

Task theme Materials Engineering



Task title Can you make your own concrete?

Learning outcomes

- To understand that materials have different properties which makes them suitable for different jobs.
- To understand why concrete is a good building material.

EHoM link



SYSTEMS THINKING

Construct an object or tool requiring the successful interaction between components and subsystems.



ADAPTING

Make objective judgements against success criteria and constraints.

EDP link



Key Stage/Year Group KS2

Resources required

- 1 cup of sand (250g)
- ½ cup of cornflour (125g)
- Handful of pebbles or gravel
- Boiling water
- Stainless steel bowl or Pyrex dish
- Saucepan

SAFETY NOTICE:

THIS ACTIVITY WOULD BE BEST DONE IN SMALL GROUPS WITH ADULT SUPERVISION, AS BOILING WATER IS INVOLVED TO INITIATE THE REACTION BETWEEN THE CORNFLOUR AND THE WATER.

How to run the task

1. Engage the children by asking them why it is important for engineers to choose the right materials for the job. Elicit their understanding by asking which materials might be used for building a load bearing structure such as a bridge and why? Which materials would certainly not be suitable? Why?
2. Explain that one of the most commonly used materials in the world is concrete. In fact, around 3 tonnes are produced every year for every single person. Discuss how concrete is made by mixing sand and small stones with water and cement, which hardens when it dries. This is because of a chemical reaction between the water and minerals in the cement.
3. Share the ingredients that the class will be using to make their version of concrete. What is different? Explain that the cornflour will be taking the place of the cement in this recipe.
4. Allow the children to explore making their own concrete, by following these steps:
 - Mix the sand and cornflour in a stainless-steel bowl. This needs to have a diameter greater than the saucepan so that it will fit on the top without touching the simmering water.
 - Boil some water in a kettle and pour some into the bottom of the saucepan. SEE SAFETY NOTICE ABOVE.
 - Place the bowl on top of the saucepan and stir the mixture gently. Be careful not to touch the sides of the saucepan, as they will be very hot.
 - Stop when the mixture gets thick. (If it is too thick, then add some more boiling water from the kettle).
 - At this point you've made mortar. Stir the gravel into the mixture to turn it into concrete.
 - Leave it to cool before shaping it into two piers and two thin rectangular beams. Curve one beam into a semi-circular arch.
 - Put all the shapes onto a baking tray and place in the oven at 135°C until the objects dry.



Top Tips

- The saucepan can be placed on a heat proof mat on the table to allow the children to stir more safely.
- Make sure that you leave the concrete to completely dry out before testing the strength. This can take a few days.

Evaluate learning

- Once the pieces have dried, the children can use them to make a beam bridge with the piers and straight beam.
- Encourage the children to evaluate the strength of their bridges by gradually adding some weight to both structures.
 - Which cracks first under pressure?
 - Is the concrete waterproof? Try putting one of the piers in water to see what happens.
- Ask the children to find out who invented concrete and how it differed from the concrete of today. What are the advantages and disadvantages of concrete?
- Extend the task by challenging the children to conduct a fair test to investigate how different amounts of ingredients affect the strength. What impact does leaving out the gravel have?
- Children could also invent their own material. What special properties would it have? Do they know that scientists have invented self-healing concrete that can fix its own cracks?

<https://www.theguardian.com/sustainable-business/2015/jun/29/the-self-healing-concrete-that-can-fix-its-own-cracks>

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As a practising teacher, Julie has written these 12 tasks to encourage more children to engage in engineering in primary schools. They have been stimulated by real-world engineering and inspirational ideas shared by others. They are linked to the Tinkering for Learning research and development project run by SEERIH.



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