# Chemistry PAG 5: Identification of species

# Suggested Activity 2: The march of the precipitANTs

## Instructions and answers for teachers & technicians

These instructions cover the learner activity section which can be found on [page 14](#_Learner_Activity). This Practical activity supports OCR GCSE Chemistry and Combined Science.

**When distributing the activity section to the learners, either as a printed copy or as a Word file, you will need to remove the teacher instructions section.**

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| This is a **suggested** practical activity that can be used as part of teaching the GCSE (9-1) Gateway Science (A) and Twenty First Century Science (B) specifications.  These are **not controlled assessment tasks**, and there is **no requirement to use these particular activities**.  You may modify these activities to suit your learners and centre. Alternative activities are available from, for example, [Royal Society of Biology](https://www.rsb.org.uk/education/teaching-resources/secondary-schools), [Royal Society of Chemistry](http://www.rsc.org/learn-chemistry), [Institute of Physics](http://www.iop.org/education/teacher/resources/index.html), [CLEAPSS](http://science.cleapss.org.uk/) and [publishing companies](https://global.oup.com/education/content/secondary/key-issues/gcse_science_2016/?region=uk), or of your own devising.  Further details are available in the [specifications](http://www.ocr.org.uk/science) (Practical Skills Topics), and in these [videos](https://www.youtube.com/playlist?list=PLBD9B84FF4BD54AA4). |

**OCR recommendations:**

**Before carrying out any experiment or demonstration based on this guidance, it is the responsibility of teachers to ensure that they have undertaken a risk assessment in accordance with their employer’s requirements, making use of up-to-date information and taking account of their own particular circumstances. Any local rules or restrictions issued by the employer must always be followed.**

**CLEAPSS resources are useful for carrying out risk-assessments: (**<http://science.cleapss.org.uk>**).**

**Centres should trial experiments in advance of giving them to learners. Centres may choose to make adaptations to this practical activity, but should be aware that this may affect the Apparatus and Techniques covered by the learner.**

### Introduction

Insoluble salts can be formed from the mixing of two solutions of different soluble salts, which results in the formation of a visible solid in the mixture known as a precipitate.

This type of reaction can be used for simple qualitative tests for the presence of cations and anions in solutions. For example, when a silver nitrate solution (clear and colourless) is mixed a with sodium chloride solution (clear and colourless), a white precipitate is formed, due to the formation of insoluble silver chloride.

In this activity, the learners will identify the colour of the precipitants formed when various pairs of salts are mixed. The activity is a micro-scale activity, carried out on a plastic covered worksheet, minimising the use of chemicals, production of waste and washing up required.

The method is based on an activity from CLEAPSS: <http://science.cleapss.org.uk/Resource-Info/Precipitates-Diffusing.aspx> (login required), which includes an online video of some of the reactions available at <https://www.youtube.com/watch?v=oizwWsm43lY>.

In addition to other practical activities [available from OCR](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-chemistry-a-j248-from-2016/#resources), suggested practical activities that fit into PAG 5 include:

* [Testing salts for anions and cations](http://www.rsc.org/learn-chemistry/resource/res00000464/testing-salts-for-anions-and-cations?cmpid=CMP00000534) from the Royal Society of Chemistry Classic Chemistry Experiments
* [Flame tests (the wooden splint method)](http://www.rsc.org/learn-chemistry/resource/res00000759/flame-tests-the-wooden-splint-method?cmpid=CMP00000838) from the Royal Society of Chemistry Chemistry for non-specialists

### DfE Apparatus and Techniques covered

The codes used below match the OCR Practical Activity Learner Record Sheet ([**Chemistry**](http://www.ocr.org.uk/Images/295630-gcse-chemistry-learner-record-sheet.doc) / [*Combined Science*](http://www.ocr.org.uk/Images/304431-gcse-combined-science-learner-record-sheet.doc)) and Trackers ([**Chemistry**](http://www.ocr.org.uk/Images/323481-gcse-chemistry-practical-tracker.zip) / [*Combined Science*](http://www.ocr.org.uk/Images/323483-gcse-combined-science-practical-tracker.zip)) available online. **There is no requirement to use these resources.**

By doing this experiment, learners have an opportunity to develop the following skills:

**3** [*8*]: Use of appropriate apparatus and techniques for: i) conducting and monitoring chemical reactions

**6** [*11*]: Safe use and careful handling of gases, liquids and solids, including: i) careful mixing of reagents under controlled conditions; ii) using appropriate apparatus to explore chemical changes and/or products

**8** [*13*]: Use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including: iii) precipitation reactions

### Aims

To observe the formation and properties of precipitants formed when different combinations of soluble substances are mixed.

### Intended class time

20 – 40 minutes

### Links to Specifications:

### Gateway Science (Suite A) – including Working Scientifically (WS)

C3.1a use chemical symbols to write the formulae of elements and simple covalent and ionic compounds

C3.1e construct balanced ionic equations

C3.1f describe the physical states of products and reactants using state symbols (s, l, g and aq)

C3.3f recall that carbonates and some metals react with acids and write balanced equations predicting products from given reactants

C4.2b describe tests to identify aqueous cations and aqueous anions [to include calcium, copper, iron(II), iron(III) and zinc using sodium hydroxide; carbonates and sulfates using aqueous barium chloride followed by hydrochloric acid; chloride, bromide and iodide using silver nitrate]

C4.2d identify species from test results

WS1.3a/WS2c presenting observations and other data using appropriate methods

WS1.3e interpreting observations and other data

WS1.3f presenting reasoned explanations

WS1.3i/WS2d communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions.

WS1.4a use scientific vocabulary, terminology and definitions

WS2a carry out experiments

WS2b make and record observations and measurements using a range of apparatus and methods

### Twenty First Century Science (Suite B) – including Ideas about Science (IaS)

C2.4.4 describe the physical states of products and reactants using state symbols (s, l, g and aq)

C3.2.3 use the names and symbols of common elements and compounds and the principle of conservation of mass to write formulae and balanced chemical equations and ionic equations

C5.2.4 describe tests to identify aqueous cations and aqueous anions and identify species from test results including: a) tests and expected results for metal ions in solution by precipitation reactions using dilute sodium hydroxide (calcium, copper, iron(II), iron(III), zinc) b) tests and expected results for carbonate ions (using dilute acid), chloride, bromide and iodide ions (using acidified dilute silver nitrate) and sulfate ions (using acidified dilute barium chloride or acidified barium nitrate)

C6.1.1 recall that acids react with some metals and with carbonates and write equations predicting products from given reactants

IaS2.1 present observations and other data using appropriate formats

IaS2.4 be able to translate data from one form to another

IaS2.8 when analysing data identify patterns/trends, use statistics (range and mean) and obtain values from a line on a graph (including gradient, interpolation and extrapolation),

IaS2.10 evaluate an experimental strategy, suggest improvements and explain why they would increase the quality (accuracy, precision, repeatability and reproducibility) of the data collected, and suggest further investigations

IaS2.11 in a given context interpret observations and other data (presented in diagrammatic, graphical, symbolic or numerical form) to make inferences and to draw reasoned conclusions, using appropriate scientific vocabulary and terminology to communicate the scientific rationale for findings and conclusions

### Mathematical Skills covered

No defined mathematical skill is covered in this experiment.

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| Technical Requirements – PER GROUPChemicals  | **Identity** | **Approximate quantity required or produced PER GROUP** | **Hazard information** | | **Risk information** | | --- | --- | --- | --- | --- | | potassium chloride solid | access to a small pot | Currently not classified as hazardous at this concentration | |  | | potassium bromide solid | access to a small pot | Currently not classified as hazardous at this concentration | |  | | potassium iodide solid | access to a small pot | Currently not classified as hazardous at this concentration | |  | | sodium sulfate(VI) solid (anhydrous or hydrated) | access to a small pot | Currently not classified as hazardous at this concentration | |  | | copper(II) sulfate(VI)-5-water solid | access to a small pot | HSE warning symbol  Very toxic to aquatic life with long lasting effects | WARNING  Harmful if swallowed. Causes skin and serious eye irritation. Very toxic to aquatic life with long lasting effects. | Amounts used are very small, which minimises the risks. Learners should treat all hazardous substances with respect and dispose of as directed. | | silver nitrate(V) solid | access to a small pot | Very toxic to aquatic life with long lasting effects  May intensify fireCauses severe skin burns and eye damage | DANGER  May intensify fire. Causes severe skin burns and eye damage. Very toxic to aquatic life with long lasting effects. | | barium chloride-2-water solid | access to a small pot | HSE toxic warning symbol | DANGER  Toxic if swallowed. Harmful if inhaled. | | sodium carbonate-10-water solid | access to a small pot | HSE warning symbol | WARNING  Causes serious eye irritation | | lead(II) nitrate(V) solid | access to a small pot | HSE warning symbol  HSE long term health hazard symbolVery toxic to aquatic life with long lasting effects. | DANGER  Harmful if swallowed. Harmful if inhaled. May damage the unborn child and suspected of damaging fertility. May cause damage to organs through prolonged or repeated exposure. Very toxic to aquatic life with long lasting effects. | Amounts used are very small, which minimises the risks. Learners should treat all hazardous substances with respect and dispose of as directed. | | iron(II) sulfate(VI)-7-water solid | access to a small pot | HSE warning symbol | WARNING  Causes skin irritation and serious eye irritation. | | iron(III) sulfate(VI)-9-water solid | access to a small pot | HSE warning symbol | WARNING  Causes skin irritation and serious eye irritation. | | zinc chloride solid | access to a small pot | Hazard warning - causes burns  HSE warning symbolVery toxic to aquatic life with long lasting damage. | DANGER  Harmful if swallowed. Causes severe skin burns and eye damage. May cause respiratory irritation. Very toxic to aquatic life with long lasting damage. | | calcium chloride | access to a small pot | HSE warning symbol | WARNING  Causes serious eye irritation. Causes skin irritation. May cause respiratory irritation. | | 0.4 mol dm–3 sodium hydroxide solution | c. 1 cm3 | HSE warning symbol | WARNING  Causes skin irritation and serious eye irritation. | | various precipitates are PRODUCED | very small amounts | Assume all precipitates are hazardous. However, as the amounts formed are very small the risks are minimised. Learners should dispose of all reagents and products down a sink with plenty of water. | | |  Equipment  * a laminated copy of Figure 1 on card or a copy of Figure 1 in a plastic wallet * small beaker of deionised/distilled water * dropper pipette * cocktail sticks |

### Notes

The major bottleneck in completing this practical is setting up the solid samples by the learners. An efficient method is to have two small pots of each solid substance with a labelled microscale spatula, which are passed around the room from group to group until they have all set up the ‘eyes’ of the ‘precipitANTs’. Once the solids have been collected in, learners can carry on with their work using labelled stock bottles/dropper bottles of sodium hydroxide, hydrochloric acid and deionised water on their benches.

An alternative method, if sample pots are available per table, is to add the water drop first, dampen a cocktail stick, dip into the solid to pick up a few crystals of solid, then transfer these into drops.

### Health and Safety

Eye protection should be worn at all times.

The risks to learners from the reagents and products are limited due to the very small quantities being used and produced. Ensure sheets are rinsed thoroughly with plenty of water and any spilt solids are dealt with appropriately.

### Method

Learners will add very small quantities of the solids to the ‘eyes’ of the ‘precipitANTS’, then carefully allow them to dissolve and mix by adding deionised water to the centre of the ‘precipitANT’.

Manual handling skills can be developed with this activity, along with careful observation as the precipitants form. For example, addition of sodium hydroxide / hydrochloric acid is achieved by moving the drops on the surface with a cocktail stick – this minimises the immediate mixing of the solutions as can come from adding drops from a pipette – and allows precipitates to form over a short time rather than immediately. This can help improve learners observations as they should be less distracted by the process of adding the drop and more focussed on the observation.

### Images from trials

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| Images from the trialImages from the trial  Image from trialImages from the trial |

Figure 1 – Images from the trial

# Analysis of results – Trial results

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| --- | --- | --- |
| **Reactant 1** | **Reactant 2** | **Observation** |
| silver nitrate | potassium chloride | white precipitate |
| silver nitrate | potassium bromide | cream precipitate |
| silver nitrate | potassium iodide | yellow precipitate |
| lead nitrate | potassium iodide | bright yellow precipitate |
| i) sodium hydroxide  ii) excess sodium hydroxide | iron(II) sulfate | i) green precipitate, turns brown over time  ii) no change |
| i) sodium hydroxide  ii) excess sodium hydroxide | iron(III) sulfate | i) brown precipitate  ii) no change |
| i) sodium hydroxide  ii) excess sodium hydroxide | copper sulfate | i) blue precipitate  ii) no change |
| i) sodium hydroxide  ii) excess sodium hydroxide | zinc chloride | i) white precipitate  ii) white precipitate dissolves |
| i) sodium hydroxide  ii) excess sodium hydroxide | calcium chloride | i) white precipitate  ii) no change |
| i) barium chloride  ii) hydrochloric acid | sodium sulfate | i) white precipitate  ii) no change |
| i) barium chloride  ii) hydrochloric acid | sodium carbonate | i) white precipitate  ii) bubbles formed at the precipitate |

The questions you set your learners will depend on the focus of the experiment.

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| **1.** | Describe the general reaction between silver nitrate and potassium halides, and how the halides can be told apart. **[2 marks]** |  |
|  | Silver nitrate and potassium halide solutions form precipitates of distinctive colour when mixed. ✓  Silver chloride is white, silver bromide is cream and silver iodide is yellow. ✓ |  |

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| **2.** | Describe the general reaction between sodium hydroxide and metal ions, and how the metal ions can be told apart. **[3 marks]** |  |
|  | (Some) metal ions react with sodium hydroxide solution to produce precipitates of different colours. ✓  Iron(II) hydroxide is green (turns brown over time); iron(III) hydroxide is brown; copper hydroxide is blue; zinc hydroxide and calcium hydroxide are white. ✓  Zinc hydroxide and calcium hydroxide can be distinguished by adding excess sodium hydroxide, and only zinc hydroxide will (re)dissolve. ✓ |  |

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| **3.** | Describe the general reaction between barium chloride and sodium carbonate/sulfate, and how the carbonate/sulfate ions can be told apart. **[2 marks]** |  |
|  | Barium chloride solutions produces white precipitates when mixed with sodium carbonate/sulfate. ✓  They can be distinguished by adding hydrochloric acid which reacts with carbonate ions causing fizzing/bubbling/effervescence. ✓ |  |

### Extension opportunities

|  |  |  |  |
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| **1.** | For each reaction carried out, write a word, full symbol and ionic equation. | |  |
|  | **(a)** | silver nitrate + halides **[9 marks]** |  |
|  |  | silver nitrate + potassium chloride → silver chloride + potassium nitrate ✓  AgNO3 (aq) + KC*l*(aq) → AgC*l*(s) + KNO3(aq) ✓  Ag+(aq) + C*l*–(aq) → AgC*l*(s) ✓  silver nitrate + potassium bromide → silver bromide + potassium nitrate ✓  AgNO3 (aq) + KBr(aq) → AgBr(s) + KNO3(aq) ✓  Ag+(aq) + Br–(aq) → AgBr(s) ✓  silver nitrate + potassium iodide → silver iodide + potassium nitrate ✓  AgNO3 (aq) + KI(aq) → AgI(s) + KNO3(aq) ✓  Ag+(aq) + I–(aq) → AgI(s) ✓ |  |

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| --- | --- | --- | --- |
|  | **(b)** | sodium hydroxide + metal ions **[15 marks]** |  |
|  |  | sodium hydroxide + iron(II) sulfate → iron(II) hydroxide + sodium sulfate ✓  2NaOH(aq) + FeSO4(aq) → Fe(OH)2(s) + Na2SO4(aq) ✓  2OH–(aq) + Fe2+(aq) → Fe(OH)2(s) ✓  sodium hydroxide + iron(III) sulfate → iron(III) hydroxide + sodium sulfate ✓  6NaOH(aq) + Fe2(SO4)3(aq) → 2Fe(OH)3(s) + 3Na2SO4(aq) ✓  3OH–(aq) + Fe3+(aq) → Fe(OH)3(s) ✓  sodium hydroxide + copper(II) sulfate → copper(II) hydroxide + sodium  sulfate ✓  2NaOH(aq) + CuSO4(aq) → Cu(OH)2(s) + Na2SO4(aq) ✓  2OH–(aq) + Cu2+(aq) → Cu(OH)2(s) ✓  sodium hydroxide + zinc chloride → zinc hydroxide + sodium chloride ✓  2NaOH(aq) + ZnC*l*2(aq) → Zn(OH)2(s) + 2NaC*l* (aq) ✓  2OH–(aq) + Zn2+(aq) → Zn(OH)2(s) ✓  sodium hydroxide + calcium chloride → calcium hydroxide + sodium chloride  ✓  2NaOH(aq) + CaC*l*2(aq) → Ca(OH)2(s) + 2NaC*l* (aq) ✓  2OH–(aq) + Ca2+(aq) → Ca(OH)2(s) ✓ |  |
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|  | **(c)** | barium chloride + sodium carbonate/sulfate **[9 marks]** |  |
|  |  | barium chloride + sodium sulfate → barium sulfate + sodium chloride ✓  BaC*l*2(aq) + Na2SO4(aq) → BaSO4(s) + 2NaC*l*(aq) ✓  Ba2+(aq) + SO42–(aq) → BaSO4(s) ✓  barium chloride + sodium carbonate → barium carbonate + sodium chloride ✓  BaC*l*2(aq) + Na2CO3(aq) → BaCO3(s) + 2NaC*l*(aq) ✓  Ba2+(aq) + CO32–(aq) → BaCO3(s) ✓  barium carbonate + hydrochloric acid → barium chloride + carbon dioxide + water ✓  BaCO3(s) + 2HC*l*(aq) → BaC*l2*(aq) + CO2(g) + H2O(l) ✓  CO32–(aq) + 2H+(aq) → CO2(g) + H2O(l) ✓ |  |

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| **2.** | A student is given a solid sample to analyse. When added to sodium hydroxide solution, a brown precipitate was seen. When added to hydrochloric acid solution the sample fizzed. Deduce the name of the substance and explain the observations. **[5 marks]** | |  |
|  |  | iron (III) carbonate ✓  Reaction with sodium hydroxide produces brown iron(III) hydroxide precipitate. ✓  sodium hydroxide + iron(III) carbonate → iron(III) hydroxide + sodium carbonate  6NaOH(aq) + Fe2(CO3)3(aq) → 2Fe(OH)3(s) + 3Na2CO3(aq)  3OH–(aq) + Fe3+(aq) → Fe(OH)3(s)  One mark for a correct word, symbol **or** ionic equation ✓  Reaction with hydrochloric acid produces carbon dioxide gas. ✓  iron carbonate + hydrochloric acid → iron chloride + carbon dioxide + water  Fe2(CO3)3(s) + 6HC*l* (aq) → 2FeC*l*3(aq) + 3CO2(g) + 6H2O(l)  CO32–(aq) + 2H+(aq) → CO2(g) + H2O(l)  One mark for a correct word, symbol or ionic equation ✓ |  |

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| **3.** | A student has a solid sample that he thought was copper(II) iodide. Describe the chemical tests he should carry out to confirm the identity of the solid. **[4 marks]** | |  |
|  |  | Add the sample to (acidified) silver nitrate solution. ✓  Look for yellow precipitate of silver iodide. ✓  Add the sample to sodium hydroxide soluion. ✓  Look for blue precipitate of copper hydroxide. ✓ |  |

### Document updates

v1 August 2016 Published on the qualification pages

v1.1 January 2017 Consolidated labelling and formatting of activities

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# Chemistry PAG 5: Identification of species

# Suggested Activity 2: The march of the precipitANTs

## Learner Activity

### Introduction

Insoluble salts can be formed from the mixing of two solutions of different soluble substances, and results in the formation of a visible solid in the mixture known as a precipitate.

This type of reaction can be used for simple qualitative tests for the presence of cations and anions in solutions. For example, when silver nitrate solution (clear and colourless) is mixed with sodium chloride solution (clear and colourless), a white precipitate is formed, due to the formation of insoluble silver chloride.

In this activity, you will identify the colour of the precipitants formed when various pairs of substances mix in solution. The activity is a micro-scale activity, carried out on a plastic covered worksheet, minimising the use of chemicals, production of waste and washing up required.

The method is based on an activity from CLEAPSS: <http://science.cleapss.org.uk/Resource-Info/Precipitates-Diffusing.aspx>

### Aims

To identify combinations of ions that form insoluble compounds in aqueous solution.

### Intended class time

20 – 40 minutes

### Health and Safety

* Eye protection should be worn at all times.
* While the hazard warnings about the substances are serious, you will be using very small amounts, which minimizes the risk to you.
* Treat all chemical substances with respect – use only the amounts indicated and only carry out the reactions as instructed.

### Chemicals and equipment (per group)

* access to small pots of solid samples of:
  + potassium chloride (low hazard)
  + potassium bromide (low hazard)
  + potassium iodide (low hazard)
  + sodium sulfate (low hazard)
  + hydrated copper sulfate (WARNING: harmful and irritant)
  + silver nitrate (DANGER: oxidant and irritant)
  + barium chloride (DANGER: toxic and harmful)
  + sodium carbonate (WARNING: irritant)
  + lead nitrate (DANGER: harmful and damaging to fertility and unborn children)
  + hydrated iron(II) sulfate (WARNING: irritant)
  + hydrated iron(III) sulfate (WARNING irritant)
  + zinc chloride (DANGER: harmful and irritant)
  + calcium chloride (WARNING: irritant)
* micro-spatulas
* 0.4 mol dm–3 sodium hydroxide solution (WARNING: irritant)
* 0.4 mol dm–3 hydrochloric acid solution
* a plastic covered copy of Figure 1
* small beaker of deionised/distilled water
* dropper pipette
* cocktail sticks

### Method

*Setting up the precipitANTs*

1. For each of the reactions, add a **few crystals** of the indicated solid onto the ‘eyes’ of the precipitANT.
2. For reactions involving sodium hydroxide or hydrochloric acid reactions, add 3-4 drops the appropriate solution into the dotted circles.

*Carrying out the reactions*

1. Using a dropping pipette, carefully add deionised water onto the middle of the precipitANT until both solids are just within the liquid.
2. Carefully observe the drop over about 30 seconds – record your observations in a table.

1. For the sodium hydroxide reactions, add the water as in Step 3 but don’t allow the water drop drops to merge with the sodium hydroxide drop yet.
2. Using the end of a cocktail stick, carefully drag the sodium hydroxide drop towards the solid/water drop until they merge.
3. Carefully observe the drop over about 30 seconds – record your observations in a table.
4. Add a few more drops of sodium hydroxide to each precipitANT.
5. Carefully observe the drop over about 30 seconds – record your observations in a table.

1. For the barium chloride reactions, after the 30 second observation, use the end of a cocktail stick to carefully drag the hydrochloric acid drop towards the solid/water drop until they merge.
2. Carefully observe the drop over about 30 seconds – record your observations in a table.

***If available, you can use the camera on a smartphone to magnify the image of the drops for closer observation and to take images for your write-up.***

*Clearing up*

1. Rinse your sheet under a tap and dry as instructed by your teacher.

### Analysis of results

You can draw your own table, or use the one below:

|  |  |  |
| --- | --- | --- |
| **Reactant 1** | **Reactant 2** | **Observation** |
| silver nitrate | potassium chloride |  |
| silver nitrate | potassium bromide |  |
| silver nitrate | potassium iodide |  |
| lead nitrate | potassium iodide |  |
| i) sodium hydroxide  ii) excess sodium hydroxide | iron(II) sulfate | i)  ii) |
| i) sodium hydroxide  ii) excess sodium hydroxide | iron(III) sulfate | i)  ii) |
| i) sodium hydroxide  ii) excess sodium hydroxide | copper sulfate | i)  ii) |
| i) sodium hydroxide  ii) excess sodium hydroxide | zinc chloride | i)  ii) |
| i) sodium hydroxide  ii) excess sodium hydroxide | calcium chloride | i)  ii) |
| i) barium chloride  ii) hydrochloric acid | sodium sulfate | i)  ii) |
| i) barium chloride  ii) hydrochloric acid | sodium carbonate | i)  ii) |

Your ability to analyse your observations may depend on how much of the GCSE Chemistry/Combined Science course you have studied. Your teacher will let you know which questions you should focus on:

|  |  |  |
| --- | --- | --- |
| **1.** | Describe the general reaction between silver nitrate and potassium halides, and how the halides can be told apart. **[2 marks]** |  |
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| --- | --- | --- |
| **2.** | Describe the general reaction between sodium hydroxide and metal ions, and how the metal ions can be told apart. **[3 marks]** |  |
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| --- | --- | --- |
| **3.** | Describe the general reaction between barium chloride and sodium carbonate/sulfate, and how the carbonate/sulfate can be told apart. **[2 marks]** |  |
|  |  |  |

### Extension opportunities

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** | For each reaction carried out, write a word, full symbol and ionic equation. | |  |
|  | **(a)** | silver nitrate + halides **[9 marks]** |  |
|  |  |  |  |
|  |  |  |  |
|  | **(b)** | sodium hydroxide + metal ions **[15 marks]** |  |
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| --- | --- | --- | --- |
|  | **(c)** | barium chloride + sodium carbonate/sulfate **[9 marks]** |  |
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|  |  |  |  |
| **2.** | A student is given a solid sample to analyse. When added to sodium hydroxide solution, a brown precipitate was seen. When added to hydrochloric acid solution the sample fizzed. Deduce the name of the substance and explain the observations. **[5 marks]** | |  |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **3.** | A student has a solid sample that he thought was copper(II) iodide. Describe the chemical tests he should carry out to confirm the identity of the solid. **[4 marks]** | |  |
|  |  |  |  |

### DfE Apparatus and Techniques covered

If you are using the OCR Practical Activity Learner Record Sheet ([**Chemistry**](http://www.ocr.org.uk/Images/295630-gcse-chemistry-learner-record-sheet.doc) / [*Combined Science*](http://www.ocr.org.uk/Images/304431-gcse-combined-science-learner-record-sheet.doc)) you may be able to tick off the following skills:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Chemistry** | | | |  | ***Combined Science*** | | | |
| 3–i | 6–i | 6–ii | 8–iii |  | *8–i* | *11–i* | *11–ii* | *13–iii* |

### The precipitANTs

|  |
| --- |
| potassium  chloride  silver  nitrate  potassium  bromide  silver  nitrate  potassium  iodide  silver  nitrate  potassium  iodide  lead  nitrate  sodium  hydroxide (drop)  iron(II)  sulfate  sodium  hydroxide (drop)  iron(III)  sulfate  sodium  hydroxide (drop)  copper  sulfate  barium  chloride  sodium  sulfate  barium  chloride  sodium carbonate  sodium  hydroxide (drop)  zinc  chloride  sodium  hydroxide (drop)  calcium chloride  hydrochloric acid (drop)  hydrochloric acid (drop) |

Figure 1: The precipitANTs