LESSON 2 / FAMILY GUIDE

Make It Cleaner

Can you design a water filter?

ENGINEERING CHALLENGE: Design a filter that removes visible material from a sample of pretend dirty water.

At a Glance

Age	6-10 years
Estimated time	45-60 minutes
Engineering field	Environmental Engineering
Engineering practices	Test, Compare, Improve
Big ideas	Filtration, materials, and water quality

Materials

Gather these first

A plastic bottle, cup with holes, funnel, or another filter holder; two clear containers; and water mixed with safe visible materials such as clean soil, leaves, or tiny paper pieces.

- Possible filter layers: cotton, fabric, paper towel, coffee filter, clean sand, small gravel, or sponge.
- The exact materials are not important. Ask: What could this material catch?

Caregiver Notes

Your role

Help with setup and safety, but let your child choose the filter design and the order of the materials.

Particles vary in size, and filters have different spaces between fibers or pieces. A test that does not catch much dirt still teaches something useful. Ask: What did we learn?

Start the Conversation

Why water engineers study this

Look closely at the pretend dirty water. What can you see floating or suspended in it?

If you cannot pick out each piece by hand, what kind of system could separate some of the visible material?

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Choose a Starting Point

Story connection

Imagine a storm washed dirt and leaves into a container of water. Your family wants to remove the visible pieces. Which available materials would you test?

Real-world connection

Where have you noticed a filter - a coffee maker, fish tank, sink, pool, vacuum, mask, or water system? Do all filters remove the same things?

Ask Your Child

- What do you notice in the water?
- What materials might catch the visible pieces?
- What evidence would show that your design made a difference?
- Does water looking clearer mean it is safe to drink?

Meet Water Engineers

Dr. Lilia Abron - Environmental Engineer

Studied sanitary and chemical engineering, worked with water and sanitation agencies, taught environmental engineering, and founded PEER Consultants. Ask: Why must water engineers understand people as well as technology?

Dr. Kartik Chandran - Environmental Engineer

Researches wastewater treatment and ways to recover useful resources such as water, nutrients, and energy. Ask: Could something called waste still be useful?

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LESSON 2 / FAMILY ENGINEERING ACTIVITY

Make It Cleaner - Let's Engineer!

YOUR CHALLENGE: Design a filter that removes visible material from a sample of pretend dirty water.

Open Challenge

Set up and explore

Observe a sample of pretend dirty water and choose a filtering material or combination of materials. Your challenge is to remove as much visible material as possible.

What to Do

1. **Imagine** Decide what you hope to remove and which materials might catch it.
2. **Create** Build a filter using one or more materials; plan the path the water will take.
3. **Predict** Describe what you think will get trapped and what may pass through.
4. **Test** Slowly pour water through the filter. Collect and compare the water before and after.
5. **Improve** Change one material, add a layer, or rearrange the layers. Repeat the test.

Make It Your Own

Getting started

Begin with just one filter material. Observe what passes through and what stays behind.

Ready for more?

- Combine two or three filtering materials.
- Change the order of the layers and compare results.
- Time how long the water takes to pass through.
- Try to make water look clearer without slowing the filter too much.

Talk About It

- What got through your filter, and what was trapped?
- Which materials helped and why?
- What evidence shows your second design performed differently?
- Why is clearer-looking water not necessarily drinkable?

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Before You Finish

> How did the redesign affect the visible particles removed and the speed of water flow?

Invite your child to share discoveries through conversation, drawing, writing, photographs, pointing, or building. Record ideas in your Unit 2 Engineering Notebook if you wish.

Safety Reminder

This is a MODEL of filtration. Never drink experiment water, even if it looks clear: invisible contaminants may remain. Real drinking-water treatment uses additional processes. Use safe pretend dirt and adult help with cutting.

ENGINEERING DESIGN PROCESS ASK > IMAGINE > CREATE > TEST > IMPROVE

Optional: Family Notes and Sketches

Use this space for a quick drawing, a question, or something you noticed while engineering together.

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