

Key 3A white

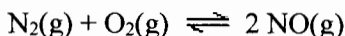
5. The reaction below was studied at 250°C.



At equilibrium, the partial pressures of the gases are as follows:  $\text{PCl}_5 = 2.0 \times 10^{-2}$  atm,  $\text{PCl}_3 = 4.2 \times 10^{-2}$  atm, and  $\text{Cl}_2 = 4.2 \times 10^{-4}$  atm. What is the value of  $K_p$  for the reaction?

(3) 
$$K_p = \frac{P_{\text{PCl}_3} P_{\text{Cl}_2}}{P_{\text{PCl}_5}} = \frac{(4.2 \times 10^{-2})(4.2 \times 10^{-4})}{2.0 \times 10^{-2}} = 8.8 \times 10^{-4}$$

6. At 2010 K, the equilibrium constant,  $K_c$ , for the following reaction is  $4.0 \times 10^{-4}$ .



If the equilibrium concentrations of  $\text{N}_2$  and  $\text{O}_2$  are 0.25 mol/L and 0.33 mol/L, what is the equilibrium concentration of  $\text{NO}$ ?

(4) 
$$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$$

I					
C					
E	0.25	0.33	x	$4.0 \times 10^{-4} = \frac{x^2}{[0.25][0.33]}$	$x = 5.7 \times 10^{-3}$

7. We place 0.064 mol  $\text{N}_2\text{O}_4(\text{g})$  in a 4.00 L flask at 200. After reaching equilibrium, the concentration of  $\text{NO}_2(\text{g})$  is 0.0030 M. What is  $K_c$  for the reaction below?

(4) 
$$\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2 \text{NO}_2(\text{g})$$

I	0.016 M	0		
C	-x	+2x		
E	0.016-x	2x		

$2x = 0.0030 \text{ M}$   
 $x = 0.0015 \text{ M}$   
 $0.016 - 0.0015 = 0.0145$

$$K_c = \frac{[0.0030]^2}{0.0145}$$

$$K_c = 6.2 \times 10^{-4}$$

8. A mixture of 0.200 mol  $\text{NO}$  and 0.200 mol  $\text{CO}_2$  is placed in a 1.00 L flask and allowed to reach equilibrium at a given temperature. Analysis of the equilibrium mixture indicates that 0.067 mol of  $\text{CO}$  is present. Calculate  $K_c$  for the reaction.

(4) 
$$\text{NO}(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{NO}_2(\text{g}) + \text{CO}(\text{g})$$

I	0.200	0.200	0	0
C	-x	-x	+x	+x
E	0.200-x	0.200-x	x	x

$x = 0.067$   
 $0.200 - 0.067 = 0.133$

$$K_c = \frac{[0.067]^2}{[0.133]^2}$$

$$K_c = 0.25$$

CHM152 Quiz 3a Spring 2019 25 Pts  
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Name: Key

1. Write the expression for  $K_c$  for the reaction below.



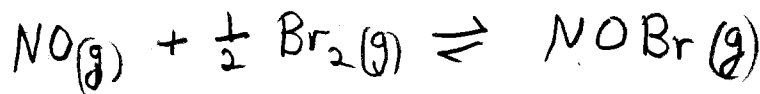
(2)

$$K_c = [\text{Mg}^{2+}]^3 [\text{PO}_4^{3-}]^2$$

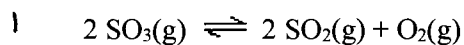
2. Write a balanced chemical reaction which corresponds to the following equilibrium constant expression.

$$K_p = \frac{P_{\text{NOBr}}}{P_{\text{NO}} P_{\text{Br}_2}^{1/2}}$$

(2)



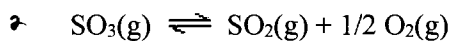
3. For the following reaction,



$$K_{P_1} = \frac{P_{\text{SO}_2}^2 P_{\text{O}_2}}{P_{\text{SO}_3}^2}$$

the equilibrium constant,  $K_p$ , is 1.32 at 627°C. What is the equilibrium constant for the reaction below?

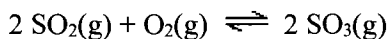
(3)



$$K_{P_2} = \frac{P_{\text{SO}_2} P_{\text{O}_2}^{1/2}}{P_{\text{SO}_3}}$$

$$\text{note } K_{P_2} = \sqrt{K_{P_1}} = 1.15$$

4. The oxidation of sulfur dioxide produces sulfur trioxide.



Calculate the value of  $K_p$ , given that  $K_c$  for the reaction is  $2.3 \times 10^4$  at 999 K. ( $R = 0.08206 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$ )

$$K_p = K_c (RT)^{\Delta n}$$

(3)

$$= 2.3 \times 10^4 (0.0821 \cdot 999)^{-1} = 280 \approx 2.8 \times 10^2$$

(10)