	Marks
• Explain why HOCl is a stronger Brønsted acid than HOBr but HCl is a weaker acid than HBr.	**2**

In Group 17 oxyacids, electron density is drawn away from the O atom as the electronegativity of the halogen increases. This in turn draws electron density away from the O–H bond and weakens it. The weaker the O–H bond, the stronger the acid. Cl is more electronegative than Br so HOCl is stronger acid than HOBr.

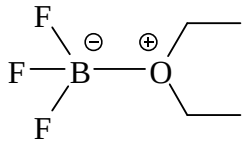
In binary acids such as HBr and HCl, the H–Br bond is longer than the H–Cl bond as Br is larger than Cl. The H–Br bond is therefore weaker than the H–Cl bond and HBr is thus a stronger acid than HCl.

- BF_3 is a Lewis acid in its reaction with diethyl ether. Explain what is meant by a Lewis acid and draw the product of this reaction.

Marks 2

A Lewis acid is an electron pair acceptor.

BF_3 possess an empty *p*-orbital on B. $CH_3CH_2OCH_2CH_3$ possess a lone pair on O. BF_3 reacts with $CH_3CH_2OCH_2CH_3$ by accepting this pair of electrons: BF_3 acts as a Lewis acid and $CH_3CH_2OCH_2CH_3$ acts as a Lewis base.

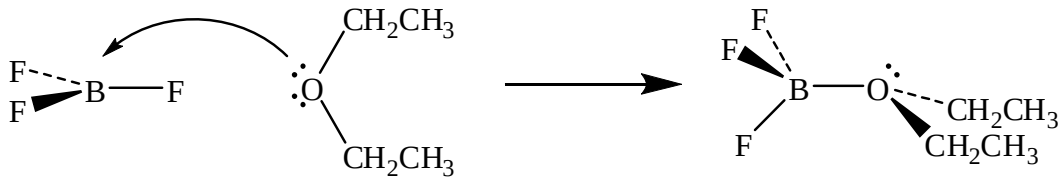


- BF_3 is a Lewis acid in its reaction with diethyl ether. Explain what is meant by a Lewis acid and draw the product of this reaction.

Marks 2

A Lewis acid is an electron-pair acceptor.

Thus, in its reaction with diethyl ether, BF_3 accepts a pair of electrons from the oxygen atom to form a B-O coordinate (dative) bond:



- Often pH is used to characterise acidic solutions. Give a brief definition of pH.

Marks 5

pH is a measure of the $H^+(aq)$ ion concentration in a solution and is defined using the equation:

$$\mathbf{pH = -\log_{10}[H^+(aq)]}$$

Describe the difference between a strong acid and a weak acid.

A strong acid dissociates completely in water. For example:

$$\mathbf{HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)}$$

A weak acid dissociated only slightly in water. For example:

$$\mathbf{HF(aq) \rightleftharpoons H^+(aq) + F^-(aq)}$$

The pH of a solution of a strong acid depends on its concentration and a strong acid can give a high pH (corresponding to low $[H^+(aq)]$) if the acid is present in a low concentration.

In general, can pH be used to define the strength of an acid? Explain your answer.

No.

The pH of a solution of a strong acid depends on its concentration. Thus, the pH of a 0.1 M solution of HCl is 1.0 and the pH of a solution of 10^{-6} M HCl is 6.0.

A low pH can arise from a solution of a strong acid or a more concentrated solution of a weak acid.

A high pH can arise from a weak solution of a strong acid or from a stronger solution of a weak acid.

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.

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- Describe the difference between a strong and a weak acid.

A strong acid dissociates completely in water: HA(aq) → H^+(aq)\+ A^-(aq)

A weak acid dissociates only partially: HA(aq) ⇆ H^+(aq) + A^-(aq) (favours the left hand side – undissociated acid)

Describe in qualitative terms how the percentage ionisation of a weak acid changes when an aqueous solution thereof is diluted.

The percentage ionization increases as a weak acid is diluted.

Which chemical principle can be used to explain the change in percentage ionisation of a weak acid on dilution and how?

The equilibrium of interest is HA(aq) + H_2O(l) ⇆ H_3O^+(aq) + A^-(aq). From Le Chatelier's principle, as more water is added, the equilibrium is pushed to the right: the amount of acid present does not change but more molecules dissociate.