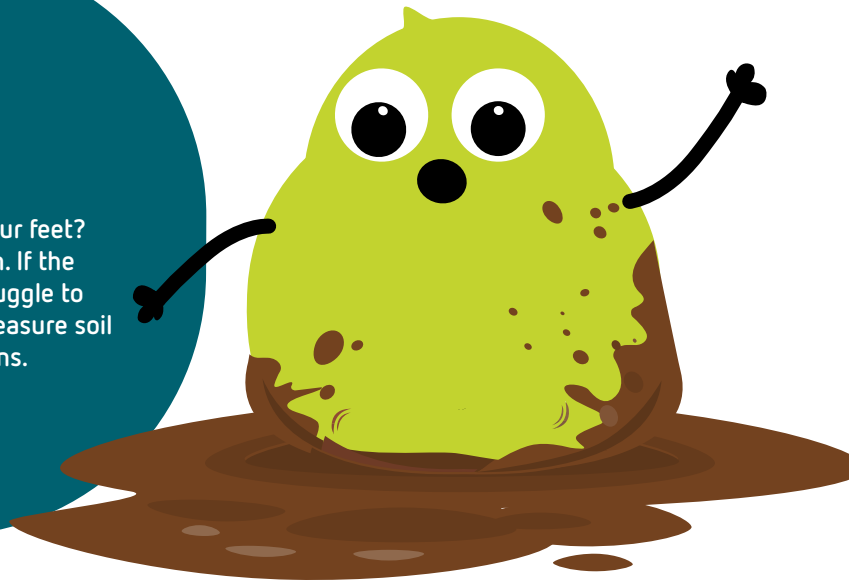


BUILD A PENETROMETER

How connected are you to the ground beneath your feet? The food we eat is reliant on the soil it is grown in. If the soil is too squashed, or compacted, plants will struggle to grow. You are going to build a penetrometer to measure soil compaction and compare soils in different locations.

🕒 1 hour

Skills unlocked: Observant



🛒 Kit list

A knitting needle or skewer

Cotton reel

Rubber band

Permanent marker

Ruler



📖 Instructions

- 1 On a hard surface, use a permanent marker to draw a line on the knitting needle at the same height as the top of the cotton reel.
- 2 Wrap a rubber band around the top of the needle.
- 3 Put the needle inside the cotton reel and slide the rubber band to the top of the cotton reel.
- 4 Choose a range of soil locations around the school – which do you think will have the most compacted soil and why?
- 5 At each location, place your penetrometer and carefully push the needle into the ground. Once you can no longer push the needle into the ground, remove the needle from the spool and measure the distance between the line and the rubber band with a ruler.
- 6 Record the reading at each location. The smaller the distance, the more compacted the soil.

⚠️ Watch out

- Remember that the end of the needle/skewer is sharp. Keep the sharp end away from your face and never point it at anyone else.
- Be very careful when pushing your needle/skewer into the ground. Do not apply excessive force.
- Wash hands thoroughly after handling soil.

➤ Next steps

Visit www.engineeringeducates.org ✨ to take part in the 'Engineering Educates: Farmvention Challenge' and discover how you can use your STEM skills to design a farm of the future.

Sign up for Science Farm LIVE!, engaging live lessons that will be beamed from the farm to the classroom during [#BSW23](https://twitter.com/BSW23): livestream.co.uk/science-farm-live-2023 ✨.

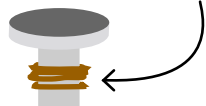
🏠 At home

Compacted soil stops plant roots from growing properly, meaning farmers have fewer crops. Can you design an invention to solve this real-life problem?

↔️ Career options

- Agronomists advise farmers on what to grow and where to grow it. They are soil experts and tools, such as penetrometers, help them to do their jobs.
- Lots of professionals use penetrometers to help them investigate how machinery affects soil including:
 - soil scientists
 - engineers
 - farmers.

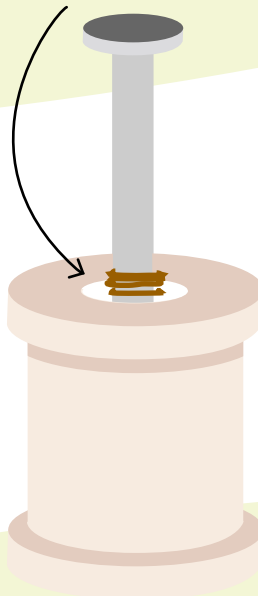
Wrap a rubber band around the top of the knitting needle.



On a hard surface, use a permanent marker to draw a line on the knitting needle at the same height as the top of the cotton reel.



Put the needle inside the cotton reel and slide the rubber band to the top of the cotton reel.



Remove the needle from the spool and measure the distance between the line and the rubber band.

