Suggested teaching program

Chapter 3: The periodic table

Time allocation: 4 weeks

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| Context and overview |
| In year 10, students investigate the atomic structure and properties of elements and explain how they are used to organise elements in the periodic table |
| Syllabus outcomes addressed |
| • The atomic structure and properties of elements are used to organise them in the Periodic Table ACSSU186  • 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 recognising that elements in the same group of the periodic table have similar properties. They describing the structure of atoms in terms of electron shells. They explain how the electronic structure of an atom determines its position in the periodic table and its properties and they investigate the chemical activity of metals.  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 |
| 3.1 Scientists refine  theories and models  over time  (pages 66–69) | Science Understanding  ACSSU186  Science as a Human Endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS198  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS208 | By the end of this unit, students should be able to:  • track the development of atomic theory over time  • name the main developers which contributed to the periodic table and state what their major discoveries were. | What if?  Students investigate the electrical conductivity of water and hypothesise as to the possible effects of adding salt to water or just passing electricity through solid salt.  The historical development of the periodic table  Place pictures of the scientists, the year and the discovery on cards and ask students in groups to organise the cards according to the discovery.  A good prior knowledge activity is to get them or organise the events from the oldest to most recent and then check against other groups, creating a discussion of which would be first and why. | Oxford Science 10 resources  • What if? Page 65  • Extend your understanding, page 69 |
| Additional resources  The Royal Society of Chemistry:  <http://www.rsc.org/periodic-table/history/about> |
| 3.2 The structure of an atom  determines its properties  (pages 70–73) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS208 | By the end of this unit, students should be able to:  • understand the difference between periods and groups  • describe the importance of atomic number in determining the number of electrons  • determine the electron configuration of atoms on the periodic table using the 2n2 rule and the trend in periods and groups  • describe the relationship between valence electrons and element properties  • describe what happens to electrons when excited, and the consequential emission of light. | Atomic structure  Students can build an atom from scratch, using protons, neutrons, and electrons. They can test different combinations to produce ions and unstable elements. They can also explore electron configuration of elements up to neon.  PhET Build and Atom: <https://phet.colorado.edu/en/simulation/build-an-atom>  Electron configuration in the periodic table  A great learning task is to get students to draw the electron configuration of the first 20 elements in a blank periodic table. This will allow them to come to their own understanding that the group number is the number of electron shells and the period number is the number of valence electrons. | Oxford Science 10 resources  • Check your learning, page 73 |
| 3.3 Groups in the periodic  table have properties  in common  (pages 74–75) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS199  ACSIS200  ACSIS204  ACSIS208 | By the end of this unit, students should be able to:  • identify the common properties of metals in general  • identify the properties of group 1, 2 and transition metals  • relate the properties of Group 1 and 2 metals to their electron configurations. | Experiment 3.3  The reactivity of metals:  Students compare the reactivity of various metals by observing their reaction with hydrochloric acid.  The Elements app  If you are unable to demonstrate the reactions of group 1 and 2 metals, a great way of allowing students to see their properties is to view them in the ‘The Elements in Action’ app. It costs to purchase the app but it is highly worth it if it can be purchased through the school, as kids love it. | Oxford Science 10 resources  • Check your learning, page 75  • Experiment 3.3, page 195 |
| Additional resources  Brainiac: Reactivity of alkali metals  <https://www.youtube.com/watch?v=m55kgyApYrY> |
| 3.4 Non-metals have properties in common  (pages 76–77) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS208 | By the end of this unit, students should be able to:  • recognise and identify non-metals and metalloids on the periodic table  • identify and explain the properties of the non-metallic groups, halogens and noble gases. | Challenge 3.4  Identifying patterns in the periodic table:  Students summarise the periodic table, labelling key information and highlighting important groups and information. | Oxford Science 10 resources  • Check your learning, page 77  • Challenge 3.4, page 196 |
| Additional resources  Crash Course Chemistry: The Periodic Table (A good, if somewhat fast, summary of the metallic and non-metallic groups as well as the history of Mendeleev’s periodic table)  <https://www.youtube.com/watch?v=0RRVV4Diomg> |
| 3.5 Metal cations and  non-metal anions combine  to form ionic compounds  (pages 78–79) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS199  ACSIS200  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • define what an ionic compound is  • explain ionic compounds using the terminology ‘anion’ and ‘cation’  • state and explain the charge on an ion  • identify and explain the properties of ionic compounds  • define and identify polyatomic ions  • draw the electron transfer between atoms and the resultant ions  • determine the chemical formulae of ionic compounds. | Experiment 3.5  Conductivity of ionic compounds:  Students investigate the electrical conductivity of two ionic compounds as a solid and in aqueous solution.  Skills Lab 3.5  Ionic compounds:  Students apply their understanding of the charges on ions to develop chemical formulas for ionic compounds.  Ionic compounds  Once students have completed the Skills Lab 3.5, as an extension, give them a valency table (there are many on the internet) and get them to create a test which they can give to other students. The test should focus on two sets of questions: 1. How to name ionic compounds from formulae; and 2. How to develop the formulae of ionic compounds from names. | Oxford Science 10 resources  • Check your learning, page 79  • Experiment 3.5, page 197  • Skills lab 3.5, page 198 |
| 3.6 Non-metals combine to  form covalent compounds  (pages 80–81) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS199  ACSIS208 | By the end of this unit, students should be able to:  • define what a covalent compound is and how it is formed  • describe the bond between covalent compounds as a sharing of electrons between nuclei  • explain what a diatomic molecule is  • draw covalent molecules, showing the sharing of electrons to complete their valence shell  • explain the properties of covalent compounds. | Challenge 3.6  Modelling covalent compounds:  Students model the sharing of electrons in covalent molecules.  Covalent Compounds  Students can investigate and draw electron dot diagrams. They can also make a test to draw and name covalent compounds which they can give to their peers to complete | Oxford Science 10 resources  • Check your learning, page 81  • Challenge 3.6, page 199 |
| 3.7 Metals form unique bonds  (pages 82–83) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS199  ACSIS208 | By the end of this unit, students should be able to:  • define what a metallic bond is  • describe the structure of metallic bonding as a grid of cations in a sea of delocalised electrons  • explain the properties of metallic compounds  • compare metallic compounds to alloy and contrast the differences between them. | Challenge 3.7  Modelling alloys:  Students compare the properties of model alloys.  Alloys  Get students to research the metals which they cannot find on the periodic table to determine which metals these are made up of. For example, cast iron, amalgam, gunmetal, pewter, solder, sterling silver, white gold, or rose gold. | Oxford Science 10 resources  • Check your learning, page 83  • Challenge 3.7, page199 |

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| 3.8 Nanotechnology involves  the specific arrangement  of atoms  (pages 84–85) | Science Understanding  ACSSU186  Science as a Human Endeavour  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS208 | By the end of this unit, students should be able to:  • define what nanotechnology is and the scale which it operates on  • convert between length measurements of nanometres to more common units, cm or m  • describe the uses of nanotechnology in society  • provide examples of the uses of nanotechnology in society  • explain how carbon nanotubes are made and hypothesise as to their potential for use in the future. | Nanotechnology  Students can research the latest discoveries on nanotechnology, pick one that they are interested in and summarise it. As there are so many fields that nanotechnology is currently making advances in, every students should find something that interests them. | Oxford Science 10 resources  • Extend your understanding, page 85 |
| Additional resources  The most popular Nanowerk Spotlight articles for each year  <http://www.nanowerk.com/topten.php>  Nanotechnology News on Science Daily  <https://www.sciencedaily.com/news/matter_energy/nanotechnology/>  Nanotechnology News on The Scientist  <http://www.the-scientist.com/?articles.list/tagNo/342/tags/nanotechnology/> |
| 3 Review  (pages 86–88) | Science Understanding  ACSSU186  Science Inquiry Skills  ACSIS208 | By the end of this unit, students should be able to:  • define all Key words listed on page 88  • outline the history of the periodic table  • explain the properties of elements on the periodic table and relate this to their structure  • explain how metals and non-metals interact and bond to form molecules and compounds  • define nanotechnology and explain how this benefits society  • 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 86–87  • Research topics, page 87  • Key words list, page 88 |