

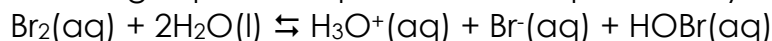
Quiz (Effect of Concentration on Chemical Equilibrium)

1. Ammonia dissolves readily in water to form an alkaline solution according to the following equation:



Referring to the above equation, explain the following:

- (a) The addition of an excess of solid sodium hydroxide to aqueous ammonia would liberate ammonia.
- (b) The addition of an excess of powdered lead(II) nitrate to aqueous ammonia would lower its pH value.
2. The following equation represents the equilibrium system of bromine water:



About 2 cm³ of orange-coloured bromine water are placed in each of two test-tubes A and B, and the following tests are carried out:

Test-tube A	Test-tube B
Add a few drops of NaOH(aq) and shake; then, add concentrated HCl dropwise, with shaking, until the solution is acidic.	Add a few drops of AgNO ₃ (aq) and shake; then allow to stand in sunlight.

- (a) Describe and explain the observations in test-tube A in terms of chemical equilibrium.
- (b) What would be observed in test-tube B? Explain your observations.

Suggested Answer

1. (a) The addition of NaOH(s) increases the $[\text{OH}^-(\text{aq})]$ when it is dissolved in the solution, and the equilibrium position will be shifted to the left.
- (b) $\text{Pb}^{2+}(\text{aq})$ from dissolved lead(II) nitrate would remove the $\text{OH}^-(\text{aq})$ to form a precipitate of $\text{Pb}(\text{OH})_2(\text{s})$ and lower the pH value.
 $\text{Pb}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \longrightarrow \text{Pb}(\text{OH})_2(\text{s})$
 $[\text{OH}^-(\text{aq})]$ is decreased, therefore, lower pH values.
2. (a) The orange colour becomes lighter / turns to pale yellow / decolourized; because $\text{H}_3\text{O}^+(\text{aq})$ reacts with $\text{NaOH}(\text{aq})$ and the equilibrium position shifts to the right / product side.

The colour of the solution becomes orange again / darker in colour; because the addition of H_3O^+ shifts the equilibrium position to the left.

(b)

Observation	Explanation
Pale yellow precipitate is formed Solution becomes lighter in colour	$\text{Ag}^+ + \text{Br}^- \longrightarrow \text{AgBr}(\text{s})$ / formation of silver bromide
Precipitate turns dark / violet upon standing in sunlight	Decomposition of AgBr / formation of finely divided silver / photochemical reaction