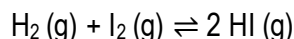


CONCEPT: ICE CHARTS

Calculating Equilibrium Amount

- An **ICE** (**I** _____, **C** _____, **E** _____) **Chart** is a table used to simplify the calculations of _____ reactions.
 - ☐ Used when missing _____ equilibrium amount for the compounds in a balanced equilibrium reaction.
 - ☐ The units of an ICE Chart are either in _____ (K_p) or _____ (K_c).

EXAMPLE: The equation for the formation of hydrogen iodide from H_2 and I_2 is given as:



The value of K_c for the reaction is 0.0218 at $25^\circ C$. What is the equilibrium concentration of HI in a sealed reaction vessel, if the initial concentrations of H_2 and I_2 are both 0.10 M and initially there is no HI present?

STEP 1: Setup an ICE Chart if missing _____ equilibrium amount for the compounds in the balanced equilibrium reaction.

ICE Chart Formation			
	$H_2(g)$	+	$I_2(g) \rightleftharpoons 2 HI(g)$
I	_____		
C	_____		
E	_____		

STEP 2: Using the _____ Row, place the amount given for any compound.

STEP 3: We _____ reactants to _____ products.

- ☐ Using the _____ Row, place an _____ for the reactants and a _____ for the products.
 - The _____ of the compound must be placed before the _____ variable.

STEP 4: Using the _____ Row, setup the equilibrium constant expression and solve.

- ☐ Check if a shortcut can be utilized to avoid the _____ formula.
 - If both shortcuts _____ then it must be used.

ICE Chart Shortcuts

Shortcut #1: _____ Root Method

When both the **top** and **bottom** of the expression are squared.

$$0.0218 = \frac{[2x]^2}{[0.10 - x]^2}$$

Shortcut #2: _____ Approximation Method

When the ratio of []₀ to K is _____ 500 you can ignore the _____.

$$\frac{[]_0}{K} = \frac{0.55 M}{2.5 \times 10^{-4}} = \quad \quad \quad 2.5 \times 10^{-4} = \frac{[x^2]}{[0.55 - x]}$$

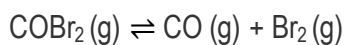
_____ Formula

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

CONCEPT: ICE CHARTS

PRACTICE: At a given temperature the gas phase reaction: $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2 \text{NO} (\text{g})$ has an equilibrium constant of 4.18×10^{-7} . What will be the concentration of NO at equilibrium if 2.00 moles of nitrogen and 6.00 moles oxygen are allowed to come to equilibrium in a 2.0 L flask?

PRACTICE: Consider the following reaction:



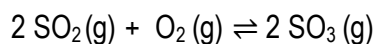
A reaction mixture initially contains 0.15 atm COBr_2 . Determine the equilibrium concentration of CO if K_p for the reaction at 25°C is 4.08.

CONCEPT: ICE CHARTS

Calculating Equilibrium Constant

- Recall, the equilibrium constant (K) is a _____ of product to reactant amounts at equilibrium.
 - When only given _____ equilibrium amount the equilibrium constant K can be determined.

EXAMPLE: An important reaction in the formation of acid rain is,



Initially, 0.30 M SO_2 and 0.20 M O_2 are mixed and allowed to react in an evacuated flask at 340°C. When an equilibrium is established the equilibrium amount of SO_3 was found to be 0.0150 M. Calculate the equilibrium constant, K_c , for the reaction at 340°C.

Follow the **STEPS 1 to 4** in order to determine the equilibrium constant expression for the reaction.

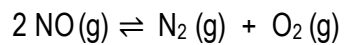
ICE Chart Formation			
	$2 \text{SO}_2(\text{g})$	$+$	$\text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g})$
I	_____		
C	_____		
E	_____		

STEP 5: Make the given equilibrium amount _____ to the value in the **EQUILIBRIUM ROW** of the compound to solve for x.

- Plug the value for x into the equilibrium constant expression to solve for _____.

CONCEPT: ICE CHARTS

PRACTICE: At a certain temperature, 0.810 mol NO is placed in a 5.00 L container. At equilibrium, 0.075 mol N₂ is present. Calculate K_c.



PRACTICE: When 0.600 atm of NO₂ was allowed to come to equilibrium the total pressure was 0.875 atm. Calculate the K_p of the reaction.

