# *PLANNING SUPPORT BOOKLET*

**J259**

**For first teaching in 2016**

This support material booklet is designed to accompany the OCR GCSE (9–1) specification in Physics B (Twenty First Century) for teaching from September 2016.

***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 B (Twenty First Century) 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 B 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.

## Ideas about Science (P7) and Practical Work (P8)

Ideas about Science (P7) and Practical Skills (P8) are not explicitly reference in the high level planning table below, as these ideas and skills are expected to be developed in the context of Topics P1–P6. Links to P7 learning outcomes and suggested practical activities are included in the outline scheme of work. Indications of where PAG activities can be carried out should not be seen as an exhaustive list.

| **Topic** | | **Teaching hours** | | **Delivery Guides** | **PAG opportunities** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Chapter 1: Radiation and waves** | | | | | | |
| 1.1 What are the risks and benefits of using radiation | 5 / 5 hours | | Radiation and waves – delivery guide | |  |
| 1.2 What is climate change and what is the evidence for it? | 3 / 3 hours | | Radiation and waves – delivery guide | |  |
| 1.3 How do waves behave? | 7 / 7 hours | | Radiation and waves – delivery guide | | PAG4: measure the speed, frequency and wavelength of a wave  PAG8: Investigate the reflection of light off a plane mirror and the refraction of light through prisms |
| 1.4 What happens when light and sound meet different materials? | 7 / 0 hours | | Radiation and waves – delivery guide | |  |
| **Total for chapter 1 = 22 / 15 hours** | | | | | |
| **Chapter 2: Sustainable energy** | | | | | |
| 2.1 How much energy do we use? | 4 / 4 hours | | Sustainable energy – delivery guide | |  |
| 2.2 How can electricity be generated? | 5 / 5 hours | | Sustainable energy – delivery guide | |  |
| **Total for chapter 2 = 9 / 9 hours** | | | | | |
| **Chapter 3 Electric circuits** | | | | | |
| 3.1 What is electric charge | 2 / 0 hours | | Electric circuits – delivery guide | |  |
| 3.2 What determines the current in an electric circuit? | 4 / 4 hours | | Electric circuits – delivery guide | | PAG6: Investigate the I-V characteristics of circuit elements |
| 3.3 How do series and parallel circuits work? | 5 / 5 hours | | Electric circuits – delivery guide | | PAG7: Investigate the brightness of bulbs in series and parallel |
| 3.4 What determines the rate of energy transfer in a circuit? | 4 / 4 hours | | Electric circuits – delivery guide | |  |
| 3.5 What are magnetic fields? | 4 / 3 hours | | Electric circuits – delivery guide | |  |
| 3.6 How do electric motors work? | 3 / 3 hours | | Electric circuits – delivery guide | |  |
| 3.7 What is the process inside an electric generator? | 4 / 0 hours | | Electric circuits – delivery guide | |  |
| **Total for chapter 3 = 26 /19 hours** | | | | | |
| **Chapter 4 Explaining motion** | | | | | |
| 4.1 What are forces? | 4 / 4 hours | | Explaining motion – delivery guide | |  |
| 4.2 How can we describe motion? | 7 / 7 hours | | Explaining motion – delivery guide | | PAG3: Investigate acceleration of a trolley down a ramp |
| 4.3 What is the connection between force and motion? | 12 / 9 hours | | Explaining motion – delivery guide | |  |
| 4.4 How can we describe motion in terms of energy transfer? | 5 / 5 hours | | Explaining motion – delivery guide | |  |
| **Total for chapter 4 = 28 / 25 hours** | | | | | |
| **Chapter 5 Radioactive materials** | | | | | |
| 5.1 What is radioactivity? | 6 / 6 hours | | Radioactive materials – delivery guide | |  |
| 5.2 How can radioactive materials be used safely? | 3 / 3 hours | | Radioactive materials – delivery guide | |  |
| 5.3 How can radioactive materials be used to provide energy? | 4 / 0 hours | | Radioactive materials – delivery guide | |  |
| **Total for chapter 5 = 13 / 9 hours** | | | | | |
| **Chapter 6 Matter – models and explanations** | | | | | |
| 6.1 How does energy transform matter? | 5 / 5 hours | | Matter – delivery guide | | PAG1: Determine the densities of a variety of objects both solid and liquid  PAG5: Determine the specific heat capacity of a metal |
| 6.2 How does the particle model explain the effects of heating? | 2 / 2 hours | | Matter – delivery guide | |  |
| 6.3 How does the particle model relate to material under stress? | 4 / 4 hours | | Matter – delivery guide | | PAG2: Investigate the effect of forces on springs |
| 6.4 How does the particle model relate to pressure in fluids? | 5 / 0 hours | | Matter – delivery guide | |  |
| 6.5 How can scientific models help us understand the Big Bang? | 6 / 0 hours | | Matter – delivery guide | |  |
| **Total for chapter 6 = 22 / 11 hours** | | | | | |
| **Total teaching hours = 120 hours / 88 hours** | | | | | |

# Outline Scheme of Work: P6 – Matter – models and explanations

## Total suggested teaching time – 22 / 11 hours

|  |  |
| --- | --- |
| **Additional online learning opportunities**  As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020. | |
| **Statement** | **Teaching activities** |
| P6.1.1 | Cambridge International [video](https://ocr.org.uk/rpgphys17) explaining how density is calculated for an irregular shaped object and a liquid.  This can be shown to students before attempting the experiments themselves. |
| P6.1.1/2 | Past paper [density questions](https://ocr.org.uk/Images/244398-question-paper-unit-b752-02-modules-p4-p5-p6-higher-tier.pdf) and [markscheme](https://www.ocr.org.uk/Images/240386-mark-scheme-unit-b752-02-modules-p4-p5-p6-higher-tier-june.pdf) that can be used by students for homework to consolidate and apply their knowledge. Go to Q15. |
| P6.1.3 | This [colourful online video](https://www.youtube.com/watch?v=3itqmCtmJPc) can be used in place of the practical and graph video for heating curve of ice – water – steam. |
| P6.1.3-5 | [Video](https://www.youtube.com/watch?v=HAPmwu7byGM) on the specific heat capacity experiment including a discussion on possible errors.  This can be used as a main activity or flipped learning activity before students carry out the experiment themselves. |
| P6.2.4 | [Worksheet](https://www.tes.com/teaching-resource/boyle-s-law-questions-for-gcse-11369938) on the relationship between pressure and volume of a gas can be used as homework. |
| P6.2.4 | Bitesize [MCQ quiz](https://www.bbc.co.uk/bitesize/guides/zwvd6yc/test) which can be used as a plenary (or homework) at end of lesson 3. |
| P6.3.2 | PAG P2 ­– Investigating the effects of forces on the compression of a sample – alternative [practical activity](https://ocr.org.uk/Images/472160-pag-activity-physics-forces-suggestion-2.docx) |
| P6.4 | [Teaching and Learning toolbox](https://sciencetltoolkit.wordpress.com/2016/11/08/top-10-pressure-demos-and-videos-for-the-new-gcse-2/) has lots of videos and activities which can be used for flipped learning for section 1.3. |
| P6.4.6 | Cambridge International [video](https://ocr.org.uk/rpgphys2) showing the collapsing can experiment which can be used as a starter activity or flipped learning to introduce atmospheric pressure. |
| P6.4.6 | An alternative air pressure [PowerPoint](https://www.tes.com/teaching-resource/air-pressure-12069845) which could be used to introduce the topic e.g. as flipped learning. |
| P6.4.6 | Q5a from Cambridge International [past paper](https://pmt.physicsandmathstutor.com/download/Physics/GCSE/Past-Papers/CIE/Paper-3/June%202017%20(v2)%20QP%20-%20Paper%203%20CIE%20Physics%20IGCSE.pdf) and [mark scheme](https://pmt.physicsandmathstutor.com/download/Physics/GCSE/Past-Papers/CIE/Paper-3/June%202017%20(v2)%20MS%20-%20Paper%203%20CIE%20Physics%20IGCSE.pdf) that could be used as a plenary activity and peer review, or homework. |
| P6.4.7 | This PhET [animation](http://phet.colorado.edu/sims/html/under-pressure/latest/under-pressure_en.html) can be used to investigate the relationship between pressure, the depth and density of a liquid and gravitational field strength.  The pressure gauge can be dragged to give a reading for pressure at different depths. |

### P6.1 How does energy transform matter? (5 / 5 hours)

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| Links to KS3 Subject content  * 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 * comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with temperatures * changes with temperature in motion and spacing of particles * internal energy stored in materials | |
| Links to Mathematical Skills  * M1a * M1b * M1c * M2a * M3b * M3c * M3d * M5c | Links to Practical Activity Groups (PAGs)  * PAG 1 – Determine the densities of a variety of objects both solid and liquid * PAG 5 – Determine the specific heat capacity of a metal |

# Overview of P6.1 How does energy transform matter?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr for separate and combined) | P6.1.1 a) define density  b) describe how to determine the densities of solid and liquid objects using measurements of length, mass and volume  M1c, M5c  *PAG1*  P6.1.2 recall and apply the relationship between density, mass and volume to changes where mass is conserved:  density (kg/m3) = mass (kg) ÷ volume (m3)  M1a, M1b, M1c, M3c  PAG1 Materials | **Engage:** Density: Density, mass, volume  A simple interactive app in which users can experiment with blocks of varying density and their behaviour in 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=291909#291909)  **Explore:** Demo PAG activity to class  **Explain:** PAG 1: Determining densities  **Evaluate:** Give pupils the Learner record sheet, from the reference materials section of the webpage. Pupils to tick of skills covered. | Link to online delivery guide – Matter  <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/>  Link to [PAG activity](https://www.ocr.org.uk/Images/293854-pag-activity-physics-materials-suggestion-1.docx)  Link to [Learner record sheet](https://www.ocr.org.uk/Images/295647-gcse-physics-learner-record-sheet.doc): |
| 2 (1hr for separate and combined) | P6.1.3 describe the energy transfers involved when a system is changed by heating (in terms of temperature change and specific heat capacity)  P6.1.4 define the term specific heat capacity and distinguish between it and the term specific latent heat  P6.1.5 a) select and apply the relationship between change in internal energy of a material and its mass, specific heat capacity and temperature:  change in internal energy (J) = mass (kg) × specific heat capacity (J/kg/°C) × change in temperature (°C)  M1a, M1c, M3d | **Engage:** A short (<3 minutes) video of some cyclohexane at its triple point, cycling between states.  [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=291925#291925)  **Explain:** An experiment to measure the specific heat capacity of water, or any available fluid.  [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=291915#291915)  **Extend:** 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.  **Evaluate:** SAM question [J259-03](http://www.ocr.org.uk/Images/234635-unit-j259-03-breadth-in-physics-higher-tier-sample-assessment-material.pdf) Question 10 | Link to online delivery guide – Matter, models and explanations  <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/>  Link to [SAM](http://www.ocr.org.uk/Images/234635-unit-j259-03-breadth-in-physics-higher-tier-sample-assessment-material.pdf) question |
| 3 (1hr for separate and combined) | P6.1.5 a) select and apply the relationship between change in internal energy of a material and its mass, specific heat capacity and temperature:  change in internal energy (J) = mass (kg) × specific heat capacity (J/kg/°C) × change in temperature (°C)  M1a, M1c, M3d  b) explain how to safely use apparatus to determine the specific heat capacity of materials  *PAG5*  PAG5 Energy | **Engage:** 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)  **Explore:** Demo PAG activity to class  **Explain:** PAG 5: Determining the specific heat capacity of a metal  **Extend:** Learners should work in small groups with one complete set of cards. The aim is to answer the questions using the information given.  [View full activity in 1.2 Changes of state – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat001-p1-matter/delivery-guide-gpadg002-p12-changes-of-state?activity=294567#294567)  **Evaluate:** Give pupils the Learner record sheet, from the reference materials section of the webpage. Pupils to tick of skills covered. | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [PAG activity](https://www.ocr.org.uk/Images/309692-pag-activity-physics-energy-suggestion-1.docx):  Link to [Learner record sheet](https://www.ocr.org.uk/Images/295647-gcse-physics-learner-record-sheet.doc) |
| 4 (1hr for separate and combined) | P6.1.6 select and apply the relationship between energy needed to cause a change in state, specific latent heat and mass:  energy to cause a change of state (J) = mass (kg) × specific latent heat (J/kg)  M1a, M1c, M3d | **Engage:** A short (3 minutes) video demonstrating latent heat with a can 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=291923#291923)  **Explore:** Specific heat capacity and latent heat: [Cyber physics Resources](http://www.cyberphysics.co.uk/Q&A/KS4/SHC/questionsSHC_GCSE.html)  A series of exam based questions which learners can use to apply their equations. The questions include solutions and a quick explanation about each key area. Many other topics can also be found.  **Explain:**Latent heat of fusion of ice  A downloadable document covering a practical that can be carried out with a class to determine the specific latent heat of ice.  [View full activity in 1.2 Changes of state – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat001-p1-matter/delivery-guide-gpadg002-p12-changes-of-state?activity=294551#294551)  **Extend:** Latent heat of fusion and vaporization  A medium-length (9 minutes) video featuring a graph of temperature against heat added for 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=291917#291917)  **Evaluate:** Example questions for specific latent heat using calculations. | Link to online delivery guide – [Matter, models and explanations](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/) |
| 5 (1hr for separate and combined) | P6.1.7 describe all the changes involved in the way energy is stored when a system changes, and the temperature rises, for example: a moving object hitting an obstacle, an object slowing down, water brought to a boil in an electric kettle  P6.1.8 make calculations of the energy transfers associated with changes in a system when the temperature changes, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes  M1a, M1c, M2a, M3b, M3c, M3d | **Engage:** Discussion on energy transfers, some of this will be revision from chapter P2  **Explore:** An app with two interactive virtual experiments; in the first, users place various combinations of a container of water and two blocks, one of brick and the other of iron, on Bunsen burners and observe the different rates at which heat energy is transferred. In the other, various combinations of energy sources, mechanisms for converting energy and recipients of energy can be interchanged.  [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=291911#291911)  **Explain:** Energy circus activity – put out example showing energy changes and pupils write down the energy transfers.  **Extend:** 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.  **Evaluate:** SAM Question [J260-07](http://www.ocr.org.uk/Images/234667-unit-j260-07-physics-higher-tier-paper-3-sample-assessment-material.pdf) Question 4 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [SAM](http://www.ocr.org.uk/Images/234667-unit-j260-07-physics-higher-tier-paper-3-sample-assessment-material.pdf) |

# Outline Scheme of Work: P6 – Matter – models and explanations

## Total suggested teaching time – 22 / 11 hours

### P6.2 How does the particle model explain the effects of heating? (2 / 2 hours)

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| --- | --- |
| Links to KS3 Subject content  * 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 * comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with temperatures * conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving * the difference in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly ice-water transition * changes with temperature in motion and spacing of particles | |
| Links to Mathematical Skills  * N/A | Links to Practical Activity Groups (PAGs)  * N/A |

# Overview of P6.2 How does the particle model explain the effects of heating?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr for separate and combined) | P6.2.1 explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules  P6.2.2 use the particle model of matter to describe how mass is conserved, when substances melt, freeze, evaporate, condense or sublimate, but that these physical changes differ from chemical changes and the material recovers its original properties if the change is reversed  P6.2.3 use the particle model to describe how heating a system will change the energy stored within the system and raise its temperature or produce changes of state | **Engage:** A short (<4 minutes) video describing heat transfer in terms of the transfer of kinetic energy between particles.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291978#291978)  **Explore:** A medium-length (7 minutes) video from the wonderful ‘Fun To Imagine’ series, in which Richard Feynman explains various phenomena including heat, energy loss and phase change in terms of the kinetic energy of particles.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291974#291974)  **Explain:** A very simple experiment with boiling water.  <https://spark.iop.org/examination-boiling>  **Extend:** Melting and freezing stearic acid practical  <http://www.rsc.org/learn-chemistry/resource/res00001747/melting-and-freezing-stearic-acid?cmpid=CMP00005262>  **Evaluate:** Pupils annotate a heating graph to show where changes of states occur. Pupils answer the question: Why does the temperature stay the same during a change of state? | Link to online delivery guide – [Matter, models and explanations](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/) Plasma, the most common phase of matter in the universe A short (<4 minutes) video about the state of matter likely to be least familiar to learners.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291984#291984) |
| 2 (1hr for separate and combined) | P6.2.4 explain how the motion of the molecules in a gas is related both to its temperature and its pressure: hence explain the relation between the temperature of a gas and its pressure at constant volume  *qualitative only* | **Engage:** A short (<2 minutes) thermal imaging (infrared) video of a rubber band being stretched and relaxed, showing the increase and decrease in heat.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291976#291976)  **Explore:** An interactive app in which users can heat particles of neon, argon, molecular oxygen and water, observing the temperatures at which phase changes occur. A second pane allows pressure to be manipulated either by adding particles or compressing the container.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291967#291967)  **Explain:** A simple experiment demonstrating one of the phenomena described in the Richard Feynman video above, using a bicycle pump. Learners can be encouraged to design their own variations on this experiment.  <https://spark.iop.org/warming-gas-speeding-its-particles>  **Extend:** A short (3 minutes) video about absolute zero.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291982#291982)  **Evaluate:** mini white board quiz – give students examples of a closed system, you tell them what changes e.g. increase temp, learners then write what happens to the pressure e.g. increases pressure | Link to online delivery guide – [Matter, models and explanations](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/) Burning paper with steel ball-bearings An extremely short (17 seconds) video demonstrating how the kinetic energy of two large masses colliding can burn paper.  [View full activity in P6.2 How does the particle model explain the effects of heating? – 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-gpbdg022-p62-how-does-the-particle-model-explain-the-effects-of-heating?activity=291988#291988) |

# Outline Scheme of Work: P6 – Matter – models and explanations

## Total suggested teaching time – 22 / 11 hours

### P6.3 How does the particle model relate to materials under stress? (4 / 4 hours)

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| --- | --- |
| Links to KS3 Subject content  * forces as pushes or pulls, arising from the interaction between two objects * forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water * forces measured in Newtons, measurements of stretch or compression as force is changed * force-extension linear relation, Hooke’s law as a special case * work done and energy changes on deformation * opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface | |
| Links to Mathematical Skills  * M1c * M2b * M2f * M3b * M3c * M3d * M4f | Links to Practical Activity Groups (PAGs)  * PAG 2 – Investigating the effects of forces on springs |

# Overview of 6.3 How does the particle model relate to materials under stress?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr for separate and combined) | P6.3.1 explain, with examples, that to stretch, bend or compress an object, more than one force has to be applied  P6.3.2 describe **and use the particle model to explain** the difference between elastic and plastic deformation caused by stretching forces | **Engage:** Elastic and plastic deformation  A medium-length (<6 minutes) video which explains in more detail the elastic and plastic deformation of metals in terms of dislocations in atomic lattices, with examples.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292030#292030)  **Explore:** Aluminium: Property definitions  A page containing a simple interactive in which users add weights to an aluminium bar, observing elastic deformation, plastic deformation and failure.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292022#292022)  **Explain:** Investigating simple steel springs, home-made springs  A pair of similar experiments to investigate the properties of springs.  <https://spark.iop.org/investigating-simple-steel-springs>  <https://spark.iop.org/home-made-springs>  **Extend:** Explaining the deformation of metal solids  A more detailed explanation, at particle level of the deformation of metals.  <https://spark.iop.org/explaining-deformation-metal-solids>  **Evaluate:** Pupils write definitions of elastic and plastic deformation | Link to online delivery guide – [Matter, models and explanations](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/) |
| 2 (1hr for separate and combined) | P6.3.3 a) describe the relationship between force and extension for a spring and other simple systems  b) describe how to measure and observe the effect of forces on the extension of a spring  M2b, M2f  *PAG2*  P6.3.4 describe the difference between the force-extension relationship for linear systems and for non-linear systems  P6.3.5 recall and apply the relationship between force, extension and spring constant for systems where the force-extension relationship is linear  force exerted by a spring (N) = extension (m) × spring constant (N/m)  M1c, M3b, M3c  PAG2 Forces | **Engage:** Feynman: Rubber bands  Another short (<2 minutes) video from the ‘Fun To Imagine’ series, in which Feynman talks about the behaviour of rubber bands.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292028#292028)  **Explore:** Demo PAG activity  **Explain:** PAG 2: Investigating the effect of forces on springs  **Extend:** Masses and springs: Mass, springs, force  An interactive app which allows users to carry out virtual experiments similar to those above with ideal springs whose properties can be adjusted.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292026#292026)  **Evaluate:** Give pupils the Learner record sheet, from the reference materials section of the webpage. Pupils to tick of skills covered. | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [PAG 2 activity](https://www.ocr.org.uk/Images/311701-pag-activity-physics-forces-suggestion-1.docx):  Link to [Learner record sheet](https://www.ocr.org.uk/Images/295647-gcse-physics-learner-record-sheet.doc) |
| 3 (1hr for separate and combined) | P6.3.5 recall and apply the relationship between force, extension and spring constant for systems where the force-extension relationship is linear  force exerted by a spring (N) = extension (m) × spring constant (N/m)  M1c, M3b, M3c  P6.3.6 a) calculate the work done in stretching a spring or other simple system, by calculating the appropriate area on the force-extension graph  M4f  b) describe how to safely use apparatus to determine the work done in stretching a spring | **Engage:** Snare and cymbal in super slow motion  A short (1 minute) [video](https://www.youtube.com/watch?v=2VfFhexTRkU) showing the deformation of drums and cymbals in use.  **Explore:** Stress and strain: Tensile stress, tensile strain, elastic strain energy, breaking stress, plastic, brittle  A webpage featuring stress/strain graphs for a variety of materials.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292034#292034)  **Explain:** stretching copper wire practical  <https://spark.iop.org/stretching-copper-wire-measuring-extension-quantitative>  **Extend:** PHY NYA baseballs are actually very soft  A medium-length (6 minutes) video showing the impact of a baseball on a bat in extremely slow motion.  [View full activity in P6.3 How does the particle model relate to material under stress? – 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-gpbdg023-p63-how-does-the-particle-model-relate-to-material-under-stress?activity=292036#292036)  **Evaluate:** SAM question [J259-03](http://www.ocr.org.uk/Images/234635-unit-j259-03-breadth-in-physics-higher-tier-sample-assessment-material.pdf) Question 7 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [SAM](http://www.ocr.org.uk/Images/234635-unit-j259-03-breadth-in-physics-higher-tier-sample-assessment-material.pdf) |
| 4 (1hr for separate and combined) | P6.3.7 select and apply the relationship between energy stored, spring constant and extension for a linear system:  energy stored in a stretched spring (J) = ½ × spring constant (N/m) × (extension (m))2  M1c, M3b, M3c, M3d  P6.3.6 a) calculate the work done in stretching a spring or other simple system, by calculating the appropriate area on the force-extension graph  M4f  b) describe how to safely use apparatus to determine the work done in stretching a spring | **Engage:** the difference between elastic and plastic deformation  <https://www.youtube.com/watch?v=Oz8fW68RY6I>  **Explore:** Stretching rubber  Here is a selection of practical’s that can be used to explain Hooke’s law, and PM2.3i, PM2.3ii.  <https://spark.iop.org/stretching-rubber>  **Explain:** A good starting point for Hooke’s law and calculations of work done, spring constant. Includes a quiz at the end.  <https://www.bbc.co.uk/bitesize/guides/zttfyrd/revision/8>  **Extend:** 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.  **Evaluate:** SAM question [J259-01](http://www.ocr.org.uk/Images/234632-unit-j259-01-breadth-in-physics-foundation-tier-sample-assessment-material.pdf) Question 1 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [SAM](http://www.ocr.org.uk/Images/234632-unit-j259-01-breadth-in-physics-foundation-tier-sample-assessment-material.pdf) |

# Outline Scheme of Work: P6 – Matter – models and explanations

## Total suggested teaching time – 22 / 11 hours

### P6.4 How does the particle model relate to pressure in fluids? (5 / 0 hours)

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| --- | --- |
| Links to KS3 Subject content  * atmospheric pressure, decrease with increase of height as weight of air above decreases with height * pressure in liquids, increasing with depth; up thrust effects, floating and sinking * pressure measured by ratio of force over area – acting normal to any surface | |
| Links to Mathematical Skills  * M1c * M3b * M3c * M3d | Links to Practical Activity Groups (PAGs)  * N/A |

# Overview of 6.4 How does the particle model relate to pressure in fluids?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr separate only) | P6.4.1 recall that the pressure in fluids causes a force normal to any surface  P6.4.2 recall and apply the relationship between the force, the pressure, and the area in contact:  pressure (Pa) = force normal to a surface (N) ÷ area of that surface (m2)  M3a, M3c | **Engage:** The real story behind Archimedes’ Eureka!: Armand D’Angour  A short (<5 minutes) video in which the real origin of the Archimedes story is explained.  [View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292067#292067)  **Explore:** show images of different objects /animals and learners compare to say which would exert more pressure on the ground and why. E.g. an elephant or an elephant wearing high heels  **Explain:** Experiment with measuring the pressure exerted by pupils by measuring weight (N) and dividing by surface area of shoes.  **Extend:** Weighing a sample of air: A rough estimate  An experiment in which air is (approximately) weighed by comparing a container full of air and one which has been evacuated.  <https://spark.iop.org/weighing-sample-air-rough-estimate>  **Evaluate:** 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. | Link to online delivery guide – [Matter, models and explanations](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/) |
| 2 (1hr separate only) | P6.4.3 recall that gases can be compressed or expanded by pressure changes and that the pressure produces a net force at right angles to any surface  P6.4.4 use the particle model of matter to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure  P6.4.5 select and apply the equation:  pressure × volume = constant (for a given mass of gas at constant temperature)  M1c, M3b, M3c, M3d | **Engage:** Charles Law and absolute zero  A fairly long (16 minutes) video featuring a demonstration of an experiment in which absolute zero is estimated by measuring the change in volume of liquids at different temperatures.  [View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292071#292071)  **Explore:** Gas properties: Gas, pressure, volume  An interactive app which allows users to add gas to a container and manipulate various variables to observe the effect on pressure and temperature.  [View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292064#292064)  **Explain:** The physics hyper textbook  Useful mini practical’s that can be completed very simply to demonstrate what happens during changes in volume creating a temperature change.  [View full activity in 1.3 Pressure – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat001-p1-matter/delivery-guide-gpadg003-p13-pressure?activity=294619#294619)  **Extend:** Evacuating a bottle  A simple demonstration of the process of evacuating a container, using a vacuum pump.  <https://spark.iop.org/evacuating-bottle>  **Evaluate:** SAM question [J259-04](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) Question 7 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to [SAM](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) |
| 3 (1hr separate only) | P6.4.6 describe a simple model of the Earth’s atmosphere and of atmospheric pressure, and explain why atmospheric pressure varies with height above the surface | **Engage:** A short (<4 minutes) video in which water is boiled at various altitudes to observe the different temperatures at which vaporisation occurs with varying atmospheric pressure.  [View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292077#292077)  **Explore:** Atmospheric pressure problems  Questions 2 and 3 are on atmospheric pressure and the problems it can cause.  <https://www.bbc.co.uk/bitesize/guides/zt4trwx/revision/4>  **Explain:** The Goldilocks principle: A model of atmospheric gases  Learners use jelly beans and coloured cotton wool to produce a model of Earth’s atmosphere. This can be completed as a comparison between Earth and the other ‘sister’ planets in a hands on way.  **Extend**: How long could you survive in outer space?  A short (5 minutes[) video](https://www.youtube.com/watch?v=_Mr8f63Vinc) about the consequences of exposure to the vacuum of outer space on humans.  **Evaluate:** SAM question 7 [J259-04](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) | Link to online delivery guide – [Matter, models and explanations](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/) |
| 4 (1hr separate only) | **P6.4.7 explain why pressure in a liquid varies with depth and density**  **P6.4.8 select and apply the equation to calculate the differences in pressure at different depths in a liquid:**  **pressure = density × gravitational field strength × depth**  M1c, M3c | **Engage:** Buoyancy of sand demonstration: Archimedes principle  A short (3 minutes) video showing a vibrating container of sand behaving like a liquid.  [View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292073#292073)  **Explore:** mini practical ideas  <http://preproom.org/practicals/pr.aspx?prID=1032&favourite=0>  **Explain:** water pressure practical  <https://spark.iop.org/investigating-pressure-water-column>  **Extend:** Change of volume: Water to water vapour  An experiment in which the difference in volume/density between water in liquid and gas form is measured.  <https://spark.iop.org/change-volume-water-water-vapour>  **Evaluate:** 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. | Link to online delivery guide – [Matter, models and explanations](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/) |
| 5 (1hr separate only) | ***P6.4.9 explain how the increase in pressure with depth in a fluid leads to an upwards force on a partially submerged object***  ***P6.4.10 describe and explain the factors which influence whether a particular object will float or sink*** | **Engage:** Why does ice float in water?: George Zaidan and Charles Morton  A short (4 minutes) video featuring an explanation of the strange behaviour of water in its solid form.  [*View full activity in P6.4 How does the particle model relate to pressure in fluids? – 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-gpbdg024-p64-how-does-the-particle-model-relate-to-pressure-in-fluids?activity=292075#292075)  **Explore:** Collapsing Can  **Explain:** Up thrust, floatation and liquid pressure  Animation and a worksheet to follow based on what has been observed.  [View full activity in 1.3 Pressure – Online delivery guide](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-physics-a-j249-from-2016/delivery-guide/topic-gpat001-p1-matter/delivery-guide-gpadg003-p13-pressure?activity=294605#294605)  **Extend:** buoyancy <https://www.youtube.com/watch?v=nMlXU97E-uQ>  **Evaluate:** SAM question 18 [J249-03](http://www.ocr.org.uk/Images/234629-unit-j249-03-physics-higher-tier-paper-3-sample-assessment-material.pdf) | Link to online delivery guide – [Matter, models and explanations](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/) |

# Outline Scheme of Work: P6 – Matter – models and explanations

## Total suggested teaching time – 22 / 11 hours

### P6.5 How can scientific models help us understand the Big Bang? (6 / 0 hours)

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| Links to KS3 Subject content  * gravity force, weight = mass × gravitational field strength (g), on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) * our Sun as a star, other stars in our galaxy, other galaxies * the seasons and the Earth’s tilt, day length at different times of year, in different hemispheres * the light year as a unit of astronomical distance | |
| Links to Mathematical Skills  * N/A | Links to Practical Activity Groups (PAGs)  * N/A |

# Overview of 6.5 How can scientific models help us understand the Big Bang?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 (1hr separate only) | P6.5.1 recall the main features of our solar system, including the similarities and distinctions between the planets, their moons, and artificial satellites | **Engage**: TEP task 5  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Explore**: TEP task 3  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Explain**: TEP task 4  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Extend**: TEP task 6  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  Evaluate: SAMs question [J259-04](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) Question 5 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to Topic exploration pack – [Space and the Big Bang](http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc)  Link to [SAM](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) |
| 2 (1hr separate only) | **P6.5.2 explain, for the circular orbits, how the force of gravity can lead to changing velocity of a planet but unchanged speed**  **P6.5.3 explain how, for a stable orbit, the radius must change if this speed changes**  ***qualitative only*** | **Engage:** Introducing circular motion  <https://spark.iop.org/circular-motion>  <https://spark.iop.org/episode-224-describing-circular-motion>  **Explore:** TEP task 7  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Explain:** circular motion practical  <https://spark.iop.org/whirling-rubber-bung-string>  **Extend:** orbits of Satellites and Moons  <https://spark.iop.org/orbits-satellites-and-moons>  **Evaluate:** Get pupils to write in their own words how circular motion leads to a changing velocity but unchanged speed. | Link to online delivery guide – [Matter, models and explanations](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/)  Link to Topic exploration pack – [Space and the Big Bang](http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc) |
| 3 (1hr separate only) | P6.5.4 recall that the solar system was formed from dust and gas drawn together by gravity  **P6.5.5 use the particle model of matter to explain how doing work on a gas can increase its temperature (e.g. bicycle pump, in stars)**  P6.5.6 explain how the Sun was formed when collapsing cloud of dust and gas resulted in fusion reactions, leading to an equilibrium between gravitational collapse and expansion due to the fusion energy | **Engage**: The lifecycle of a star  <https://www.youtube.com/watch?v=PM9CQDlQI0A>  **Explore**: I am a star class activity  <https://www.stem.org.uk/elibrary/resource/33688>  **Explain:** TEP Task 2  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Extend:** Colour and temperature of stars experiment  <https://www.stem.org.uk/elibrary/resource/29945>  **Evaluate:** SAM question [J259-04](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) Question 7b | Link to online delivery guide – [Matter, models and explanations](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/)  Link to Topic exploration pack – [Space and the Big Bang](http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc)  Link to [SAM](http://www.ocr.org.uk/Images/234636-unit-j259-04-depth-in-physics-higher-tier-sample-assessment-material.pdf) |
| 4 (1hr separate only) | P6.5.7 explain the red-shift of light from galaxies which are receding  *qualitative only*  P6.5.8 explain that relationship between the distance of each galaxy and its speed is evidence of an expanding universe model | Engage: What is red-shift?  <https://www.youtube.com/watch?v=FhfnqboacV0>  **Explore:** Show an expanding universe with a balloon  <http://www.astro.ucla.edu/~wright/balloon0.html>  **Explain:** TEP Task 1  <http://www.ocr.org.uk/Images/301917-global-challenges-part-3-topic-exploration-pack.docx>  **Extend:** red and blue shift class activity  <https://www.stem.org.uk/user/login?destination=node/29947>  **Evaluate:** SAMs question [J259-02](http://www.ocr.org.uk/Images/234633-unit-j259-02-depth-in-physics-foundation-tier-sample-assessment-material.pdf) Question 3 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to Topic exploration pack – [Space and the Big Bang](http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc) |
| 5 (1hr separate only) | P6.5.9 explain how the evidence of an expanding universe leads to the ‘Big Bang’ model | **Engage:** Big band theory  <https://www.youtube.com/watch?v=DY03Xbcxis8>  **Explore:** Big Bang worksheet and PowerPoints  <https://www.stem.org.uk/elibrary/resource/26991>  **Explain:** TEP Activities  <http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc>  **Extend:** Big Bang to Lunch worksheet  <https://www.stem.org.uk/user/login?destination=node/26991>  **Evaluate:** SAMs question [J259-03](http://www.ocr.org.uk/Images/234635-unit-j259-03-breadth-in-physics-higher-tier-sample-assessment-material.pdf) Question 8 | Link to online delivery guide – [Matter, models and explanations](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/)  Link to Topic exploration pack – [Space and the Big Bang](http://www.ocr.org.uk/Images/309129-space-and-the-big-bang-topic-exploration-pack.doc) |
| 6 |  | Pupils to complete the [End of chapter quiz P6](https://interchange.ocr.org.uk/Downloads/Twenty-First-Century-Physics-Quizzes.zip). After completion pupils to swap and mark quizzes.  Pupils use their quizzes to create a revision list from Chapter 6 | [End of chapter quiz P6](https://interchange.ocr.org.uk/Downloads/Twenty-First-Century-Physics-Quizzes.zip) is available on OCR interchange, a login will be required |

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