4. Testing the tablet shape

1 ½ hours

The children investigate the effects of a range of tablet shapes on 'swallowing' as they compare the speed at which different shapes travel through liquid.

OBJECTIVES

- To identify the effects of air resistance, water resistance and friction, that act between moving surface.
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.

RESOURCES

(Per group of 4 children, unless otherwise stated)

Approach 1

- Activity sheet 10
- Stop watch
- 250 ml measuring cylinder or
- 1 litre pop bottle
- Jug or 1 litre pop bottle
- Water or cellulose paste

Approach 2

- 50 cm x 15 mm diameter plastic tubing (just wide enough for plaster tablets to pass through)
- Funnel (to fit in tubing)
- Cup or beaker
- Water

Both approaches

- Plaster shapes from Activity 3 (or modelling clay to form new tablets)
- Clay tools
- Sand paper
- Range of sweets and tablets
- Range of sweet and tablet packaging types

INTRODUCING THE ACTIVITY

The tablets are carefully removed from the moulds. Unless children have designed 'lumpy' tablets, the children can smooth their tablets with clay tools and sand paper. This can lead to discussion of 'real' moulds. The design of machinery/ moulds for industry is a highly skilled job involving the use of computerised design packages and cutting tools.

Modelling clay can be used for this investigation, as an alternative to the plaster of Paris tablets.

Groups spend five minutes discussing the success of the tablet making exercise:

- *Are your tablets all perfect shapes?*
- *Are they all exactly the same size and shape?*
- *Are they hard or do they crumble?*
- *How could you improve the next batch that you make?*
- *What are the implications for making moulds for industrial production of tablets?*

The investigation is to discover which of the shapes that have been made would be the easiest for a dog to swallow, and the children can predict which would be the best for this. They could draw their predictions in order from the best to worst; discuss their reasoning with talk partners and then the rest of the class. They should be prompted to explain how and why they have made their decisions. For example, the sphere might be a good shape to swallow because it is rounded whereas the cube shape might be unpleasant to swallow due to corners and sharp edges.

Ask the class how they might test the shapes and discuss the advantages and disadvantages of their ideas.

The use of plaster or clay tablets and a representation of the throat can provide the context for discussing the difficulties companies face when trialling new medicines. Every effort is made to try things in the laboratory before animal testing is used. This investigation lends itself to a thorough evaluation by the children because they make comparisons between what they did and what it represented, in addition to commenting on how well they performed the investigation and what they would try to improve in future testing.

Two approaches are provided here, but the children may devise tests of their own that you wish to pursue.

Safety note

Emphasise to the children that they are not to actually put the tablet shapes in their mouths.

MAIN ACTIVITY: APPROACH 1

The children observe and measure the time taken for different shaped tablets to reach the bottom of a measuring cylinder or pop bottle filled with liquid. This represents the journey the tablet takes when swallowed. Water can be used, but cellulose paste more closely replicates industrial practice, and also provides more accurate results.

Provide children with the equipment listed and ask them to decide which variables they would keep the same to make it a fair test, and add this information to Activity sheet 10.

The children test the shapes of the tablets by dropping them into the liquid and timing how long it takes to get to the bottom. Encourage children to practice this technique to ensure accurate measurement. (Please note: use of cellulose paste results in more accurate results, as it takes longer for the shapes to drop through this liquid. As the tablets fall through the water quickly, it is difficult to measure accurately. Because of this, cellulose paste is the preferred liquid to use in industrial tests.)

One child can use the stopwatch while another holds the tablet at the liquid's surface and counts down to ensure the drop and timing occur simultaneously. This affects the accuracy of their measurements.

They can retrieve the tablet by pouring the liquid into a jug or pop bottle, catching the tablet and re-filling the measuring cylinder/bottle to the same level to start again.

Discuss the fact that repeating the test makes the results more reliable. They can do this by taking three measurements, and selecting the middle one (median). Very able children can calculate the mean. The children can record their results on Activity sheet 10.

MAIN ACTIVITY: APPROACH 2

Each group is provided with a length of tubing, which they can bend to represent the bend in the throat. They test the different shaped tablets to see which will pass through the tubing most easily. They need to work out a method that they will repeat for each shape, keeping the technique as constant as possible. This could involve 'washing' the tablet down the tube with a constant volume of water. The time for each tablet to pass through the tube can be recorded on a table similar to that provided on Activity sheet 10. The children should be encouraged to collect repeat results so that they have a sound indication of the reliability of their results.

PLENARY

Discuss the success of the investigation with the children:

- *How much do you think that the tube, bottle or cylinder is like the throat?*
- *Was it easy to keep the test fair?*
- *Are the results that they have achieved reliable?*
- *If their results were not reliable, what prevented them from repeating results accurately?*

Can they show that for each shape the time was usually about the same, and that they got different times for the different shapes? The investigation may be more successful using tablets made from modelling clay as the size and shape can be more easily controlled.

The children would probably say that the tablet that travelled through the tube/cylinder most easily would be the best for the dog to swallow but do they think that the tube/bottle is a close enough model to the real thing? For example, the throat has a 'squeezing action' that moves the tablet along, which is very difficult to represent.

Ask the children for suggestions for the company to carry out a more reliable test. One possible suggestion would be to make the tablet shapes out of something harmless that the dogs could eat and ask pet owners to volunteer to give these to their pets for a period of time and report back their observations on how easily the pet swallowed each shape.

- *Which tablet shapes do you think are made in industry?*

They are usually a flat rounded shape. The dry ingredients are bound together with a moulded stamp that creates the shape as the ingredients are forced together.

- *Other than the tablet's shape, what else will industry need to think about when making dog tablets?*

Pharmaceutical companies need to consider the flavour, fragrance, coating and packaging.

SAFETY WITH MEDICINES

Show examples of sweets that look like tablets. Cut them, look at the coating, colour, etc. Ask the children how to tell the difference between sweets and tablets. Children may come up with responses such as smell, colour, hardness, etc. Explain that these are not fool proof and the only way to really know is from the packaging. Show children packaging of sweets and tablets and discuss the differences. The tablets have secure and distinctive packaging with dosage instructions. Emphasise the importance of knowing sweets should come from a sealed package. They have a right to choose to say no if offered 'sweets', as they should not eat anything that looks like sweets unless certain of their origin. Advise the children only to take tablets/medicines from adults who are responsible for them. This could lead to a circle time or role play activity.

1 Note: The Association of the British Pharmaceutical Industry produces two posters on 'safety with medicine', which are available free of charge from their website, www.abpi.org.uk