

Unless otherwise specified, each question is worth 4 points.

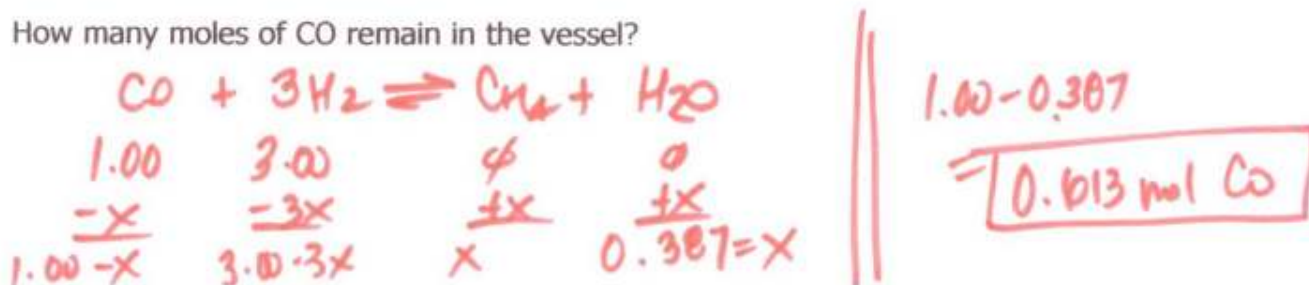
1. Write the equilibrium constant expression ($K=...$) for the following reaction.



$$K = \frac{[\text{CH}_4][\text{H}_2\text{O}]}{[\text{CO}][\text{H}_2]^3}$$

2. Carbon monoxide and hydrogen react according to the reaction shown in question 1, above. When 1.000 mol CO and 3.000 mol H_2 are placed in a 10.00-L vessel at 1200 K and allowed to come to equilibrium, the mixture is found to contain 0.387 mol H_2O .

- a. How many moles of CO remain in the vessel?



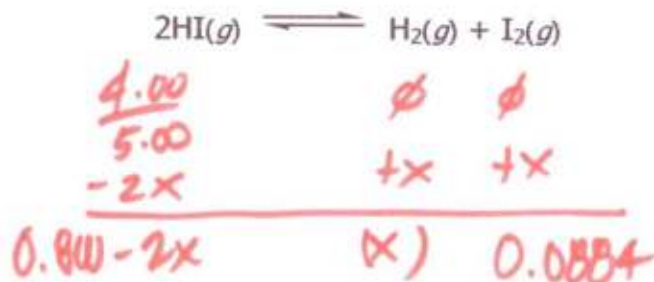
- b. What is the concentration of CO in the vessel at this equilibrium?

$$\frac{0.613 \text{ mol CO}}{10.0 \text{ L}} = \boxed{0.0613 \frac{\text{mol CO}}{\text{L}}}$$

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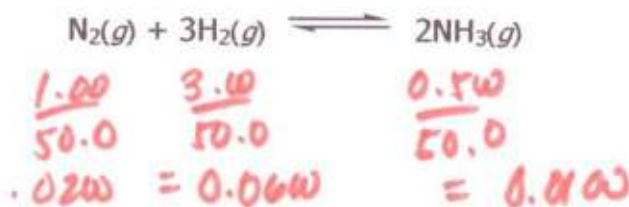
3. Hydrogen iodide decomposes according to the following equation shown below.

When 4.00 mol HI was placed in a 5.00-L vessel at 458°C, the equilibrium mixture was found to contain an a concentration of iodine: $[I_2]=0.0884 \text{ mol/L}$. What is the value of K for the decomposition of HI at this temperature?



$$K = \frac{(0.0884)(0.0884)}{(0.800 - 2(0.0884))^2} = \boxed{0.0201}$$

4. A 50.0-L reaction vessel contains 1.00 mol N_2 , 3.00 mol H_2 , and 0.500 mol NH_3 . Will more ammonia be formed or will it dissociate when the mixture goes to equilibrium at 400C? Briefly explain your answer. The equilibrium constant for this reaction is $K = 0.500$.



$$Q = \frac{(0.0100)^2}{(0.0200)(0.0600)^3} = 23 \quad \text{> } K$$

SHIFT = \leftarrow
(DECOMPOSE NH_3)

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5. Predict the direction of the reaction ("equilibrium shift") when H_2 is removed from a mixture in which the following equilibrium has been established:

