# PLANNING SUPPORT BOOKLET

**J249**

**For first teaching in 2016**

This support material booklet is designed to accompany the OCR GCSE (9–1) specification in Physics A and Combined Science A (Gateway Science).

***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 OCR GCSE (9-1) specification in Physics A (Gateway) for teaching from September 2016.

The Planning Guidance table on the following pages sets out *suggested* teaching times for the topics within the specification. Note that we always recommend that individual centres plan their schemes of work according to their individual needs. Actual teaching times for topics will 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 suites them.

## Delivery guides

The column ‘Delivery guides’ refers to individual teacher guides available from the GCSE Physics A qualification page.

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 p9 (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 for where the PAG techniques can be are included throughout the table. This is by no means and exhaustive list of potential practical activities.

| **Topic** | **Teaching hours**separate / combined | **Delivery Guides** | **PAG opportunities** |
| --- | --- | --- | --- |
| **Topic 1: Matter** |
| 1.1 The particle model | 3 / 3 hours | Matter – delivery guide | PAG1: Determine the densities of a variety of objects both solid and liquid  |
| 1.2 Changes of state | 5 / 5 hours | Matter – delivery guide | PAG5: Determine the specific heat capacity of a metal (Activity 1)PAG5: Kettle design (Activity 2) |
| **1.3 Pressure (separate science only)** | 6 / 0 hours | Matter – delivery guide |  |
| **Total for topic 1 = 14 / 8 hours** |
| **Topic 2: Forces** |
| 2.1 Motion | 5 / 5 hours | Forces and Motion – delivery guide | PAG3: Investigate acceleration of a trolley down a ramp (Activity 1)PAG3: Investigating fluid flow (Activity 2) |
| 2.2 Newton’s laws | 12 / 11 hours | Forces and Motion – delivery guide |  |
| 2.3 Forces in action | 8 / 4 hours | Forces and Motion – delivery guide | PAG 2: Investigate the effect of forces on springs (Activity 1)PAG 2: Investigating the effects of forces on the compression of a sample (Activity 2) |
| **Total for topic 2 = 25 / 20 hours** |
| **Topic 3 Electricity** |
| 3.1 Static and Charge | 4 / 3 hours | Electricity – delivery guide |  |
| 3.2 Simple circuits | 7 / 7 hours | Electricity – delivery guide | PAG6: Investigate the I-V characteristics of circuit elements (Activity 1)PAG6: Mystery circuit elements (Activity 2)PAG7: Investigate the brightness of bulbs in series and parallel |
| **Total for topic 3 = 11 / 10 hours** |
| **Topic 4 Magnetism** |
| 4.1 Magnets and magnetic fields | 5 / 5 hours | Magnetism – delivery guide |  |
| 4.2 Uses of magnetism | 8 / 2 hours | Magnetism – delivery guide |  |
| **Total for topic 4 = 13 / 7 hours** |
| **Topic 5 Waves** |
| 5.1 Wave behaviour | 7 / 4 hours | Waves – delivery guide | PAG4: Measuring the speed, frequency and wavelength of a wave (Activity 1)PAG4: Tsunami (Activity 2)PAG4: Measuring the speed, frequency and wavelength of a wave |
| 5.2 The electromagnetic spectrum | 4 / 4 hours | Waves – delivery guide |  |
| 5.3 Wave interactions  | 5 / 1 hours | Waves – delivery guide | PAG8: Investigate the reflection of light off a plane mirror and the refraction of light through prisms (Activity 1)PAG8: Reflection within a material (Activity 2) |
| **Total for topic 5 = 16 / 9 hours** |
| **Topic 6 Radioactivity** |
| 6.1 Radioactive emissions | 6 / 6 hours | Radioactivity – delivery guide |  |
| 6.2 Uses and Hazards  | 5 / 1 hours | Radioactivity –delivery guide |  |
| **Total for topic 6 = 11 / 7 hours** |
| **Topic 7 Energy** |
| 7.1 Work done | 5 / 5 hours | Energy – delivery guide |  |
| 7.2 Power and efficiency | 6 / 6 hours | Energy – delivery guide |  |
| **Total for topic 7 = 11 / 11 hours** |
| **Topic 8 Global Challenges** |
| 8.1 Physics on the move | 5 / 4 hours | Global challenges – delivery guide |  |
| 8.2 Powering Earth | 6 / 5 hours | Global challenges – delivery guide |  |
| **8.3 The Earth and beyond (separate science only)** | 8 / 0 hours | Global challenges – delivery guide |  |
| **Total for topic 8 = 19 / 9 hours** |
| **Total teaching hours = 120 / 81 hours** |

🗹 This symbol indicates content that is found only in the physics separate science qualification

# Outline Scheme of Work: P3 – Electricity

## Total suggested teaching time – 11 / 10 hours

### P3.1 Static and charge (4 / 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
 |

# Overview of P3.1 Static and charge

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr for separate and combined) | 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 for separate and combined) | 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 (1 hr separate science only) | P3.1d explain the concept of an electric field and how it helps to explain the phenomena of static electricity 🗹 | **Starter:** Create your own lightningA fun and simple experiment by Planet Science to demonstrate static charge.[View full activity in 3.1 Static and charge – 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-gpadg007-p31-static-and-charge?activity=294767#294767)**Main:** Electric fields experimentA simple experiment to show electric field patterns using semolina and castor oil.<https://spark.iop.org/electric-field-patterns>**Plenary:** Learners to write a paragraph explain how electric fields explain the phenomena of static electricity. These can be swapped with a partner to amend/improve. | 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/) |
| 4 (1hr for separate and combined) | P3.1e recall that current is a rate of flow of charge (electrons) and the conditions needed for charge to flowP3.1f recall that current has the same value at any point in a single closed loopP3.1g 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/) |

|  |
| --- |
| 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.  |
| 3 | P3.1d | [Video](https://www.youtube.com/watch?v=_v4ugAwV59U) with clear explanation of electric fields to use as flipped learning. |
| 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

## Total suggested teaching time – 11 / 10 hours

### P3.2 Simple circuits (8 / 8 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 Mathematical Skills* 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 | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr for separate and combined) | 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 for separate and combined) | 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 for separate and combined) | 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 for separate and combined) | 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 for separate and combined) | 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 for separate and combined) | 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 for separate and combined) | 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/) |
| 8 | End of chapter quiz | Pupils to complete the end of chapter quiz P3. Aftercompletion pupils to swap and mark quizzes.Pupils use their quizzes to create a revision list from Chapter 3***.*** | [End of topic quiz P3](https://interchange.ocr.org.uk/Downloads/Gateway-Physics-Quizzes.zip) available on OCR interchange:  |

|  |
| --- |
|  Additional online learning opportunitiesAs 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 | Bitesize practical activity [link](https://www.bbc.co.uk/bitesize/guides/zq3wtv4/revision/4) which could be used as flipped learning for PAG 7. |



We’d like to know your view on the resources we produce. Click ‘Like’ or ‘Dislike’ to send us an auto generated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email will not be used or shared for any marketing purposes.

Looking for another resource? There is now a quick and easy search [tool to help find free resources](http://www.ocr.org.uk/i-want-to/find-resources/) for your qualification.

OCR is part of Cambridge Assessment, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.
Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England.
Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals
and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up to date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please contact us.

© OCR 2021 - You can copy and distribute this resource freely if you keep the OCR logo and this small print intact and you acknowledge OCR as the originator of the resource.

OCR acknowledges the use of the following content: N/A

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our [Expression of Interest form](https://www.ocr.org.uk/qualifications/expression-of-interest/).

Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.