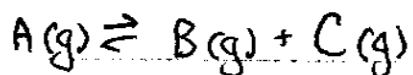


eg of difficult Gas Phase Keq Calculation.

For the equilibrium: in a 5.0L flask



Equilibrium concentrations are found to be 0.05 mol/L, 0.02 mol/L and 0.04 mol/L. What would the concentrations become if the flask volume was increased to 8L. To the original mixture, what amount of A would be required to increase the of [C] to 0.05 mol/L?

	A	B	C
Initial []	0.05 mol/L	0.02 mol/L	0.04 mol/L
Initial Amount	0.25 mol	0.10 mol	0.20 mol
Final Amount	0.25 - x	0.10 + x	0.20 + x
Final []	$\frac{0.25-x}{8}$	$\frac{0.10+x}{8}$	$\frac{0.20+x}{8}$

5.0L

8.0L

S: ↓ P (↑V)

R: ↑ P

H: make more gas

D: shift Right

E:

① equilibrium

Let x represent the amount of A that reacts

$$K_{eq} = \frac{[B][C]}{[A]}$$

$$0.016 = \frac{\left(\frac{0.10+x}{8}\right)\left(\frac{0.20+x}{8}\right)}{\left(\frac{0.25-x}{8}\right)}$$

$$0.016 = \left(\frac{0.10+x}{8}\right)\left(\frac{0.20+x}{8}\right)\left(\frac{8}{0.25-x}\right)$$

$$0.128(0.25-x) = (0.10+x)(0.20+x)$$

$$0.032 - 0.128x = 0.02 + 0.30x + x^2$$

$$0 = x^2 + 0.428x - 0.012$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-0.428 \pm \sqrt{(0.428)^2 - 4(1)(-0.012)}}{2}$$

$$K_{eq} = \frac{[B][C]}{[A]}$$

$$K_{eq} = \frac{(0.02)(0.04)}{(0.05)}$$

$$K_{eq} = 0.016$$

$$x = \frac{-0.428 \pm 0.48082}{2}$$

~~x = -0.454~~ or x = 0.0264
extraneous (gives -ve amounts)

$$[A] = \frac{0.25-x}{8} = \frac{0.25-0.0264}{8} = 0.0279 \text{ mol/L}$$

$$[B] = \frac{0.10 + x}{8}$$

$$= 0.0158 \text{ mol/L}$$

$$[C] = \frac{0.20 + x}{8}$$

$$= 0.0283 \frac{\text{mol}}{\text{L}}$$

Check: $\frac{[B][C]}{[A]}$

$$= 0.016 = K_{eq} \text{ 😊}$$

$A \rightleftharpoons B + C$

Initial []	0.05 mol	0.02 mol L	0.04 mol L	5.0 L * assume volume stays @ 5.0 L
Initial Amount	0.25 mol + x	0.10 mol	0.20 mol	S: ↑ [A] R: ↓ [A]
Final Amount	0.25 + x - 0.05 = 0.20 + x	0.10 + 0.05 = 0.15	0.20 + 0.05 = 0.25 mol	H: use A D: shift right*
Final []	$\frac{0.20 + x}{5}$	0.03 mol L	0.05 mol L	E:

Let x represent the amount of A added.

$$K_{eq} = \frac{[B][C]}{[A]}$$

$$0.016 = \frac{(0.03)(0.05)}{\left(\frac{0.20 + x}{5}\right)}$$

$$0.016 = 0.0015 \times \left(\frac{5}{0.20 + x}\right)$$

$$0.20 + x = 0.46875$$

$$x = 0.26875 \text{ mol}$$