Stock cubes are **packed** in **boxes**

If you had to design a box which would hold 36 stock cubes which **cuboid** would you choose?

Why would you make this choice?

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Cubes have six square faces.

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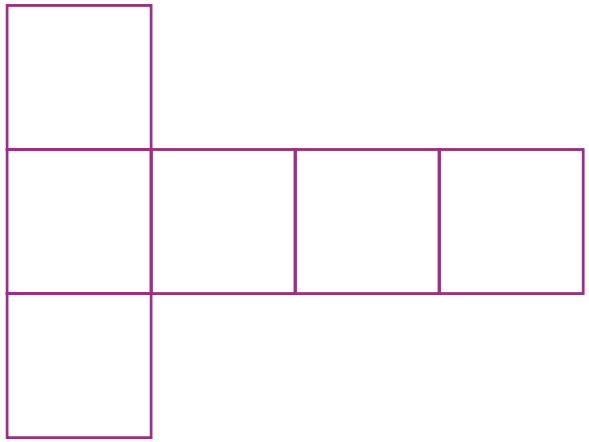
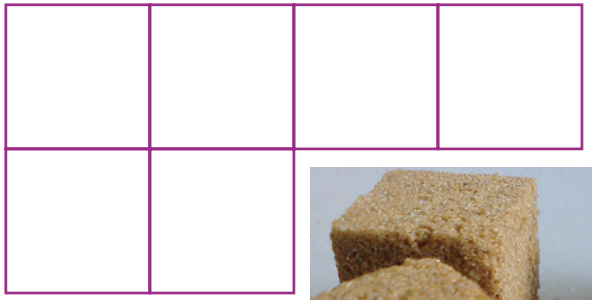
This will fold to make a cube.



But this won't.



Investigate different arrangements of 6 squares. Which ones will make the net of a cube?

Manufacturers want to waste as little card as possible.

Which nets would they prefer?

Arrange the **bottles** that you have been given in order of the **amount** of **liquid** they can hold.

- Take the label off one of the bottles to see how much it holds.
- Use this to help you estimate the capacity of all the other bottles.
- Record your estimate for each of them.

Try to half fill each of the bottles with water by estimating. Use a measuring jug to see how accurate you were.

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Food and drink: Boxes and bottles

Description

Boxes and bottles come in all shapes and sizes. This topic explores some of the mathematics behind packaging decisions taken by manufacturers.

Activity 1: Boxing stock cubes

Activity 2: Folding cubes

Activity 3: How much does it hold?

Boxing stock cubes asks pupils to explore the number of different cuboids that can be made with a constant volume. It is most effective to work in pairs on this activity. Give each pair enough multilink cubes to make a range of cuboids made of 36 cubes. Pupils may need to be encouraged to find a way of recording the different cuboids they make. You may want some pupils to think about other starting numbers of cubes and ask which numbers offer them the widest range of cuboids and which will offer only one.

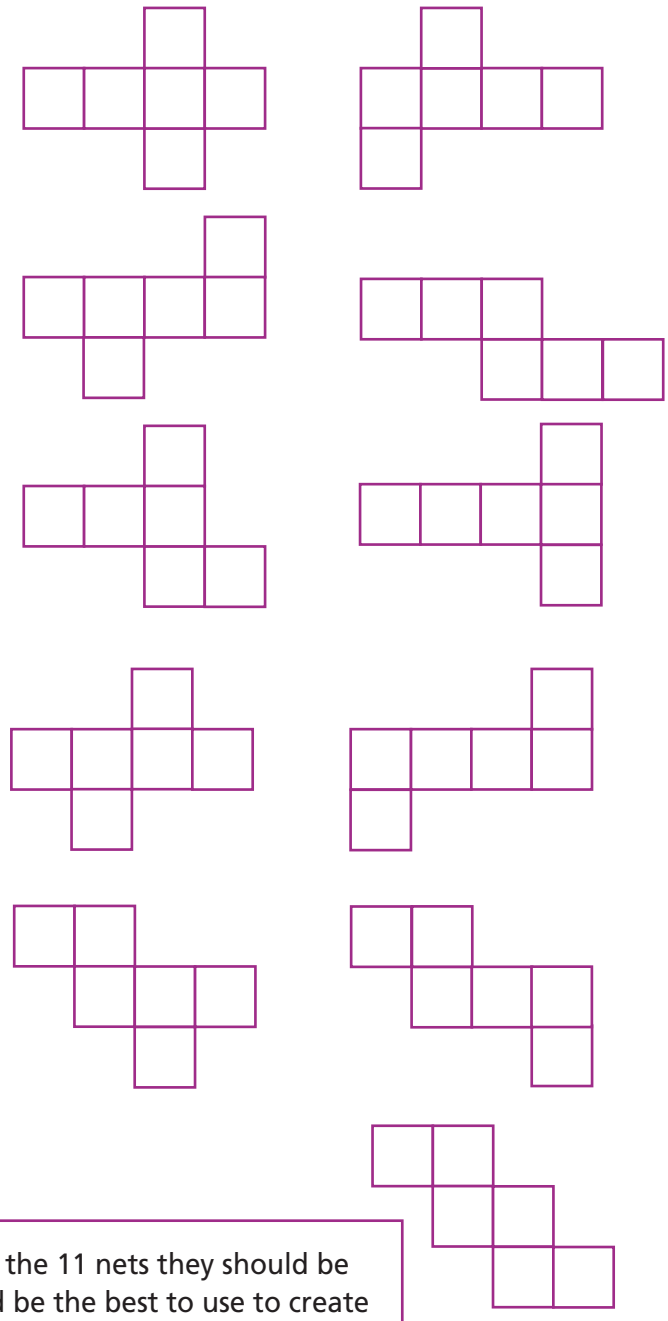
Ask the pupils to decide which cuboid they would use if they were designing a box to hold 36 stock cubes. Encourage them to come up with reasons for their choice and compare the decisions that different groups make.

Exploring nets is the focus of **Folding cubes**. Ask pairs to find as many different arrangements of 6 squares as they can. It is useful to provide 2cm squared paper as the resulting nets are easier to manipulate. The pupils will need questioning to allow them to notice rotations and flips and to come to a decision about which arrangements they will count as the same and which they will see as different. After some time on the activity it may be useful to record all the different arrangements the group has found as a plenary.

Resources

Multilink cubes; a range of containers; measuring jugs.

Which of these arrangements will fold up to make a cube and which will not? These are the 11 nets that will make a cube.



When the pupils have found the 11 nets they should be asked to decide which would be the best to use to create boxes to hold eight 1cm^3 cubes of sugar. They will need to find which nets tessellate so that repeated patterns of the nets can be placed efficiently on a large sheet of card.

Food and drink: Boxes and bottles

How much does it hold? asks the pupils to estimate capacity in a range of differently shaped containers. They explore this in order to understand how manufacturers market children's drinks.

As water and measuring jugs are important for this activity you may want to use a science lab to carry out the session. You will need to collect a range of bottles of various designs to offer a challenge to the pupils when they try to estimate the capacity of the bottles. Each group of pupils should be given about 6 different bottles. Put a sticky label over the capacity which can be easily removed. For some groups of pupils, you may want to ensure that you include a 1 litre bottle and that this label is removed to allow for simpler ratio work. The groups should first try to order the containers and then estimate the capacity of each container. The next stage is to try to half fill each container, again by estimating. Finally, the pupils check their work with the measuring jug.

The volume of liquid in a ready prepared stoppered conical flask which is two thirds full appears very different when the flask is held upside down. High attaining pupils can work with the formula for the volume of a cone to explore this.

The mathematics

Through these activities pupils will be asked to make and argue for conjectures and to find efficient ways of recording results in order to justify claims they are making. In **Boxing stock cubes**, pupils will develop their knowledge of factors and prime numbers and **Folding cubes** will develop their understanding of how 2 dimensional nets relate to 3 dimensional shapes. They are asked to estimate capacities and to convert between litres to millilitres in **How much does it hold?**