PROVISIONAL

TRANSITION GUIDE

Theme: Magnets and Magnetic Fields

June 2015

GCSE (9–1) Gateway Combined Science A

KS3–KS4

GCSE REFORM

OCR
Oxford Cambridge and RSA

We will inform centres about any changes to the specification. We will also publish changes on our website. The latest version of our specification will always be the one on our website (www.ocr.org.uk) and this may differ from printed versions.

Copyright © 2015 OCR. All rights reserved.

Copyright
OCR retains the copyright on all its publications, including the specifications. However, registered centres for OCR are permitted to copy material from this specification booklet for their own internal use.

Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee.
Registered in England. Registered company number 3484466.

Registered office: 1 Hills Road
Cambridge
CB1 2EU

OCR is an exempt charity.

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) Gateway Combined Science A.**

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

- Magnetic poles, attraction and repulsion
- Magnetic fields by plotting with compass, representation by field lines
- Earth's magnetism, compass and navigation
- The magnetic effect of current, electromagnets, D.C. motors (principles only).

Key Stage 4 Content

GCSE Subject Criteria Content

- Learners should be able to describe:
  - the attraction and repulsion between unlike and like poles for permanent magnets
  - the difference between permanent and induced magnets
  - describe the characteristics of the magnetic field of a magnet, showing how strength and direction, change from one point to another
- Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic
- Describe how to show that a current can create a magnetic effect and the directions of the magnetic field around a conducting wire
- Recall that the field strength depends on the current and the distance from the conductor
- Explain how solenoid arrangements can enhance the magnetic effect
- Describe how a magnet and a current-carrying conductor exert a force on one another
- Understand and apply Fleming's left-hand rule
- Apply the equation F=BIL
- Explain how DC electric motors work

KS3 ➡ KS4

To return to this page at any point click on this button.

Explore the Guide

Comment

A well delivered and well understood study of magnetism at KS3 should make it easier for learners to grasp the more complex ideas delivered at GCSE and beyond. Consequently, it is important to ensure both content and delivery effectively targets the common misconceptions which arise during KS3. The following list of misconceptions is not exhaustive, but it does contain much of what causes problems for learners:

- All metals will be attracted to magnets, and all magnets are made of iron
- A physically large magnet must be a stronger magnet than a smaller one
- Magnetic fields will freely move through all materials
- The geographic and magnetic North Poles are the same
- Magnetic field lines can touch or cross over each other and only exist outside a magnet
- Only magnets produce magnetic fields.

Imprecise use of language at KS3 can be a hindrance when making the step up to GCSE. It is essential to encourage the accurate and precise use of technical terminology across all abilities. This can be aided by the display of relevant vocabulary within the classroom, which learners are encouraged to consult whenever possible.

Next

Comment

The importance of language can be demonstrated when talking about magnetic fields it is helpful for learners to realise that when they place their compass in a magnetic field the North Pole of that compass will experience a force of attraction. To help avoid the previously mentioned misconception that charges are attracted to magnetic poles, talk in terms of the direction to which the North Pole of a compass would point when located in a magnetic field.

Use the word 'density' when explaining how the number and distance between magnetic field lines indicates field strength. This will help learners when the term 'magnetic flux' is introduced at GCSE and beyond. It is also vitally important that learners are encouraged to draw magnetic field lines with care, paying attention to the direction and density of the lines they draw. They need to understand that the density of magnetic field lines indicate the strength of different areas of a magnet.

When looking at attraction and repulsion of magnets learners can become familiar with the pattern of magnetic field diagrams, at the expense of the realisation that these two magnetic fields are affecting each other. Diagrams can aid descriptions and help to demonstrate how these magnetic fields are interacting with each other. This is something that will help at GCSE level when considering how the magnetic field around a current carrying wire interacts when placed between the poles of a permanent magnet. It will also be of benefit when discussing the principle of how a DC motor works.

Previous

Possible Teaching Activities (KS3 focus)

Click here to view page

Magnetic cereal
Sciencebob.com

Most cereals claim to supply all or most of our daily recommended supply of iron. Does that make cereal magnetic? In this video clip 'Science Bob' attempts to answer that question. This could be used as a video clip or if suitable neodymium magnets are available would make an interesting demonstration.

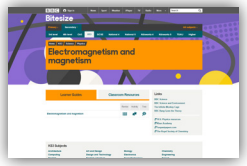
Resources: http://www.sciencebob.com/experiments/videos/video-iron_cereal.php

Click here to view page

Magnetic nails
You Tube

This video might be one way of gaining some interest in magnetic field patterns. Nail varnish is not usually encouraged in school, but in this instance it may be worth sourcing some for experimental purposes.

Resources: https://www.youtube.com/watch?v=xqas6ym_BuU



Click here to view page

3D magnetic fields
BBC

This video clip demonstrates the often overlooked fact that magnetic fields are three-dimensional. It also usefully looks at how a current flowing through a coil of wire can produce an electromagnet. The magnetism section of the BBC Bitesize KS3 website contains additional and useful classroom resources as well as links to other material.

Resources: http://www.bbc.co.uk/education/topics/zrvbkqt

Click here to view page

Magnetic Earth
PhET

This interactive simulation allows the exploration of fields around, the Earth, bar magnets and electromagnets. There is an accompanying teacher's guide and other ideas supplied by users of the simulation.

Resources: https://phet.colorado.edu/en/simulation/magnets-and-electromagnets

Checkpoint Tasks

Click here to view page

Click here to view page

The checkpoint task is centred on the use of a PowerPoint containing six different activities. The task has been designed to consolidate KS3 learning and aid the move up to GCSE. The task can be utilised in a variety of different ways:

- Individually or pairs as a class
- All six activities can be laid out in the form of 'stations' which learners can visit in small groups. The PowerPoint can then be used to facilitate whole class discussion at the end of the session. The numbering of each checkpoint task allows differentiation via the allocation of prescribed routes around the activities.
- Divide the class into 9 or less teams. Using the PowerPoint allow learners to select a picture. Each slide can either be discussed in small groups or as a class. Similarly, individual 'station' slides can be printed out and put in envelopes and distributed between teams. Each team discussing and presenting their findings to the whole class. The advantage of the latter method is it allows differentiation through selective distribution of envelopes.
- All activities can alternatively be used for starters, plenaries or revision sessions at both KS3 and GCSE.

Click here to view page

Click here to view page

Resources:

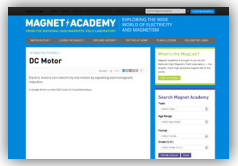
www.ocr.org.uk/Images/221025-magnets-and-magnetic-fields-checkpoint-instructions.pdf

www.ocr.org.uk/Images/221026-magnets-and-magnetic-fields-checkpoint-activity.ppt

www.ocr.org.uk/Images/221023-magnets-and-magnetic-fields-true-north-learner-activity.doc

www.ocr.org.ukl/Images/221024-magnets-and-magnetic-fields-patterns-learner-activity.doc

Possible Teaching Activities (KS4 focus)



Click here to view page

DC Motors
Magnet Academy

This DC motors simulation shows clearly how the force on a current carrying conductor is used to cause rotation in an electric motor. The magnet academy web site contains a variety of useful material and some excellent simulations.

Resources: https://nationalmaglab.org/education/magnet-academy/watch-play/interactive/dc-motor

Click here to view page

Interacting fields
S-cool

This web page contains an animation showing the interaction between a current carrying conductor and a permanent magnet. This GCSE revision web site has other clear diagrams and animations that are useful.

Resources: http://www.s-cool.co.uk/gcse/physics/magnetism-and-electromagnetism/revise-it/electromagnetism

Click here to view page

Twist and bend
Cool Magnet Man

This web page has a series of animated gif files which show how the magnetic fields twist and bend as magnets are broken apart, moved about with respect to each other and steel plates. The web site in general is worth exploring with plenty of useful information and interesting experiments you can do with permanent magnets and electro-magnets.

Resources: http://www.coolmagnetman.com/magmotion.htm

Click here to view page

Measuring the Earth's magnetic field
You Tube

Magnetometry 101 is a short informative video showing how the Earth's magnetic field has been measured by magnetometers.

Resources: https://www.youtube.com/watch?v=ljfa1R9JXWk

Possible Extension Activities (KS4 focus)

Click here to view page

Yogurt cup speakers
Teach Engineering

An understanding of electromagnetism plays a significant role in a number of engineering disciplines. This web site provides a number of useful potential lessons in this topic area. This particular lesson involves building speakers from yogurt pots, and should stretch and challenge learners in their understanding of the relationships between electricity and magnetism.

Resources: https://www.teachengineering.org/view_activity.php?url=collection/usc_/activities/usc_speakers/usc_speakers_activity1.xml

Click here to view page

Force on a current-carrying wire
The Institute of physics

The Institute of physics TAP (Teaching Advanced Physics) program, although aimed at A Level is a useful resource for GCSE extension tasks. Episode 412: The force on a conductor in a magnetic field contains clearly laid out experiments and an easily edited worksheet of questions using the formula F=BIL.

Resources: http://tap.iop.org/fields/electromagnetism/412/page_46925.html

Click here to view page

Homopolar motor
Physics central/Evil Mad Scientist

This could be used as a video clip or would make a fascinating demonstration. Learners can be challenged to explain the physics that is causing this motor to operate. These two websites both contain instructions for slightly different motors, videos and explanation.

Resources: http://www.physicscentral.com/experiment/physicsathome/homopolar-motor.cfm

http://www.evilmadscientist.com/2006/how-to-make-the-simplest-electric-motor/

Click here to view page

Next

Possible Extension Activities (KS4 focus)

Click here to view page

Build your own magnetometer
NASA

The activities on this website allow learners to develop their understanding of the importance of the Earth's magnetic fields for our own lives. This particular challenge is for learners to build their own magnetometer.

Resources: http://image.gsfc.nasa.gov/poetry/activities.html

Previous

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.

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/

Find resources and qualification information through our science page: www.ocr.org.uk/qualifications/by-subject/science/

Contact the team: GCSEScience@ocr.org.uk

Continue the discussion on the science community forum: http://social.ocr.org.uk/ and follow us on Twitter, @ocr_science

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

Topic: Magnets and Magnetic Fields


We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

If you do not currently offer this OCR qualification but would like to do so, please complete the Expression of Interest Form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: *the small print*

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

© OCR 2015 - This resource may be freely copied and distributed, as long as the OCR logo and this message remain intact and OCR is acknowledged as the originator of this work.

OCR acknowledges the use of the following content:
Thumbs up and down icons: alexwhite/Shutterstock.com, Globe: Bananaboy/Shutterstock.com/, Compass: olegganko/Shutterstock.com.
Powerpoint images: slide 1: magnet: Oleksiy Mark/Shutterstock.com, kilogram: Jane Kelly/Shutterstock.com, bar magnet: Matthew Cole/Shutterstock.com, globe: Ohmega1982/Shutterstock.com, table with book: donatas1205/Shutterstock.com and rangizzz/Shutterstock.com, sign for north pole: Aqua/Shutterstock.com. Slide 2: bar magnet: Matthew Cole/Shutterstock.com, horseshoe magnet: http://upload.wikimedia.org/wikipedia/commons/0/08/MagnetEZ.jpg, magnet: The effects of magnetism https://commons.wikimedia.org/wiki/File%3AThe_Effects_of_Magnetism.JPG. Slide 3: large hadron collider: Nicholas Greenaway/Shutterstock.com, voltage sign: popular business/Shutterstock.com. Slide 5: mystery object https://commons.wikimedia.org/wiki/File%3ADip_needle%2C_by_W._Wilson%2C_1_Belmont_St.%2C_London%2C_NW%2C_for_measuring_vertical_aspect_of_Earth's_magnetic_field%2C_c._1900_-_Museum_of_Science_and_Industry_(Chicago)_-_DSC06529.JPG. Slide 7: a compass: sergign/Shutterstock.com.

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@oc.org.uk

ocr.org.uk/gcsereform

OCR customer contact centre

General qualifications

Telephone 01223 553998

Facsimile 01223 552627

Email general.qualifications@ocr.org.uk

A DIVISION OF CAMBRIDGE ASSESSMENT

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.

© **OCR 2015** Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England.
Registered office 1 Hills Road, Cambridge CB1 2EU. Registered company number 3484466. OCR is an exempt charity.

LLOYD'S REGISTER · LRQA

ISO 9001

UKAS MANAGEMENT SYSTEMS

001