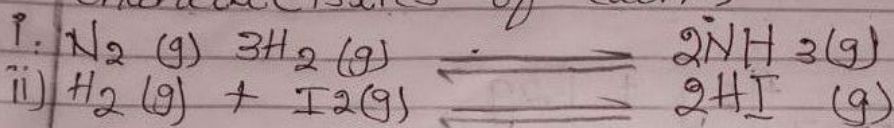


CHAPTER #9

CHEMICAL EQUILIBRIUM

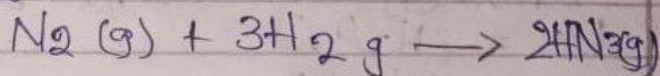
SELF ASSESSMENT Exercise 9.1

Q Write Both forward and reverse reactions and describe macroscopic characteristics of each.

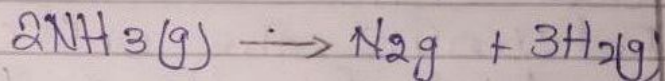


Solution:

Forward reactions:

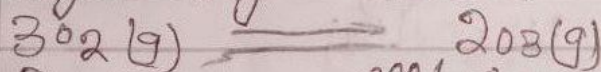


Reverse reactions:



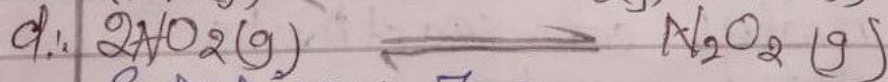
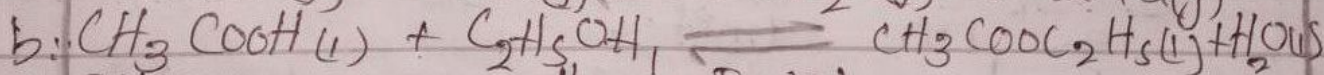
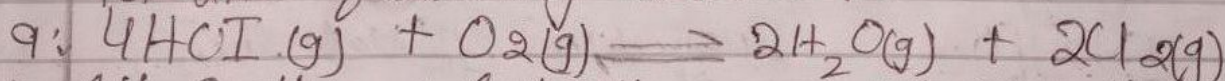
Self Assessment Exercise 9.2

= Following reactions can occur during lightning storms.

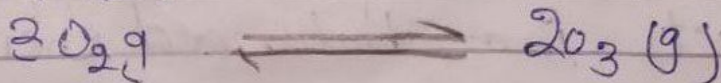


Derive equilibrium constant expression for this reaction.

2. Write equilibrium constant expression for the following reaction.

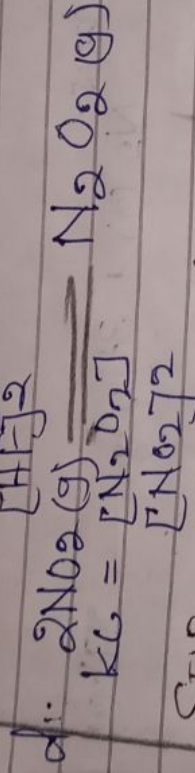
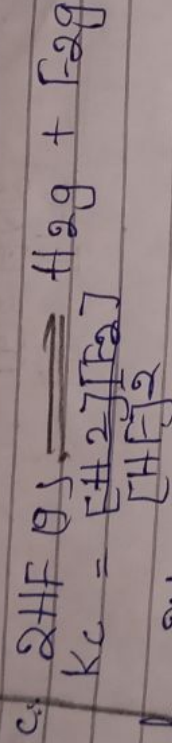
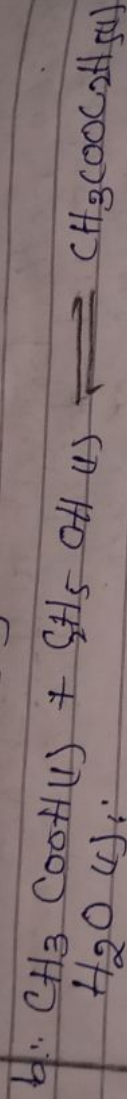
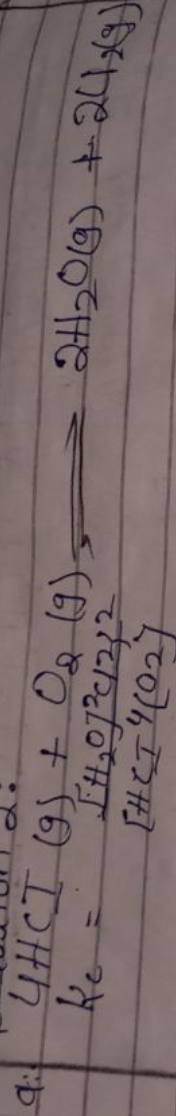


Solution: 1.



$$K_c = \frac{\{0.3\}^2}{\{0.2\}^3}$$

Solution 2:



SELF ASSESSMENT Exercise 9.3.

Determine the units of equilibrium constant for the following reactions.

- $\text{N}_2 \text{(g)} + \text{O}_2 \text{(g)} \rightleftharpoons 2\text{NO (g)}$
- $\text{H}_2 \text{(g)} + \text{CO}_2 \text{(g)} \rightleftharpoons \text{H}_2\text{O (g)} + \text{CO (g)}$
- $\text{PCl}_5 \text{(g)} \rightleftharpoons \text{PCl}_3 \text{(g)} + \text{Cl}_2 \text{(g)}$
- $\text{CO (g)} + 2\text{H}_2 \text{(g)} \rightleftharpoons \text{CH}_3\text{OH (g)}$

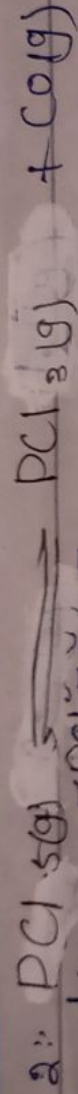
Solution:

1. $\text{N}_2 \text{(g)} + \text{O}_2 \text{(g)} \rightleftharpoons 2\text{NO (g)}$
 $K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} = \frac{\text{mole-dm}^{-3} \times \text{mole-dm}^{-3}}{[\text{mole-dm}^{-3}][\text{mole-dm}^{-3}]}$
 $= \text{no units}$

Note: K_c has no unit when the total number of moles of reactants is equal to the total number of moles of products in a balanced chemical equation.

a. $K_c = \frac{[\text{PCl}_3]^2}{[\text{PCl}_5]}$

b. $K_c = \frac{[\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}]}$



$$K_c = \frac{[\text{PCl}_3][\text{CO}]}{[\text{PCl}_5][\text{CO}_2]} = \frac{[\text{mole-dm}^{-3}][\text{mole-dm}^{-3}]}{[\text{mole-dm}^{-3}][\text{mole-dm}^{-3}]} = \frac{[\text{mole-dm}^{-3}]}{[\text{mole-dm}^{-3}]}$$

$$= [\text{mole-dm}^{-3}]$$



$$K_c = \frac{[\text{CH}_3\text{OH}]}{[\text{CO}][\text{H}_2]^2} = \frac{[\text{mole-dm}^{-3}]}{[\text{mole-dm}^{-3}][\text{mole-dm}^{-3}]}$$

$$= [\text{mole-dm}^{-3}]^{-2} = \text{mole}^{-2} \text{ dm}^6$$