

AS 91162: Carry out procedures to identify ions present in solution

Procedure Charts

A. Testing for anions: Cl^- , CO_3^{2-} , I^- , NO_3^- , OH^- , SO_4^{2-}

Ion	Tests	Observations
Cl^-	Add red litmus Add $AgNO_3(aq)$ Add $NH_3(aq)$	<ul style="list-style-type: none"> does not change the colour forms a white precipitate <ul style="list-style-type: none"> $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ precipitate dissolves <ul style="list-style-type: none"> $Ag^+(aq) + 2NH_3(aq) \rightarrow [Ag(NH_3)_2]^+(aq)$
CO_3^{2-}	Add red litmus Add $HCl(aq)$	<ul style="list-style-type: none"> turns red litmus blue bubbles are produced
I^-	Add red litmus Add $AgNO_3(aq)$ Add $NH_3(aq)$	<ul style="list-style-type: none"> does not change the colour forms a yellow precipitate <ul style="list-style-type: none"> $Ag^+(aq) + I^-(aq) \rightarrow AgI(s)$ precipitate remains
NO_3^-	Add red litmus Add $AgNO_3(aq)$ Add $BaCl_2(aq)$	<ul style="list-style-type: none"> does not change the colour does not form a precipitate does not form a precipitate
OH^-	Add red litmus Add $HCl(aq)$	<ul style="list-style-type: none"> turns red litmus blue no bubbles are produced
SO_4^{2-}	Add red litmus Add $AgNO_3(aq)$ Add $BaCl_2(aq)$ or $Ba(NO_3)_2(aq)$	<ul style="list-style-type: none"> does not change the colour does not form a precipitate forms a white precipitate <ul style="list-style-type: none"> $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

B. Testing for cations: Ag^+ , Al^{3+} , Ba^{2+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mg^{2+} , Pb^{2+} , Na^+ , Zn^{2+}

Ion	Tests	Observations
Ag^+	Add 2 drops $\text{NaOH}(\text{aq})$ Add 2 drops $\text{NH}_3(\text{aq})$ to a new sample Add excess $\text{NH}_3(\text{aq})$	<ul style="list-style-type: none"> forms a brown precipitate <ul style="list-style-type: none"> $2\text{Ag}^+(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Ag}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l})$ forms a brown precipitate <ul style="list-style-type: none"> $2\text{Ag}^+(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Ag}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l})$ precipitate dissolves <ul style="list-style-type: none"> $\text{Ag}^+(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow [\text{Ag}(\text{NH}_3)_2]^+(\text{aq})$
Al^{3+}	Add 2 drops $\text{NaOH}(\text{aq})$ Add excess $\text{NaOH}(\text{aq})$ Add 2 drops $\text{NH}_3(\text{aq})$ to a new sample Add excess $\text{NH}_3(\text{aq})$ Add $\text{H}_2\text{SO}_4(\text{aq})$ to a new sample	<ul style="list-style-type: none"> forms a white precipitate <ul style="list-style-type: none"> $\text{Al}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Al}(\text{OH})_3(\text{s})$ precipitate dissolves <ul style="list-style-type: none"> $\text{Al}^{3+}(\text{aq}) + 4\text{OH}^-(\text{aq}) \rightarrow [\text{Al}(\text{OH})_4]^-(\text{aq})$ forms a white precipitate <ul style="list-style-type: none"> $\text{Al}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Al}(\text{OH})_3(\text{s})$ precipitate remains forms a colourless solution
Ba^{2+}	Add 2 drops $\text{NaOH}(\text{aq})$ Add excess $\text{NaOH}(\text{aq})$ Add $\text{H}_2\text{SO}_4(\text{aq})$ to a new sample	<ul style="list-style-type: none"> forms a white precipitate <ul style="list-style-type: none"> $\text{Ba}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Ba}(\text{OH})_2(\text{s})$ precipitate remains forms a white precipitate <ul style="list-style-type: none"> $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
Cu^{2+}	Add 2 drops $\text{NaOH}(\text{aq})$ Add 2 drops $\text{NH}_3(\text{aq})$ to a new sample Add excess $\text{NH}_3(\text{aq})$	<ul style="list-style-type: none"> forms a blue precipitate <ul style="list-style-type: none"> $\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$ forms a blue precipitate <ul style="list-style-type: none"> $\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$ forms a deep blue solution <ul style="list-style-type: none"> $\text{Cu}^{2+}(\text{aq}) + 4\text{NH}_3(\text{aq}) \rightarrow [\text{Cu}(\text{NH}_3)_4]^{2+}(\text{aq})$
Fe^{2+}	Add 2 drops $\text{NaOH}(\text{aq})$	<ul style="list-style-type: none"> forms a green precipitate <ul style="list-style-type: none"> $\text{Fe}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s})$
Fe^{3+}	Add 2 drops $\text{NaOH}(\text{aq})$ Add 2 drops $\text{KSCN}(\text{aq})$ to a new sample	<ul style="list-style-type: none"> forms an orange precipitate <ul style="list-style-type: none"> $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$ forms a dark red solution <ul style="list-style-type: none"> $\text{Fe}^{3+}(\text{aq}) + \text{SCN}^-(\text{aq}) \rightarrow [\text{FeSCN}]^{2+}(\text{aq})$

Ion	Tests	Observations
Mg²⁺	Add 2 drops NaOH(aq) Add excess NaOH(aq) Add H ₂ SO ₄ (aq) to a new sample	<ul style="list-style-type: none"> forms a white precipitate <ul style="list-style-type: none"> $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$ precipitate remains forms a colourless solution
Pb²⁺	Add 2 drops NaOH(aq) Add excess NaOH(aq) Add 2 drops NH ₃ (aq) to a new sample Add excess NH ₃ (aq) Add H ₂ SO ₄ (aq) to a new sample	<ul style="list-style-type: none"> forms a white precipitate <ul style="list-style-type: none"> $\text{Pb}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Pb}(\text{OH})_2(\text{s})$ precipitate dissolves <ul style="list-style-type: none"> $\text{Pb}^{2+}(\text{aq}) + 4\text{OH}^{-}(\text{aq}) \rightarrow [\text{Pb}(\text{OH})_4]^{2-}(\text{aq})$ forms a white precipitate <ul style="list-style-type: none"> $\text{Pb}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Pb}(\text{OH})_2(\text{s})$ precipitate remains forms a white precipitate <ul style="list-style-type: none"> $\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$
Na⁺	Add 2 drops NaOH(aq)	<ul style="list-style-type: none"> does not form a precipitate
Zn²⁺	Add 2 drops NaOH(aq) Add excess NaOH(aq) Add 2 drops NH ₃ (aq) to a new sample Add excess NH ₃ (aq)	<ul style="list-style-type: none"> forms a white precipitate <ul style="list-style-type: none"> $\text{Zn}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s})$ precipitate dissolves in excess <ul style="list-style-type: none"> $\text{Zn}^{2+}(\text{aq}) + 4\text{OH}^{-}(\text{aq}) \rightarrow [\text{Zn}(\text{OH})_4]^{2-}(\text{aq})$ forms a white precipitate <ul style="list-style-type: none"> $\text{Zn}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s})$ precipitate dissolves in excess <ul style="list-style-type: none"> $\text{Zn}^{2+}(\text{aq}) + 4\text{NH}_3(\text{aq}) \rightarrow [\text{Zn}(\text{NH}_3)_4]^{2+}(\text{aq})$