Only a few crystals occur naturally in the shape of regular solids. Regular solids are called **Platonic solids**. They are made from regular polygons – all their faces are identical. **All their vertices are identical too.**

Crystals occur naturally in four of these shapes.

R.Weller/Cochise College

Halite

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Tetrahedrite

Uncut industrial grade diamond. Shieldforyoureyes Dave Fischer.31 August 2008. Source, Wikimedia Commons

Diamond

R.Weller/Cochise College

Pyrite

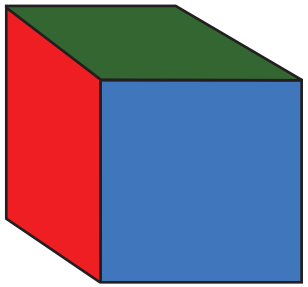
Build the five Platonic solids.
Explain why there are only five.

working with chemicals

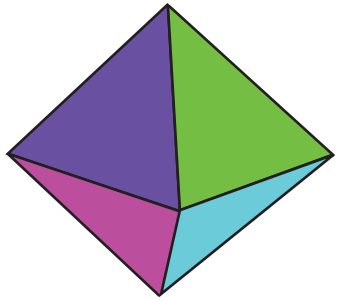
Choose a shape – the rest of your group has to identify it just from your yes/no answers to their questions.

create maths

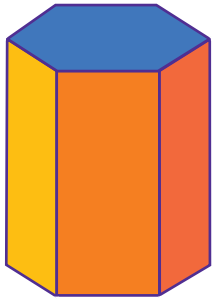
working with chemicals



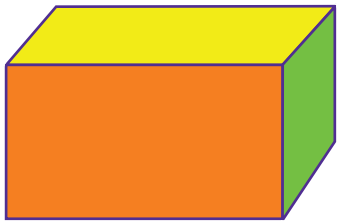
cube



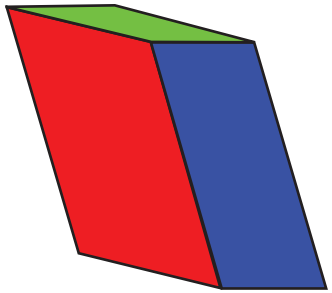
octahedron



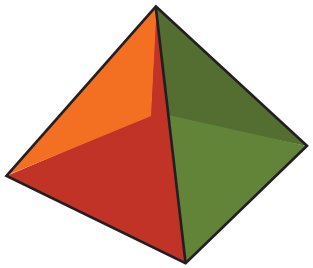
hexagonal prism



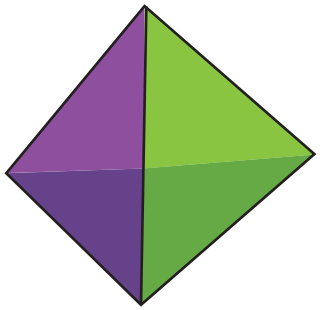
cuboid



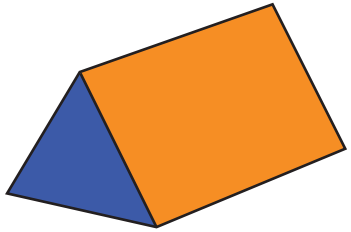
parallelepiped



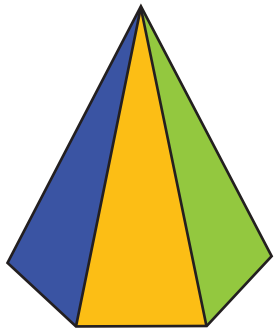
square-based pyramid



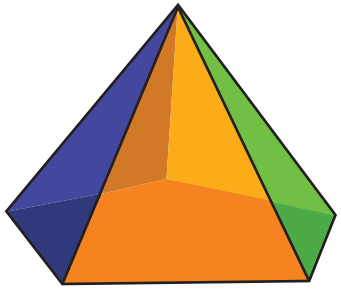
tetrahedron



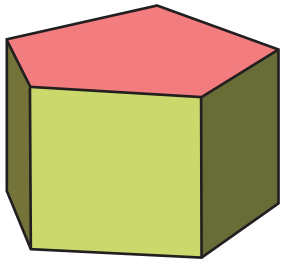
triangular prism



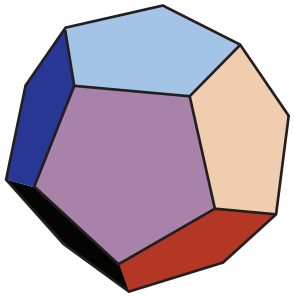
hexagon-based pyramid



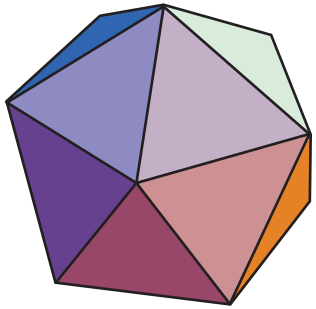
pentagonal pyramid



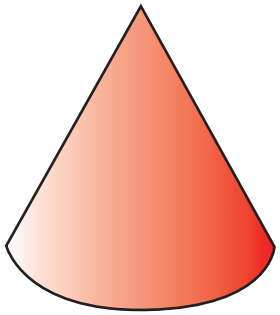
pentagonal prism



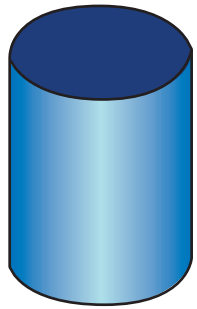
dodecahedron



icosahedron

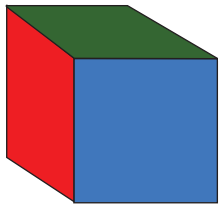
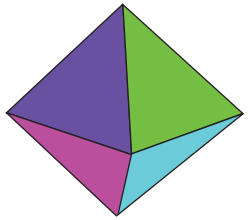
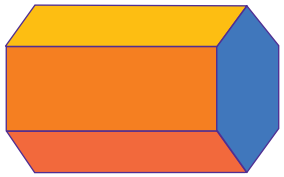
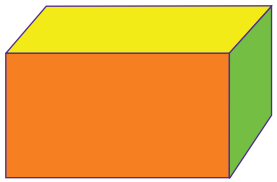
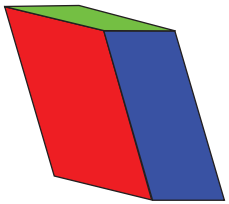
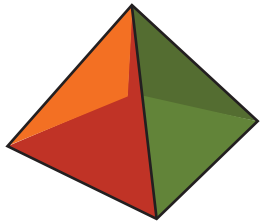
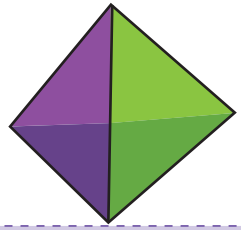
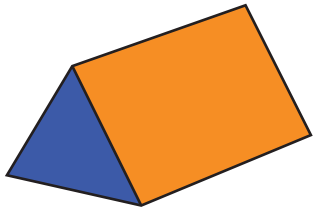
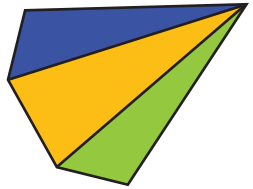
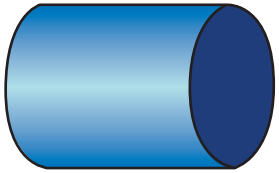


cone



cylinder

Match the solids with their names and properties.

triangular prism	hexagon-based pyramid	hexagonal prism	cylinder	parallelepiped
tetrahedron	cuboid	octahedron	square-based pyramid	cube
				
				
I have no vertices.	All my faces are identical.	Only two different types of face are needed to make me.	I must have at least one regular face.	All my faces are triangles.
I have just 3 pairs of parallel faces.	I have exactly 6 edges.	All my faces are rectangular.	The sum of my edges and faces is 19.	I can have 4 pairs of parallel faces.

working with chemicals

Teacher notes

Working with chemicals : Crystal shapes 2

Description

This topic takes a further look at the mathematical structure of some naturally occurring crystals and some related mathematical solids.

Resources

Polydron™ or Clixi™ triangles, squares, pentagons. (Polydron™ have sets of polygons with sufficient triangles, squares and pentagons to make the full set of 5 platonic solids.)

Activity 1: Platonic solids

Activity 2: The yes/no game

Activity 3: Matching shapes, names and properties

In Platonic solids pupils work in groups of 3 or 4 to build the Platonic solids using a construction tool like Polydron™. Encourage them to explain why there are only 5 Platonic solids. Providing hexagons and octagons may help them think about this.

A set of 15 crystal shape cards are provided on The yes/no game. Introduce the game by choosing a shape yourself from the card and asking the pupils to guess your shape. They are allowed to ask questions to which you can answer 'yes' or 'no'. Use this teacher led activity to draw attention to the need for carefully phrased questions. For example, the answer to the question "Does your shape have 6 faces?" is yes for an hexagonal prism but no for "Does your shape *only* have 6 faces?". Pupils then go on to play the game in groups of 2 to 4. One person chooses a shape. The rest have to identify the shape by asking yes/no questions."

An alternative game is to cut out the crystal shape cards and begin with the teacher directing pupils to place the shapes, one by one, on one of two piles. The pupils have to decide which rule is being used to choose the pile. Having played this a few times as a teacher led activity pupils can play the game in small groups taking turns to be the rule chooser.

R.Weller/Cochise College

Halite

R.Weller/Cochise College

Tetrahedrite

Uncut industrial-grade diamond. Shieldforyoureyes Dave Fischer 31 August 2008. Source, Wikimedia Commons.

Diamond

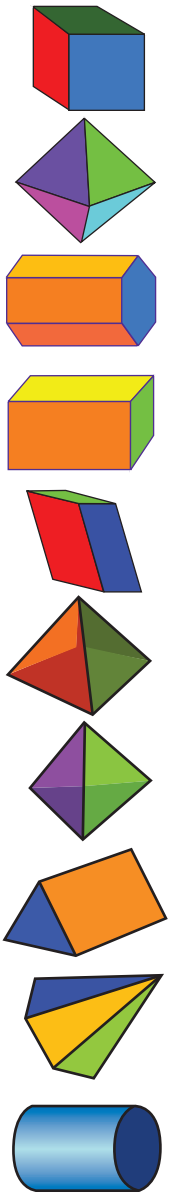
R.Weller/Cochise College

Pyrite

In the challenging third activity pupils work in small groups to match solids with their names and properties. Give each group a set of the 30 cards comprising 10 pictures of 3-dimensional shapes, 10 name cards, and 10 property cards provided on the Matching solids, names and properties cut out sheet.

Working with chemicals : Crystal shapes 2

The matches, together with some other properties of each shape, are shown here:



	Differentiating statements	Vertices	Edges	Faces	Curved faces	Pairs of parallel faces	Number of different shaped faces
Cube	All my faces are identical.	8	12	6	0	3	1
Octahedron	All my faces are triangles.	6	12	8	0	4	1
Hexagonal prism	I can have 4 pairs of parallel faces.	12	18	8	0	4	2
Cuboid	All my faces are rectangular.	8	12	6	0	3	3
Parallelepiped	I have just 3 pairs of parallel faces.	8	12	6	0	3	3
Square-based pyramid	I must have at least one regular face.	5	8	5	0	0	2
Tetrahedron	I must have at least one regular face.	4	6	4	0	0	1
Triangular prism	Only 2 different types of face are needed to make me.	6	9	5	0	1	2
Hexagonal -based pyramid	The sum of my edges and faces is 19.	7	12	7	0	0	2
Cylinder	I have no vertices.	0	2	3	1	1	2

The Mathematics

This set of activities gives pupils experience in building and considering the properties of 3-dimensional shapes. They also learn about a special group of polyhedra, the Platonic solids.