



COOL FOR CATS

MAKE A MODEL OUT OF MILK

LEARNING OBJECTIVES

- Make a model from the protein **casein**

🕒 10 – 20 MINS

INDEPENDENT LEARNING

DIFFICULTY: ★★★★★

YOUR MISSION

This is a fantastic activity to get your creative juices (and some smelly vinegar) flowing!

Casein is a protein that is found in milk. It forms a **polymer** – a long repeating chain. As an early type of plastic it was quite commonly used before more modern, synthetic plastics were developed in the mid 20th century. Jewellery, buckles and buttons have all been made from casein. Artist Andy Warhol even used casein-based paints in a few of his early works, including 'Pop-Eye' and 'Dick Tracy'.

To get a really flexible and waterproof material to mould with, you would have to add a toxic material called **formaldehyde** – so we will be skipping that step! The finished material is a little crumbly but can certainly be used to make a basic model or placed into a mould to make something more elaborate!

GET STARTED

PHASE 1:

With an adult on hand to help where necessary, place a cup of milk into a saucepan and heat it until it's just steaming. Do not heat it too much. **It will be very hot, so you should be careful throughout this activity to avoid burns or scalding.**

PHASE 2:

Whilst the milk is heating up, pour 4 or 5 teaspoons of white vinegar into a mug. If you want to colour the casein, add some food colouring to the vinegar at this point.

PHASE 3:

With an adult's help, pour the heated milk into the mug of vinegar. You should see **curds** start to form. It will look lumpy – that is the casein forming.

PHASE 4:

Stir gently for about a minute. Don't be too rough with the mixture because that will not form a very good moulding material. It also risks spilling the hot milk.

YOU WILL NEED

- A responsible adult
- 1 cup of semi-skimmed or skimmed cow's milk
- 4-5 tsp white vinegar
- Saucepan
- Hob
- Spoon
- Paper towels
- A coffee/tea mug
- Food colouring (optional)
- Strainer (optional)
- Small cookie cutters (optional)
- Moulds (optional)

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PHASE 5:

Leave the mixture to cool for a few minutes. Ask an adult to check that it is cool enough to handle. You can put the mixture through a strainer or remove the lumpy curds with a spoon and pour off the excess liquid. Place the curds on a paper towel.

PHASE 6:

Gently roll the casein in your hands. Keep removing excess liquid using the paper towels. The more liquid you remove, the shorter the drying time. Be gentle with your moulding material – it can be a little crumbly if handled too roughly.

PHASE 7:

Get creative! You can use a small mould, a cookie cutter or your own imagination to make a model of your choice. Leave the finished model to dry for two days. Then you can sand it down if some of the edges need neatening up. If you like, you can paint it with acrylic paints! Why not make a number of batches of casein and see how big a statue you can make? A self-portrait, perhaps?

THINGS TO THINK ABOUT

* The form of casein found in milk is SOLUBLE in water. Adding the vinegar makes it INSOLUBLE. Find out what these words mean, and think about why buttons made from a soluble material might not be a good idea.

* Other acids, such as lemon juice, can also be used to make the casein insoluble. Why not try it and compare the result with the model you made using vinegar? Are there any differences?

* Investigate how different amounts of fat in the milk affect your model. How could you test your model to find out what fat content works best?

* What do you think would happen if you tried this experiment with soya or oat milk?

* Did you know that DNA is a type of polymer? Find out what polymers we commonly use in our everyday lives. What would life be like without them?