

***GREAT JOB!***  
***Exciting Careers in Science, Technology, Engineering, and Math***  
**EDUCATOR GUIDE**

**Segment Topic:** Chemical Engineering

**Ohio Science Academic Content Standards/Benchmarks Grades 6-8**

***2002 Ohio Science Standards:***

**Scientific Ways of Knowing**

Benchmark C. Give examples of how thinking scientifically is helpful in daily life.

**Physical Science**

- A. Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter.
- B. In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object.

**Science and Technology**

- A. Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life.
- B. Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety, and aesthetics).

**Scientific Inquiry**

- A. Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.

***2010 Ohio Science Standards:***

**Grade Band Theme: (Grades 6-8) Order and Organization**

*This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures and relationships that may be described by simple principles. These principles are related to the properties or interactions within and between systems.*

**Pre-Viewing Activity**

1. **CUE** the video the 00:07 second mark at the scene of the garden hose and **PAUSE**. **Mute** the sound.

2. Tell students that there are great jobs in science, technology, engineering and math and they are going learn about a great job in Northeast Ohio! Challenge students to predict what the job involves by watching 18 seconds of the video while muted.
3. **PLAY** muted video from 00:07 to 00:25 and **PAUSE** at the scene of the Parker building.
4. Question students about what they think the job involves and why. **FOCUS FOR MEDIA INTERACTION** by asking the students to watch the same clip but with sound and look and listen for what the job involves.
5. **CUE** the video back to the 00:07 mark and **PLAY** with sound to the 00:25 second mark and **PAUSE**. Check for comprehension about what the job involves (hoses).
6. Tell students that they are now ready to learn about the job presented by the video!

### Active Viewing Procedures

1. **FOCUS FOR MEDIA INTERACTION** by telling students that the video will feature the company Parker Hannifin in the Hose Division. Have students take out a sheet of paper and pencil. Tell them to listen for the 3 dedicated principles (design, fabrication, testing) of the Parker Hannifin's Hose division and record on their paper. **PLAY** Video from the beginning. **PAUSE** at the 00:36 second mark where Becky Ramsay is walking down the hallway. Check student responses for comprehension.
2. **FOCUS FOR MEDIA INTERACTION**. In the upcoming clip, Becky Ramsay explains what her job as a chemical engineer team leader is. Have students raise their hands when they hear Becky state her responsibilities. **PLAY** the video and **PAUSE** at the 00:53 second mark where you see a man in a hard hat and yellow safety vest. Check for student comprehension.

**OPTIONAL:** Have students view How Hydraulic Machines Work from the web site *How Stuff Works*. Information from this site may provide more in-depth hydraulic content knowledge featuring Force and Motion which is part of 8<sup>th</sup> grade ODE Physical Science Standards.

#### How Stuff Works "How Hydraulic Machines Work"

<http://science.howstuffworks.com/transport/engines-equipment/hydraulic.htm>

3. **FOCUS FOR MEDIA INTERACTION**. Tell students that the hydraulic hose in the upcoming clip has 6 layers used for 3 functions. The 3 functions are featured in red in the video. Have student listen for the 3 functions. **PLAY** the video from 00:53 and **PAUSE** at 01:26 where you will see the last red segment of the hose. Check for student comprehension.

4. **FOCUS FOR MEDIA INTERACTION.** Tell students to bark when they hear “dog bone”. Students should be able to explain what the “dog bone” is used for. **PLAY** video and **PAUSE** at the 2:15 mark where you see the polymer “dog bone.” Check for student comprehension of tensile strength and why it is important.
5. For the remainder of the video provide a **FOCUS FOR MEDIA INTERACTION** by having students record the following questions on their paper. Students should record their answers after viewing the remainder of the video.
- \*What happens to the graph as the numerical data change?
  - \*What do you think is the main reason for running several quality tests?
  - \*Name two school subjects that Becky states are used in engineering.

**PLAY** the video from the 2:15 mark until the end. Allow students time to respond to the questions and then check for student comprehension.

6. Tell the students that Becky Ramsay graduated from Case Western Reserve University with a degree in chemical engineering. Let the students know that they are going to investigate the college courses needed to prepare for a career as a chemical engineer. Next, students will track middle school and high school classes to help them prepare for a career in engineering.

### Post-Viewing Activity

Additional Post-viewing questions (Check for Comprehension/Understanding)

1. What is a polymer?
  2. Becky Ramsay mentioned an X-axis and Y-axis in the video. Where would you find the X-axis and Y-axis on a graph?
  3. List and/or research machines that have hydraulic hoses.
  4. Give examples of how scientific thinking demonstrated by Becky Ramsay can be helpful in everyday life.
1. Provide each student a copy or project the Case Western Reserve University Chemical Engineering course requirements.
- Case Western Reserve University Chemical Engineering Course Requirements**  
<http://www.case.edu/cse/eche/Curriculum.html>
2. Discuss the different types of math, science, engineering, chemistry, and writing classes in the Common Courses section.

3. Discuss the types of science, materials and breadth sequence classes in the Elective Courses section.
4. Provide students with a copy of your districts middle and high school course selection and have students select courses that best prepare them for a career in chemical engineering. Discuss their course selections.
5. Encourage students to keep their eyes open for a “Great Job!” in careers that involve science, technology, engineering and math!

**NOTE:**

The Physical Science concepts delivered in the video align with 8<sup>th</sup> grade Physical Science Standards. The Ohio Resource Center provides lessons, resources, and assessments for Physical Science 8<sup>th</sup> grade indicators.

**Ohio Resource Center: 8<sup>th</sup> Grade Ohio Physical Science Standards Resources**

<http://www.ohiorc.org/standards/ohio/grade/science/grade8.aspx>

**Additional Web Sites**

**Sloan Career Cornerstone Center**

<http://www.careercornerstone.org/>

**WVIZ/PBS ideastream “Imagine”**

<http://www.ideastream.org/imagine>

**How Stuff Works “How Hydraulic Machines Work”**

<http://science.howstuffworks.com/transport/engines-equipment/hydraulic.htm>

**Cleveland Plain Dealer: Parker Hannifin developing hydrogen fuel cells for Airbus**

[http://www.cleveland.com/business/index.ssf/2011/07/parker\\_hannifin\\_developing\\_hyd.html](http://www.cleveland.com/business/index.ssf/2011/07/parker_hannifin_developing_hyd.html)

**Middle School Chemistry**

<http://www.middleschoolchemistry.com/>

**PBS Teachers: STEM Education Resource Center**

<http://www.pbs.org/teachers/stem/>

**Career Day: Exploring Careers in Science, Technology, Engineering, and Mathematics**

[http://www.fcps.edu/fairfaxnetwork/career\\_day/index.html](http://www.fcps.edu/fairfaxnetwork/career_day/index.html)