



**Paper Imagination
Teacher Information Sheet**

This activity can be run with KS3 students and involves constructing several of the platonic solids using paper folding and gives the opportunity to investigate their mathematical properties.

Students should have pencil, ruler, scissors and protractor.

Also requires: envelopes (old used ones will do), A4 paper (a variety of bright colours is best), square pieces of paper (gummed squares are fine) and adhesive tape.

Suggested timings:

- 5+ minutes **Discussion of solid shapes on first slide** – what do students already know?
Introduction of platonic solids – these 5 shapes belong to a special family because they are the only ones which satisfy the rules on the second slide.
- 10+ minutes **Students make a regular tetrahedron from an old envelope.**
See instructions on slides.
N.B. If an isosceles triangle is drawn rather than an equilateral triangle, then a tetrahedron will result but it won't be regular. A possible activity is to get students to investigate what kind of triangle they need to draw in order to make a regular tetrahedron.
Properties can be discussed such as planes of symmetry and the two types of rotational symmetry of the tetrahedron. We found that it works well to make a large tetrahedron from an A4 envelope and put a knitting needle along each axis of symmetry so that the students can physically rotate the shape.
- 20+ minutes **Students make an icosahedron** each making a truncated tetrahedron from a sheet of A4 paper as shown on slides. 20 of these can then be taped together to form an icosahedron. (It is best to tape them together after the lesson, as this takes around 10 minutes.) It is nice to get pupils to write their name on their individual piece.
- 20+ minutes **Students make a cube** by making 6 modules as shown on the worksheet and sliding them together.

Further extensions could include discussing the mathematical shapes formed during each construction and even proving/justifying why this happens.

Guide to further slides:

The ancient Greeks recognized that the platonic solids were special shapes and thought that the elements (air, fire, water etc.) were made up of the platonic solids.

The platonic solids are also still very important today. Many viruses take the shape of icosahedra and research is being conducted into their symmetries to help us to understand them so that cures can be found (<http://pass.maths.org.uk/latestnews/sep-dec07/twarock/index.html>). Many popular objects are based on the platonic solids – for instance there is an icosahedron inside a magic 8 ball and a football is actually an icosahedron with all its vertices sliced off!

The message we wanted to emphasise was that maths is everywhere, fascinating and extremely useful!

Good websites containing more 2D and 3D shape constructions using paper are

http://motivate.maths.org/conferences/conference.php?conf_id=89 and

<http://www.ncetm.org.uk/Default.aspx?page=13&module=res&mode=100&resid=9273>

www.moremathsgrads.org.uk

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more maths grads is a three-year project funded by the Higher Education Funding Council for England to develop, trial and evaluate means of increasing the number of students studying mathematics and encouraging participation from groups of learners who have not traditionally been well represented in higher education.