Suggested teaching program

Chapter 5: Global systems

Time allocation: 5 weeks

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| Context and overview |
| In year 10, students investigate global systems, including the carbon cycle. They determine that these cycles rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere. |
| Syllabus outcomes addressed |
| • Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189)  • Scientific understanding, including models and theories, is contestable and are refined over time through a process of review by the scientific community ACSHE157  • Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries ACSHE158  • People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions, and advances in science can affect people’s lives, including generating new career opportunities ACSHE160  • The values and needs of contemporary society can influence the focus of scientific research ACSHE228  • Formulate questions or hypotheses that can be investigated scientifically ACSIS164  • Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods ACSIS165  • Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data ACSIS166  • Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies ACSIS169  • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence ACSIS170  • Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data ACSIS171  • Critically analyse the validity of information in secondary sources and evaluate the approaches used to solve problems ACSIS172  • Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations ACSIS174 |

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| Achievement standards |
| Students describe and analyse interactions and cycles within and between Earth’s spheres. They investigate how human activity affects global systems and model a cycle, such as the water, carbon, nitrogen or phosphorus cycle within the biosphere. They explain the causes and effects of the greenhouse effect and investigate the effect of climate change on sea levels and biodiversity. Students consider the long-term effects of loss of biodiversity and investigate currently occurring changes to permafrost and sea ice and the impacts of these changes. They examine the factors that drive the deep ocean currents, their role in regulating global climate, and their effects on marine life.  Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others’ methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences. |

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| Student book section | AC Syllabus links | Suggested indicators of learning and understanding | Suggested teaching and learning activities | Resources |
| 5.1 The Earth’s Spheres are Balanced  (pages 112–115) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE195  ACSHE230  Science Inquiry Skills  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • identify the differences between the lithosphere, atmosphere, hydrosphere and biosphere  • explain how each sphere interacts with each other. | What if?  Students hypothesise as to the effect of sea level rise on residential and farming areas. They determine the impact that such a rise in sea level will have on our current way of life.  Challenge 5.1  Using computer simulations:  Students use second-hand data to create a graph which depicts the temperature of the Earth’s mantle at different depths. They demonstrate their ability to graph using Excel. | Oxford Science 10 resources  • What if? Page 111  • Check your learning, page 115  • Challenge 5.1, page 210 |
| 5.2 Matter cycles through the Earth’s spheres  (pages 116–119) | Science Understanding  ACSSU189  Science Inquiry Skills  ACSIS198  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • explain how matter moves through the following cycles:  –oxygen  –nitrogen  –phosphorous  • explain the key participants in the three cycles and how they are able to cycle the matter. | Experiment 5.2  Testing phosphorous:  Students determine if phosphorus is present in a variety of detergents. They use this knowledge to discuss the impact of increased phosphorous in waterways and thus the phosphorous cycle. | Oxford Science 10 resources  • Check your learning, page 119  • Experiment 5.2, page 211  Additional resources  NASA | Why is the Ozone Hole Getting Smaller?  <https://www.youtube.com/watch?v=lBu3vltczRw> |
| 5.3 The water cycle is a global cycle  (pages 120–123) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • explain the three states of matter and how they are formed  • explain how water cycles through these three states of matter based on the temperature of the globe  • explain how various weather patterns are created by the cycling of air around the globe based on global temperatures  • describe the Coriolis effect  • read weather maps to determine weather patterns. | Experiment 5.3  Make your own clouds:  Students simulate the process of condensation to explain how water cycles through the atmosphere in various states of matter.  Challenge 5.3  Making a simple barometer:  Students create a simple barometer which is capable of measuring air pressure and use the particle model of matter to explain how a barometer works.  How Is Your Hydrosphere Activity – Coolaustralia.org  Students examine the global systems (interactions involving the biosphere, lithosphere, hydrosphere and atmosphere) to see how changes to the global systems can potentially impact on the hydrosphere or water cycle. | Oxford Science 10 resources  • Check your learning, page 123  • Experiment 5.3, page 211  • Challenge 5.3, page 212  Additional resources  How Is Your Hydrosphere Activity – Coolaustralia.org  <http://www.coolaustralia.org/activity/how-is-your-hydrosphere-910/> |
| 5.4 Human activity affects the carbon cycle  (pages 124–125) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • explain how matter moves through the carbon cycle  • explain the key participants in the carbon cycle and how they are able to cycle carbon  • apply the carbon cycle to explain a carbon sink  • identify and describe the impact that humans have on the carbon cycle. | Challenge 5.4  Modelling a carbon sink:  Students model a carbon sink by placing dry ice over a beaker of water containing phenolphthalein. They observe what happens to the indicator as the carbon dioxide reacts with the water. They use their conclusions to explain the effect that an increased carbon dioxide concentration in the atmosphere has on ocean acidification.  Ocean Acidification Activity – Coolaustralia.org  In this activity students either work independently or in groups to research the role that oceans have to play in the carbon cycle, and how our oceans might be affected by climate change. | Oxford Science 10 resources  • Check your learning, page 125  • Challenge 5.4, page 212  Additional resources  Ocean Acidification Activity – Coolaustralia.org  <http://www.coolaustralia.org/activity/earth-hour-ocean-acidification-year-10/> |
| 5.5 Evidence supports enhanced global warming  (pages 126–129) | Science Understanding  ACSSU189  Science Inquiry Skills  ACSIS198  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • explain the trend in increased temperature over time  • define the greenhouse effect and the gases that cause it  • explain why greenhouse gas concentrations in the atmosphere are rising  • explain the various impacts of an increase in the concentration of greenhouse gases. | Experiment 5.5A  What factors affect a greenhouse?  Students determine which surfaces of  the Earth absorb energy and radiate it as heat and so are likely to contribute most to the warming of the atmosphere.  Experiment 5.5B  Melting ice and its effect on sea levels:  Students observe the effect of a melting sea and sheet ice on global sea levels. | Oxford Science 10 resources  • Check your learning, page 129  • Experiment 5.5A, page 213  • Experiment 5.5B, page 214  Additional resources  NASA | A Year in the Life of Earth's CO2  <https://www.youtube.com/watch?v=x1SgmFa0r04>  A visual tour of the world's CO2 emissions  <https://www.youtube.com/watch?v=fJ0o2E4d8Ts>  Time-lapse history of global CO2 emissions by humans 1751-2008  <https://www.youtube.com/watch?v=SAhZ1fA1AJs>  NASA Sees Temperatures Rise and Sea Ice Shrink - Climate Trends 2016  <https://www.youtube.com/watch?v=JK7NV2YheGk&list=PL56E41EA9A09368F2&index=19> |
| 5.6 Enhanced global warming has widespread effects  (pages 130–133) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • describe the effects that small increases in global temperatures have on  –extreme weather events  –health and disease  –loss of biodiversity  –deep ocean currents and climate control. | Challenge 5.6  Salt water density  Students investigate the density of different concentrations of salty water (sea water).They relate their knowledge of density to the movement of water in global ocean currents. | Oxford Science 10 resources  • Check your learning, page 133  • Challenge 5.6, page 214  Additional resources  National Geographic Before The Flood – Leonardo Dicaprio Documentary  <http://channel.nationalgeographic.com/before-the-flood/videos/watch-before-the-flood-for-free-everywhere/>  YouTube Video  Extreme Weather and Climate Change: A Closer Look  <https://www.youtube.com/watch?v=i30pZSVuyv8> |
| 5.7 Humans can reduce global warming  (pages 135–135) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • recognise the importance of the Kyoto Protocol and explain why it was implemented  • explain the various political and governmental policies which have been put in place to encourage large companies to reduce their greenhouse emissions  • explain how greenhouse emissions can be reduced by humans. | Activity:  The Cool Australia website has fantastic activities based around the Earth Sciences. The link to the right is their Earth Hour activity. All activities within the website contain curriculum maps, introductions, worksheets with answers and ideas for future lessons. They also contain assignments and other assessment tasks.  A **Global Warming debate** is a great way to develop students’ persuasive writing skills in Science while developing their scientific literacy. | Oxford Science 10 resources  • Extend your understanding, page 135  Additional resources  How Carbon Credits Work In Less Than 2 Minutes - Qiewie  <https://www.youtube.com/watch?v=mZOaRdb0jNo>  How does the emission trading scheme work?  <https://www.youtube.com/watch?v=ReOj12UAus4>  Cool Australia Resources:  <http://www.coolaustralia.org/activity/earth-hour-a-history-of-climate-change-year-10/> |
| 5 Review  (pages 136–137) | Science Understanding  ACSSU189  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS204  ACSIS208 | By the end of this unit, students should be able to:  • define all Key words listed on page 138  • identify and explain processes in the earth’s spheres  • explain earths cycles and Identify the key participants involved with them:  –carbon  –oxygen  –nitrogen  –phosphorous  –water  • identify and explain the human impacts on the carbon cycle  • define global warming, the factors which contribute to it, its effects and the methods that humans can employ to reduce these effects  • identify areas of personal strengths and weaknesses in their knowledge and understanding of the topic. | Revision activities  • Students could play ‘celebrity heads’ with the Key words list  • Students can make dominoes with Key words on one end and definitions/diagrams/examples on the other end  • Students can create mind maps, Venn diagrams or other graphic organisers to summarise the key concepts of this chapter  • Peer teaching: students can work in groups to reteach the content of the unit to the class for the purpose of revision. Each group could be allocated a double-page to summarise. | Oxford Science 10 resources  • Review questions, pages 136–137  • Research topics, page 137  • Key words list, page 138 |