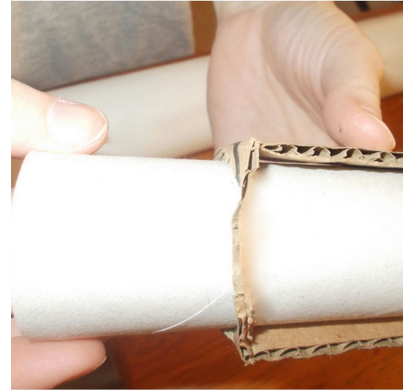


Lesson 3: Design a Device (Day 2)

Summary

The goal of this lesson is to build a magnifying device based on students' design from the previous lesson. If there is time, students might improve on their initial design.



Next Generation Science Standards

Disciplinary Core Ideas

- ETS1.B Developing possible solutions.

Science and Engineering Practices

- Planning and carrying out investigations
- Using mathematics and computational thinking
- Constructing explanations and designing solutions

Cross Cutting Concepts

- Structure and function

Materials

Building materials: Have these available for groups to start building.

Gather the materials ahead of time in bags or trays for each group based on their approved materials list and place them out on the tables. Alternatively, one or two representatives from each group could come up with an approved materials list to gather what that group needs.

- ★ cardboard
- ★ cardboard tubes
- ★ plastic or paper cups
- ★ construction paper
- ★ tape

- ★ scissors
- ★ other materials you may have on hand such as foil, egg cartons, plastic tubing, wooden dowels (optional)
- ★ other materials brought in by students (optional) *subject to your approval*

- ★ Engineering Design Process handout from yesterday

- ★ **Hi Tech option** device to take digital pictures of students' finished or unfinished devices before they disassemble them at the end of class (recommended)

Engage

None. This is a continuation of the previous lesson. Students gather materials and begin building.

Explore (25 min.)

Students use their approved design from the previous lesson to build a device that magnifies.

- Allow students to begin building based on their designs.
- For any teams that did not have a complete design or materials list, go over expectations. Help them problem solve so they can get back on track.

❖ Start building a magnifying device based on your approved design.

- As groups are working, circulate and note good use of the engineering design process to share later.
- Pause after 15 minutes and let teams look at each other's progress. You might want to ask a few teams to share particular challenges or successes they have had.

- ❖ Continue to build your device. If you are making any changes to your design, draw a diagram of your revised design and explain the changes you made and why.

Teams may modify their designs; it is fine to innovate based on new ideas. But students should track their progress and thought process in their notebooks. They should draw each iteration of their design and describe the rationale for any changes and improvements they made. This reflection and communication are as important as the finished product.

- (Optional) Photograph the students' finished (or unfinished) product. They can include the image in their work, or you can use the images the next day for discussion.
- Unless you have enough lenses for all your classes, *have groups take apart their device and clean up before the end of class*. Remind them that learning from the experience is as important as the finished product.

Explain (10 min.)

- If time, have one or two groups demonstrate their finished devices.

Elaborate (5 min.)

- Highlight how groups used the engineering design process or exhibited good work habits and cooperation.
- Have students take apart their devices and return the lenses.
- **Hi Tech option** If your students have access to computer-aided design (CAD) software and you have more time, they can re-design their device and build an improved version.

Extend

- (Optional) Have students do further research on magnification and microscopy.

Evaluate (5 min.)

- Review students' labeled drawings and explanations. Examine their finished (or unfinished) product to see how well it matches their design.

Homework

- ❖ Evaluate your design. What worked well? What have you learned? What could you do to improve your design?
- ❖ What were the limitations you faced in building your device? How would you change the design if you could have any materials you wanted?
- ❖ Reflect on working with your partner the past two days. What worked well? What would you do differently?