# Reactivity series of metals: supporting resources

This resource supports the practical video Reactivity series of metals, available here: [rsc.li/3baSTPO](file:///C%3A%5CUsers%5Cryderk%5CDownloads%5Crsc.li%5C3baSTPO)

#### Using the structure strips

Writing about chemistry encourages learners to reflect on their understanding, formulate new ideas and make links between ideas in new ways. Learners also need to practice for longer-answer questions in examinations. Structure strips provide scaffolded prompts and help overcome ‘fear of the blank page’. The learner sticks the strip into the margin of their exercise book or onto an A4 sheet of paper and writes alongside it. Use this long- answer question to consolidate learning after the practical and/or for revision. (Read more at <rsc.li/2P0JDlW>.)

**Long-answer question:**

*A student has a sample of an unknown metal solid, labelled ‘metal x’. The sample is shiny in appearance and grey in colour.*

*Describe two different experiments that the student could carry out to place metal x in the reactivity series. Describe the reactions that would take place and the expected results if metal x is more reactive than copper but less reactive than iron.*

*Suggest an identity for metal x.*

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| **Reactivity of metals Structure strip** | **Reactivity of metals Structure strip** | **Reactivity of metals Structure strip** | **Reactivity of metals Structure strip** | **Reactivity of metals Structure strip** |
| How can a metal–acid reaction be used to determine reactivity? | How can a metal–acid reaction be used to determine reactivity? | How can a metal–acid reaction be used to determine reactivity? | How can a metal–acid reaction be used to determine reactivity? | How can a metal–acid reaction be used to determine reactivity? |
| Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. | Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. | Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. | Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. | Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. |
| Describe and explain the results you would expect to see. | Describe and explain the results you would expect to see. | Describe and explain the results you would expect to see. | Describe and explain the results you would expect to see. | Describe and explain the results you would expect to see. |
| What is a displacement reaction? | What is a displacement reaction? | What is a displacement reaction? | What is a displacement reaction? | What is a displacement reaction? |
| Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. | Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. | Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. | Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. | Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. |
| Suggest an identity for metal *x* using the reactivity series. | Suggest an identity for metal *x* using the reactivity series. | Suggest an identity for metal *x* using the reactivity series. | Suggest an identity for metal *x* using the reactivity series. | Suggest an identity for metal *x* using the reactivity series. |

#### Structure strip: suggested answer content

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| **Reactivity of metals Structure strip** |  |
| How can a metal–acid reaction be used to determine reactivity? | To work out the relative reactivity of metal *x* to both copper and iron you could use a metal–acid neutralisation reaction and a displacement reaction. |
| Describe a method for metal–acid reaction.Include the measurements you will need to take and the equipment you will use. | A metal–acid neutralisation reaction is exothermic. This means that during the reaction energy is released to the surroundings. We can observe this as a temperature change. The more reactive the metal, the greater the temperature change that will be observed. The general equation for a metal–acid reaction is:metal + acid → metal salt + hydrogenTo compare the reactivity of iron, copper and metal *x* you will need to measure 20 cm3 of hydrochloric acid into an insulated cup with a lid. Measure the starting temperature with a thermometer. Add 1–2 spatulas of the metal powder and wait until the maximum temperature is reached, then record. The temperature change can be calculated by taking the starting temperature away from the maximum temperature reached. Repeat for each metal powder. |
| Describe and explain the results you would expect to see. | Copper does not react with hydrochloric acid so there will be no change in temperature. Iron reacts with hydrochloric acid so there will be a small temperature change of 4–5 °C. If metal *x* is more reactive than copper but less reactive than iron then it should produce a temperature change between 0–4 °C. However, if metal *x* is less reactive than hydrogen then there will be no reaction and we will not be able to deduce whether copper or metal *x* is the most reactive. |
| What is a displacement reaction? | To further confirm the relative reactivity of metal *x* we can use a displacement reaction. During a displacement reaction a more reactive metal will displace a less reactive metal from its compound. You will need to use a metal compound in aqueous solution such as iron(II) sulfate solution, copper(II) sulfate solution and metal *x* sulfate solution. You will also need a small piece of iron, copper and metal *x* ribbon. |
| Describe a method to show the relativereactivity of iron, copper and metal *x* using displacement.Include the chemicals and equipment you will need.What are the expected results?Write an equation for the reactions that take place. | In a test tube or spotting tile you will need to add a small piece of metal *x* to iron(II) sulfate solution and copper(II) sulfate solution. If metal *x* is more reactive than copper then there should be a displacement reaction:metal *x* + copper sulfate → copper + metal *x* sulfateYou will observe a brown precipitate of copper forming and the solution may change colour. If metal *x* is less reactive than iron then there should be no reaction with the iron(II) sulfate.Next you should add a small piece of copper and a small piece of iron to a few drops of metal *x* sulfate. If metal *x* is more reactive than copper then there should be no reaction. If metal x is less reactive than iron then the iron will displace metal *x* from the compound:iron + metal *x* sulfate → metal *x* + iron sulfateYou will observe a grey precipitate of metal *x* forming and the solution may change colour. |
| Suggest an identity for metal *x* using the reactivity series. | Metal *x* is a grey coloured shiny metal which is more reactive than copper but less reactive than iron. A possible identity, using the reactivity series of metals, for metal *x* could be lead, nickel or tin. |

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