



Aim

Investigate the contrasting behaviours of granular and cohesive soils using household materials.

Materials

Per small group:

- Granular material supplied by your teacher
- Container (Tupperware or ice cream tub)
- Full bottle of water or oil (for load demonstration)
- Plastic bottle with lid
- Coarse sand (or other granular material)
- Food dye
- Transparent straw
- Bowl
- Spoon
- Custard powder or cornflour
- Water in a measuring jug

Method

Activity 1A

1. Pour granular material between containers to observe flow.
2. Place a water bottle on settled granular material to observe solid-like behaviour.
3. Fill a bottle with granular material, invert, and observe jamming (figure 1).
4. Tap the bottle to restart flow and note changes.

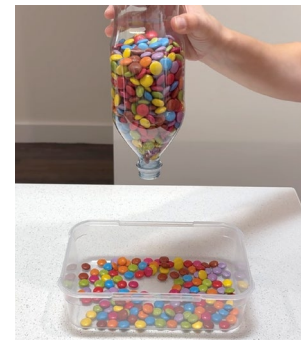


Figure 1: Jamming of smarties in bottle

Activity 1B

1. Put a hole in a plastic bottle lid, no larger than the diameter of a straw.
2. Fill the bottle with granular material.
3. Add water until the sand is fully saturated so that all pore spaces are filled.
4. Insert a straw into the opening.
5. Squeeze the bottle and observe what happens to the water level (figure 2).

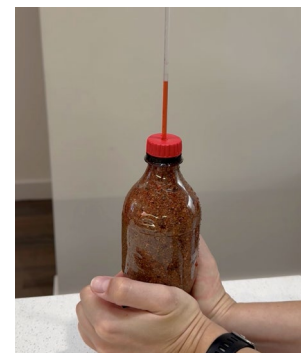
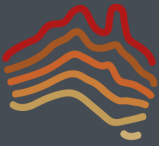


Figure 2: squeezing a bottle containing water-saturated coarse sand



Activity 2

1. Mix custard powder or cornflour with water and test its resistance with a spoon (figure 3).
2. Roll the mixture into a ball and observe behaviour when moving vs. resting.
3. Optional: add a small amount of water gradually while mixing with a spoon to see how the mixture changes its behaviour.



Figure 3: cornflour mixed with water

Results

Write your observations in the table below:

Experiment	Observation
Granular flow (Activity 1A)	
Jamming (Activity 1A)	
Granular dilation (Activity 1B)	
Cohesive behaviour (Activity 2)	

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Discussion Questions:

1. Why do granular materials like chickpeas sometimes behave like a liquid and sometimes like a solid?

2. What causes “jamming” in the bottle experiment, and why is this phenomenon useful in geotechnical engineering?

3. How does the custard (cornflour and water) experiment help us understand the behaviour of cohesive soils like clay?

Extension

Imagine you are a civil engineer tasked with designing the foundation for a large building on a site with both sand and clay soils. What challenges might arise from these soil types, and what strategies could you use to ensure the ground is stable and safe for construction?

Use reliable sources to answer this question. Remember to reference your sources.