

2. A leaky line



1 - 2
hours

Investigating sealants to choose the most suitable for joining a pipeline that will carry water. The problem of sealing sections of pipeline is tackled. Children investigate the effectiveness of a variety of sealants to join 'pipes'.

OBJECTIVES

- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.
- 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)

- Food can, with both ends removed to form a tube.
- Food can, with one end removed.
- 2 x 1-litre plastic measuring jugs
- Range of adhesives, e.g. Blu-tack, Sellotape, PVA glue, insulating tape, glue gun
- Safety tin-opener
- Activity sheets 8 and 9

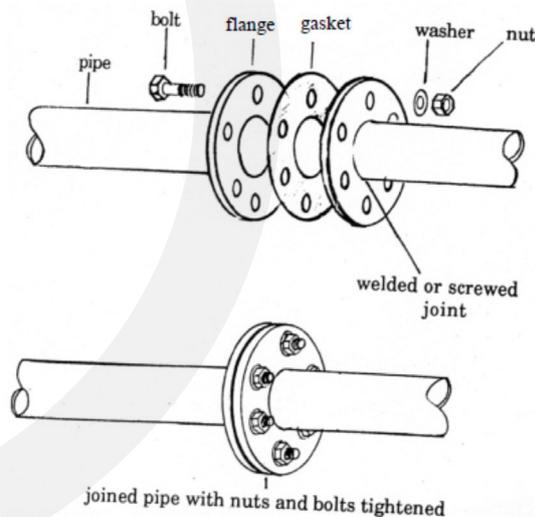
Safety note

Certain adhesives, such as glue from a glue gun, may need to be applied by an adult. Check your education authority policy and safety warnings on the adhesive's packaging.

BACKGROUND INFORMATION

A good sealant needs to stick successfully to the surface of the pipe material and remain attached with added water pressure, be water-resistant, and leave no air gaps when joining the two surfaces.

Blu-tack and PVA glue do not often provide air-tight seals. Blu-tack tends to be 'pushed away' from the surface of the pipe by the water pressure. PVA glue can take over an hour to dry. Sellotape is not very resistant to water, but provides a good seal if several layers are used. Insulating tape seals the pipe well. Glue from a glue gun forms a strong, water-resistant seal if a thick layer is applied.



In industry pipes are usually sealed using flanges and gaskets to prevent leaks. The gasket is often an open circle of asbestos, plastic or rubber, which is compressed between the flanges, which are also open circles. The thickness of the flange depends on how much pressure there will be inside the pipe.

The joints are then either threaded so they screw onto the pipeline, or they are welded to the pipeline. The welded joint can be explained as similar to the join using a glue gun, using molten metal instead of molten glue.

Sections of pipe for cooling water in industry can be 6-12 metres long, e.g. as long as 4-8 children lying end-to-end.

CARRYING OUT THE ACTIVITY

To help the children choose the sealants they are going to test, the class brainstorm methods of joining two items. The list could include paper-clips, pins, needle and thread, glue, Sellotape, etc. This could be a competition, or a challenge to the class to make the longest list possible. Once completed, the children pick the feasible methods to join the pipeline. From this reduced list, groups of children choose four sealants to test, filling in the names of these sealants on Activity sheet 8.

N.B. The teacher should allow discussion of feasible methods for joining a pipeline that children suggest but cannot investigate in the classroom, e.g. screw-fitting or soldering.

The cans are joined using one of the chosen sealants. The children then place the cans in the measuring jug, being careful not to break the seal.

Before pouring water in to each 'pipeline', the children predict how suitable the sealant will be. The teacher encourages the children to think of reasons to substantiate their predictions where possible.

An appropriate quantity (say 800 ml) of water is poured into the cans, ensuring that the water level is above that of the sealant, whilst maintaining 'fair' conditions. The cans are then left for 10 minutes before observing for leakage. The amount of water that has collected in the jug can be measured and recorded on Activity sheet 9. How the children measure the volume of water will depend upon their ability. Some may simply mark the water level on each picture. Others may use non-standard measures such as egg-cups, and the more able children may measure in millilitres.

The cans are dried thoroughly and the procedure repeated for each sealant being tested.

N.B. A thick layer of glue from a glue gun is required to produce a good seal.

On Activity sheet 2, children can show where sealants are needed to join pipes.

DISCUSSION QUESTIONS

- What must a good sealant be like?
- Which sealants were good?
- Would any of these be used in real water pipes? Why?
- What else might factories use to seal their pipes together?
- How long do you think each piece of pipeline would be ?

EXTENSION ACTIVITY

The children investigate changing the thickness of the sealant layer on the effectiveness of the seal, i.e. using 1, 2, 3, etc. layers of Sellotape; 1, 2, 3, etc. spatulas of PVA glue.

The ambassador can initiate these activities and act as an advisor/consultant if present for the practical sessions. The ambassador may also play the part of a judge and provide detailed information for the latter stages of the activities, such as marketing aspects.