

SL & HL Answers to Properties of acids & bases questions

1. i. $\text{HCl(aq)} + \text{KOH(aq)} \rightarrow \text{KCl(aq)} + \text{H}_2\text{O(l)}$ or $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O(l)}$.
 ii. $\text{HCl(aq)} + \text{NH}_3(\text{aq}) \rightarrow \text{NH}_4\text{Cl(aq)}$ or $\text{H}^+(\text{aq}) + \text{NH}_3(\text{aq}) \rightarrow \text{NH}_4^+(\text{aq})$
 iii. $2\text{HCl(aq)} + \text{CuO(s)} \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O(l)}$
 iv. $\text{HCl(aq)} + \text{NaHCO}_3(\text{s}) \rightarrow \text{NaCl(aq)} + \text{CO}_2(\text{g}) + \text{H}_2\text{O(l)}$
 or $\text{H}^+(\text{aq}) + \text{HCO}_3^-(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O(l)}$
 v. $2\text{HCl(aq)} + \text{CaCO}_3(\text{s}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O(l)}$
 or $2\text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O(l)}$
 vi. $2\text{HCl(aq)} + \text{Zn(s)} \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g})$ or $2\text{H}^+(\text{aq}) + \text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$

2. A base is a substance that can neutralise an acid. An alkali is a soluble base.

3. (i) Add a dilute acid, such as hydrochloric acid, to the sodium hydroxide solution. Universal indicator paper (or another indicator such as phenolphthalein) or a pH meter can be used to show the pH moves from above 7 to below 7 as the sodium hydroxide solution is first neutralised then the acid is present in excess.
 (ii) Add the sodium hydroxide solution to solid ammonium chloride and warm. The smell of ammonia being evolved will be noticed.

4. $\text{NH}_4\text{Cl(s)} + \text{KOH(aq)} \rightarrow \text{KCl(aq)} + \text{NH}_3(\text{g}) + \text{H}_2\text{O(l)}$ or $\text{NH}_4^+(\text{s}) + \text{OH}^-(\text{aq}) \rightarrow \text{NH}_3(\text{g}) + \text{H}_2\text{O(l)}$

5. i. Green/blue as the pH will be about 8 - 10 depending upon the concentration of the ammonia.
 ii. Change to red/pink as the pH will drop to about 3 or slightly less depending upon the concentration of the acid.

6. $\text{MgO(s)} + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{s}) + \text{H}_2\text{O(l)}$