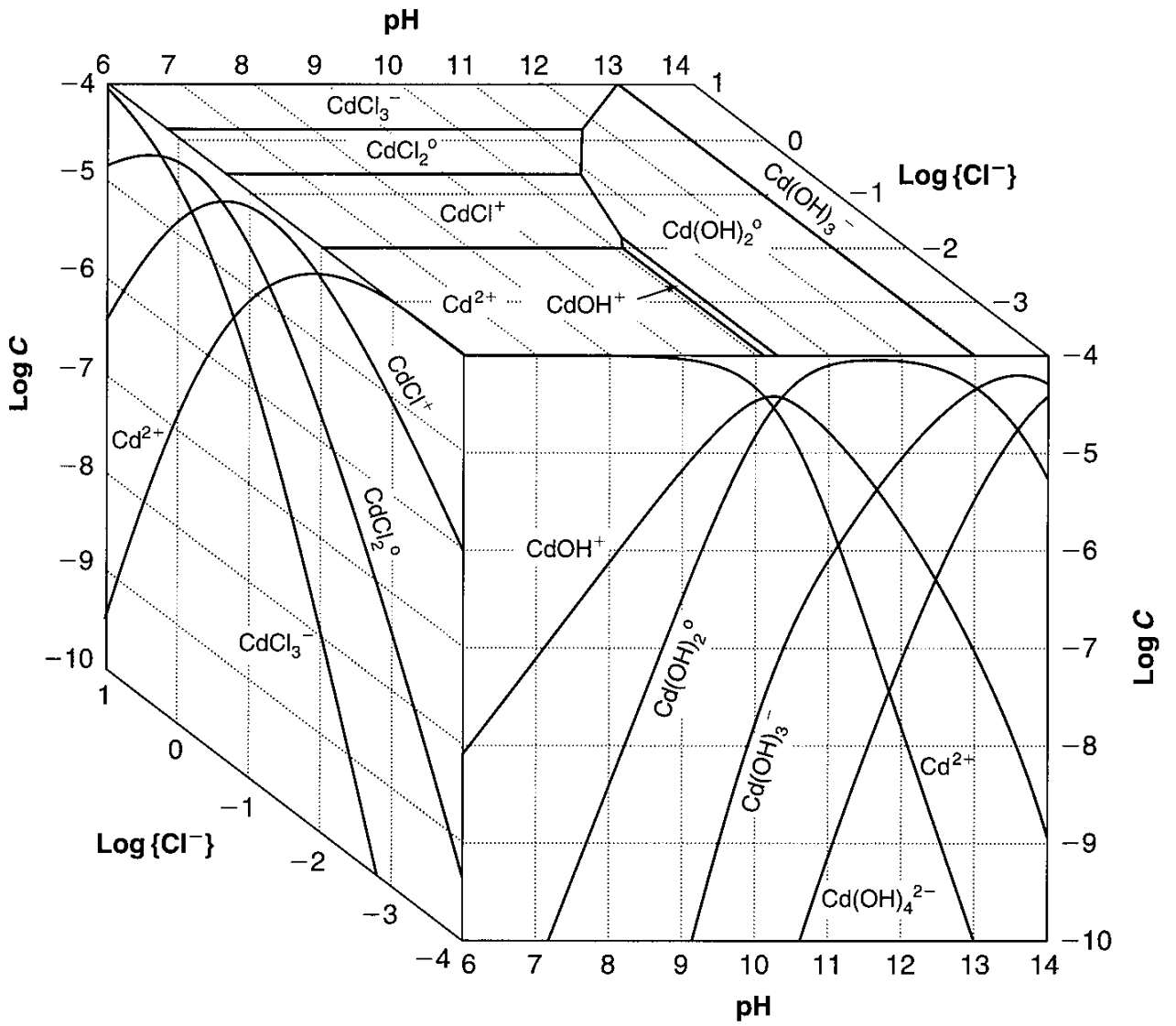




Not really "concentration", more accurately the mass of precipitate per L solution

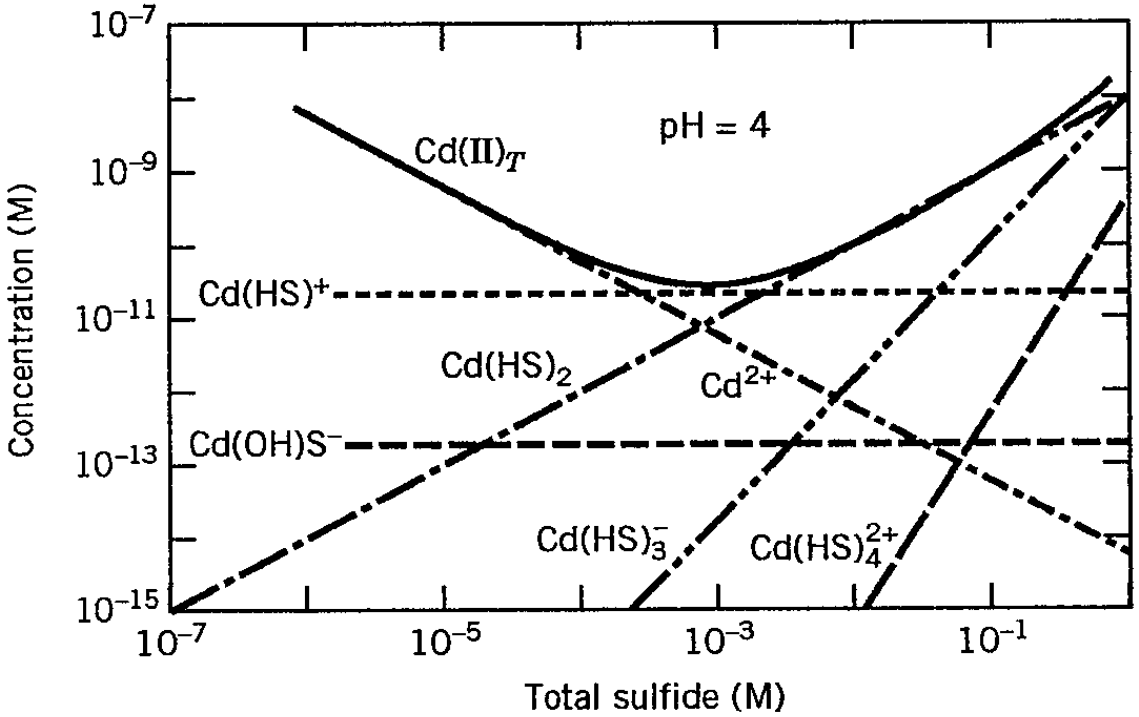
3D, 4D, 5D?

- Fig 8.7 in Benjamin

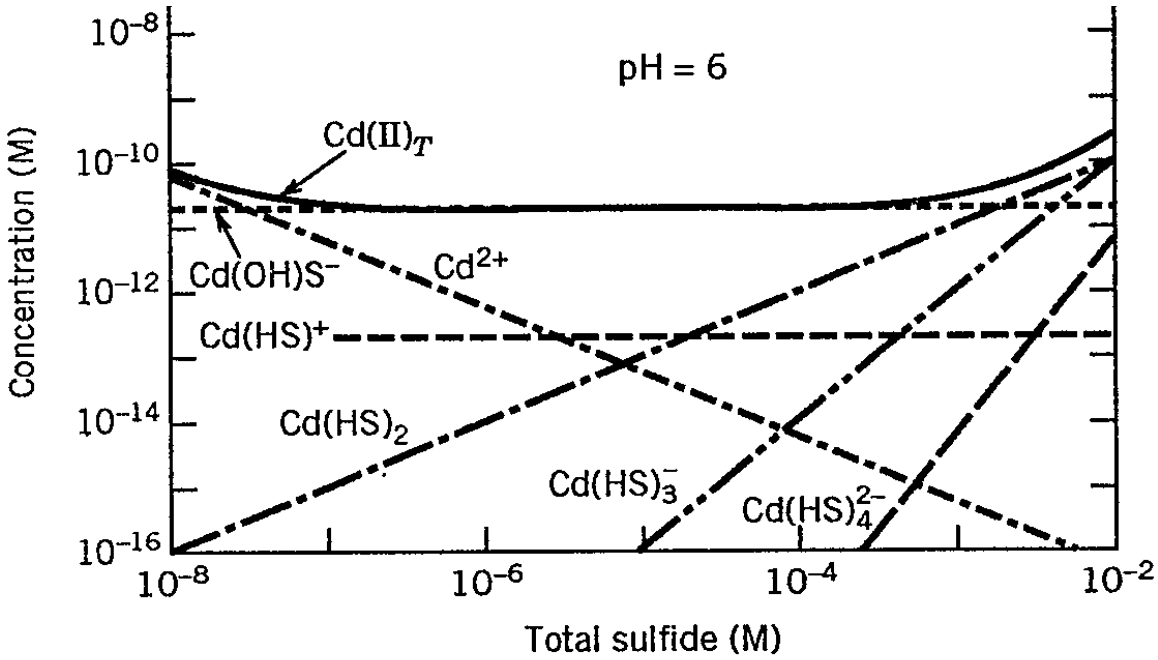


With S^{-2}, low pH

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

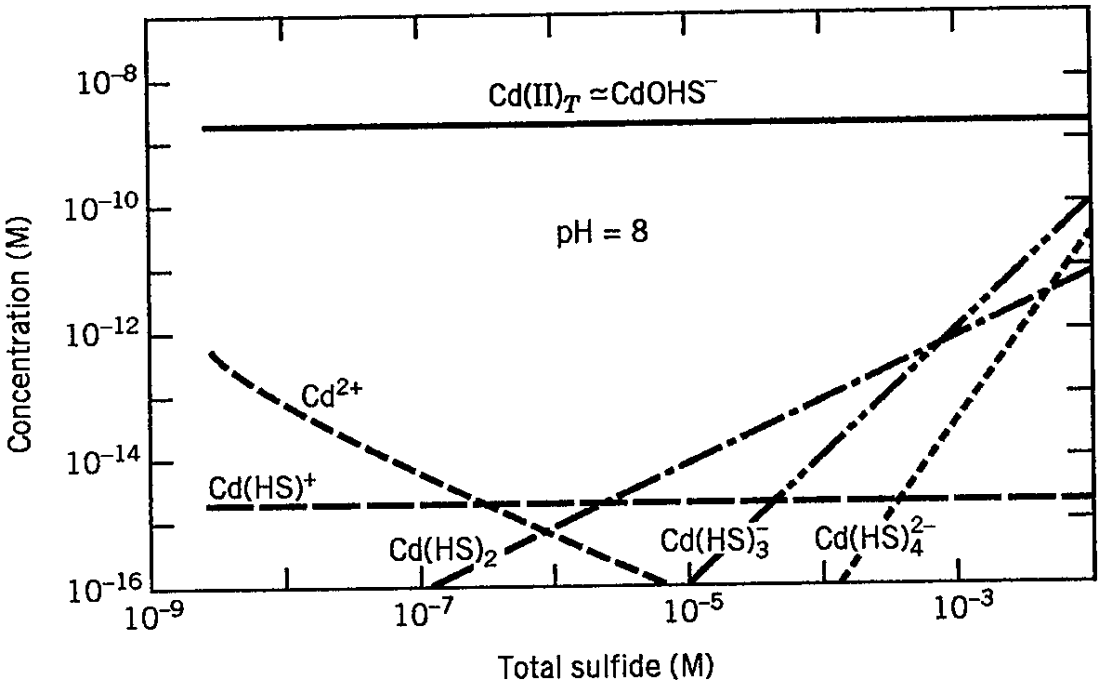


Stumm & Morgan, 1996, Figure 7.19b, pg. 405

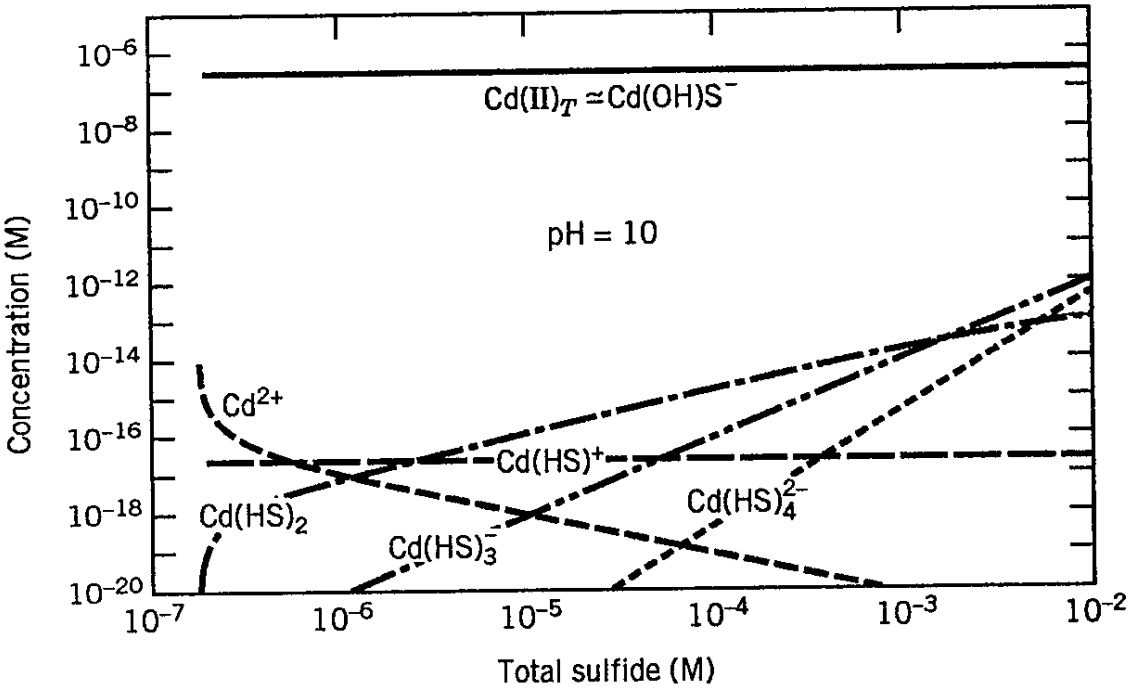


With S^{-2}, high pH

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

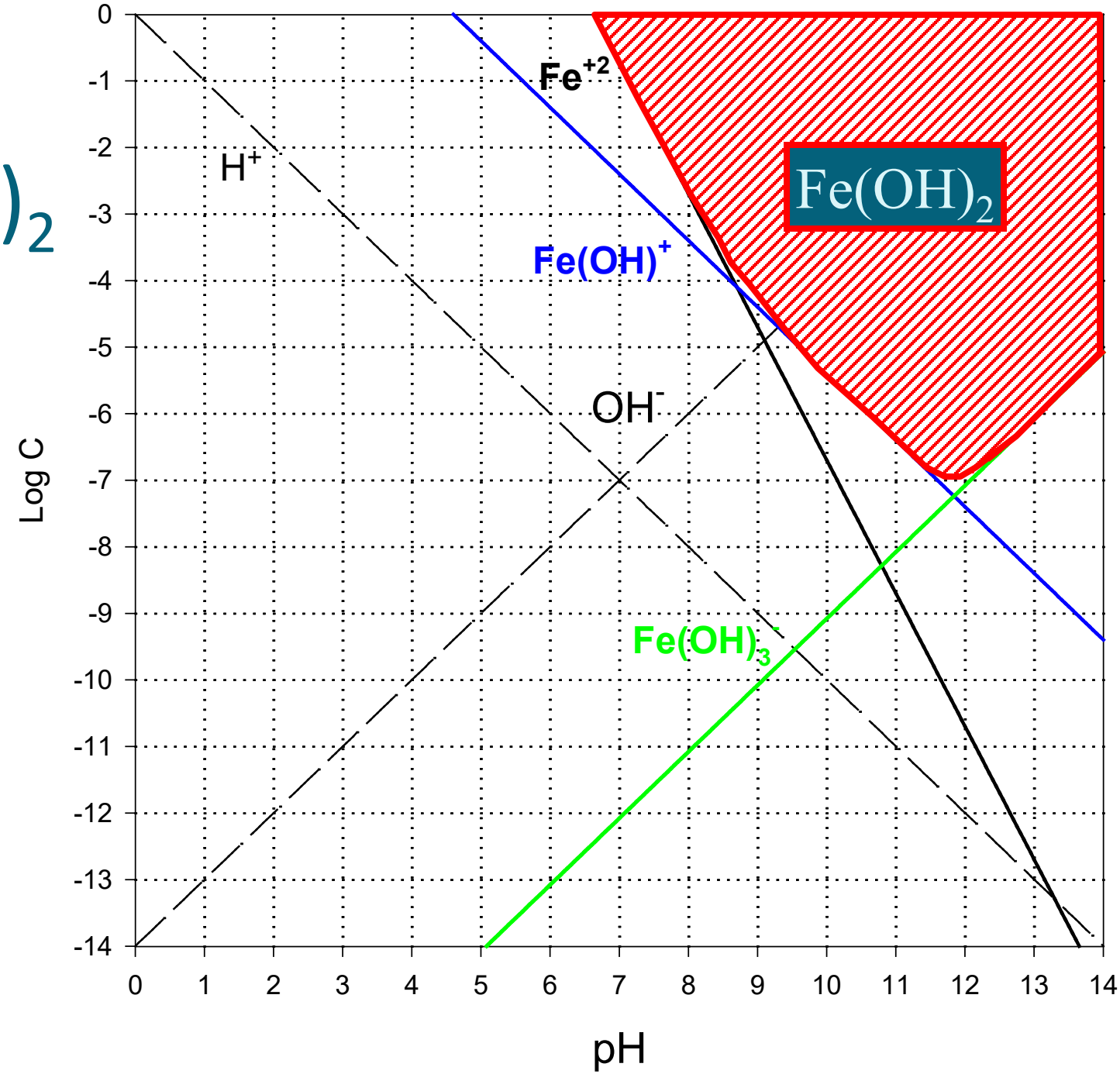


Stumm & Morgan, 1996, Figure 7.19d, pg. 406

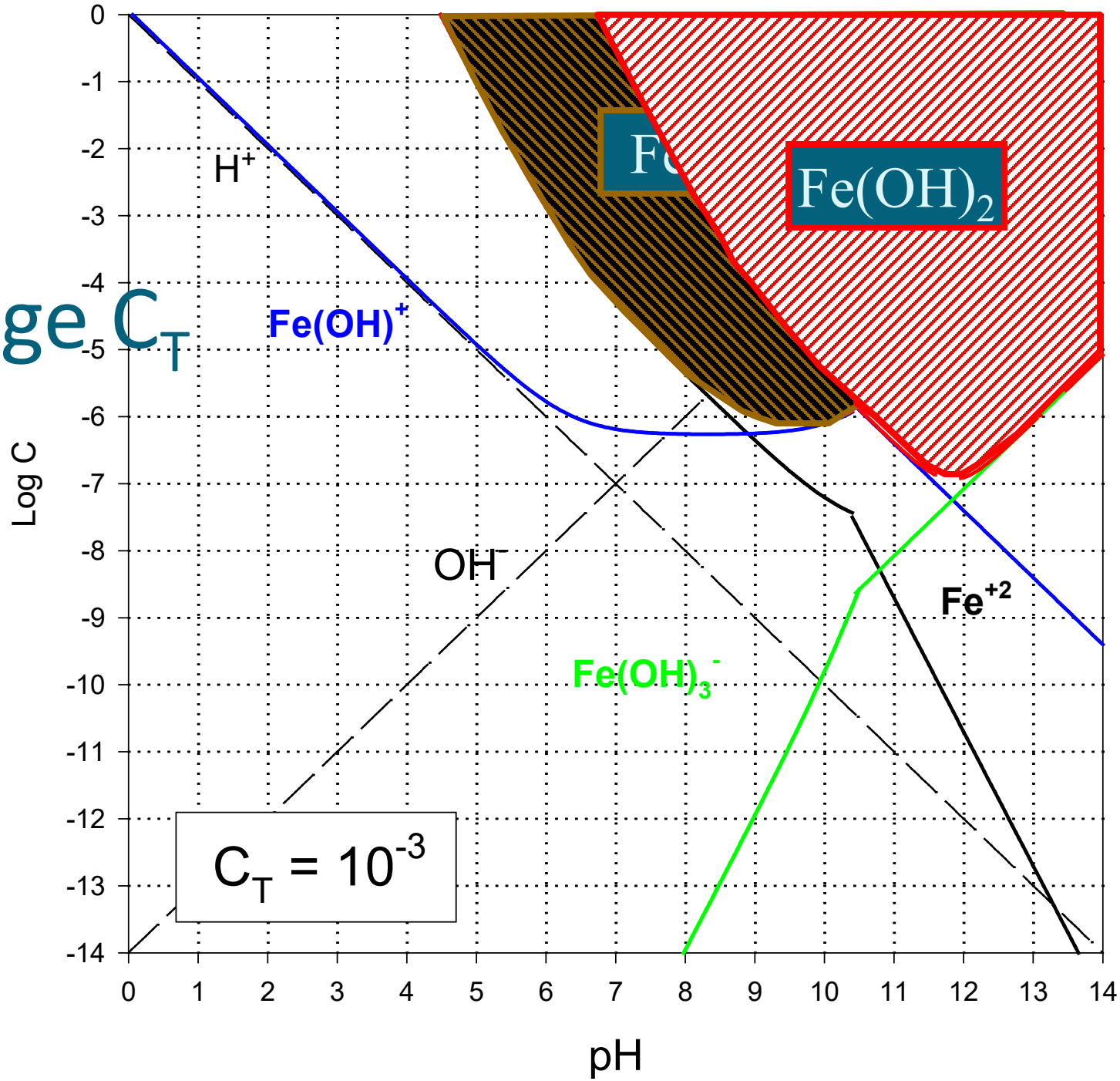


$Fe(OH)_2$

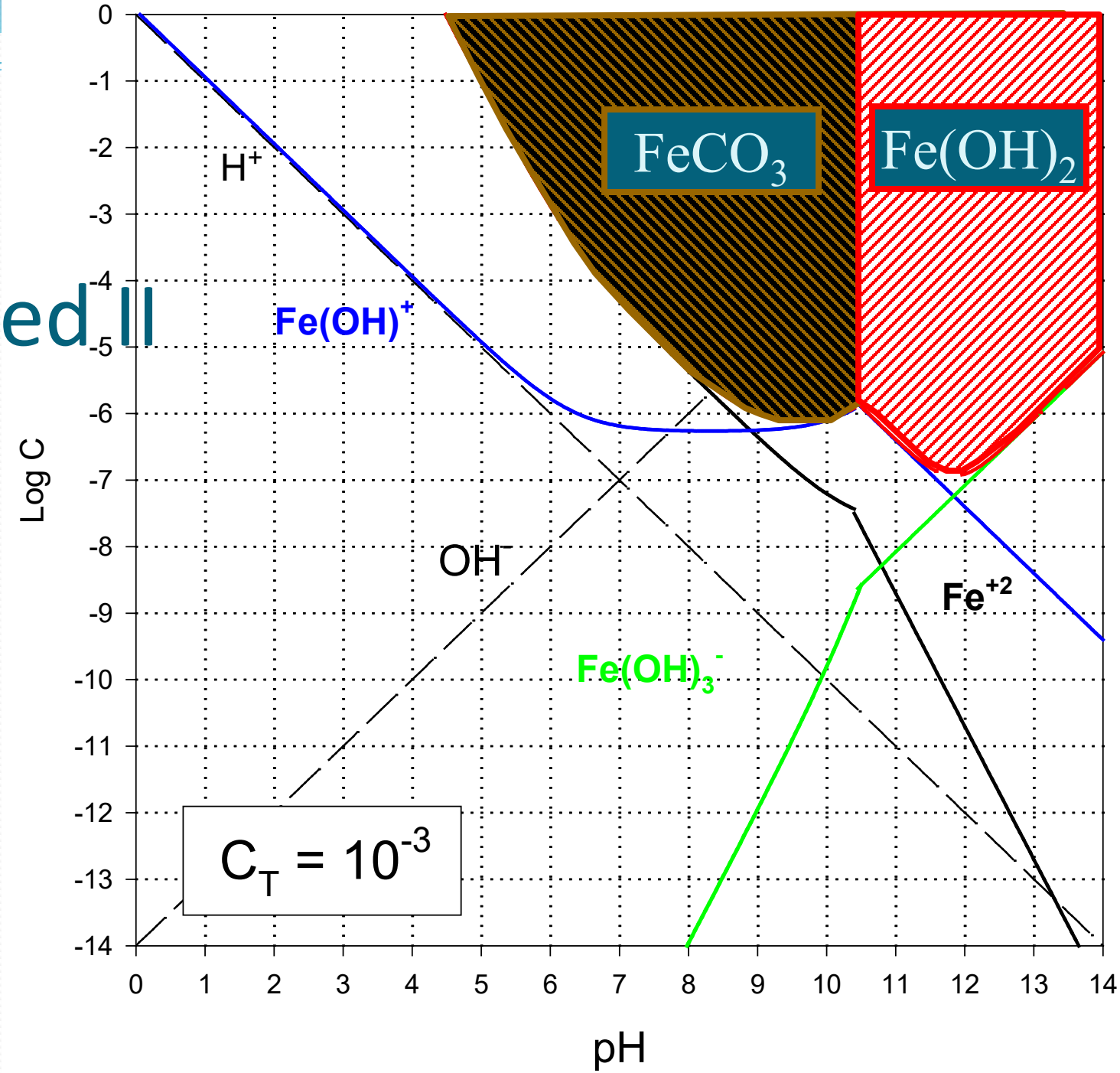
- No C_T


Fe(OH)2
Fe+2
H+
Fe(OH)+
OH-
Fe(OH)3-
Log C
pH
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

Mid-range C_T


Log C
pH
H+
OH-
Fe(OH)+
Fe(OH)2
Fe(OH)3-
Fe+2
CT = 10-3
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

Mid C_T Combined II



- To next lecture