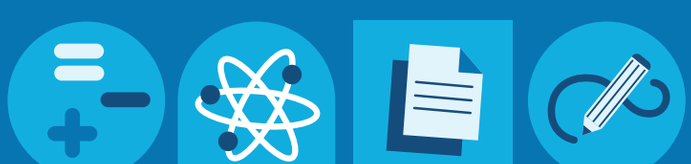
Suitable for 3-7 years

- Solo
- Pairs
- Groups

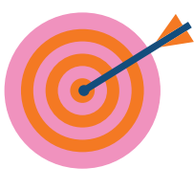
Ameya's activity

Make a blood model

How to guide

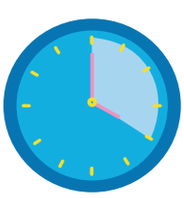


Ameya's activity
Make a blood model



Aim

The aim of this activity is to find out more about human blood as well as create a 'blood testing kit' to check how healthy someone is by looking for 'fat' in the 'blood'.



Time required

~15:00 minutes per activity with 2 main activity stages

Story to guide activity

A Drop of Blood by Paul Showers

Materials and equipment

- Plastic bottle with lid (something with a large lid to make adding components easy is a good idea)
- Something for red blood cells, e.g. some kind of red sweets (ideally these would be disc shaped for accuracy but spherical is fine too)
- Something for white blood cells, e.g. butter beans (there are about 700 red blood cells for every white blood cell so you don't need as much of these – and no need to actually count how many you add!)
- Something for platelets, e.g. some kind of sprinkles
- Something for the plasma (corn syrup, liquid hand gel or clear glue – real plasma has a faint yellow tinge to it so you could add a drop of yellow food colouring if you wanted)

- Something else to add to blood to represent bacteria or other chemicals, e.g. a pompom, some strips of paper or a disc with an angry face drawn on it (to be a bacteria)
- Filter paper (Whatman Grade 1 Lab filter paper or coffee filters or kitchen towel)
- Scissors
- Sellotape or masking tape
- Pipettes
- Lemon juice and water plus a couple of coloured containers to mix up these solutions in - prep this beforehand
- Litmus paper (blue) and similar coloured card (it could be helpful to pre-cut the card into strips about the same width as the litmus paper)

Extra information

- Further advice on making up the blood can be found here, and by visiting icanteachmychild.com.

Activity 1 Instructions

1. Read the story **A Drop of Blood** by Paul Showers
2. Working in small groups mix up your own blood model in a bottle. As you add each ingredient discuss what each ingredient represents. Once finished tip the bottle upside down and watch the components float around.

Activity 2 Instructions

1. Take out a blood model you made earlier with a couple of extra components added – ask the children if they notice anything different.

Explain that there are lots of other things in blood at low levels like:

- Some viruses or bacteria if we are infected with them
- Certain chemicals (e.g. sugars, hormones, enzymes, proteins, vitamins, iron and fats) which can show how healthy we are.

2. Engineers help design tests that doctors or even ourselves at home can use to check our blood to see how healthy we are. Today we are going to make a blood testing kit, looking for fats in the blood. Some types of fat at high levels can lead to heart disease and if we test for this in time people can make changes to a healthier (more exercise, better diet) lifestyle.

3. Optional large scale messy play style activity. Explain that it can be tricky to make a test looking for things in the blood as there are so many red blood cells, white blood cells and platelets in the way. Set up a blood model in a large container (with red blood cells, white blood cells, platelets and whatever you are using for a 'fat' component) and get the children to scoop out the components so they can count the levels of 'fat' in the 'blood'. Use spoons or hands depending on what you want to practise!

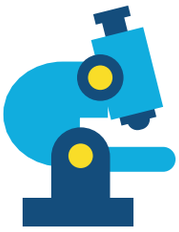
4. Engineering a test strip. Provide children with filter paper and ask them to cut a thin strip - approx 2cm wide and 10cm long.

5. To prepare the test strip we need two regions, one is the test zone and one is the control zone. They might recognise this concept from a Covid lateral flow test. Get the children to cut a small piece of litmus paper and a small piece of similarly coloured card. Stick both onto the back of the test strip and press firmly - it is recommended to place the tape all along the back of the paper strip to prevent leakages.

6. Once a child has prepared their test strip ask them to add some blood solution (you can explain that you are not working with real blood as you need special permissions to be allowed to do that but that you have a solution which will act a bit like the blood - use a few drops of lemon juice in water - add a bit of red food colouring if you want to be even more realistic though this might make the colour change more challenging to observe). Get the children to add a couple of drops of this

solution using a pipette to one end of their test strip. You will observe the 'blood' wicking along the strip and reacting at the test area (nothing should happen at the control area). If the 'blood sample' you have is from a patient with high fat levels the test should work, i.e. turn change colour.

7. The children can make multiple tests and explore how the flow of the water changes with different sized strips. To show that a colour change isn't always observed you could set up two tables each with their own test character (we used two Playmobil people), one with plain water as their sample and the other with a lemon juice sample (if you place the solutions into a coloured container the children won't notice that these samples are differently coloured from the beginning). The children can then move between the tables and use their test strips to test both characters and see which one is healthy/unhealthy.
Note: make sure the pipettes stay at the different tables to prevent transfer of solutions.



How it works?

Doctors use blood tests for all sorts of different diseases and conditions. Engineers like Ameya are working to make the tests easier to use, so that people can even use them at home to test themselves. His company are interested in testing fat levels in the blood to give an indication of the risk for heart disease. A person takes a small amount of blood, e.g. a fingerprick, and adds a drop to the test strip. At the far end of the test strip there will be a colour change to purple if there are high amounts of certain types of fat (LDL vs HDL cholesterol) in the blood. A purple result means it might be a good idea to see if any lifestyle changes like exercise or diet can help the person become healthier. Taking a photo of the test strip and using an app will allow for more accurate results than merely observing by eye. It is tricky to make a test work and in real blood the lots and lots of red blood cells can get in the way of a test working in solution so having a flowing test that helps remove red blood cells is useful. Tests like this can also be used with other samples, e.g. urine, nasal swabs etc to look for diseases or for pregnancy tests. The colour change happens There is still lots of work to do to improve medical tests and this is why engineers are needed to work on developing tests and helping doctors and patients.

In this activity the colour change is simplified and works using litmus paper as an indicator with lemon juice to make the litmus paper turn red. You could use litmus paper to investigate other solutions in the classroom.

Prompt questions:

- What components are in blood?
- How do doctors tell if we are healthy?
- What is happening when we add water to the bottom of the paper strip?
- What is happening when the water passes the coloured regions?

Extensions

The children could explore the flow of solutions through the paper with different sizes and shapes of paper and with different colours. For example with a Y shaped piece of paper the children could add a drop of different food colouring solutions to the top arms of the Y and observe the mixing that takes place when the solutions meet.

You can also use filter paper to observe component colours in pens. Try putting a dot on the paper with a felt-tip pen and adding a drop of water. Try this Royal Society of Chemistry video for a guide.

You could also explore colour change chemistry with red cabbage solution (boil up a few strips of red cabbage in a little bit of water for 5 mins, strain and retain the purple solution; it will keep for up to a week in the fridge) as an indicator. Test other chemicals to see if they are acid (e.g. vinegar, lemon juice, coffee, tomato juice) or basic (baking soda, milk of magnesia, soapy water, sea water)

Find out more about what other types of biomedical engineers do (e.g. make different medical technologies from stethoscopes to ultrasound, manufacture medicines, 3D print new organs for transplants, design hip and knee replacements or replacement limbs like prosthetic legs or hands) – you could:

- Try to make a model hand with moveable fingers
- Meet our engineer Uwe who works on understanding the strength of materials like bones and coral and do a strength testing experiment
- Meet our engineer Paul who learns from how the human eye and brain work to help computers see better
- Watch this video about 3D printing of medicines and make your own Playdough medicine model