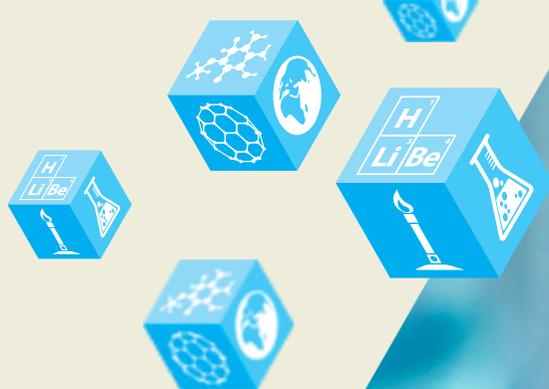


PROVISIONAL



TRANSITION GUIDE

Topic: Endothermic and Exothermic reactions

June 2015

**GCSE (9-1) Twenty
First Century
Chemistry B**

KS3–KS4



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This resource is an exemplar of the types of materials that will be provided to assist in the teaching of the new qualifications being developed for first teaching in 2016. It can be used to teach existing qualifications but may be updated in the future to reflect changes in the new qualifications. Please check the OCR website for updates and additional resources being released. We would welcome your feedback so please get in touch.



Welcome

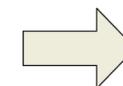
Welcome to the KS3–KS4 transition guide for **GCSE (9–1) Twenty First Century Chemistry B**.

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.

Go to topic comparison



Key Stage 3 Content

Key Stage 3 National Curriculum Content

- Exothermic and endothermic reactions (qualitative).



Key Stage 4 Content

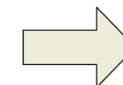
GCSE Subject Criteria Content

- When a fuel is burned in oxygen the surroundings are warmed; these are exothermic reactions.
- Chemical reactions that cool their surroundings are endothermic reactions.
- Energy has to be supplied before a fuel burns.
- For all reactions, there is a certain minimum energy needed to break bonds so that the reaction can begin. This is the activation energy.
- The activation energy, and the amount of energy associated with the reactants and products, can be represented using a reaction profile.
- Atoms are rearranged in chemical reactions. This means that bonds between the atoms must be broken and then reformed.
- Breaking bonds requires energy (activation energy) whilst making bonds gives out energy.
- Energy changes in a reaction can be calculated if we know the bond energies involved in the reaction.



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Explore the Guide



KS3



KS4

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Possible Teaching
Activities (KS3 focus)

Checkpoint Tasks

Possible Teaching
Activities (KS4 focus)Possible Extension
Activities (KS4 focus)Resources, links and
support

Comment

Difference in the level of demand at KS3 and KS4

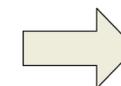
The move from KS3 to KS4 requires the students to progress from giving examples of endothermic and exothermic reactions and explaining why the reactions give out or take in energy with respect to bonds being broken/made to drawing and interpreting graphs showing reaction profiles and calculating energy changes in a reaction using bond energies given.

Essential knowledge from KS3

From their work at KS3, students should be able to explain that atoms are re-arranged in chemical reactions, meaning bonds must be broken and reformed and that energy is required to break bonds and is released when forming bonds. This will need recapping with students and wherever possible demonstrations/student experiments of endothermic and exothermic reactions will help. This gives a good basis to then apply that knowledge to explain and interpret graphs showing reaction profiles.

For students moving on to calculating energy changes in a reaction using bond energies, research has shown that most students were more competent at understanding and answering bond energy related questions when they were presented visually rather than asked verbally, as students found it easier when they are able to visually see what is occurring in the reactions. Bear this in mind when introducing this part of the specification and giving students questions to practice.

Next



KS3



KS4

Comment

Possible Teaching
Activities (KS3 focus)

Checkpoint Tasks

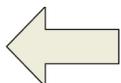
Possible Teaching
Activities (KS4 focus)Possible Extension
Activities (KS4 focus)Resources, links and
support

Comment

Common student misconceptions

- Some students will believe that a burning candle is an example of an endothermic reaction as heat (a burning match) is required to initiate the reaction. This can be rectified by demonstrating a candle burning and discussing with students that the small amount of energy needed to initiate the reaction is the activation energy and once the candle is burning it continues without adding any more energy. The teacher can then explain that much more energy is given out as heat and light than was taken in from the match making the reaction exothermic.
- Many students may believe that it is the reactants themselves that release energy or absorb energy, not the bonds breaking and forming. As students have learned that chemicals can store energy (e.g. fossil fuels), they naturally think that this energy is released when the bonds of the chemical break when it reacts with another chemical. They need to understand that energy is only released to the surroundings when the energy released forming the products is greater than the energy needed to break the bonds in the reactants eg when the fossil fuel reacts with oxygen.
- A number of students will believe that it is bond formation that requires energy as they think that to make something you need to put effort/energy into it. Therefore they also think that bonds breaking releases energy. This can very simply be shown by asking students to 'rip apart' molymod models of methane and oxygen to show that energy is needed to break the bonds before rearranging the atoms into the products carbon dioxide and water.

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KS3



KS4

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Possible Teaching Activities (KS3 focus)

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Possible Teaching Activities (**KS4 focus**)

Possible Extension Activities (**KS4 focus**)

Resources, links and support

Possible Teaching Activities (KS3 focus)



Energy Changes in Chemical Reactions Lesson Plan

This lesson is expected to be taught after students have covered different types of chemical reaction and learned that bonds break in reactants and reform in products. It consists of two experiments for the students to carry out, video clips to watch and an activity sheet to complete. It also contains an extension activity for higher ability students which could be replaced by the 'Apprentice' activity mentioned later in this section.

Click here to view page

Resources: <http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson7>



Endothermic and Exothermic Top Trumps

This simple card game highlights real life examples of endothermic and exothermic reactions. This is particularly good for lower ability students or as part of an introduction to the topic.

Click here to view page

Resources: <https://www.tes.co.uk/teaching-resource/Exothermic-and-Endothermic-Top-Trumps-6349716>



Apprentice style drink can challenge

This resource leads students through an Apprentice-style challenge to design a product that uses an endothermic or exothermic reaction to heat or cool a sports drink. You will need to adapt the PowerPoint slightly as it was targeting the 2012 Olympics, and depending on group sizes, you may also want to remove some of the student roles that are currently on the PowerPoint.

Click here to view page

Resources: <https://www.tes.co.uk/teaching-resource/Endo-or-Exothermic-reactions--Apprentice-Style-6306100>



Endothermic and exothermic reactions practical

This resource gives instructions for students to carry out four endothermic/exothermic reactions. Teachers can use the notes at the end of the resource to recap with students how to write word and symbol equations for each of the reactions and to revise types of reaction (neutralisation, displacement etc).

Click here to view page

Resources: <http://www.nuffieldfoundation.org/practical-chemistry/exothermic-or-endothermic>

KS3



KS4

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Checkpoint Tasks



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This activity provides a check to see if the concepts of endothermic and exothermic reactions taught at KS3 have been fully understood by students. It gives them the opportunity to show their understanding of the processes and use of terms. There is also an opportunity for peer assessment.

Notes for teachers: Students complete the questions on the first part of the worksheet. They then plan a short presentation about a chosen endothermic or exothermic reaction, including word and symbol equations of the chosen reaction, background information about the reaction and an explanation of the energy changes in the reaction.

For higher ability students, the teacher can let them research and choose their own use. For lower ability students, the teacher may give one or two uses and some information to get them started. A proforma printed onto A3 paper may also be of use for these students.

Students can peer assess others after all students have completed their presentations by going round the class and writing one thing that the student did well and one area for improvement on the back of each student's visual aid. Students can then use these comments to evaluate their work. Teacher instructions and a learner worksheet are available for this checkpoint task.

Resources:

<http://www.ocr.org.uk/Images/221036-endothermic-and-exothermic-reactions-checkpoint-instructions.pdf>

<http://www.ocr.org.uk/Images/221040-endothermic-and-exothermic-reactions-checkpoint-activity.doc>

KS3



KS4

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Possible Teaching Activities (KS3 focus)

Checkpoint Tasks

Possible Teaching Activities (KS4 focus)

Possible Extension Activities (KS4 focus)

Resources, links and support

Possible Teaching Activities (KS4 focus)

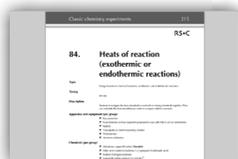


Endothermic and exothermic lesson plan: The lesson 2 PowerPoint starts with what endothermic and exothermic reactions are and how they are represented with simple energy level diagrams. Teachers will need to familiarise themselves with the teacher demos/videos of reactions mentioned. A plenary exam question is included.

Click here to view page

The second part of the PowerPoint starts with a quick recap quiz, then explains activation energy, bonds breaking and reforming taking in/giving out energy and how to calculate enthalpy step-by-step.

Resources: <https://www.tes.co.uk/teaching-resource/OCR-C7-Energetics-and-Equilibria-lessons-6130745>



Heats of Reaction experiments: This resource gives instructions for four endothermic/exothermic reactions for students to carry out. Questions at the end link these reactions to real-life situations: cold packs and hand-warmers.

Click here to view page

Resources: <http://www.nationalstemcentre.org.uk/elibrary/resource/9704/heats-of-reaction-exothermic-or-endothermic-reactions>



Endothermic or Exothermic worksheet: This worksheet consists of summary questions about endothermic and exothermic reactions, it asks students to draw out reactants and products and use those diagrams to calculate energy in and energy out. For lower ability students, teachers may want to give students the structural formulae/diagrams for the reactants and products of each reaction.

Click here to view page

Resources: <https://www.tes.co.uk/teaching-resource/Exothermic-and-Endothermic-reactions-6336123>

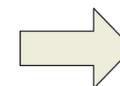


Energetics animation and quick quiz: This animation and quick quiz is good for lower ability students to summarise endothermic and exothermic reactions and activation energy.

Click here to view page

Resources: <http://bpes.bp.com/secondary-resources/science/ages-12-to-14/energetics/energetic-reactions/>

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Possible Teaching
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Possible Extension
Activities (KS4 focus)

Resources, links and
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Possible Teaching Activities (KS4 focus)

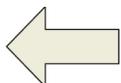


Endothermic and exothermic formative assessment: This superb resource involves students taking on the role of safety director of the ESA (European Space Agency) to produce a briefing for new staff about the reaction between oxygen and hydrogen used to fuel rockets. Clear objectives are set and a grade ladder to aid students at all levels of GCSE.

Click here to
view page

Resources: <https://www.tes.co.uk/teaching-resource/Reactions--formative-assessment-6070771>

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KS3



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Possible Teaching
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Possible Teaching
Activities (KS4 focus)

**Possible Extension
Activities (KS4 focus)**

Resources, links and
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Possible Extension Activities (KS4 focus)



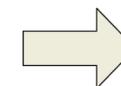
DIY cold pack investigation: This activity involves students carrying out an investigation into what mass of potassium chloride is best to make a cold pack for a school hiking expedition to the Lake District. More able students can be challenged to plan the investigation using worksheet A. The teacher may want to demonstrate the practical and indicate roughly what masses of potassium chloride they should think about testing.

Lower ability students can do this as an extension activity following the instructions and questions on worksheet B.

Resources: <http://www.ocr.org.uk/Images/221042-endothemic-and-exothermic-reactions-extension-activity.doc>

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Possible Teaching Activities (KS3 focus)

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Possible Teaching Activities (KS4 focus)

Possible Extension Activities (KS4 focus)

Resources, links and support

Possible Extension Activities (KS4 focus)

Hot Pack/Cold Pack presentation

Students can research how instant hot packs and cold packs work and what they are used for. They can then present this to the class verbally, using visual aids, PowerPoint presentations, videos etc.

Some possible websites to use as a starting point for students:

<https://www.youtube.com/watch?v=-IHZg0tMdVU>

http://www.pa.msu.edu/sciencet/ask_st/031595.html

http://www.ehow.co.uk/list_6021583_chemicals-hot-cold-packs_.html

http://www.ehow.com/how-does_4925771_instant-ice-packs-work_.html

The teacher will need to decide what criteria students must cover (this may include presentation skills in addition to subject content).



Students can be given green post-it notes to write positive comments about each presentation and pink post-it notes to write one piece of constructive feedback for each. They can then be collected by the teacher and handed to the relevant groups who can use them to evaluate their presentation.



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KS4

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Resources, links and
support

Resources, links and support



Additional
Topic 1



Additional
Topic 2



Additional
Topic 3

As we develop Transition Guides for further topics we'll update these links, making it easy for you to browse all the guides for your chosen subject.



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