



Year 12 Chemistry

Tutorial 9.5.F – Sodium Carbonate

Answers

- True
 - True
 - False
 - True
 - False
- 2.12 tonnes
- Sodium hydrogen carbonate decomposes on heating to release carbon dioxide which acts as a raising agent in cooking.
$$2\text{NaHCO}_3 (\text{s}) \rightarrow \text{Na}_2\text{CO}_3 (\text{s}) + \text{H}_2\text{O} (\text{g}) + \text{CO}_2 (\text{g})$$
- 2.7 kg
 - $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} (\text{s}) \rightarrow \text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O} (\text{s}) + 9\text{H}_2\text{O} (\text{g})$
- The partitions create more surface area over which the dissolution of ammonia can occur.
 - The dissolution of ammonia in the brine is exothermic and the ammoniacal brine must be cool for the next step in the carbonating tower.
- Carbonating tower
 - $\text{NH}_3 (\text{aq}) + \text{H}_2\text{CO}_3 (\text{aq}) \rightarrow \text{NH}_4^+ (\text{aq}) + \text{HCO}_3^- (\text{aq})$
 - The cooling tower will drive the exothermic neutralisation to favour the products. The removal of hydrogen carbonate ions as sodium hydrogen carbonate (which has a low solubility in the ammoniacal brine) will also drive the equilibrium towards the products.
- Ammonia is expensive (derived from the Haber process). It should not be allowed to escape into the environment as it will contribute to pollution.
 - The filtrate formed when sodium hydrogen carbonate crystallises contains ammonium chloride. It is mixed with lime from the production of carbon dioxide step and heated using steam. Ammonia is refined and recycled.
$$\text{CaO} (\text{s}) + \text{H}_2\text{O} (\text{l}) \rightarrow \text{Ca}^{2+} (\text{aq}) + 2\text{OH}^- (\text{aq})$$
$$\text{NH}_4^+ (\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow \text{NH}_3 (\text{g}) + \text{H}_2\text{O} (\text{l})$$