# *PLANNING SUPPORT BOOKLET*

**J250**

**For first teaching in 2016**

This support material booklet is designed to accompany the

OCR GCSE (9–1) specification in Gateway Combined Science A - Physics

***DISCLAIMER***

This resource was designed using the most up to date information from the specification at the time it was published. Specifications are updated over time, which means there may be contradictions between the resource and the specification, therefore please use the information on the latest specification at all times.If you do notice a discrepancy please contact us on the following email address: resources.feedback@ocr.org.uk

# Introduction

This support material is designed to accompany the new OCR GCSE (9-1) specification for first teaching from September 2016 for:

* [Combined Science A (Gateway Science – J250)](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-combined-science-a-j250-from-2016/)

We recognise that the number of hours available in timetable can vary considerably from school to school, and year to year. As such, these ***suggested*** teaching hours have been developed on the basis of the experience of the Science Subject Specialist team in delivering GCSE sciences in school. The hours are what we consider ideal for providing the best opportunity for high quality teaching and engagement of the learners in all aspects of learning science.

While Combined Science is a double award GCSE formed from the three separate science GCSEs, the DfE required subject content is greater than a strict two-thirds of the separate science qualifications, hence the suggested hours here are greater than a strict two-thirds of the separate science hours.

The ***suggested*** hours take into account all aspects of teaching, including pre- and post-assessment. As a linear course, we would recommend on-going revision of key concepts throughout the course to support learner’s learning. This can help to minimise the amount of re-teaching necessary at the end of the course, and allow for focused preparation for exams on higher level skills (e.g. making conceptual links between the topics) and exam technique.

Actual teaching hours will also depend on the amount of practical work done within each topic and the emphasis placed on development of practical skills in various areas, as well as use of contexts, case studies and other work to support depth of understanding and application of knowledge and understanding. It will also depend on the level of prior knowledge and understanding that learners bring to the course.

The table follows the order of the topics in the specification. It is not implied that centres teach the specification topics in the order shown. Centres are free to teach the specification in the order that suits them.

Should you wish to speak to a member of the Science Subject Team regarding teaching hours and scheme of work planning, we are available at scienceGCSE@ocr.org.uk or 01223 553998.

## Delivery guides

Delivery guides are individual teacher guides available from the qualification pages.

These Delivery guides provide further guidance and suggestions for teaching of individual topics, including links to a range of activities that may be used and guidance on resolving common misconceptions.

## Practical work

Specification Topic CS7 (Practical skills) is not included explicitly in the Planning Guidance table. The expectation is that the practical skills are developed throughout the course and in support of conceptual understanding.

Suggestions where the PAG activities can be included are given in the table below. This is by no means an exhaustive list of potential practical activities that can be used in teaching and learning of Physics.

| **Topic** | **Teaching hours**combined | **Delivery Guides** | **PAG opportunities** |
| --- | --- | --- | --- |
| **Topic 1: Matter** |
| 1.1 The particle model | 3 hours | Matter – delivery guide | PAG1: Determine the densities of a variety of objects both solid and liquid |
| 1.2 Changes of state | 6 hours | Matter – delivery guide | PAG5: Determine the specific heat capacity of a metal |
| **Total for topic 1 = 9 hours** |
| **Topic 2: Forces** |
| 2.1 Motion | 5 hours | Forces and Motion – delivery guide | PAG3: Investigate acceleration of a trolley down a ramp |
| 2.2 Newton’s laws | 11 hours | Forces and Motion – delivery guide |  |
| 2.3 Forces in action | 4 hours | Forces and Motion – delivery guide | PAG 2: Investigate the effect of forces on springs |
| **Total for topic 2 = 20 hours** |
| **Topic 3 Electricity and magnetism** |
| 3.1 Static and Charge | 3 hours | Electricity – delivery guide |  |
| 3.2 Simple circuits | 7 hours | Electricity – delivery guide | PAG6: Investigate the I-V characteristics of circuit elementsPAG7: Investigate the brightness of bulbs in series and parallel |
| 3.3 Magnets and magnetic fields | 7 hours | Magnetism – delivery guide |  |
| **Total for topic 3 = 17 hours** |
| **Topic 4 Waves and radioactivity** |
| 4.1 Wave behaviour | 4 hours | Waves – delivery guide | PAG4: Measuring the speed, frequency and wavelength of a wave |
| 4.2 The electromagnetic spectrum | 5 hours | Waves – delivery guide |  |
| 4.3 Radioactivity | 7 hours | Radioactivity – delivery guide |  |
| **Total for topic 4 = 16 hours** |
| **Topic 5 Energy** |
| 5.1 Work done | 5 hours | Energy – delivery guide |  |
| 5.2 Power and efficiency | 6 hours | Energy – delivery guide |  |
| **Total for topic 5 = 11 hours** |
| **Topic 6 Global Challenges** |
| 6.1 Physics on the move | 4 hours | Global challenges – delivery guide |  |
| 6.2 Powering Earth | 5 hours | Global challenges – delivery guide |  |
| **Total for topic 6 = 9 hours** |
| **Total teaching hours = 82 hours** |

Statements shown in **bold** type will only be tested in the Higher Tier papers. All other statements will be assessed in both Foundation and Higher Tier papers

# Outline Scheme of Work: P3 – Electricity and Magnetism

## Total suggested teaching time – 17 hours

### P3.1 Static and charge (3 hours)

|  |
| --- |
| Links to KS3 Subject content* separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects
* the idea of electric field, forces acting across the space between objects not in contact
 |
| Links to Mathematical Skills* M1a
* M2a
* M3a
* M3b
* M3c
* M3d
* M5b
 | Links to Practical Activity Groups (PAGs)* N/A
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# Overview of P3.1 Static and charge

| Lesson | Statements (bold = Higher tier) | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr) | P3.1a describe that charge is a property of all matter and that there are positive and negative charges. The effects of the charges are not normally seen on bodies containing equal amounts of positive and negative charge, as their effects cancel each other out | **Starter:** Gas station fire, static electricity starts a flash fireA short piece of security camera footage in which a spark from a driver’s jumper at a petrol station causes a fire.[View full activity in P3.1 What is electric charge? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg007-p31-what-is-electric-charge?activity=288901#288901)**Main:** ElectrostaticsA range of insulating materials can be used to demonstrate this phenomenon.<https://spark.iop.org/electrostatics>**Plenary:** Q: Why do we not normally see the effects of charges. You can either post this as a question for learners to write an answer to or discuss as a class. | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |
| 2 (1hr) | P3.1b describe the production of static electricity, and sparking, by rubbing surfaces, and evidence that charged objects exert forces of attraction or repulsion on one another when not in contactP3.1c explain how transfer of electrons between objects can explain the phenomena of static electricity | **Starter:** John TravoltageRubbing John’s foot on the carpet and moving his finger near the doorknob gives him an electric shock, and the flow of charges can be traced.[View full activity in P3.1 What is electric charge? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg007-p31-what-is-electric-charge?activity=288893#288893)**Main:** Experiments with a Van de Graff generator These IOPSpark demonstrations are a fun way to show the effects of electrostatic charge.<https://spark.iop.org/experiments-van-de-graaff-generator>CLEAPSS also has [safety notes and guidance on use.](http://science.cleapss.org.uk/Resource/Using-the-Van-de-Graaff-generator.vid) **Plenary:** Learners to write down an explanation as to how the Van de Graaf generator works, learners discuss the movement of electrons in their answer. | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |
| 3 (1hr) | P3.1d recall that current is a rate of flow of charge (electrons) and the conditions needed for charge to flowP3.1e recall that current has the same value at any point in a single closed loopP3.1f recall and use the relationship between quantity of charge, current and timePM3.1i recall and apply: charge flow (C) = current (A) × time (s) | **Starter options:** Does volts or amps kill you? Voltage, current and resistanceA short video about the relative dangers of different amounts of current and voltage on humans.[View full activity in P3.2 What determines the current in an electric circuit? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg008-p32-what-determines-the-current-in-an-electric-circuit?activity=288949#288949)Electric potential: Visualizing voltage with 3D animationsA video in which potential and potential difference are visualised using a gravitational analogy and CGI.[View full activity in P3.2 What determines the current in an electric circuit? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg008-p32-what-determines-the-current-in-an-electric-circuit?activity=288956#288956)**Main:** Pupils should be given the opportunity to build some basic circuits, testing their knowledge and understanding from KS3.**Plenary:** Pupils should be given the opportunity to practice using the equation, including rearranging and converting between units. | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |

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| --- |
| **Additional online learning opportunities*****As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020.*** |
| **Lesson** | **Statement** | **Teaching activities** |
| 1 | P3.1a, P3.1b, P3.1c | Elevate [video](https://www.ocr.org.uk/Images/587852-p3-cup-elevate-video-static-electricity.mp4) can be used as flipped learning to introduce static electricity.  |
| 1 | P3.1a, P3.1b, P3.1c | Alternative [video](https://ocr.org.uk/rpgphys6) from Cambridge International to introduce static electricity.  |
| 4 | PM3.1i | Online [test](https://www.gcse.com/ctest.htm) which could be set as homework to practice *Q* = *It*. |

# Outline Scheme of Work: P3 – Electricity and magnetism

## Total suggested teaching time – 17 hours

### P3.2 Simple circuits (7 hours)

|  |
| --- |
| Links to KS3 Subject content* electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge
* potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as a ratio of potential difference (p.d.) to current
* difference in resistance between conducting and insulating components (quantitative)
* comparing power ratings of appliances in watts (W, kW)
* comparing amount of energy transferred (J, kJ, KW hour)
* other processes that involve energy transfers: completing an electrical circuit
 |
| Links to Mathematical Skills* M1a
* M2a
* M3a
* M3b
* M3c
* M3d
 | Links to Practical Activity Groups (PAGs)* PAG 6: Investigate the I-V characteristics of circuit elements
* PAG 7: Investigate the brightness of bulbs in series and parallel
 |

# Overview of P3.2 Simple circuits

| Lesson | Statements (bold = Higher tier) | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr) | P3.2a describe the differences between series and parallel circuitsP3.2b represent d.c. circuits with the conventions of positive and negative terminals, and the symbols that represent common circuit elements | **Starter:** Demo PAG activity to class**Main:** PAG 7: Investigating the brightness of bulbs in series and parallel**Plenary**: Give pupils the candidate progress sheet, from the practical activities section of the webpage. Pupils to tick of skills covered.   | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/)Link to [PAG activity](https://www.ocr.org.uk/Images/324542-pag-activity-physics-series-and-parallel-circuits-suggestion-1.docx):PAG P7 – Investigation the brightness of bulbs in series and parallel can be found in the practical activities sectionLink to [Candidate progress sheet](https://www.ocr.org.uk/Images/295647-gcse-physics-learner-record-sheet.doc) |
| 2 (1hr) | P3.2c recall that current (I) depends on both resistance (R) and potential difference (V) and the units in which these are measuredP3.2d recall and apply the relationship between I, R and V, and that for some resistors the value of R remains constant but that in others it can change as the current changesPM3.2i recall and apply: potential difference (V) = current (A) × resistance (Ω) | **Starter:** Ohm’s law using emojisA short video using emojis to represent charged particles and current flow.[View full activity in P3.2 What determines the current in an electric circuit? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg008-p32-what-determines-the-current-in-an-electric-circuit?activity=288953#288953)**Main options:** Investigating factors that affect resistance A practical is an excellent way to illustrate the relationship between I, R and V. Practicals help learners to master the skills necessary for all GCSE Science subjects.<https://spark.iop.org/ohms-law>Measuring current and p.d. in different circuitsThe webpage details a range of practical activities in order to investigate the current around a circuit.<https://spark.iop.org/investigating-current-around-circuit>**Plenary:** [SAM](https://www.ocr.org.uk/Images/234629-unit-j249-03-physics-higher-tier-paper-3-sample-assessment-material.pdf) J249-03 Question 19Pupils should be given the opportunity to practice using the equation, including rearranging and converting between units. | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/)Link to [SAM](https://www.ocr.org.uk/Images/234629-unit-j249-03-physics-higher-tier-paper-3-sample-assessment-material.pdf) |
| 3 (1hr) | P3.2e explain that for some resistors the value of R remains constant but that in others it can change as the current changesP3.2f explain the design and use of circuits to explore such effects | **Starter:** Electric potential: Visualizing voltage with 3D animationsA video in which potential and potential difference are visualised using a gravitational analogy and CGI.[View full activity in P3.2 What determines the current in an electric circuit? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg008-p32-what-determines-the-current-in-an-electric-circuit?activity=288956#288956)**Main options:** Temperature change and resistanceThe resource link directs learners how to investigate the changing resistance of a wire as it heats up. As well as learner instructions, there are also teaching notes and health and safety procedures.<https://spark.iop.org/temperature-change-and-resistance>Resistance effectsThe webpage details a range of practical activities in order to investigate resistance, including how fuses work.<https://spark.iop.org/collections/resistance-effects#gref>**Plenary:** [SAM](https://www.ocr.org.uk/Images/234625-unit-j249-01-physics-foundation-tier-paper-1-sample-assessment-material.pdf) J249-01 Question 21  | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/)Link to [SAM](https://www.ocr.org.uk/Images/234625-unit-j249-01-physics-foundation-tier-paper-1-sample-assessment-material.pdf) |
| 4 (1hr) | P3.2g use graphs to explore whether circuit elements are linear or nonlinear (M4c, M4d)P3.2h use graphs and relate the curves produced to the function and properties of circuit elements (M4c, M4d) | **Starter:** Demo PAG activity to class**Main:** PAG 6: I-V characteristics**Plenary**: Give pupils the candidate progress sheet, from the practical activities section of the webpage. Pupils to tick of skills covered.   | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/)Link to [PAG activity](https://www.ocr.org.uk/Images/311746-pag-activity-physics-circuits-suggestion-1.docx):PAG P6 – Investigation IV characteristics of circuit elements can be found in the practical activities sectionLink to [Candidate progress sheet](https://www.ocr.org.uk/Images/295647-gcse-physics-learner-record-sheet.doc):GCSE Physics A and B – Candidate progress sheet can be found in the practical activities section of the subject page. |
| 5 (1hr) | P3.2i explain why, if two resistors are in series the net resistance is increased, whereas with two in parallel the net resistance is decreased (qualitative explanation only) | **Starter options:** resistors in series and parallel video<https://www.youtube.com/watch?v=x2EuYqj_0Uk>Circuit construction kit (DC Only), Virtual lab: Circuits, light bulbs, batteries A flexible Java application modelling a circuit. Users can investigate the effects of combining different components in various ways.[View full activity in P3.3 How do series and parallel circuits work? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg009-p33-how-do-series-and-parallel-circuits-work?activity=290118#290118)**Main options:** experiment resistors in series and parallel<http://www.umsl.edu/~physics/files/pdfs/Electricity%20and%20Magnetism%20Lab/Exp4.SeriesParallel.pdf>Resistors in circuitsThis is a great resource where all the various factors in a circuit have been collated together, and can be compared easily. This is a resource for teachers as opposed to learners.[View full activity in 3.2 Simple circuits – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/delivery-guide-gpadg008-p32-simple-circuits?activity=294830#294830)**Plenary**: Resistors in series and parallelThe worksheet from TES is great for learners to work through in their own time. It comes with an example then questions that follow.[View full activity in 3.2 Simple circuits – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/delivery-guide-gpadg008-p32-simple-circuits?activity=294836#294836) | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |
| 6 (1hr) | P3.2j calculate the currents, potential differences and resistances in d.c. series and parallel circuits P3.2k explain the design and use of such circuits for measurement and testing purposes | **Starter:** Question: how can we build a sensing circuit?Pupils to research the uses of LDRs and thermistors and feedback uses to the class**Main options:** The experiments in this IOPSpark resource can be used as an introduction to potential dividers for transition to GCE as well as featuring the use of thermistors and LDRs in a circuit.<https://spark.iop.org/sites/default/files/media/documents/episode-118-1-potential-dividers.doc>Thermistor experimentA video demonstration of an experiment to calibrate a thermistor.[View full activity in P3.3 How do series and parallel circuits work? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg009-p33-how-do-series-and-parallel-circuits-work?activity=290128#290128)**Plenary:** potential divider questions<http://www.petervis.com/GCSE_Design_and_Technology_Electronic_Products/Potential_Divider/Potential_Divider_Questions.html> | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |
| 7 (1hr) | P3.2l explain how the power transfer in any circuit device is related to the potential difference across it and the current, and to the energy changes over a given timeP3.2m apply the equations relating potential difference, current, quantity of charge, resistance, power, energy, and time, and solve problems for circuits which include resistors in series, using the concept of equivalent resistance (M1c, M3b, M3c, M3d)PM3.2ii recall and apply: energy transferred (J) = charge (C) × potential difference (V) PM3.2iii recall and apply: power (W) = potential difference (V) × current (A) = (current (A))2 × resistance (Ω)PM3.2iv recall and apply: energy transferred (J, kWh) = power (W, kW) × time (s, h) = charge (C) × potential difference (V) | **Starter:** electrical powerThe YouTube video is a worked example of applying the electricity equations in the context of household appliances.[View full activity in 3.2 Simple circuits – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/delivery-guide-gpadg008-p32-simple-circuits?activity=294846#294846)**Main options:** practical <https://www.stem.org.uk/elibrary/resource/26282/episode-120-energy-transfer-in-electric-circuits>practical – using an energy meter to measure power<https://spark.iop.org/using-energymeter-measure-power-electrical-circuits>**Plenary:** Pupils should be given the opportunity to practice using the equation, including rearranging and converting between units. | Link to delivery guide [Electricity](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat003-p3-electricity/) |

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| --- |
| **Additional online learning opportunities**As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020. |
| **Lesson** | **Statement** | **Teaching activities** |
| 4 | P3.2c, P3.2d, P3.2e, P3.2g, P3.2h | PAG 6 [alternative](https://www.ocr.org.uk/Images/473501-pag-activity-physics-circuits-suggestion-2.docx) – Mystery circuit elements - an alternative practical activity that could be used to identify circuit components from I-V characteristics.  |
| 4 | P3.2g, P3.2h | P3.2 lesson 4 flipped learning [video](https://www.youtube.com/watch?v=ksPfzUjMbBk) on I-V characteristic graphs. |
| 4 | P3.2g, P3.2h | Flipped learning opportunity with information and questions from [cyberphysics](https://www.cyberphysics.co.uk/topics/electricity/basic_electricity/characteristics.htm).  |
| 6 | P3.2j, P3.2k | YouTube [video](https://www.youtube.com/watch?v=YoxxwHmLBf0) explaining variable resistor circuits which can be used as flipped learning. |
| 7 | P3.2a, P3.2b | BBC Bitesize practical activity [link](https://www.bbc.co.uk/bitesize/guides/zq3wtv4/revision/4) which could be used as flipped learning for PAG 7. |

# Outline Scheme of Work: P3 – Electricity and magnetism

## Total suggested teaching time – 17 hours

### 3.3 Magnets and Magnetic fields (7 hours)

|  |
| --- |
| Links to KS3 Subject content* magnetic poles, attraction and repulsion
* magnetic fields by plotting compass, representation of field lines
* Earth’s magnetism, compass and navigation
 |
| Links to Mathematical Skills* M1c
* M5b
 | Links to Practical Activity Groups (PAGs)* N/A
 |

# Overview of P3.3 Magnets and Magnetic fields

| Lesson | Statements (bold = Higher tier) | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr) | P3.3a describe the attraction and repulsion between unlike and like poles for permanent magnetsP3.3b describe the difference between permanent and induced magnets | **Starter:** How do magnets work?: James May’s Q and AA short video in which James May explains magnetism.[View full activity in P3.5 What are magnetic fields? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg011-p35-what-are-magnetic-fields?activity=290147#290147)**Main options:** Magnets and electromagnets: Magnetism, magnetic field, electromagnetsAn interactive Java application in which a magnet and an electromagnet can be moved relative to a compass.[View full activity in P3.5 What are magnetic fields? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg011-p35-what-are-magnetic-fields?activity=290145#290145)practical electromagnetic induction<http://www.allaboutcircuits.com/textbook/experiments/chpt-2/electromagnetic-induction-experiment/>**Plenary options:** Magnetism for kidsProvides a variety of resources and video links at all key stage levels covering all content. Shows the history of magnets.[View full activity in 4.1 Magnets and magnetic fields – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields?activity=287717#287717) | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields) |
| 2 (1hr) | P3.3c describe the characteristics of the magnetic field of a magnet, showing how strength and direction change from one point to another | **Starter options:** Magnetic fieldsA clip, which illustrates and explain the magnetic field.[View full activity in 4.1 Magnets and magnetic fields – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields?activity=287720#287720)Magnetic field lines, 3DA video of a simple experiment with a suspension of iron filings to show magnetic field lines in three dimensions.[View full activity in P3.5 What are magnetic fields? – Online delivery guide](https://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg011-p35-what-are-magnetic-fields#290155)**Main:** Investigating with magnets – pupils use magnets and compasses to plot field lines of one and two magnets, showing attraction and repulsion.**Plenary:** [SAM](https://www.ocr.org.uk/Images/234625-unit-j249-01-physics-foundation-tier-paper-1-sample-assessment-material.pdf) J249-01 Question 17 | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields)Link to [SAM](https://www.ocr.org.uk/Images/234625-unit-j249-01-physics-foundation-tier-paper-1-sample-assessment-material.pdf) |
| 3 (1hr) | P3.3d explain how the behaviour of a magnetic (dipping) compass is related to evidence that the core of the Earth must be magnetic | **Starter:** Why earth’s magnetic shield mattersA short video about Earth’s magnetosphere.[View full activity in P3.5 What are magnetic fields? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg011-p35-what-are-magnetic-fields?activity=290149#290149)**Main:** CompassA step-by-step guide on how to make a compass.<https://www.bbc.co.uk/bitesize/topics/zrvbkqt/articles/zfb6pbk>**Plenary:** How does a compass work? Pupils discuss and write a paragraph to explain. | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields) |
| 4 (1hr) | P3.3e describe how to show that a current can create a magnetic effect and describe the directions of the magnetic field around a conducting wireP3.3f recall that the strength of the field depends on the current and the distance from the conductor | **Starter options:** Richard Feynman on magnetsA ten-minute video of Richard Feynman being asked to explain magnetic attraction and repulsion.[View full activity in P3.5 What are magnetic fields? – Online delivery guide](https://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg011-p35-what-are-magnetic-fields?activity=290149/#290161)Magnetic field around a wireA simple interactive page in which the magnetic field around a current-carrying wire is shown.[View full activity in P3.6 How do electric motors work? – Online delivery guide](https://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg012-p36-how-do-electric-motors-work#290163)**Main:** Magnetic fields due to current in wiresThese are a collection of experiments designed for learners to do themselves to gain experience on magnetic fields and electromagnets.[View full activity in 4.1 Magnets and magnetic fields – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields?activity=287724#287724)**Plenary:** Give pupils mini white boards then get them to draw field lines for single magnets, magnets showing attraction and repulsion and a current carrying wire as a mini quiz. | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields) |
| 5 (1hr) | P3.3g explain how solenoid arrangements can enhance the magnetic effect | **Starter:** SolenoidA clear animation, which allows learners to amend voltage to see how a solenoid is affected and the magnetic field.[View full activity in 4.1 Magnets and magnetic fields – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields?activity=287728#287728)**Main:** Solenoid magnetic effectThe task allows learners to independently build up knowledge on solenoids. They should be able to draw its magnetic field and explain what affects its strength. The task is aimed at learners who are familiar with magnetic field around a straight wire but now need to look at a solenoid and its magnetic field.[View full activity in 4.1 Magnets and magnetic fields – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields?activity=287726#287726)**Plenary:** [SAM](https://www.ocr.org.uk/Images/234657-unit-j250-11-physics-higher-tier-paper-11-sample-assessment-material.pdf) J250-11 question 12  | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields)Link to [SAM](https://www.ocr.org.uk/Images/234657-unit-j250-11-physics-higher-tier-paper-11-sample-assessment-material.pdf) |
| 6 (1hr) | **P3.3h describe how a magnet and a current-carrying conductor exert a force on one another****P3.3i show that Fleming’s left-hand rule represents the relative orientations of the force, the conductor and the magnetic field** | **Starter options:** Physics misconceptionsA list of misconceptions or difficulties learners may have with electricity.[View full activity in 4.2 Uses of magnetism – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg010-p42-uses-of-magnetism?activity=287758#287758)Fleming’s left hand ruleA video clip, which explains Fleming’s left hand rule.[View full activity in 4.2 Uses of magnetism – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg010-p42-uses-of-magnetism?activity=287756#287756)**Main:** practical force on a current carrying conductor<https://spark.iop.org/force-wire-carrying-current-magnetic-field>**Plenary:** Pupils write a paragraph to explain force on a current carrying conductor in a magnetic field. | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields) |
| 7 (1hr) | **P3.3j apply the equation that links the force on a conductor to the magnetic flux density, the current and the length of conductor to calculate the forces involved****PM3.3i apply: force on a conductor (at right angles to a magnetic field) carrying a current (N) = magnetic flux density (T) × current (A) × length (m)** | **Starter:** Right and left hand rulesA very basic page with graphics showing both the right hand rule and Fleming’s left hand rule.[View full activity in P3.6 How do electric motors work? – Online delivery guide](https://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg012-p36-how-do-electric-motors-work#290165)**Main:** Pupils should be given the opportunity to practice using the equation, including rearranging and converting between units.Pupils draw a labelled diagram or label a diagram given to them showing Fleming’s left hand rule and what each finger represents.**Plenary:** [SAM](https://www.ocr.org.uk/Images/234629-unit-j249-03-physics-higher-tier-paper-3-sample-assessment-material.pdf) J249-03 Question 21  | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields)Link to [SAM](https://www.ocr.org.uk/Images/234629-unit-j249-03-physics-higher-tier-paper-3-sample-assessment-material.pdf) |
| 8 (1hr) | **P3.3k explain how the force exerted from a magnet and a current-carrying conductor is used to cause rotation in electric motors** | **Starter:** demo a simple electric motor. Use a kit if you have one available**Main options:** It really spins around!: Simple models of electric motorA set of simple motors that can be made with easily available materials.[View full activity in P3.6 How do electric motors work? – Online delivery guide](https://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt03-p3-electric-circuits/delivery-guide-gpbdg012-p36-how-do-electric-motors-work#290169)the electric motor practical<https://spark.iop.org/electric-motor>**Plenary:** The electric motorProvides clear explanation about an electric motor. It is also engaging with a simulation of how magnetic field and voltage are affected by turning the coil. Test can be used for homework.[View full activity in 4.2 Uses of magnetism – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg010-p42-uses-of-magnetism?activity=287761#287761) | Link to [delivery guide](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat004-p4-magnetism-and-magnetic-fields/delivery-guide-gpadg009-p41-magnets-and-magnetic-fields) |

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| **Additional online learning opportunities*****As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020.*** |
| **Lesson** | **Statement** | **Teaching activities** |
| 1 | P3.3a, P3.3b | Bitesize [introduction to magnets](https://www.bbc.co.uk/bitesize/guides/zxxbkqt/revision/1) can be used as flipped learning. |
| 1 | P3.3a, P3.3b | [Question 11 on paper 3](https://ocr.org.uk/rpgphys15) of this Cambridge International resource could be used as a plenary or homework. |
| 1 | P3.3a, P3.3b | [Quiz](https://www.footprints-science.co.uk/index.php?quiz=Magnets) on magnets that could be used as plenary or homework. |
| 2 | P3.3c | A Bitesize [resource](https://www.bbc.co.uk/bitesize/guides/zxxbkqt/revision/2) that could be used as flipped learning for lesson 2 and the test as a homework. |
| 2 | P3.3c | [Short clip](https://www.ocr.org.uk/Images/587853-p4-cup-elevate-video-iron-filings-in-a-magetic-field.mp4) of iron filings showing magnetic field from CUP Elevate.  |
| 5 | P3.3g | [Video](https://ocr.org.uk/rpgphys8) from Cambridge International on electromagnets can be used as flipped learning. |
| 2 | P3.3j, PM3.3i | [Video](https://www.youtube.com/watch?v=jxFB_CWKj5M) to show how to use *F* = *BIL* - can be used as flipped learning. |
| 2/3 | P3.3j, PM3.3i | [Worksheet](https://www.tes.com/teaching-resource/p7-magnetism-force-on-a-current-carrying-wire-11666999) for homework on *F* = *BIL*. |
| 3 | P3.3k | CUP Elevate [resource](https://www.ocr.org.uk/Images/587854-p4-cup-elevate-resource-electric-motors.zip) that can be used as flipped learning to introduce electric motors. |

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