Equilibrium 7 · CHEM 220

Directions: For questions 1-3, indicate whether and ICE or NICE table is most appropriate and set up the table. You need not calculate the equilibrium concentrations. For other questions answer the question posed.

1. For the reaction below, at 250 K, $K_P = 3.0 \times 10^{-5}$.

Reaction	$2\ NOCl_{(g)} \rightleftharpoons$	$2\ NO_{(g)}$ (LR) +	$Cl_{2(g)}$
Start	0 atm	1.0 atm	0.75 atm
Assume	+1.0	-1.0	-0.5
N.I.	1.0 atm	Ø	0.25 atm
C.	$-2x$	$+2x$	$+x$
E.	$1-2x$	$2x$	$0.25+x$
	≈ 1.0		≈ 0.25

Small K - should be as far left as possible to start analysis (NICE)

$$K = \frac{(0.25)(2x)^2}{(1.0)^2}$$

2. For the reaction below, at 350 K, $K_C = 2.2 \times 10^5$.

Reaction	$2\ NO_{(g)}$ +	$Br_{2(g)} \rightleftharpoons$	$2\ NOBr_{(g)}$
Start (I)	0 *M*	4.0 *M*	3.0 *M*
C	$+2x$	$+x$	$-2x$
E	$2x$	$4+x$	$3-2x$
		≈ 4.0	≈ 3.0

LARGE K - already as far to RIGHT as possible (ICE)

$$K = \frac{(3)^2}{(2x)^2 4}$$

3. For the reaction below, at 350 K, $K_C = 2.2 \times 10^5$.

Reaction	$2\,NO_{(g)}$ (LR) +	$Br_{2(g)}$ ⇌	$2\,NOBr_{(g)}$
Start	6.0 *M*	8.0 *M*	3.0 *M*
Assume	-6	-3	+6
NI	0	5	6
C	+2x	+x	-2x
E	2x	5+x	6-2x
		≈5	≈6

NI-C-E Table

large K

Reaction will go as far to the right as possible.

$$K = \frac{6^2}{(2x)^2 \cdot 5}$$

4. For the reaction below, at 600 K, K_P is not known. The initial mixture of reactants and products is given. At equilibrium, $P_{total} = 2.00$ atm. Calculate K_P at 600 K.

Reaction	$2\,NOCl_{(g)}$ ⇌	$2\,NO_{(g)}$ +	$Cl_{2(g)}$
Start I	0.50 atm	1.2 atm	0.75 atm
C	+2x	-2x	-x
E	0.5+2x	1.2-2x	0.75-x
	1.4 atm	0.3 atm	0.30 atm

$= P_{TOT} = 2.45$ atm (must go down to reach 2.00 atm total. ∴ shifts to side w/ fewer particles.)

$$P_{tot} = 2.00\text{ atm} = (0.5+2x) + (1.2-2x) + (0.75-x)$$

$$2.00 = 2.45 - x$$

$$x = 0.45$$

$$2x = 0.90$$

$$K_p = \frac{(0.3)^2(0.3)}{(1.4)^2} = \boxed{0.014 = K_p}$$