

BACKGROUND

Petroleum engineers and geologists have developed technology to increase exposure of an oil and gas reservoir by drilling horizontally or at an angle. This method of drilling can produce three to five times more oil and gas than vertical drilling.

Perforation refers to a hole punched in the casing, or liner, of an oil well to connect it to a reservoir of oil or gas. These holes in the horizontal well casing allow oil and gas to flow easily into the wellbore, increasing production of a reservoir.

This activity models the differences in production of a perforated and non-perforated well casing. After the activity, discuss with students the model limitations and ways to improve the experiment.

QUESTION

How do you think adding holes to a well casing will influence the amount of petroleum or natural gas that a well can produce?

MATERIALS

- 2 kitchen sponges, the same size and shape
- Flexible straws
- Pushpin
- Shallow tray
- Plastic wrap
- 1–3 heavy books or weights
- 10 mL graduated cylinder
- Cup of water

INSTRUCTIONS

1. Lay plastic wrap across your tray.
2. Place one sponge on the plastic wrap on the tray. Lay a straw on the sponge so the elbow is beyond the edge of the sponge. If necessary, trim the straw so the end of it is inside the end of the sponge by at least 3 cm (see diagram).
3. Lay the other sponge on top of the straw/sponge combination so the edges align with the first sponge. Pour water on the sponges so they are saturated but almost no water is leaking out.
4. Wrap both sponges in plastic wrap to seal and reduce water leaking out. The straw should protrude outside the plastic wrap.
5. Gently lay a heavy book (or even pressure from your hands) on top of the sponges and observe the amount of water that comes from the straw.
6. Add another book to the first, and continue until no water comes from the straw. Try using your arms to provide more mass, if needed.
7. Record observations. Measure the amount of water in the collecting tray by pouring it into the graduated cylinder.
8. Disassemble the stack of books, sponges, and straw.
9. Using a pushpin, poke several holes about 3–5 mm apart on both sides of the straw. (If straws are striped, use the stripes as a guide).
10. Replace the straw in the stack of sponges and rewet the sponges as before.
11. Repeat steps 5–8.
12. Record observations.



Perforated Well Casing

CONCLUSIONS

1. How did perforating (poking holes in) the straw change the amount of water you collected?

2. Using your observations, explain how perforating the well casing would be beneficial in a drilling scenario.

