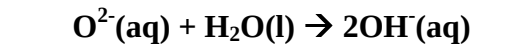
- Briefly explain how the concept of electronegativity can rationalise the existence of acidic, basic and amphoteric oxides.

Marks 3

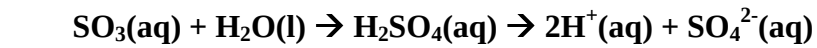
Oxides of the *least* electronegative elements (the *most* electropositive elements – the metals) are very ionic. They consist of a cation and the oxide, O^{2-}, ion. The oxide ion is *extremely* basic. For example, it will react rapidly with water:



$$O^{2-}(aq) + H_2O(l) \rightarrow 2OH^-(aq)$$

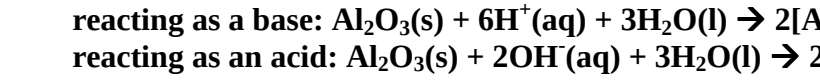
Dissolution of the oxide of an element of low electronegativity will result in a strongly basic solution.

The oxides of the *most* electronegative elements (the non-metals) are covalent and contain E=O bonds (where E is the electronegative element). They react with water to form acids. For example, sulfur trioxide reacts with water to produce sulfuric acid which rapidly ionizes to give an acidic solution:



$$SO_3(aq) + H_2O(l) \rightarrow H_2SO_4(aq) \rightarrow 2H^+(aq) + SO_4^{2-}(aq)$$

Elements with intermediate electronegativity form oxides which react with both acids and bases. As a result, they are classified as being amphoteric. Aluminium oxide is an example. It will dissolve in acidic and in alkaline solutions according to the reactions:



reacting as a base: $Al_2O_3(s) + 6H^+(aq) + 3H_2O(l) \rightarrow 2[Al(OH_2)_6]^{3+}$

reacting as an acid: $Al_2O_3(s) + 2OH^-(aq) + 3H_2O(l) \rightarrow 2[Al(OH)_4]^-$

You would *not* have needed to remember these reactions of SO_3 or Al_2O_3 to get full marks on this question. They are given here as examples.