SL & HL Answers to questions on Acid deposition

1. i. Carbonic acid is a weak acid so is only very slightly dissociated

$H_2CO_3(aq) \rightleftarrows H^+(aq) + HCO_3^-(aq)$

so that, even in a saturated solution, the concentration of hydrogen ions can never give a pH lower than 5.6.

ii. Ten times more acidic (as the pH has decreased by one unit)

2. i. $2NO(g) + O_2(g) \rightarrow 2NO_2$

$2NO_2(g) + H_2O(l) \rightarrow HNO_3(aq) + HNO_2(aq)$

(nitric acid can also be formed from: $4NO_2(g) + O_2(g) + 2H_2O(l) \rightarrow 4HNO_3(aq)$)

ii. $SO_2(g) + H_2O(l) \rightarrow H_2SO_3(aq)$

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ then $SO_3(g) + H_2O(l) \rightarrow H_2SO_4(aq)$

3. Tree growth is stunted with thinning of the tops and loss and yellowing of leaves. This is due to the leaching of important nutrients, such as Ca^{2+}, Mg^{2+} and K^+ from the soil. The loss of Mg^{2+} causes a reduction of chlorophyll which lowers the ability of the tree to photosynthesise. The leaching of Al^{3+} from rocks into the soil affects the ability of the roots of the tree to take up sufficient water and nutrients to survive.

4. $CO_3^{2-}(s) + 2H^+(aq) \rightarrow CO_2(g) + H_2O(l)$

5. Calcium hydroxide and calcium oxide are both strong bases and can neutralise the acid.

$Ca(OH)_2(aq) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + 2H_2O(l)$

$CaO(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l)$

This increases the amount of calcium ions in the lake water and also helps to precipitate aluminium ions from the water.

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