

Cutting Edge: Science of Precision

Introduction to Lasers and Laser Cutters

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Grade Level	6th – 9th Grade	**Time Frame**	105 minutes
Subject	Science	**Duration**	2–3 periods
Course	Physical Science		

Essential Question

How do lasers work?

Summary

In this technology lesson, students will explore the science of laser cutters. Students will view a variety of videos on lasers, work in stations to develop Frayer Models, and build a shared definition of how a laser functions. The lesson concludes with students developing a product pitch for something that can be made with a laser cutter.

Snapshot

Engage

Students view a Wakelet with information on lasers and complete an I Notice, I Wonder activity.

Explore

Students complete a station activity and record their findings in a Frayer Model. They then compare their findings with other students.

Explain

Students watch a video on laser cutting, share their Muddiest Point, and clear up misconceptions.

Extend

Students use the 8-Up instructional strategy to create a group definition of how a laser functions.

Evaluate

Students develop a product pitch of something they can make with a laser cutter tool.

Standards

ACT College and Career Readiness Standards - Science (6-12)

SIN202: Understand the tools and functions of tools used in a simple experiment
SIN401: Understand a simple experimental design
SIN701: Understand precision and accuracy issues
SIN702: Predict the effects of modifying the design or methods of an experiment

Next Generation Science Standards (Grades 6, 7, 8)

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Oklahoma Academic Standards (6th Grade)

6.PS1.4.2: The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.
6.PS3.3.3: Energy is spontaneously transferred out of hotter regions or objects and into colder ones.

Attachments

- Frayer Model—Science of Precision - Spanish.docx
- Frayer Model—Science of Precision - Spanish.pdf
- Frayer Model—Science of Precision.docx
- Frayer Model—Science of Precision.pdf
- Lesson Slides—Science of Precision.pptx
- Pitch Ideas—Science of Precision - Spanish.docx
- Pitch Ideas—Science of Precision - Spanish.pdf
- Pitch Ideas—Science of Precision.docx
- Pitch Ideas—Science of Precision.pdf
- Station 1 Precision Dots—Science of Precision - Spanish.docx
- Station 1 Precision Dots—Science of Precision - Spanish.pdf
- Station 1 Precision Dots—Science of Precision.docx
- Station 1 Precision Dots—Science of Precision.pdf
- Station Cards—Science of Precision.pdf

Materials

- **Lesson Materials**
  - Lesson Slides (attached)
  - Station Cards (attached; 1–2 sets)
  - Station 1 Precision Dots handout (attached; as needed per group)
  - Frayer Model handout (attached; one per group)
  - Pitch Ideas handout (attached; one per group)
  - Internet-connected device (one per student)
  - Chart paper (one per group)
  - Scratch paper (one per student)
  - Writing utensils (one per student)

Lab Materials List

- Instruments for cutting: pizza cutter, plastic Knife, & exacto knife
- Sample materials to be cut: foam, balsa wood, tortilla, plastic, cardboard, fabric, & cork
- String
- Marker
- Scissors
- Tape

- Station 1 Precision Dots handout (attached; as needed per group)

Teacher's Note

While the term "laser cutter engraver" is the industry name for this type of machine, we will shorten it to "laser cutter" for the sake of clarity and flow throughout this lesson. See our linked Tech Tool card for more information.

Teacher's Note: Stations

Before class starts, print a copy of the **Station Cards** and **Station 1 Precision Dots**. Laminate them or place them in sheet protectors. Set up each station in accordance with the station cards and then place the laminated cards with the instructions next to them. We suggest having at least two copies of the station cards at each station. You will also want to setup a class Tinkercad before beginning.

15 minutes

Engage

Use the attached **Lesson Slides** to facilitate the lesson. Transition through **slides 3–4** and discuss the Essential Question and Learning Objectives in as much detail as you feel necessary.

Display **slide 5**. Explain that the students will have the opportunity to interact with a Wakelet. Instruct students to access the linked *The Lit World of Lasers* Wakelet by typing in the URL or scanning the QR code. Then, ask each student to choose one example to focus on. Inform them they only have 10 minutes to choose and watch their example. Tell them to try to choose something different from the people around them. If they finish viewing their resources before the time is up, they can choose to explore the other resources.

Navigate to **slide 6**. Using the I Notice, I Wonder instructional strategy, have students record their initial thoughts from the Wakelet example they chose. What were some details that stood out the most to them? What do they still wonder about?

30 minutes

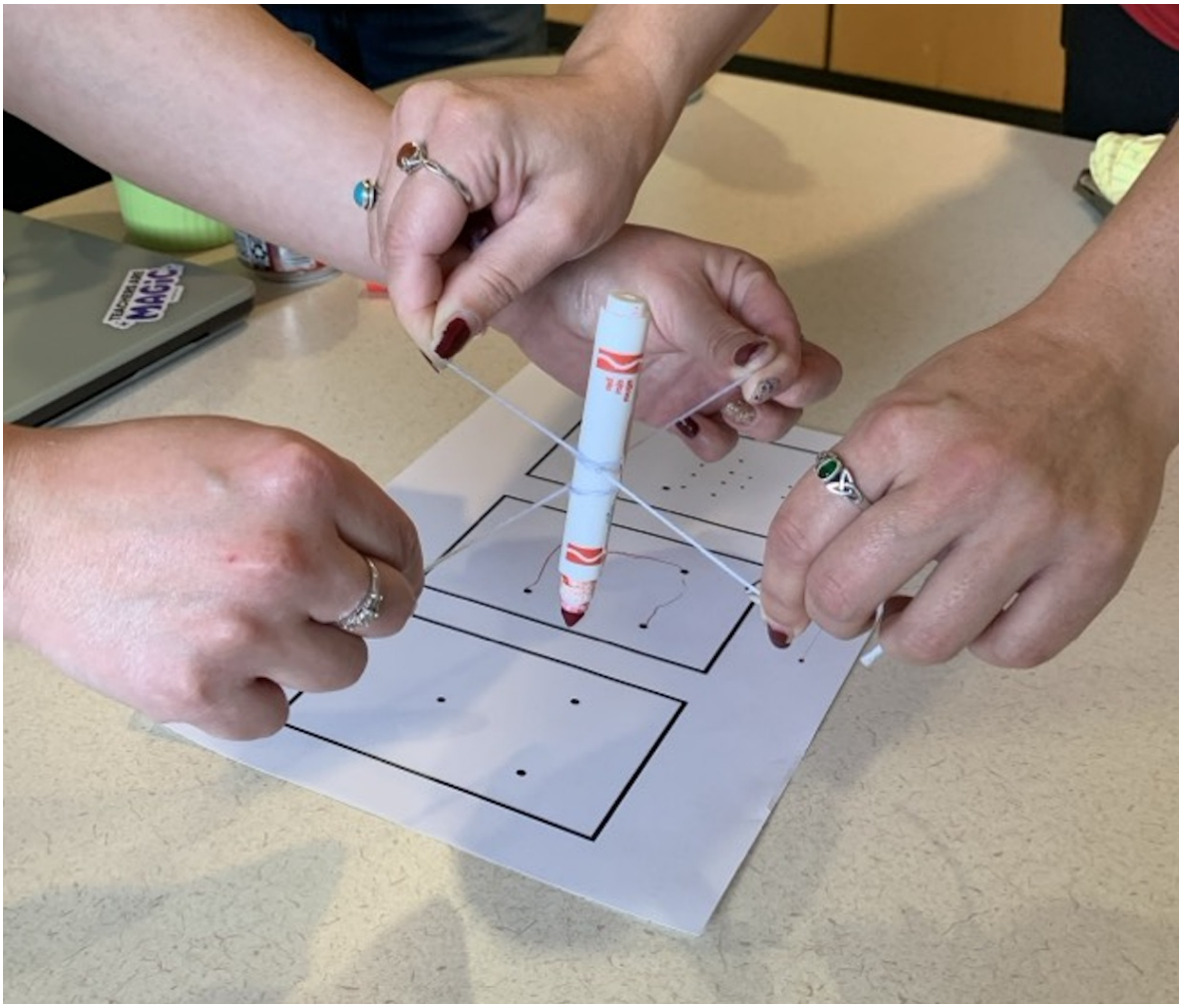
Explore

If you have not previously set up the materials for the stations, do so now.

Move to **slide 7** and explain that students will be working in small groups at their assigned station. Explain that each station has its own station card that provides a description of their task, materials needed, and a list of procedures. Inform students that there may be multiple groups at each station doing similar activities. Accordingly, place students into small groups, with no more than four students per group.

Now that students are in their groups, pass out the **Frayer Model** handout to each group. Explain that students will complete a Frayer Model like the example on the slide and fill in each section as they work through the station's procedures. Allow students time to work through their respective stations. After about 10–15 minutes, remind students to complete the "summary" and "questions" parts of their handout if they haven't already.

Here is an image of the Station 1 Precision Dots setup. Students are experimenting with lengths of string and methods to attach the strings. You may choose to show your students this image or just let them experiment.



As groups are starting to finish, move to **slide 8**. After all groups at a station have completed the task(s), have students compare their Frayer Models and using the chart paper to create a combined Frayer Model similar to the example on the slide.

After students have finished the work at their station, move to **slide 9** and explain that each group will share their observations from their station. After each group has shared, have students fill in the bottom part of their Frayer Models (or on the back) with a prediction of how the science at their station connects with the science at the other stations to create the whole (i.e., the function of a laser cutter).

Teacher's Note: Optional Extension

After all the groups have shared their Frayer Models about their stations, consider showing students the impact of burning different materials. This can be accomplished with a high-powered laser, open-flame Bunsen burners, or a magnifying glass.

15 minutes

Explain

Transition to **slide 10** and have students take out a piece of paper. Inform students that they will be writing notes about what they learned from the following video using the strategy Muddiest Point. Move to **slide 11** and play the Learn to Laser Cut! video.

Embedded video
https://youtube.com/watch?v=P7s3KXXJYHg

After the video, give students time to finish writing about their Muddiest Point(s).

Move to **slide 12.** As a class, discuss the questions on the slide:

- What is a laser and what makes it different from regular light?
- What happens to the material when a laser beam hits it at high intensity?
- What kinds of things do you think laser cutters are most useful for making or designing?

Continue until students have asked enough questions to clear up any misconceptions.

25 minutes

Extend

Move to **slide 13**. Give students some time to come up with their own individual definitions of the science behind lasers and how they function. Have them write this definition on the back of their Muddiest Point paper.

Transition to **slide 14** and introduce students to the instructional strategy 8 Up. Tell students that, as a class, they will be creating a group definition of how a laser functions but first they will create a definition with their small group, then in larger groups, before coming together as a class.

Divide your class into groups of 2–3, then move to **slide 15**. Instruct students to share their definitions with their group. Together, they should come to a consensus on two definitions for the function of a laser.

Once time is up, move to **slide 16** and have groups partner up with another group and share their responses. You should now have four larger groups. Together, they should take their four responses and whittle them down to just two. Have the large groups share their definitions with one another and as a whole class decide on one definition.

20 minutes

Evaluate

Transition to **slide 17**. This video is of some of the creations the students at Darnaby Elementary, in Tulsa, Oklahoma, have made with their laser cutter. This can serve as inspiration for project ideas.

After watching the video, move to **slide 18** and explain that students will create their own pitch for a product that uses a laser cutter. Place students into small groups and pass out a **Pitch Ideas** handout to each group. Have them complete the handout by brainstorming ideas and then coming up with their own "pitch" for a product they could make. Remind students that they should review all the notes from the stations and the class definition of how a laser functions to help with their pitches. Allow students time to work.

Evaluate the pitches informally on feasibility, reasoning, and viability. For example, can students accomplish the design? Is this a design that could be created using a laser cutter?

Follow-up Activities

Now that your students have an introduction to laser cutters, consider teaching the Cutting Edge: Design to Prototype lesson, which focuses more on laser cutters. Afterwards, consider teaching the culminating lesson: Burn It or Build It, which combines laser cutters and 3D printers.

Resources

- Beauty and the Bolt. (2017, January 21). *Learn to laser cut!* [Video]. YouTube. https://www.youtube.com/watch?v=P7s3KXXJYHg
- K20 Center. (2021, September 21). *3 Minute Timer* [Video]. YouTube. https://youtu.be/iISP02KPau0?feature=shared
- K20 Center. (2021, September 21). *4 Minute Timer* [Video]. YouTube. https://youtu.be/kpCsfuvzQeY?feature=shared
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- McDonald, M. (2024). *The Lit World of Lasers*. Wakelet. https://wakelet.com/wake/RE8nTJkTnEq8DJSvsZ1Ut