

**teachers guide**

**Structure and bonding 1:**

**Molecular structures**

# Components

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|  | NAME | DESCRIPTION | AUDIENCE |
|  | *Molecular structures*  teachers guide | This shows how the resource may be used to engage students’ interest in structure and bonding by examining the use of mesoporous silica capsules in drug delivery. | teachers |
|  | *Building with molecules*  video | Concepts of structure and bonding are introduced through current research at The University of Western Australia into how mesoporous silica capsules could be used for drug delivery. | students |
|  | *Building with molecules*  worksheet | This student worksheet is for use with the video *Building with molecules*. | students |

Purpose

To **Engage** students’ interest in structure and bonding by examining silica capsules, and their potential use in drug delivery.

# Activity summary

Outcomes

Students will be able to:

* describe the bonding capacity of silicon,
* link properties of a material to its structure and uses, and
* describe how scientists can apply their knowledge to solve real world problems.

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| ACTIVITY | POSSIBLE STRATEGY |
| Show the video *Building with molecules*. Use the questions below to raise issues relating to structure and bonding. | small groups |

# Technical requirements

The teachers guide requires Adobe Reader (version 5 or later), which is a free download from [www.](http://www/) adobe.com.

The videoclip *Building with molecules* is provided in two formats: on a standard DVD-video disk and as a QuickTime movie. QuickTime version 7 or later is required to view the movie. This is a free download from [www.apple.com/quicktime.](http://www.apple.com/quicktime)

# Using the video

Play the videoclip *Building with molecules.* Discuss it with students to draw out the idea that scientists

can manipulate elements and compounds to produce materials with specific properties.

Student discussion following the videoclip can be teacher-led as a whole group discussion, or in small groups using strategies such as Think, Pair, Share.

Suitable discussion questions are outlined on the *Building with molecules* worksheet, or students could be asked to write three of their own questions during or after the videoclip. Students should aim to write one question of each of the types listed below:

* a question with the answer in the video (‘In what form does the element silicon usually occur?’);
* a question with the answer not directly from the video (‘Why is research being carried out using curcumin in the mesoporous silica capsules?’); and
* a question without a correct answer (‘How might mesoporous silica capsules be used in the future?’).



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Students should share their questions with the class and thereby raise issues, relating to the video, from their perspective. These discussions provide a springboard into the **Explore** activity relating properties to the bonding of materials.

# Associated SPICE resources

*Structure and bonding 1: Molecular structures* may be used in conjunction with related SPICE resources to address the broader topic of structure and bonding.

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| 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 introduces 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 various 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** |

Credits for video, *Building with molecules*

* ‘Earth from space’ by NASA/Lewis Research Center, PD-USGOV-NASA, grcimagenet.grc.nasa.gov/GRCDig italImages/1990/1990\_07066L.jpg
* ‘Earth image from NASA’s Terra satellite’ by NASA/ GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team. PD-USGOV-NASA, photojournal.jpl. nasa.gov/catalog/PIA03898
* ‘Perspective with Landsat overlay’ by NASA/JPL. PD- USGOV-NASA, photojournal.jpl.nasa.gov/catalog/ PIA02775
* ‘Silicon wafer with a mirror finish’ by NASA, PD- USGOV-NASA.
* ‘*Navicula bullata*’ by Ernst Haeckel. PD, commons. wikimedia.org/wiki/File:Navicula\_bullata\_-\_Haeckel. jpg
* ‘Amethyst’ by Todd Petit. CC-BY-2.0, [www.flickr.com/](http://www.flickr.com/) photos/starmist1/220701529/
* ‘Opal’ by JJ Harrison. CC-BY-SA-2.5, commons. wikimedia.org/wiki/File:Opal\_from\_Yowah,\_ Queensland,\_Australia.jpg
* ‘Carbon-silicon carbide fiber panel’ by NASA Glenn Research Center. PD-USGOV-NASA, nix.ksc.nasa.gov/ info?id= C-2004-01562&orgid=2
* ‘Silicon carbide chunk’ by Steve Karg. CC-BY-2.5, en.wikipedia.org/wiki/File:Silicon\_carbide\_chunk.jpg
* ‘Silicone toy’ by pinki. CC-BY-2.5, [www.flickr.com/](http://www.flickr.com/) photos/55638925@SiN00/375409352/
* Silicon city 2’ by Maciej (Mat) Radoszewski. CC-BY-NC-2.5, [www.flickr.com/photos/](http://www.flickr.com/photos/) fantomdesigns/2299894322/
* stock images of of pills: morgueFile
* ‘Pills’ by Darren Hester. Used by permission. [www.](http://www/) flickr.com/photos/ppdigital/2054205021/
* ‘Just Got Feet, Don’t Got Shoes’, written and performed by Derek R Audette, © 2004 (Socan). CC, derekaudette.ottawaarts.com
* additional photos by Paul Ricketts, Nigel Clifford and Dr Iyer Swaminathan.

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