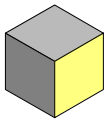
minicubes

intro

In this investigation pupils look at the effect on surface area of breaking up a cube into smaller cubes.

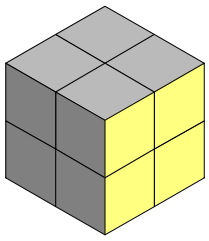


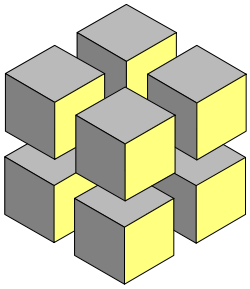
first steps

- You can find the surface area of a cuboid by adding together the separate areas of its faces. That's not too difficult! In the case of a cube, though, the surface area is very easy to calculate – since all the faces are the exactly the same, you just find the area of one face and multiply by 6.Suppose we have a cube and we cut it in half. Will the total surface area stay the same or will it increase? Pretty obviously it will increase. If you're not sure of this, imagine your cube is a wooden one and that you've painted it red all over; when you cut this cube in half, you'll still have the red surface you've already painted but now you'll have two unpainted faces as well (which means that to have all surfaces painted red, you'd have to do some more painting) . . . so the surface area has definitely increased!
- In this investigation we're going to look at what happens to the total surface area when we break up a cube into smaller cubes.

the investigation

Ask pupils to work out what happens to the total surface area when you take a cube and break it up into 8 smaller cubes.





If they're not sure how to get started, suggest that instead of trying to think of cubes in the abstract, they look at a cube with specific measurements eg 2cm x 2cm x 2cm and then investigate this.

results

A 2cm cube has a surface area of 6 x 4 = 24 cm^2. Eight 1cm cubes will have a total surface area of 8 x 6 = 48 cm^2. In other words, the total surface area has doubled. Can any pupils explain graphically why this should be so? (Try to get them to think in terms of getting the 8 small cubes by successively cutting the original cube in half in each of the three directions).

next steps

Now get pupils to investigate what happens when a cube is broken into 27 or into 64 smaller cubes. Again, to make life easier they can give the original cube some suitable specific measurements eg 3cm x 3cm x 3cm or 4cm x 4cm x 4cm and take things from there.

notes

- Pupils might already have encountered the problem of the cube which is painted red all over and then broken up into smaller cubes – and where they are asked to calculate the fraction / percentage of faces now painted red.
- What would be the 2-D equivalent of this 3-D investigation? (*answer: Looking at how the total perimeter is changed when a square is split up into smaller squares.*) How do the results work out for the 2-D version?