

Physical Chemistry HW 3

Nikhil Menon

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1. a. The equilibrium constant K is equal to

$$\frac{k_1}{k_2} = \frac{[B][C]}{[A]} = \frac{1}{2}$$

We also know that 1 mol of A becomes 1 mol of B and 1 mol of C. If the amount of mol B at equilibrium is x ,

$$\frac{1}{2} = \frac{x^2}{1-x}$$

Solving for x gives

$$x = 0.5$$

Thus, at equilibrium, there would be 0.5 mol of A.

b. The decomposition of D creates B, which is a product in the decomposition of A. Thus, when D is added, the amount of A increases and the amount of C decreases.

c. The rate equation for B is

$$\frac{-d[B]}{dt} = k_2[B][C] - k_1[A] + k_4[B][E] - k_3[D]$$

which equals 0 at equilibrium. Thus,

$$0 = k_2[B][C] - k_1[A] + k_4[B][E] - k_3[D]$$

Solving for $[B]$ gives

$$[B] = \frac{k_1[A] + k_3[D]}{k_2[C] + k_4[E]}$$