

GCSE (9–1)

Transition Guide

TWENTY FIRST CENTURY SCIENCE CHEMISTRY B

J258

For first teaching in 2016

KS3–KS4 focus

Reactivity of Metals

Version 1

Can also be
used for teaching:
**GCSE (9–1)
TWENTY FIRST
CENTURY
COMBINED
SCIENCE B**



GCSE (9–1)**TWENTY FIRST CENTURY SCIENCE CHEMISTRY B**

Key Stage 3 to 4 Transition guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 3 which will help prepare students for progression to Key Stage 4;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 3 and 4 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 3 and assess their 'readiness for progression' to Key Stage 4 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 3 teaching of the topic or by Key Stage 4 teachers to establish their students' conceptual starting point.

Key Stage 3 to 4 Transition Guides are written by experts with experience of teaching at both key stages.



'These draft qualifications have not yet been accredited by Ofqual. They are published (along with specimen assessment materials, summary brochures and sample resources) to enable teachers to have early sight of our proposed approach.'

Further changes may be required and no assurance can be given at this time that the proposed qualifications will be made available in their current form, or that they will be accredited in time for first teaching in 2016 and first award in 2018 (2017 for AS Level qualifications).'

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Key Stage 3 Content

- reactions of acids with metals to produce a salt plus hydrogen
- reactions of acids with alkalis to produce a salt plus water
- the properties of metals and non-metals
- the chemical properties of metal and non-metal oxides with respect to acidity
- the order of metals and carbon in the reactivity series
- the use of carbon in obtaining metals from metal oxides



Key Stage 4 Content

C3.2.1 deduce an order of reactivity of metals based on experimental results including reactions with water, dilute acid and displacement reactions with other metals

C3.2.2 explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion to include potassium, sodium, calcium, aluminium, magnesium, zinc, iron, lead, [hydrogen], copper, silver

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

C3.2.4 explain, using the position of carbon in the reactivity series, the principles of industrial processes used to extract metals, including the extraction of zinc

C3.2.5 explain why electrolysis is used to extract some metals from their ores

C3.2.6 evaluate alternative biological methods of metal extraction (bacterial and phytoextraction)

Comment

It is very likely that learners will have covered reactions of metals, and the reactivity series. It is likely they will have seen the reactions of Group 1 metals and carried out reactions with some metals with oxygen, water and acids. They will have also covered displacement reactions, and are often encouraged to draw 'cartoon strips' to represent the displacement with more 'reactive' metals. They may also have learnt mnemonics to help them remember the order of the reactivity series. Most learners will have covered word equations for these reactions and some learners will be able to balance simple equations and name salts. During Key Stage 4 it is important to consolidate this understanding and ensure all learners can write balanced equations for these equations.

With the introduction of the understanding of ions, and how the formulae are put together learners should be able to write the balanced equations more easily instead of just remembering them which is often the basis of their understanding at Key Stage 3.

Learners will vary in understanding of the reactivity series at Key Stage 3, but many will have learnt the order or the reactions with little understanding of why it happens, or how. Their understanding of reactivity will be along the lines of 'the faster a metal reacts, the more reactive it is'.

Bringing their understanding into line with the extraction of metals is where you can shift the focus at Key Stage 4. They may have some understanding from History or even Geography when learning about the Iron Age. They will have visited this at Key Stage 3 linking rocks and the rock cycle, but will have mainly focused on displacement of metals and may not have applied this to the extraction of metals. They need to understand that the more reactive a metal the harder it is to extract from its ore. The terms reduction and oxidation also can be explained in terms of electrons loss and gain, rather than just the removal or gain of oxygen.

The checkpoint tasks should be used to identify learners' understanding in key areas. You may wish to do a recap lesson before this where you utilise some of the Key Stage 3 resources, or do this without preparation and then go back. The alternative would be to use the Key Stage 3 links as a piece of 'flipped learning' where the learners can review this information prior to the lesson, the checkpoint can then be used at the start of the lesson to determine the starting point for the learners.

In terms of order, it is important that learners do have an understanding of the formation of ions, and electron structure before they visit this topic.

Activities

Reactivity Series video

Teachers Tv

Resources: <https://www.tes.com/teaching-resource/teachers-tv-periodic-table-ferocious-elements-6038964>

Teachers TV video on Reactive elements. This is quite lengthy but has some key ideas in terms of metals, their uses and the reactivity of these elements, as well as the reactivity of Group 7 elements.

Mnemoics of the Periodic table

Mnemonicate

Resources: <https://www.youtube.com/watch?v=XWjQUgq2u9E>

Mnemoics to help remember the reactivity series.

Reactivity of metals experiment

Oresomeresources

Resources: http://www.oresomeresources.com/resources_view/resource/experiment_metal_reactivity

A page containing an experimental worksheet for the reactivity of metals with metal ion solutions. This is focusing on displacement.

Brainiac Reactivity of Group 1 metals

Brainiac

Resources: <https://www.youtube.com/watch?v=m55kgyApYrY>

The Brainiac video looks at the reactivity of Group 1 metals, this is a good follow up video after you have demonstrated the reactivity of lithium, sodium and potassium with water.

Reactivity worksheets

Resources: <http://hs.eriding.net/download/Ks3/Science/Y9/Y9%20Chemistry%20revision%20booklet.pdf>

This booklet covers other topics too, but offers some nice activities which can be used to teach the reactivity series. There is a reactivity quiz that could also be used.

Reactivity – teaching sequence

Resources: <http://www.oxfordhomeschooling.co.uk/wp-content/uploads/KS3-Sci-Yr9-lessons+-Twig-0513.pdf>

A summary document designed for home schooling, but covers the key areas which should be covered at Key Stage 3. It includes activities and also practical ideas, as well as self assessment checks and questions.

Metals and their reactivity PowerPoint

Resources: http://stmaryschs.org.uk/files/Departments/Science/end%20of%20year%20exams/Year%208/Reactivity_and_the_Reactions_of_Metals.ppt

A PowerPoint covering all of the main areas in the Key Stage 3 curriculum that could be used for learners to check their understanding (including lots of quizzes).

Checkpoint task

The checkpoint task is called the 'reactivity challenge'. There are three mini activities that become progressively more challenging. The task is designed to initially assess learners' understanding of the properties of metals in challenge 1, progressing to displacement in challenge 2 and finally writing balanced equations in challenge 3. The organisation of the activity will depend on the nature of the group. With motivated high ability, or competitive groups it would be ideal to turn each challenge as a race. Less confident or lower ability groups may prefer to work through it at their own pace. However, as the activity covers a range of skills it would be beneficial to check answers after each challenge. Problems and barriers with the individual challenges can be resolved challenge by challenge. These tasks will enable the class teacher to assess what knowledge and skills can be recalled from the Key Stage 3 topic before moving into the GCSE content. Answers are provided in the teacher's section.

Teacher Guidance:

To run this activity you could either split your group into small groups or ask them to work individually. You may wish to supply learners with periodic tables, or you may have chosen to watch some of the videos suggested in the transition resources to refresh learners' knowledge.

Checkpoint Task:

www.ocr.org.uk/Images/304424-reactivity-of-metals-checkpoint-activity.doc

Activities

Ionic bonding

BBC Bitesize

Resources: <http://www.bbc.co.uk/education/guides/zd8hvcw/activity>

A short activity about ionic bonding to remind learners of the loss and gain of electrons to form ionic compounds which can be applied to metal ores, or salts in the reaction of metals with acids.

Reactivity series investigation

Creative Chemistry

Resources: <http://www.creative-chemistry.org.uk/gcse/documents/Sc1/reactivity>

A set of experiments and guidance for learners to plan their own investigation to put together their own reactivity series based on the observations they make.

Reactivity series videos

Resources: <http://www.chemguide.co.uk/igcse/chapters/chapter8.html>

Although designed for iGCSE this list of video links and practical links could be very useful to give the context of the metal extraction. Learners could work through these videos, and it could be differentiated for different groups depending on the complexity of the experiments.

Metals quiz

Learn Chemistry

Resources: http://www.rsc.org/learn-chemistry/wiki/Quiz:GeneralF001:_Metals_and_the_activity_series

A list of multiple choice questions on this topic. As multiple choice is entering the new GCSE this is a useful form of practice.

Correct answers are:

1. Sodium
2. Aluminium
3. $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$
4. $\text{FeCO}_3(\text{s}) \rightarrow \text{FeO}(\text{s}) + \text{CO}_2(\text{g})$
5. $\text{Cu}(\text{s}) + 2 \text{AgNO}_3(\text{aq}) \rightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2 \text{Ag}(\text{s})$
6. $\text{Pb} + \text{Cl}_2 \rightarrow \text{PbCl}_2$
7. Calcium is too reactive; it lies well above hydrogen in the reactivity series and therefore will displace hydrogen from water. Copper lies well below hydrogen, and it can remain as the element for long periods
8. Aluminium metal is above carbon in the reactivity series, so it cannot be displaced from Al_2O_3 ; iron is below carbon and can be displaced.
9. Reduce the silver nitrate to silver by adding iron metal
10. Magnesium and copper

Activities

Extraction of metals quiz

Resources: <http://www.educationquizzes.com/gcse/chemistry/metals-extraction-of-metals-1/>

An online quiz covering the key areas of this topic which learners could use to check their understanding. It gives instant feedback so would be a good activity for them to complete independently and identify their strengths and weaknesses.

Correct answers are:

1. Gold
2. Phytomining
3. the price of copper has risen significantly
4. iron is more reactive than copper
5. Mg, Al, Zn, Fe, Sn
6. ores contain enough metal to make it economically viable
7. $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
8. Aluminium is more reactive than carbon
9. Bioleaching is slower
10. filling up landfill sites

Activities

'Chemistry blog'

Resources: <http://askmichellechemistry.blogspot.co.uk/2012/08/more-on-electrolysis.html>

A detailed account of this topic. Going into plenty of detail to support both the teacher and learner in their understanding. Could be good for an independent research activity.

Exam Questions

Chem Active

Resources: http://chemactive.com/worksheets/gcse/chemistry/metals_questions.pdf

http://chemactive.com/worksheets/gcse/chemistry/metals_answers.pdf

A huge bank of questions linked to Reactivity series. This could be turned into a 'stations' activity where learners work in groups on individual questions, or this could be given as a homework activity. Individual questions could be separated out and used to compliment individual lessons.

Resources, links and support

Science Spotlight – Our termly update Science Spotlight provides useful information and helps to support our Science teaching community. Science Spotlight is designed to keep you up-to-date with Science here at OCR, as well as to share information, news and resources. Each issue is packed full with a series of exciting articles across the whole range of our Science qualifications: www.ocr.org.uk/qualifications/by-subject/science/science-spotlight/

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Contact the team: science@ocr.org.uk

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To find out more about GCSE and A Level reform please visit: <http://www.ocr.org.uk/qualifications/gcse-and-a-level-reform>



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