teachers guide

Structure and bonding 3: Chemical bonds

Components

	NAME	DESCRIPTION	AUDIENCE
	Chemical bonds teachers guide	This shows how the resource may be used and explains the use of the various learning materials.	teachers
	Chemical bonds learning object	The learning object contains animations and diagrams to illustrate four types of bonding: ionic, covalent, covalent network and metallic.	students
	Chemical bonds worksheet	Students answer questions as they work through the learning object.	students
	Concept map: chemical bonds worksheet	Students build a concept map to represent their knowledge of chemical bonds.	students

Purpose

To **Explain** bond formation and characteristics graphically.

Outcomes

Students will be able to:

- describe and explain the formation and characteristics of ionic bonds and ionic substances, metallic bonds and metallic substances, covalent bonds and covalent network and molecular substances; and
- describe and explain the relationships between the properties and structures of ionic, metallic, covalent network and covalent molecular substances.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
View the learning object *Chemical bonds*.	individual, small group or whole group
Complete the worksheet and/or concept map. A sample completed concept map is included at the end of this guide.	individual or small groups

Technical requirements

The teachers guide and worksheets require Adobe Reader (version 5 or later), which is a free download from www.adobe.com. The worksheets are also provided in Microsoft Word format.

The concept map template is best printed on A3 paper.

The learning object requires Adobe Flash Player version 8 or later on the client machine (this is a free download from www.adobe.com).

Teacher notes

Students view the learning object and complete the worksheet, *Chemical bonds*. As an alternative to the worksheet questions, students may summarise information from the learning object, in a concept map. To guide them when making their concept maps, provide an outline of a map and instructions for its completion.

The representation of ionic bonding in the learning object shows the diameter of atoms changing as they become ions. The diameter of a sodium atom is 186 pm and that of the sodium ion 116 pm. This can be explained to students in terms of the greater 'pulling power' of protons on a reduced number of electrons and in terms of the outer shell now being empty.

The diameter of a chlorine atom is 100 pm and that of a chloride ion 167 pm. This can be explained in terms of the reduced 'pulling power' of protons on an increased number of electrons.

Carborundum (SiC) is typically man-made. It does occur naturally as the mineral moissanite, but is extremely rare. It is more common in space where it is found as stardust around carbon-rich stars.

Corundum (Al_2O_3) is often cited as a covalent network substance. Research[1] suggests that the Al-O bonds have a strong ionic component. It is intermediate in character between ionic and covalent network structure.

The learning object is intended to build on students' knowledge of electron configuration and valence electrons. Electron dot diagrams may also be introduced here, perhaps using the interactive periodic table as an aid.

Acknowledgements

Designed and developed by the Centre for Learning Technology, The University of Western Australia. Project team: Shaun Barton, Alwyn Evans, Bob Fitzpatrick, Sally Harban, Trevor Hutchison, Michael Wheatley and Yvonne Woolley with thanks to Fred Deshon, Roger Dickinson, Jenny Gull and Wendy Sanderson.

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Reference

1) Sousa, C. and Illas, F. (1993). Can corundum be described as an ionic oxide? *Journal of Chemical Physics, 99* (9), 6818–6823.

Associated SPICE resources

Structure and bonding 3: Exploring conductivity may be used in conjunction with related SPICE resources to address the broader topic of structure and bonding.

DESCRIPTION	LEARNING PURPOSE
Structure and bonding This learning pathway shows how a number of SPICE resources can be combined to teach the topic of structure and bonding.	
Structure and bonding 1: Molecular structures A short video and worksheet that introduce the concept of structure and bonding by looking at how silica capsules may be used in drug delivery.	**Engage**
Structure and bonding 2: Exploring conductivity Students perform experiments to examine the conductivity of a range of materials, and sort them into groups.	**Explore**
Structure and bonding 3: Chemical bonds Students learn about types of bonding by working through a learning object and worksheet.	**Explain**
Structure and bonding 4: Molecules by design Students learn about different applications of bonding through a series of fact sheets on current research at The University of Western Australia.	**Elaborate**