AQA Chemistry A-level

Topic 2.6 - Reactions of Ions in Aqueous Solution

Flashcards

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Are 2+ ions or 3+ ions more acidic in solution? why?

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Are 2+ ions or 3+ ions more acidic in solution? why?

3+ ions are much more acidic

3+ ions are smaller and more highly charged, so have a higher charge density. They attract the electrons from the oxygen of the ligands much more strongly. This weakens the O-H bonds, so the complex readily releases a H^+ ion into the solution, making it acidic.

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Write an equation for the hydrolysis of a 3+ ion to release a proton

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Write an equation for the hydrolysis of a 3+ ion to release a proton

$$[Fe(H_2O)_6]^{3+}(aq) \rightleftharpoons [Fe(H_2O)_5(OH)]^{2+}(aq) + H^+(aq)$$

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What kind of acid is the complex ion acting as? Why?

$$[Fe(H_2O)_6]^{3+}(aq) \rightleftharpoons [Fe(H_2O)_5(OH)]^{2+}(aq) + H^+(aq)$$

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What kind of acid is the complex ion acting as?

Why? $[Fe(H_2O)_6]^{3+}(aq) \rightleftharpoons [Fe(H_2O)_5(OH)]^{2+}(aq) + H^+(aq)$

Bronsted-Lowry - donates a proton

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Define a Lewis acid

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Define a Lewis acid

Electron pair acceptor

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Define a Lewis base

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Define a Lewis base

Electron pair donor

What is acting as the Lewis acid and what is acting as the Lewis base during the formation of complex ions?

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What is acting as the Lewis acid and what is acting as the Lewis base during the formation of complex ions?

The metal ion is acting at the Lewis acid and the ligands as Lewis bases

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Fill in the table for Fe^{2+} reactions

Test	Complex ion	Colour
In aqueous solution		
Add NaOH (dropwise and excess)		
Add NH_3 (dropwise and excess)		
Add Na_2CO_3		

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Fill in the table for Fe^{2+} reactions:

Test	Complex ion	Colour
In aqueous solution	$[Fe(H_2O)_6]^{2+}$ (aq)	*Green*
Add NaOH (dropwise and excess)	$[Fe(H_2O)_4(OH)_2]$ (s)	*Green ppt, goes brown on standing in air*
Add NH_3 (dropwise and excess)	$[Fe(H_2O)_4(OH)_2]$ (s)	*Green ppt, goes brown on standing in air*
Add Na_2CO_3	$FeCO_3$	*Green ppt*

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Why does the green ppt go brown on standing in air in the reaction of Fe^{2+} with NH_3?

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Why does the green ppt go brown on standing in air in the reaction of Fe^{2+} with NH_3?

Oxygen in the air oxidises Fe^{2+} to Fe^{3+}, and $[Fe(OH)_3(H_2O)_3]$ is brown, so colour changes

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Fill in the table for the reactions of Cu^{2+}

Test	Complex ion	Colour
In aqueous solution		
Add NaOH (dropwise and excess)		
Add NH_3 (dropwise)		
Add NH_3 (excess)		
Add Na_2CO_3		
Add concentrated HCl		

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Fill in the table for the reactions of Cu^{2+}

Test	Complex ion	Colour
In aqueous solution	$[Cu(H_2O)_6]^{2+}$	*Blue*
Add NaOH (dropwise and excess)	$[Cu(H_2O)_4(OH)_2]$ (s)	*Blue ppt*
Add NH_3 (dropwise)	$[Cu(H_2O)_4(OH)_2]$ (s)	*Blue ppt*
Add NH_3 (excess)	$[Cu(H_2O)_2(NH_3)_4]^{2+}$ (aq)	*Deep blue solution*
Add Na_2CO_3	$CuCO_3$	*Blue-green ppt*
Add concentrated HCl	$[CuCl_4]^{2-}$ (aq)	*Pale Green/yellow solution*

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Fill in the table for the reactions of Fe^{3+}

Test	Complex ion	Colour
In aqueous solution		
Add NaOH (dropwise and excess)		
Add NH_3 (dropwise and excess)		
Add Na_2CO_3		

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Fill in the table for the reactions of Fe^{3+}

Test	Complex ion	Colour
In aqueous solution	$[Fe(H_2O)_6]^{3+}$	*Purple solution, may look yellow-brown due to $[Fe(H_2O)_5(OH)]^{2+}$ (aq)*
Add NaOH (dropwise and excess)	*$[Fe(H_2O)_3(OH)_3]$ (s)*	*Brown ppt, may look orange-brown*
Add NH_3 (dropwise and excess)	*$[Fe(H_2O)_3(OH)_3]$ (s)*	*Brown ppt, may look orange-brown*
Add Na_2CO_3	*$[Fe(H_2O)_3(OH)_3]$ (s)*	*Brown ppt, may look orange-brown, effervesence*

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Fill in the table with the reactions of Al^{3+}

Test	Complex ion	Colour
In aqueous solution		
Add NaOH (dropwise)		
Add NaOH (excess)		
Add NH_3 (dropwise and excess)		
Add Na_2CO_3		

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Fill in the table with the reactions of Al^{3+}

Test	Complex ion	Colour
In aqueous solution	$[Al(H_2O)_6]^{3+}$	*Colourless solution*
Add NaOH (dropwise)	$[Al(H_2O)_3(OH)_3]$ (s)	*White ppt*
Add NaOH (excess)	$[Al(OH)_4]^-$ (aq)	*Colourless solution*
Add NH_3 (dropwise and excess)	$[Al(H_2O)_3(OH)_3]$ (s)	*White ppt*
Add Na_2CO_3	$[Al(H_2O)_3(OH)_3]$ (s)	*White ppt, effervescence*

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Fill in the table for the reactions of Co^{2+}

Test	Complex ion	Colour
In aqueous solution		
Add NaOH (dropwise and excess)		
Add NH_3 (dropwise and excess)		
Add Na_2CO_3		
Add HCl		

CC BY NC ND

Fill in the table for the reactions of Co^{2+}

Test	Complex ion	Colour
In aqueous solution	$[Co(H_2O)_6]^{2+}$	*Pink*
Add NaOH (dropwise and excess)	$[Co(H_2O)_4(OH)_2]$ *(s)*	Blue ppt
Add NH_3 (dropwise and excess)	$[Co(NH_3)_6]^{2+}$ *(aq)*	*Pale brown solution*
Add Na_2CO_3	$CoCO_3$ *(s)*	*Purple ppt*
Add HCl	$[CoCl_4]^{2-}$ *(aq)*	*Blue solution*

CC BY NC ND