

## Making Mudbricks: Science and Technology Challenge!

### Building with Mud and Stone

Soil (mud) has been used to build things for thousands of years. Soil is almost everywhere. This means it is easy to find. When mixed with water and other materials it can be used in lots of ways. The big problem with buildings made from mud is that they can be easily damaged and need regular repair.

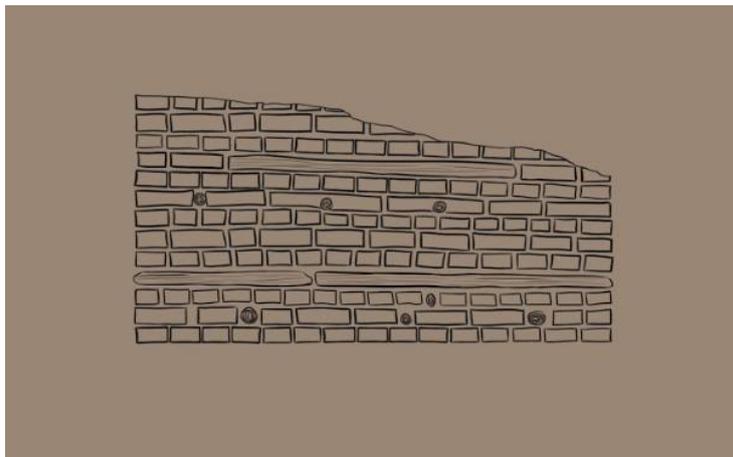
Most buildings in ancient Amarna were made from mudbrick. Only the most important parts of the city – like the temples – were made of stone. The stone was cut into small blocks called talatat at the nearby quarries. The blocks were designed to be carried by one strong person. Look back at the measuring challenge to figure out how big a talatat block was. It measured one cubit long by half a cubit wide and half a cubit thick. Do you think you would be strong enough to carry one?



Mudbricks were used to build all the houses at ancient Amarna, even the house of the King! Mudbricks were much thinner and lighter than stone blocks and varied in size depending on how they were made. At Amarna, mudbricks measured about 34cm long, 17cm wide and 8cm thick.

Soil from near the river Nile made the best mudbricks. The mud was mixed with sand and gravel from the desert and water was added to help hold it together. The wet mudbrick mix was then put into a rectangular wooden mould to give it the right shape. The mould was then lifted off the brick which was left in the sun to dry.

To build a wall, the bricks were laid out in overlapping patterns. This helped to make the wall stronger. The bricks were fixed in place with a wet layer of mud called mortar. When the mud dried it held the bricks firmly together.

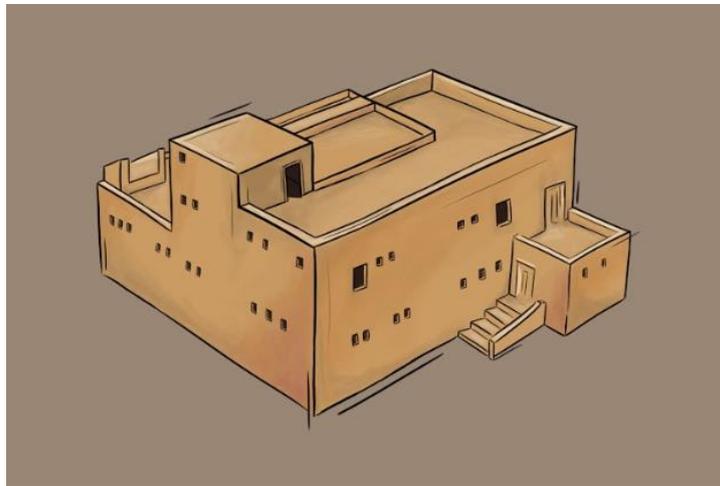


Once a wall was finished it would be plastered inside and out. The plaster was also made of mud. The mud was turned into a paste with water, and bits of straw were added to stop the plaster cracking when it dried. Some of the mudbrick houses at ancient Amarna were painted white inside. In the larger houses, belonging to important people in the city, beautiful coloured paintings were sometimes placed on the walls, ceilings and around the doorways.

Windows and doors were made of wood or stone and often painted red. Floors could be made of mud plaster or brick, but were often just the natural ground smoothed flat by water and the trampling of feet!

Roofs were flat and were usually supported by wooden beams held up by columns in the larger rooms. The beams would be covered in mats or plant material and a layer of mud. If the roof was strong enough, the house might have a second storey.

Mudbrick is a good insulator. This means it helps keep houses cool in summer and warm in winter. As there was no heating or air conditioning in ancient Egypt this would have been really important!



### Science Challenge!

Can you follow the ancient Egyptian method below to make your own mudbricks? Perhaps you can try adding different amounts of sand, gravel or straw to your mud mix to see what makes the strongest brick? You can test the strength by placing the ends of your brick across a gap between two tables. Gradually add small weights to the middle of the brick and see how many it can take before it breaks. Make sure your toes are not in the way when the brick cracks!

You will need:

- a small but strong plastic box that you can pierce holes into that will act as your brick mould. The ancient Egyptians didn't have plastic as it wasn't invented. Their brick moulds were made of wood. For our experiment, plastic butter or ice cream tubs are ideal but something a bit bigger or smaller will also work!
- plenty of fine soil (mud)
- water
- sharp scissors (get an adult to help with these)
- a good supply of sand and/or gravel (small stones) – you could also use some chopped up straw if you have it
- a large container like a plastic bucket or dustbin

Step 1. Prepare the soil by crumbling up any big lumps and removing large stones or pieces of twig.

Step 2. Use your hands to mix the soil and water together in your large container to create a thick mud (it should be just wet enough to stick together!).

Step 3. Add a few handfuls of sand, gravel and/or straw (we call these additions *temper*) to stop your bricks from cracking.

Step 4. Mix the mud and temper together really thoroughly.

Step 5. Use the scissors to pierce a few large holes in the bottom of your small plastic container so the air can get in (this will stop your mud mix from getting stuck). Get an adult to help with the scissors and watch your fingers! Then scoop in the mixture. Make sure you fill the brick moulds to the top and pat them down firmly. This will help to make the surface flat and remove any air bubbles.

Step 6. Turn your brick out straight away by quickly but carefully flipping the mould upside-down onto a wooden board or surface covered with sand or straw (so it doesn't stick!). Then gently lift off the plastic container ready to use for your next brick. If your brick starts to sag or slump the mixture is too wet. Try adding some more soil. If your brick crumbles and starts to fall apart your mixture is too dry. Try adding a little more water.

Step 7. Let the bricks dry in the sun (you need to be patient – this could take a few days or even weeks!). You'll know the bricks are dry when their colour has changed to a lighter shade of brown or grey all over and they feel totally dry to touch.

### **Experiment Time!**

After the bricks have dried, they are ready to be used in your strength experiments. What are your conclusions?

What is the best temper or mix of tempers?

What is the ideal amount of temper to add to make the strongest bricks?

How much weight can your different bricks hold?