

Answers to Exercise 7.2

Reactions of Carbonates

1.

- (a) $\text{Na}_2\text{CO}_3(s) + 2\text{H}^+(aq) \rightarrow 2\text{Na}^+(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
- (b) $\text{BaCO}_3(s) + 2\text{H}^+(aq) \rightarrow \text{Ba}^{2+}(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
- (c) $\text{Cs}_2\text{CO}_3(s) + 2\text{HCl}(aq) \rightarrow 2\text{CsCl}(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
- (d) $\text{MgCO}_3(s) + 2\text{HCl}(aq) \rightarrow \text{MgCl}_2(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$

While H_2CO_3 may be formed as an intermediate (when CO_3^{2-} reacts with H^+), it decomposes to give H_2O and CO_2 . Remember the bubbles when the antacid tablet reacted with acid in lab!

Net ionic equations are also acceptable:

- (c) $\text{Cs}_2\text{CO}_3(s) + 2\text{H}^+(aq) \rightarrow 2\text{Cs}^+(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
- (d) $\text{MgCO}_3(s) + 2\text{H}^+(aq) \rightarrow \text{Mg}^{2+}(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$

2.

- (a) $2\text{LiOH}(aq) + \text{CO}_2(g) \rightarrow \text{Li}_2\text{CO}_3(aq) + \text{H}_2\text{O}(l)$
- (b) $2\text{NaOH}(aq) + \text{CO}_2(g) \rightarrow \text{Na}_2\text{CO}_3(aq) + \text{H}_2\text{O}(l)$
- (c) $\text{Ca}(\text{OH})_2(s) + \text{CO}_2(g) \rightarrow \text{CaCO}_3(s) + \text{H}_2\text{O}(l)$
- (d) $\text{Ba}(\text{OH})_2(aq) + \text{CO}_2(g) \rightarrow \text{BaCO}_3(s) + \text{H}_2\text{O}(l)$

These are effectively the reverse of the reactions in Question 1.

Adding a carbonate to acid gives CO_2 . Adding CO_2 to hydroxide gives a carbonate.

Net ionic equations are also acceptable:

- (a) $2\text{OH}^-(aq) + \text{CO}_2(g) \rightarrow \text{CO}_3^{2-}(aq) + \text{H}_2\text{O}(l)$
- (b) $2\text{OH}^-(aq) + \text{CO}_2(g) \rightarrow \text{CO}_3^{2-}(aq) + \text{H}_2\text{O}(l)$
- (d) $\text{Ba}^{2+}(aq) + 2\text{OH}^-(aq) + \text{CO}_2(g) \rightarrow \text{BaCO}_3(s) + \text{H}_2\text{O}(l)$

3.

- (a) $\text{CaCO}_3(s) \xrightarrow{\Delta} \text{CaO}(s) + \text{CO}_2(g)$
- (b) $\text{BaCO}_3(s) \xrightarrow{\Delta} \text{BaO}(s) + \text{CO}_2(g)$

The Δ above the reaction arrow indicates that heat is required for the reaction to proceed.