90934 Demonstrate understanding of aspects of chemical reactions

Collated questions on Precipitation 2011-2013

Question One

An experiment in a school laboratory involves adding colourless solutions together.

Test tube A: Potassium sulfate solution + lead nitrate solution
Test tube B: Potassium iodide solution + lead nitrate solution

Analyse the reactions that occur in test tube A and test tube B.

In your answer:

- record any observations you would make, and link these observations to the products formed in each reaction
- identify the type of reaction occurring in test tube A and test tube B, and justify your choices
- write a balanced ionic equation for each reaction.

You may refer to the solubility rules in the resource booklet.

Question Two

The water in a swimming pool contains chloride ions as a result of adding chlorine to help keep the water safe to swim in.

Outline how you could test that there are chloride ions in the swimming pool. You may use the solubility rules provided in the resource booklet.

In your answer you should:

- describe what you would do to test for chloride ions
- identify the type of reaction and explain how this reaction helps identify the chloride ions
- describe all observations and link these to the chemical species involved
- write a balanced ionic equation for the reaction.

Question Three

A chemical reaction occurs when a solution of calcium nitrate is added to a solution of sodium hydroxide.

Analyse this reaction by:

- describing any observations that would be made
- identifying the products
- explaining what happens to EACH ion that is present in these two solutions
- writing a balanced symbol equation for this reaction. (Spectator ions may be omitted.)

Answers

Question One

Test tube A, a white precipitate / solid forms. The precipitate is lead sulfate.

Test tube B, a bright yellow precipitate / solid forms. The precipitate is lead iodide.

The type of reaction occurring in both tubes is a precipitation reaction (or exchange reaction) because when the two solutions are added together an insoluble substance (the precipitate) forms. This settles at the bottom of the test tubes.

A: $Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$ - *balanced ionic equation*

or $Pb(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow PbSO_4(s) + 2KNO_3(aq)$

B: $Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$ - *balanced ionic equation*

or $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

Question Two

A solution containing silver ions can be used to test for chloride ion e.g. silver nitrate solution.

It is a precipitation reaction. Silver chloride would form a white precipitate if the pool water was mixed with the aqueous silver solution. The white precipitate forms because the Ag^+ ions are attracted to and combine with to the Cl^- ions in solution, forming insoluble AgCl, silver chloride.

The pool water is colourless and silver nitrate solution is colourless but when they are mixed, a white precipitate of silver chloride is formed.

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ - *balanced ionic equation*

Question Three

A white precipitate forms in a colourless solution.

Calcium hydroxide $Ca(OH)_2$ precipitate would form. The solution would be sodium nitrate solution.

The Ca^{2+} and OH^- ions would be attracted to each other to form the insoluble precipitate.

Sodium nitrate is soluble and so the Na^+ and NO_3^- ions would be found (on their own) in the solution as spectator ions.

$Ca^{2+}(aq) + 2OH^-(aq) \rightarrow Ca(OH)_2(s)$ - *balanced ionic equation*

OR $Ca(NO_3)_2(aq) + 2NaOH(aq) \rightarrow Ca(OH)_2(s) + 2NaNO_3(aq)$