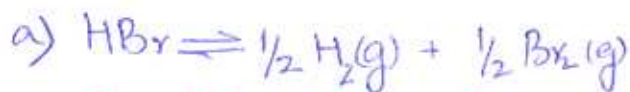
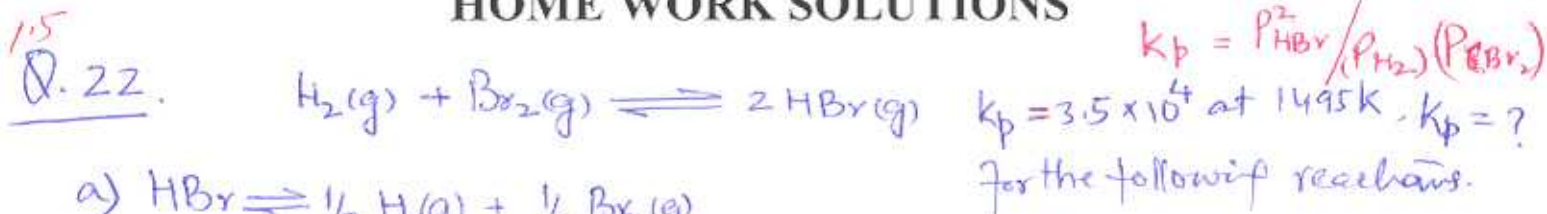
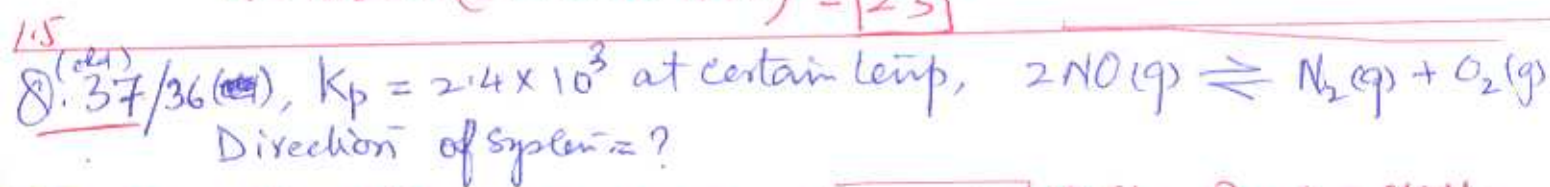
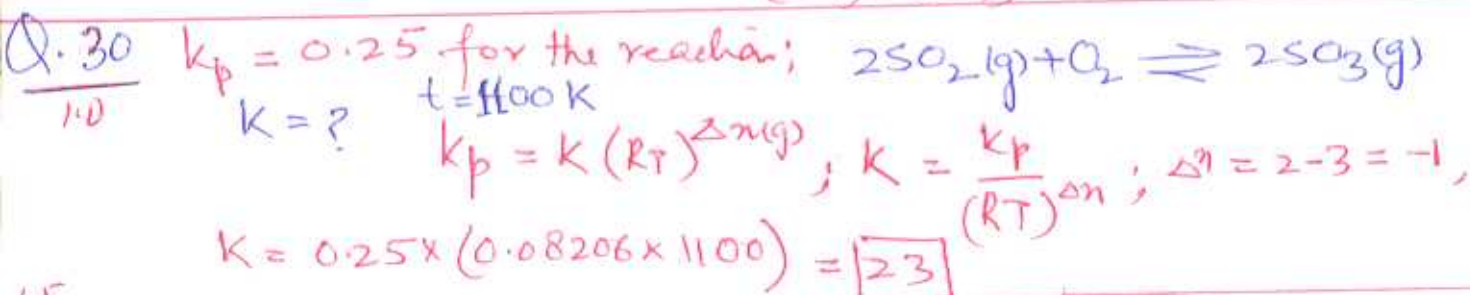
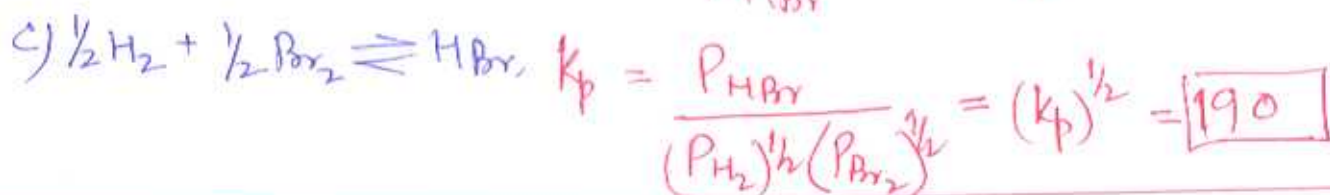
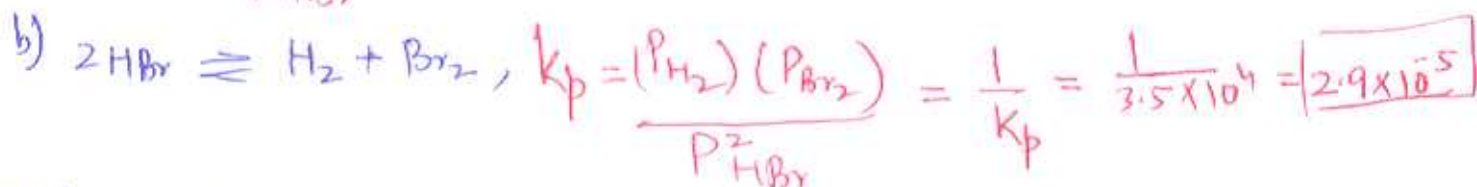


# CHAPTER 13

## HOME WORK SOLUTIONS



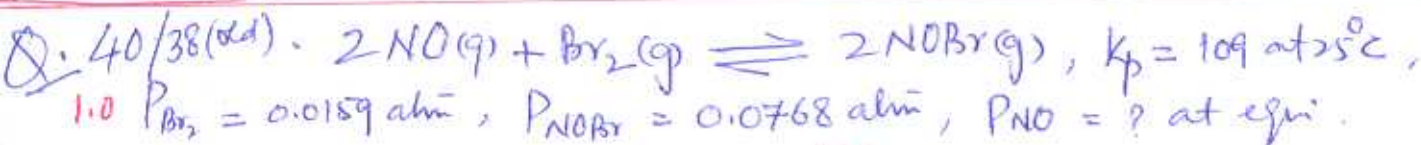
$$K_p = \frac{(P_{H_2})^{1/2} (P_{Br_2})^{1/2}}{P_{HBr}} = \left(\frac{1}{K_p}\right)^{1/2} = \left[\frac{1}{3.5 \times 10^4}\right]^{1/2} = \boxed{5.3 \times 10^{-3}}$$



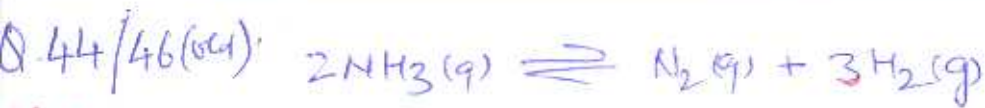
a)  $Q = \frac{P_{N_2} \times P_{O_2}}{P_{NO}^2} = \frac{(0.11)(2.0)}{(0.010)^2} = \boxed{2.2 \times 10^3}$   $Q < K_p$ , Reaction shift right to reach equilibrium.

b)  $Q = \frac{(0.36)(0.67)}{(0.0078)^2} = \boxed{4.0 \times 10^3}$   $Q > K_p$  Reaction shift to left to reach equilibrium.

c)  $Q = \frac{(0.51)(0.18)}{(0.0862)^2} = \boxed{2.4 \times 10^3}$   $Q = K_p$ , system at equilibrium.



$$K_p = \frac{P_{NOBr}^2}{P_{NO}^2 \times P_{Br_2}}$$
,  $109 = \frac{(0.0768)^2}{P_{NO}^2 \times 0.0159} = P_{NO} = \boxed{0.0583 \text{ atm}}$



1.5 Initial 4.0 mol/2.0 L                      0                      0

Let  $2x$  mol of  $\text{NH}_3$  react to reach equilibrium

Change  $-2x \rightarrow +x \quad +3x$

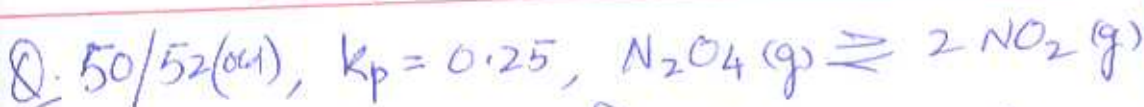
Equil 2.0 - 2x                      x                      3x

$[\text{NH}_3]_e = 2.0 \text{ mol}/2.0 \text{ L remain,} = 1.0 \text{ M} = 2.0 - 2x$

$x = 0.5 \text{ M}$

$[\text{N}_2] = x = 0.5 \text{ M}; [\text{H}_2] = 3x = 3(0.5 \text{ M}) = 1.5 \text{ M}$

$K = \frac{[\text{N}_2][\text{H}_2]^3}{[\text{NH}_3]^2} = \frac{(0.50)(1.5)^3}{(1.0)^2} = 1.7$



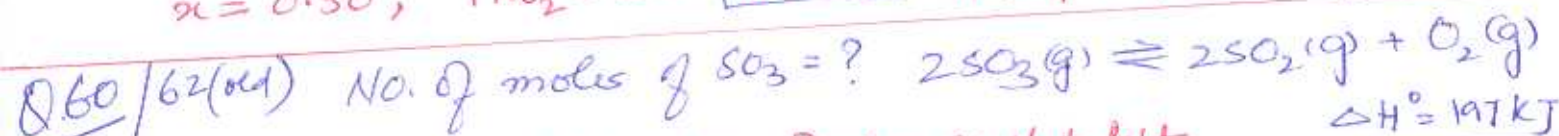
1.5 a) Initial P 4.5 atm                      0  
Change  $-x \rightarrow +2x$   
Equil. 4.5 - x                      2x

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

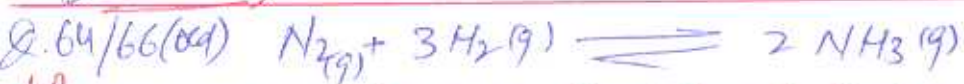
$K_p = \frac{P_{\text{NO}_2}^2}{P_{\text{N}_2\text{O}_4}} = \frac{(2x)^2}{4.5 - x} = 0.25$

Use quadratic equation ①  
 $4x^2 + 0.25x - 1.125 = 0$

$x = 0.50, P_{\text{NO}_2} = 2x = 1.0 \text{ atm}$                        $P_{\text{N}_2\text{O}_4} = 4.5 - x = 4.0 \text{ atm}$



- 1.0
- a) The moles of  $\text{SO}_3$  will increase, Reaction shift to left
  - b) Increase; Reactant has less molecule than product gas molecules, Reaction shift left with decreasing volume.
  - c) NO effect,
  - d) Increase; Heat +  $2\text{SO}_3 \rightleftharpoons 2\text{SO}_2 + \text{O}_2$ , Decreasing T will remove heat, Shifting this endothermic to the left.
  - e) Decrease;



1.0 Temperature increase, the value of K decreases. This is consistent with an exothermic reaction, In an exothermic reaction, heat is a product and increase in temperature shifts the equilibrium to the reactant side.