# The simple cubic structure (sc)

The simple cubic structure is also sometimes called the primitive cubic structure. As the name itself suggests, this crystal structure has a cube-shaped unit cell. The length of each edge is given by the lattice parameter 'a'. There is a lattice point at each corner of the cube, which marks the position of either a single atom, or the same motif of atoms.

With this model sheet and instructions, you can make your own 3D paper model of a simple cubic crystal, similar to one shown in the image. Once you are done, see if the 3D model makes it easier for you to answer the questions at the end.
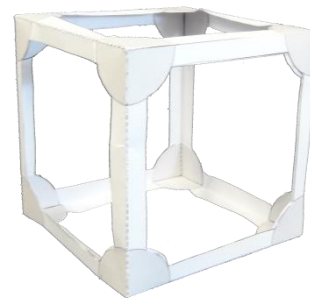
To make this paper crystal you will need:

- 1 sheet of white paper card (A4 size), 150-200 gsm
- Crayons, colours pencils
- Scissors or paper knife
- Ruler
- Craft glue, or a glue stick

Instruction

1. Download the model sheet from our homepage, and print it one-sided on a white A4 size paper card.

2. The grey shaded regions correspond to the position of the atoms. Colour them with the crayons in your favourite colour. Use the same colour for all the grey fields.

3. Cut along the solid lines, and start with the outer shape. Cut out all pieces.

4. To remove the inner parts, make a small hole with the tip of your scissor in each field you want to cut out. Then use a fine, small scissor – for example a nail scissor – and cut carefully along the inner solid lines.

5. Put your ruler on the dashed lines, and score gently with the scissor tip along these lines.

Paper card, crayons, and scissors needed for the paper model
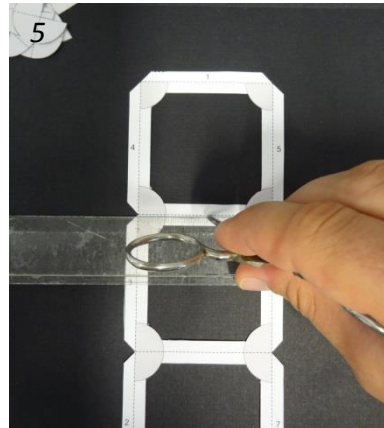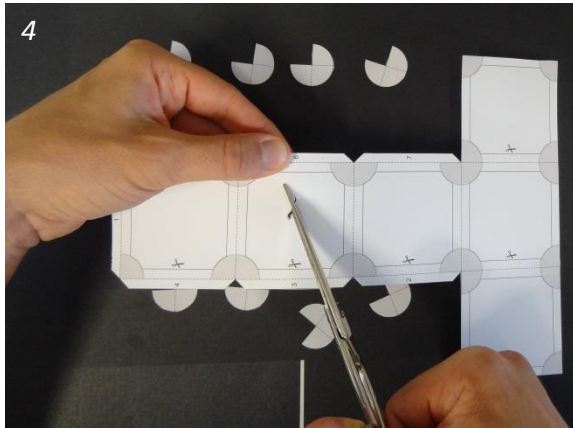
6. *Fold the paper now along the dashed lines, and form a cube.*

7. *Glue the sections 1, 2, 3, and 4 following the order of the numbers.*

8. *Fold all ¾ circles, so that they form grey corners. Then stick one of the ¾ circles at each of the 8 corners inside the cube.*

9. *Glue now the lid on the sections 5, 6, and 7 to close the cube.*

Can you answer the questions on the crystal properties?

1. *How many nearest neighbours does each atom have? Take into account that several neighbouring unit cells surround each cubic unit cell.*

2. *How many atoms are in each simple cubic unit cell?*

3. *What is the distance between nearest neighbours? (Use the length of the cube edge 'a' as ascaling parameter.)*

4. *The packing efficiency describes the ratio of the maximal volume occupied by the atoms and the volume of the cubic unit cell. In your 3D paper model, now assume that the neighbouring atoms are touching each other, then, what will be the packing efficiency for the simple cubic structure? Compare the result with the values of other crystal structures.*
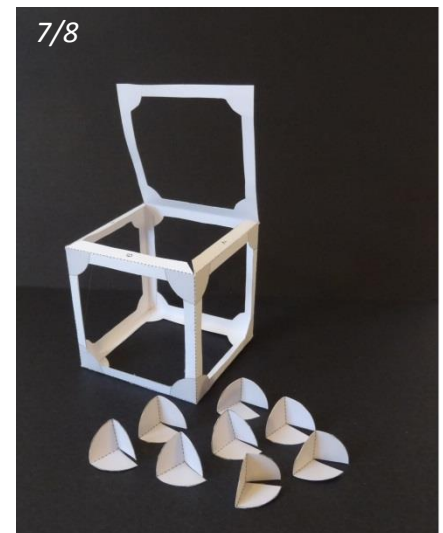
The cubic frame and the atoms for the inner corners.

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Enjoy your new 3D paper crystal!
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