# 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](mailto: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: P7 – Energy

## Total suggested teaching time – 11 / 11 hours

### P7.1 Work done (5 / 5 hours)

|  |  |
| --- | --- |
| Links to KS3 Subject content  * Heating and thermal equilibrium * Processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels * Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change * Work done and energy changes on deformation | |
| Links to Mathematical Skills  * M1a * M1b * M1c * M2a * M3a * M3b * M3c * M3d | Links to Practical Activity Groups (PAGs)  * N/A |

# Overview of P7.1 Work done

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | P7.1a describe for situations where there are energy transfers in a system, that there is no net change to the total energy of a closed system (qualitative only) | **Starter:** When a physics teacher knows his stuff! A video of a physics teacher risking his life for science. [View full activity in P4.4 How do we describe motion in terms of energy transfers? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt04-p4-explaining-motion/delivery-guide-gpbdg017-p44-how-do-we-describe-motion-in-terms-of-energy-transfers?activity=291140#291140)  **Main:** Energy circus  learners to move around the room looking at different appliances and identifying their energy transformation.  **Plenary:** [SAMs](https://www.ocr.org.uk/Images/234630-unit-j249-04-physics-higher-tier-paper-4-sample-assessment-material.pdf) question J249-04 Question 20 | Link to delivery guide  <https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/>  Link to [SAM](https://www.ocr.org.uk/Images/234630-unit-j249-04-physics-higher-tier-paper-4-sample-assessment-material.pdf) |
| 2 | P7.1b describe all the changes involved in the way energy is stored when a system changes for common situations | **Starter:** The ramp: Force, energy, work  A simple interactive applet in which objects can be pushed, pulled or allowed to slide up or down a ramp, with various adjustable parameters.  [View full activity in P4.4 How do we describe motion in terms of energy transfers? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt04-p4-explaining-motion/delivery-guide-gpbdg017-p44-how-do-we-describe-motion-in-terms-of-energy-transfers?activity=291136#291136)  **Main:** Practical work done by a force:  <https://www.stem.org.uk/elibrary/resource/26336/episode-214-work-done-force>  **Plenary:** Quizzes  A variety of engaging and exciting quizzes to test learners’ knowledge on the topic. There are premade quizzes and learners compare their scores with others.  <https://kahoot.it/#/> | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 3 | P7.1c describe the changes in energy involved when a system is changed by heating (in terms of temperature change and specific heat capacity), by work done by forces, and by work done when a current flows | **Starter:** Bigger red hot nickel ball in hot water  A short (2 minutes) video in which a red-hot ball of nickel is dropped into a container of water.  [View full activity in P6.1 How does energy transform matter? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt06-p6-matter-models-and-explanations/delivery-guide-gpbdg021-p61-how-does-energy-transform-matter?activity=291927#291927)  **Main:** A simple interactive app in which heat is added to a virtual substance represented as a set of variously energetic particles, with a kinetic and potential energy indicators and a graph of total energy against time.  [View full activity in P6.1 How does energy transform matter? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt06-p6-matter-models-and-explanations/delivery-guide-gpbdg021-p61-how-does-energy-transform-matter?activity=291913#291913)  **Plenary:** [SAMs](https://www.ocr.org.uk/Images/234630-unit-j249-04-physics-higher-tier-paper-4-sample-assessment-material.pdf) question J249-04 Question 21 | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/)  Link to [SAM](https://www.ocr.org.uk/Images/234630-unit-j249-04-physics-higher-tier-paper-4-sample-assessment-material.pdf) |
| 4 | P7.1d make calculations of the energy changes associated with changes in a system, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes; thereby express in quantitative form and on a common scale the overall redistribution of energy in the system (M1a, M1c, M3c) | **Starter:** Kinetic energy  An animation video, which looks at kinetic energy and potential energy.  <https://www.youtube.com/watch?v=ASZv3tIK56k>  **Main:** Energy  There are a number of experiments, which look at energy from power and work done.  <https://spark.iop.org/collections/introducing-energy>  Introduce the required equations to the pupils; pupils should work through example calculations with the teacher first before being given the opportunity to practice using these. Make sure pupils are comfortable rearranging equations and converting between units.  **Plenary:** [SAM](https://www.ocr.org.uk/Images/234626-unit-j249-02-physics-foundation-tier-paper-2-sample-assessment-material.pdf) question J249-02 Question 19 | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/)  Link to [SAM](https://www.ocr.org.uk/Images/234626-unit-j249-02-physics-foundation-tier-paper-2-sample-assessment-material.pdf) |
| 5 | P7.1e calculate the amounts of energy associated with a moving body, a stretched spring and an object raised above ground level | **Starter:** What is potential energy?  A short video containing a slightly deeper exploration of the concept of potential energy.  [View full activity in P4.4 How do we describe motion in terms of energy transfers? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt04-p4-explaining-motion/delivery-guide-gpbdg017-p44-how-do-we-describe-motion-in-terms-of-energy-transfers?activity=291134#291134)  **Main:** Work on a spring  There are many animations which allow the learner to take control.  <https://phet.colorado.edu/sims/html/hookes-law/latest/hookes-law_en.html>  <https://lab.concord.org/embeddable.html#interactives/interactions/spring.json>  **Plenary:** Energy transfer  The content of GPE and KE is covered well. There is also a quiz at the end to test the learners.  <http://www.gcsescience.com/pen29-gpe-transfer-ke.htm> | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |

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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 | P7.1a | These GCSE Physics online videos describe the stores of energy and can be used as flipped learning. [Video 1](https://www.youtube.com/watch?v=lBKjThIlOUA). [Video 2](https://www.youtube.com/watch?v=5f3Q56rlaRs). |
| 2 | P7.1b | Quick Footprints science [quiz on changes of state](https://www.footprints-science.co.uk/index.php?quiz=Changes_of_state) as alternative to kahoot quiz for homework. |
| 3 | P7.1c | Good explanation of [energy stores and transfers](http://physics-schooluk.com/energy_stores_and_systems.html) with short quizzes which can be used as flipped learning instead of the main activity (broken link). |
| 4 | P7.1d | [Worksheet](https://www.tes.com/teaching-resource/worksheet-energy-calculations-6098294) which can be used as homework to practise energy calculations. |

# Outline Scheme of Work: P7 – Energy

## Total suggested teaching time – 11 / 11 hours

### P7.2 Power and efficiency (6 / 6 hours)

|  |  |
| --- | --- |
| Links to KS3 Subject content  * Comparing power ratings of appliances in watts (W, kW) * Comparing amounts of energy transferred (J, kJ, kW hour) * Domestic fuel bills, fuel use and costs * Heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators. | |
| Links to Mathematical Skills  * M1a * M1b * M1d * M2a * M3a * M3b * M3c * M3d | Links to Practical Activity Groups (PAGs)  * N/A |

# Overview of P7.2 Power and efficiency

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | P7.2a describe, with examples, the process by which energy is dissipated, so that it is stored in less useful ways  P7.2b describe how, in different domestic devices, energy is transferred from batteries or the a.c. from the mains | **Starter:** Energy transfers  This video can be a resource for energy transfers.  [View full activity in P2.1 How much energy do we use? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt02-p2-sustainable-energy/delivery-guide-gpbdg005-p21-how-much-energy-do-we-use?activity=294231#294231)  Show pupils images of a battery and a power station, ask pupils what is similar about them? Try to illicit the knowledge pupils have of energy stores and transfers that they may already have.  **Main:** Energy transfers  A selection of simple practicals that can be used to show energy transfers.  <https://spark.iop.org/collections/examples-energy-going-one-thing-another>  Pupil draw energy transfer diagrams for all devices looked at in the lesson.  **Plenary:** Pupil draw energy transfer diagrams for all devices looked at in the lesson. | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 2 | P7.2c describe, with examples, the relationship between the power ratings for domestic electrical appliances and how this is linked to the changes in stored energy when they are in use | **Starter:** Power and kWh  A video which can help with the introduction of the concepts of power and kWh.  [View full activity in P2.1 How much energy do we use? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt02-p2-sustainable-energy/delivery-guide-gpbdg005-p21-how-much-energy-do-we-use?activity=294235#294235)  **Main:** Power  A selection of practicals that can be used to explain power.  <https://spark.iop.org/collections/power>  **Plenary:** Power ratings  This worksheet has a large amount of calculations on it which can help learners calculate the power rating of devices.  <https://www.tes.com/teaching-resource/electrical-energy-and-power-worksheets-6233193> | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 3 | P7.2d calculate energy efficiency for any energy transfer | **Starter:** IR images to show where heat is being lost. Show these to pupils and illicit ideas of how we can reduce this energy dissipation through heat.  **Main:** Energy, efficiency  A number of practical ideas and content, which covers all aspects of energy and efficiency.  <https://spark.iop.org/trolley-collisions>  Pupils should be given the opportunity to practice using the efficiency equation, including rearranging the equation.  Efficiency  A clear method on how to calculate efficiency. Introduces equation and provides an example.  [View full activity in 7.2 Power and efficiency – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/delivery-guide-gpadg017-p72-power-and-efficiency?activity=298560#298560)  **Plenary:** Calculating efficiency  A good worksheet that allows learners to practice their efficiency equation.  [View full activity in 7.2 Power and efficiency – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/delivery-guide-gpadg017-p72-power-and-efficiency?activity=298568#298568) | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 4 | **P7.2e describe ways to increase efficiency**  P7.2f explain ways of reducing unwanted energy transfer | **Starter:** Efficiency  Here is a video tutorial which can help learners calculate efficiency.  [View full activity in P2.1 How much energy do we use? – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-physics-b-j259-from-2016/delivery-guide/topic-gpbt02-p2-sustainable-energy/delivery-guide-gpbdg005-p21-how-much-energy-do-we-use?activity=294223#294223)  **Main:** Investigating the effect of insulation  Link to a practical which links to this work, where learners investigate the effect of insulation.  <https://www.bbc.co.uk/bitesize/guides/z2gjtv4/revision/3>  **Plenary:** Reducing heat loss  A good way of starting revision and ensuring that subject knowledge is up to scratch. Contains quizzes to test learners.  [View full activity in 7.2 Power and efficiency – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/delivery-guide-gpadg017-p72-power-and-efficiency?activity=298562#298562) | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 5 | P7.2g describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls (qualitative only) | **Starter:** Show images of houses painted white in hot country, people wrapped in foil blankets, insulating clothes etc discuss with class  **Main:** Mechanisms of heat loss  Contains many animations of how heat is lost from a building and how to reduce it. There is also a test at the end.  [View full activity in 7.2 Power and efficiency – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/delivery-guide-gpadg017-p72-power-and-efficiency?activity=298566#298566)  **Plenary:** Energy efficiency  A variety of engaging and exciting quizzes to test learner’s knowledge on the topic. There are premade quizzes and learners compare their scores with others.  [View full activity in 7.2 Power and efficiency – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/delivery-guide-gpadg017-p72-power-and-efficiency?activity=298570#298570) | Link to delivery guide - [Energy](https://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat007-p7-energy/) |
| 6 |  | Pupils to complete the end of chapter quiz P7. After completion pupils to swap and mark quizzes.  Pupils use their quizzes to create a revision list from Chapter 7 | [End of chapter quiz](https://interchange.ocr.org.uk/Downloads/Gateway-Physics-Quizzes.zip) P7 will be available on OCR interchange: |

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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 | P7.2e | [Video and notes](https://keystagewiki.com/index.php/GCSE_Physics_Required_Practical:_Investigating_Thermal_Insulators) on insulation – can be used as flipped learning. |



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