

EQUILIBRIUM CALCULATIONS

Two types of questions:

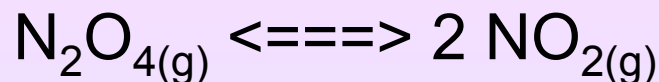
1. calculating K_{eq} from known concentration values

2. calculating concentration values when K_{eq} is given

EQUILIBRIUM CALCULATIONS

Calculating K_{eq}

Example #1



At 25°C, the equilibrium concentrations are:

$$[\text{N}_2\text{O}_4] = 0.0292 \text{ mol / L}$$

$$[\text{NO}_2] = 0.0116 \text{ mol / L}$$

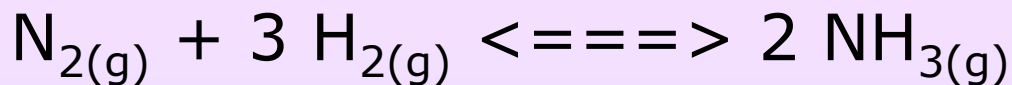
Calculate K_{eq} at 25°C.

$$\therefore k_{eq} = 4.61 \times 10^{-3}$$

EQUILIBRIUM CALCULATIONS

Calculating K_{eq}

Example #2



At 200°C, the concentrations at equilibrium are:

$$[\text{N}_2] = 2.12, [\text{H}_2] = 1.75, \text{ and } [\text{NH}_3] = 84.3$$

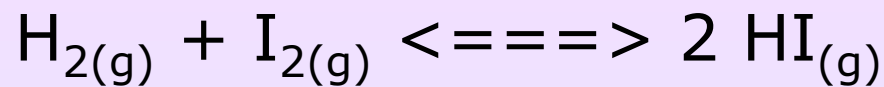
Calculate K_{eq} at 200°C.

∴ the k_{eq} is 625

EQUILIBRIUM CALCULATIONS

Calculating K_{eq}

Example #3



Initial moles in a 2.00 L flask:

$[\text{H}_2] = 0.200 \text{ mol}$ and $[\text{I}_2] = 0.200 \text{ mol}$

At equilibrium, $[\text{I}_2] = 0.020 \text{ mol / L}$.

a) What is K_{eq} at steady conditions?

b) What percent of iodine vapour reacted?

EQUILIBRIUM CALCULATIONS

ICE tables

Whenever questions involve initial conditions changing to reach equilibrium, ICE tables are a good method to organize your information.

I = initial concentrations

C = change in concentrations

E = equilibrium concentrations

EQUILIBRIUM CALCULATIONS

Calculating K_{eq} - Example #3

Initial moles in a 2.00 L flask: $[H_2] = 0.200$ mol and $[I_2] = 0.200$ mol

At equilibrium, $[I_2] = 0.020$ mol / L.



I

C

E

a) What is K_{eq} at steady conditions?

b) What percent of iodine vapour reacted?

$$\therefore \%I_2 \text{ reacted} = 80\%$$

$$\therefore K_{eq} = 64$$

EQUILIBRIUM CALCULATIONS

Calculating K_{eq}

Example #4

2.00 mol of HI in 2.00 L flask at 425°C react to produce H_2 and I_2 . At equilibrium, $[H_2]$ and $[I_2] = 0.214 \text{ mol / L}$.

What is K_{eq} for this reaction?

EQUILIBRIUM CALCULATIONS

Calculating K_{eq} - Example #4

2.00 mol of HI in 2.00 L flask at 425°C react to produce H_2 and I_2 . At equilibrium, $[H_2]$ and $[I_2] = 0.214 \text{ mol / L}$.

What is K_{eq} for this reaction?



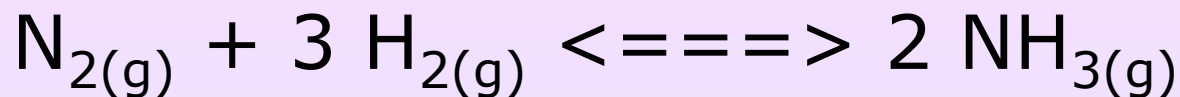
I
C
E

\therefore the K_{eq} is 0.140

EQUILIBRIUM CALCULATIONS

Calculating K_{eq}

Example #5



Initial concentrations:

$$[\text{N}_2] = 0.32 \text{ M and } [\text{H}_2] = 0.66 \text{ M}$$

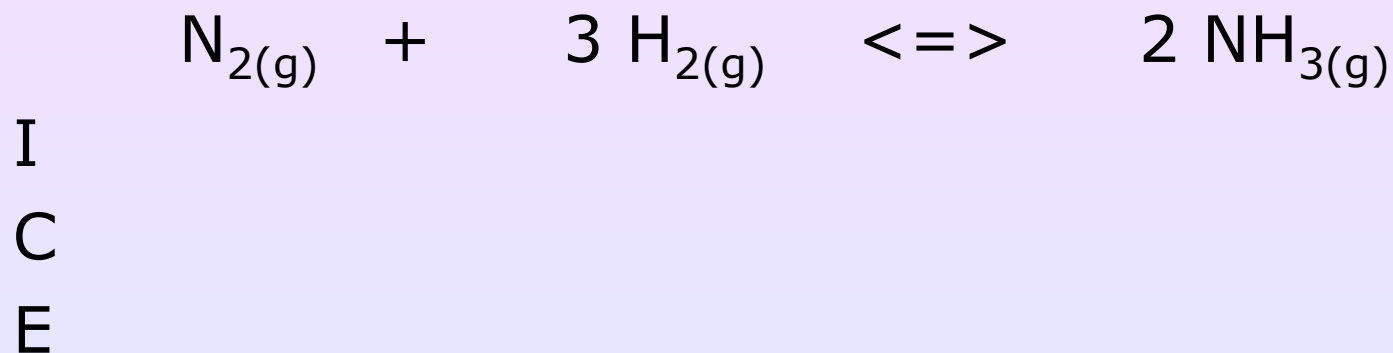
What is K_{eq} when equilibrium $[\text{H}_2]$ is 0.30 M?

EQUILIBRIUM CALCULATIONS

Calculating K_{eq} - Example #5

Initial concentrations: $[N_2] = 0.32 \text{ M}$ and $[H_2] = 0.66 \text{ M}$

What is K_{eq} when equilibrium $[H_2]$ is 0.30 M ?

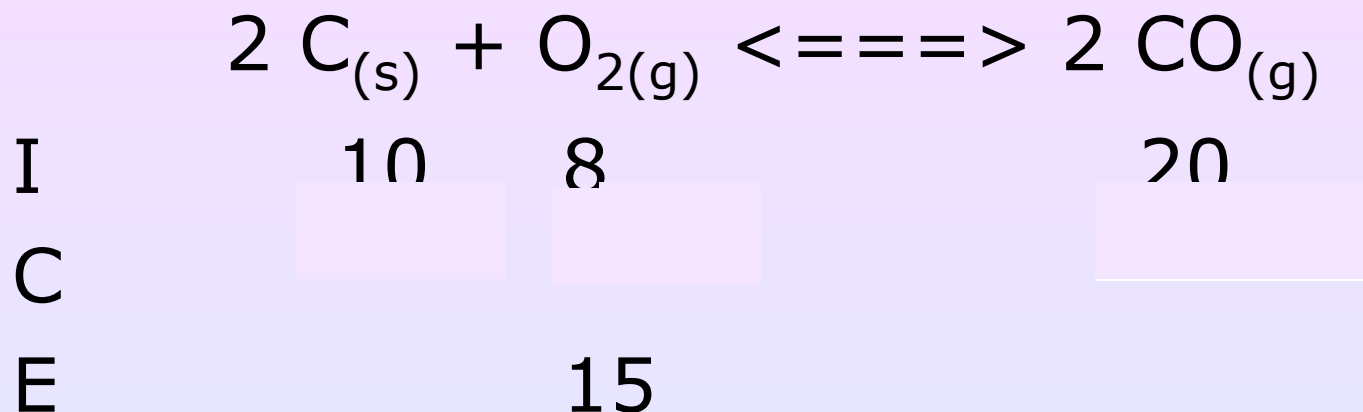


$$\therefore k_{eq} = 11$$

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Calculating K_{eq} - Example #6

Calculate K_{eq} .



$$\therefore K_{eq} = 2$$

EQUILIBRIUM CALCULATIONS

Homework:

- Textbook Questions
- Read Section 7.1
- p 428 #1
- p 437 # 6, 7
- p 438 # 3, 4, 7, 8, 9
- p 448 – 449 #6