

## How It's Made

“South Carolina seventh-grade students engage in thinking and solving problems the way scientists and engineers do to help them better see how science is relevant to their lives.” (SC Dept. of Ed.) Science educators have the challenge of teaching the content standards by connecting them to real world applications within the limitations of classrooms and curricula that predate the new generation of standards. Today's students aren't learning content in a vacuum, instead they are engaging with the core content standards with hands-on and real world applications- through the lens of the engineering design process.

### **The goals of this project include:**

- Providing students with resources and opportunities to apply Physical Science standards to real world scenarios
- Emphasize the importance of the Engineering Design Process and how it is used in and out of the classroom setting
- Allow students to use Physical Science and the Design Process to produce tangible commodities as well as to create a podcast where they share their findings

This will be done through the following units projects:

### **Energy Project Management:**

With this unit project, students will be assigned into design teams where they will each have a distinct job and responsibility and go through the entire Engineering Design Process with the final product being a small-scale roller coaster. The roller coaster will then be used to test and observe Newton's Laws of Motion. Each team will be given a set of controlled materials and specifications and they will have to work together to plan, design, build, and then test the final product. The whole process will be student led and driven with group members acting as project managers, material managers, quality control, and communication officers. Throughout the unit students will be learning and demonstrating concepts such as kinetic and potential energy, relationships between mass and speed, gravity, momentum, and other physics concepts. Students will use the iPads to assist in their design through student focused engineering programs like TinkerCad. The tubes, tape, and foam insulation will be used to implement those designs.

### **Chemical and Physical Reactions in Manufacturing:**

The Chemical and Physical Reactions in Manufacturing project has students using chemistry to actually manufacture products on a small scale- soap and candles. A challenge in introducing middle schoolers to basic chemistry is the fact that they often struggle with abstract concepts and it's hard for many to visualize something as small as an atom. This obstacle will be overcome using interactives to show the reactions at a molecular level, followed by performing actual chemical reactions with the purchased materials. The iPads will be used to model molecule building by virtually rearranging atoms in potassium hydroxide (lye) and oils to show soap at the molecular level. The oils, lye, crock pots, and various containers will be used to facilitate the chemical reaction that produces soap. The chemical reaction of soap will serve as a contrast to the physical changes that take place in the production of candles. We will once again use online simulations to show the molecular activity- this time melting and freezing. Crockpot, wax, and related materials will be used by the students to produce candles. The end result is that students are making two different viable products using natural and synthetic materials while using chemistry.

### **How It's Made Podcast:**

An often neglected step of the Engineering Design Process is the final one- sharing the findings. Each group will first use the iPads and earbuds to listen to several How It's Made type podcasts and be asked to reverse engineer it. After breaking down what goes into a successful podcast, student groups will use the knowledge they gained through their hands-on projects as content to write and produce their own podcast. Podcasting equipment such as microphones and portable sound booths will allow students to create a polished, finished product that can be shared with classmates and other students in the school. Podcasting will be used throughout the units to reflect and update on their progress.

## The proposed project will cover the following SC State Standards:

### Disciplinary Core Ideas

7-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

7-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

7-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

7-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

7-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

7-PS3-1. Construct and interpret graphical displays of data to describe the proportional relationships of kinetic energy to the mass of an object and to the speed of an object.

7-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Item	Category	Usage	Link	Price
Large Cardboard Tubes	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/eP0T WV3">https://a.c/o/d/eP0T WV3</a>	\$26.99 x 4 = \$107.96
Brushes	Energy Project Management	Customizing roller coasters	<a href="https://a.c/o/d/eP0T WV3">https://a.c/o/d/eP0T WV3</a>	\$29.99
Small Cardboard Tubes	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/6Ro55 vH">https://a.c/o/d/6Ro55 vH</a>	\$25.99 x 4 = \$103.96
Paint	Energy Project Management	Customizing roller coasters	<a href="https://a.c/o/d/gWXyl ND">https://a.c/o/d/gWXyl ND</a>	\$33.99
Ball Bearings	Energy Project Management	Balls will be used to test different masses	<a href="https://a.c/o/d/5Vxou tC">https://a.c/o/d/5Vxou tC</a>	\$10.99 x 4 = \$43.96
Foam Pipe Insulators	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/bO2G 6OZ">https://a.c/o/d/bO2G 6OZ</a>	\$18.99 x 8 = \$151.92
Assorted Duct Tape	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/hveY MBQ">https://a.c/o/d/hveY MBQ</a>	\$20.99 x 4 = \$83.96

10 rolls masking tape	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/hi993TY">https://a.c/o/d/hi993TY</a>	\$18.70 x 4 = \$74.80
Popsicle Sticks	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/e8JZWFa">https://a.c/o/d/e8JZWFa</a>	\$16.28 x 4 = \$65.12
Air Dry Clay	Energy Project Management	Building materials for roller coasters.	<a href="https://a.c/o/d/9Ewm96Q">https://a.c/o/d/9Ewm96Q</a>	\$6.99 x 12 = \$83.88
7 quart crock pots	Chemical and Physical Reactions in Manufacturing	Heating soap making materials and melting wax for candles	<a href="https://a.c/o/d/dZYYBTG">https://a.c/o/d/dZYYBTG</a>	\$38.69 x 4 = \$154.76
Set of 4 Silicone Mixing Bowls	Chemical and Physical Reactions in Manufacturing	The bowls will be used by students to “customize” their soap compound and then their candle wax during the two separate projects.	<a href="https://a.c/o/d/eYIILC8">https://a.c/o/d/eYIILC8</a>	\$17.79 x 24 = \$426.96
Infrared Thermometer	Chemical and Physical Reactions in Manufacturing	Measuring temperatures during soap and candle manufacturing.	<a href="https://a.c/o/d/eYIILC8">https://a.c/o/d/eYIILC8</a>	\$9.39 x 6 = \$56.34
Extension Cord	Chemical and Physical Reactions in Manufacturing	Providing power to the crock pots	<a href="https://a.c/o/d/05YaAj5">https://a.c/o/d/05YaAj5</a>	\$8.99 x 4 = \$35.96
Power Strip	Chemical and Physical Reactions in Manufacturing	Providing power to the crock pots	<a href="https://a.c/o/d/fdGN2p7">https://a.c/o/d/fdGN2p7</a>	\$14.99 x 4 = \$59.96
Sodium Hydroxide (lye)	Chemical and Physical Reactions in Manufacturing	Soap making material	<a href="https://a.c/o/d/fZnzKkl">https://a.c/o/d/fZnzKkl</a>	\$15.70 x 4 = \$62.80
Nitrile Disposable Gloves 100 count	Engineering Soap with Chemical Changes	Personal protection	<a href="https://a.c/o/d/cexQN2C">https://a.c/o/d/cexQN2C</a>	\$8.26 x 4 = \$33.04
Coconut Oil 1 gallon	Engineering Soap with Chemical Changes	Soap making material	<a href="https://a.c/o/d/9jpmlyA">https://a.c/o/d/9jpmlyA</a>	\$35.99 x 4 = \$143.96
Dried Flowers	Chemical and Physical Reactions	Soap and candle additives	<a href="https://a.c/o/d/gOBCG4U">https://a.c/o/d/gOBCG4U</a>	\$29.99 x 4 = \$119.96

Vegetable Oil 1 gallon	Chemical and Physical Reactions in Manufacturing	Soap making material	<a href="https://a.c/o/d/fqklAKo">https://a.c o/d/fqklAK o</a>	\$11.97 x 4 = \$47.88
Soy Candle Wax for Candle Making	Chemical and Physical Reactions in Manufacturing	Candle making material	<a href="https://a.c/o/d/96BTBbL">https://a.c o/d/96BTB bL</a>	\$31.35 x 4 = \$125.40
Candle Wicks 100 count	Chemical and Physical Reactions in Manufacturing	Candle making material	<a href="https://a.c/o/d/9cYwcJh">https://a.c o/d/9cYwc Jh</a>	\$6.75
Candle Tins with lids 24 count	Chemical and Physical Reactions in Manufacturing	Candle making material	<a href="https://a.c/o/d/8lu4Q3J">https://a.c o/d/8lu4Q 3J</a>	\$23.99 x 4 = \$95.96
Dyes for Candle and Soap Making	Chemical and Physical Reactions in Manufacturing	Soap and candle additives	<a href="https://a.c/o/d/6lc6kz6">https://a.c o/d/6lc6kz 6</a>	\$13.99 x 8 = \$111.92
Bamboo Skewers 100 count	Chemical and Physical Reactions in Manufacturing	Candle making material	<a href="https://a.c/o/d/eIWslxS">https://a.c o/d/eIWslx S</a>	\$7.89
Wooden Clothespins	Chemical and Physical Reactions in Manufacturing	Candle making material	<a href="https://a.c/o/d/5G3iZX2">https://a.c o/d/5G3iZ X2</a>	\$7.99 x 2 = \$15.98
Essential Oils	Chemical and Physical Reactions in Manufacturing	Soap and candle additives	<a href="https://a.c/o/d/fdGN2p7">https://a.c o/d/fdGN2 p7</a>	\$16.99 x 4 = \$67.96
Portable Sound Booth	How It's Made Podcast	Sound proof space for podcast recording	<a href="https://a.c/o/d/g5Hzhfw">https://a.c o/d/g5Hzh fw</a>	\$199.99 x 3 = \$599.97
Podcast Equipment Bundle	How It's Made Podcast	Equipment for recording podcast	<a href="https://a.c/o/d/5vYaSQj">https://a.c o/d/5vYaS Qj</a>	\$39.99 x 3 = \$119.97
Earbuds (50)	How It's Made Podcast	Enough earbuds for each student to be able to have a clean pair for listening to podcast playbacks	<a href="https://a.c/o/d/ewQoqhh">https://a.c o/d/ewQo qhh</a>	\$23.99 x 2 = \$47.98
ipad mini	All Sections	Used throughout all the projects to design roller coasters and do molecule simulations. Will record and produce podcasts	<a href="https://a.c/o/d/5oIOe2f">https://a.c o/d/5oIOe 2f</a>	\$299.99 x 6 = \$1799.94

Total \$4,931.87