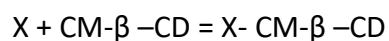


## Answer on - Chemistry - Physical Chemistry

Question:

13. The stability constant of the complex of {2-[5-(3-Chloro-4-methyl-phenylamino)-1,2,4-thiadiazole-3-yl]-1-methyl-ethyl}-(2,2,6,6-tetramethyl-piperidine-4-yl)-amine with  $\beta$ -cyclodextrin ( $\beta$ -CD) is  $\beta=540 \text{ M}^{-1}$ . Estimate the concentration of free substance X if its initial concentration is 0.01 M and CM- $\beta$ -CD concentration is 0.2 M.

**Solution:**



$$C_0 \quad 0.01 \quad 0.2 \quad 0$$

$$\Delta C \quad -x \quad -x \quad x$$

$$[C] \quad 0.01-x \quad 0.2-x \quad x$$

$$\beta = [X\text{-CM-}\beta\text{-CD}] / ([X][\text{CM-}\beta\text{-CD}]);$$

$$540 = x / ((0.01-x)(0.2-x));$$

$$540 = x / (0.002 - 0.21x + x^2);$$

$$x = 540x^2 - 113.4x + 1.08;$$

$$540x^2 - 114.4x + 1.08 = 0$$

$$x = 0.00991$$

$$\text{So, } (-x) \text{ of } x = -0.0099 \text{ M};$$

$$\text{So, } [X] = 0.01 - 0.0099 = 0.0001 \text{ M.}$$

**Answer:** 0.0001 M.