The Five Platonic Solids

Cut-out sheets for a set of platonic solids with a uniform side length of 5cm.
Includes hangers to build a mobile.

The five platonic solids are named after the Greek philosopher Plato, who described them extensively in his dialogue "Timaeus". He saw in them the smallest, invisible building blocks of the world and assigned them to the classical elements: tetrahedron - fire, octahedron - air, hexahedron (cube) - earth, icosahedron - water, dodecahedron - ether (the basis of the all-surrounding cosmos). However, the five solids have been known for much longer, as for example 5000 year old engraved stones from Scotland show.

The platonic solids are so-called convex regular polyhedra (greek: "multi-flat"). Each one of them consists of a certain number of equal regular surfaces, so-called polygons (greek: "multi-corner"). The surfaces of the platonic solids are made up of either equilateral triangles, squares, or pentagons. There are always the same number of polygons meeting on each corner of a platonic solid.

From this we can deduce the following properties:
✳ **Tetrahedron** (greek: "four-flat"): 4 triangles, 4 corners, 6 edges
✳ **Octahedron** (greek: "eight-flat"): 8 triangles, 6 corners, 12 edges
✳ **Hexahedron** (greek: "six-flat", cube): 6 squares, 8 corners, 12 edges
✳ **Icosahedron** (greek: "twenty-flat"): 20 triangles, 12 corners, 30 edges
✳ **Dodecahedron** (greek: "twelve-flat"): 12 pentagons, 20 corners, 30 edges

Octahedron and Hexahedron are a "dual pair": one has as many sides as the other has corners. If you connect the centre points of the sides of the octahedron, the lines form a hexahedron inside the octahedron. If you do the same with the sides of the hexahedron, you will find an octahedron inside. The dodecahedron and the icosahedron are also a dual pair. The tetrahedron forms a dual pair with itself: if you connect the centre points of its sides, you will find that the connecting lines will form another tetrahedron.

You can find all five platonic solids in nature in diverse and unexpected places: e.g. in crystals of minerals or in the structure of molecules and viruses.

The kit contains 5 cut-out sheets and these instructions.

You will also need for assembly:
✳ Standard solvent based all purpose glue, e.g. UHU, Evo-Stik Impact, B&Q All Purpose Glue. **Do not use water-based glue**: it softens and warps the cardboard, and doesn't stick properly to the printed surfaces. Solvent based glues also dry much faster.
✳ A sharp pair of scissors or a sharp knife with a fine point (thin carpet knife, scalpel), to cut the parts from the cardboard.
✳ A ruler and a blunt knife or an empty biro to groove the folding lines.
✳ A cutting board or mat, made from hardboard, plastic, or wood. Self healing cutting mats are ideal as the material re-closes after each cut.
✳ Thin thread and a sewing needle to turn the solids into a mobile.

Tips for successful construction - Please read before commencing!
✳ All folding lines (dashed) need to be prepared by grooving them with a blunt knife and ruler. You get a straighter fold if you position the folding line over a sharp edge.
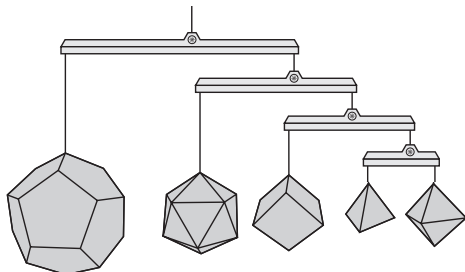
✳ The numbers on the grey glueing areas indicate the order in which the tags are glued in place. The numbers on the back of the print denote which tag goes where.
✳ **Important:** If you want to hang up the five solids as a mobile, you need to attach a thread **before glueing the last tag**. Affix the thread to one of the holding disks (sheet 5) and pull the other end through one of the corners of the solid with a needle.

A. Dodecahedron, Sheets 1 and 2:
Step 1: Cut out part 1, groove all dashed lines and fold them backwards.
Step 2: Glue tags 1 to 5 in place.
Step 3: Cut out part 2, groove all dashed lines and fold them backwards, and glue tags 6 to 8 in place.
Step 4: Glue tag 9 of part 2 onto its designated place on the back of part 1, which connects the two halves of the dodecahedron. Now glue tags 10 to 16 in place.
Step 5: The last pentagon is now glued in one go onto tags 17, 18, 19, and 20. Decide if you want to attach a string beforehand.

B. Icosahedron, Sheet 4:
Step 6: Cut out, groove, fold, and glue tags 1 to 9 in place.
Step 7: Glue the last triangle onto tags 10a and 10b (attach string beforehand, if required).

C. Hexahedron (Cube), Sheet 3:
Step 8: After cutting out, grooving, and folding both parts, connect them by glueing tag 1 onto its designated place on the back of the other part. Then glue tag 2 in place.
Step 9: Glue the penultimate square onto tags 3a, b, and c and the last one onto tags 4a, b, and c (attach string beforehand, if required).

D. Octahedron, Sheet 3:
Step 10: After cutting out, grooving, and folding, glue tags 1, 2, and 3 in place. Glue the last triangle onto tags 4a and b (attach string beforehand, if required).

E. Tetrahedron, Sheet 2:
Step 11: After cutting out, grooving, and folding, glue tag 1 in place. Glue the last triangle onto tags 2a and b (attach string beforehand, if required).

Congratulations, you have completed your five Platonic Solids!

If you want to hang up your Platonic Solids as a mobile, you need to construct the hangers on Sheet 5 as well (of course you can also use thin steel wires or something similar).

The hangers have different lengths and the inscriptions at the ends indicate which solid goes where. The positions of the hexagonal tags on top are calculated so that all five solids are held in equilibrium.

All hangers are constructed in the same way: Cut out the parts and groove the dashed lines. Then fold the outer two grooves forwards and the inner two backwards. Pierce the holes in the centre of the four stars with a pin and glue the two outer strips back to back, applying glue only to the grey glue areas. This way a very stable rail with a triangular cross section is formed.

Start with the tetrahedron, the octahedron, and the shortest hanger. To hang a solid from the hanger, use a needle to thread its string from the underside through the star into the hanger and secure it with a knot (and maybe a bit of glue) at the desired length. To fix a lower hanger to the next upper one, first attach the string to the hexagonal tab on the lower (shorter) hanger and then thread it through the hole in the star at the end of the upper one. The diagram on the left shows the arrangement of the platonic solids and the hangers in the mobile. Should there be a slight imbalance, you can insert small weights (e.g. bits of wood or cork) into the end of the hanger that is pointing up.