August-October 2019 • Volume 8, No. 1

SYSTEM ALERT!

Tomorrow is almost here.

Supply chains link the world

Product packaging, glossy and vibrant, often disguises the human work and natural resources that create products. But look closer:

- On an ingredient list: "Kosher gelatin, citric acid, natural flavor . . ."
- On a pair of shoes: "Made in China."
- On a tube of lipstick: "Certified organic."

Products begin as raw materials shipped across the planet. They are manufactured, inspected, distributed, and sold. This process is called a **supply chain**.

Want to learn more about supply chains? Check out the following by Pitsco Education:

- ***Transportation Stations*** **STEM Expedition®**
- ***Special Delivery*** **Career Expedition**
- ***Mechanical Makers*** **Career Expedition**

LEARN MORE!

TAKE A TRIP DOWN THE SUPPLY CHAIN

Every tube of Smile Slime toothpaste is manufactured in the heartland of the USA. But that's not the start of the tale. Follow the paths around the world to learn how this fictional product comes to be.

SUPPLY CHAIN MANAGER

At every link in the chain, workers and machines do their part. But who sees the *whole* process? **Supply chain managers** oversee the path raw materials take to become a finished product. They rely on data, technology, and communication skills. They keep the wheel of production in the global economy moving.

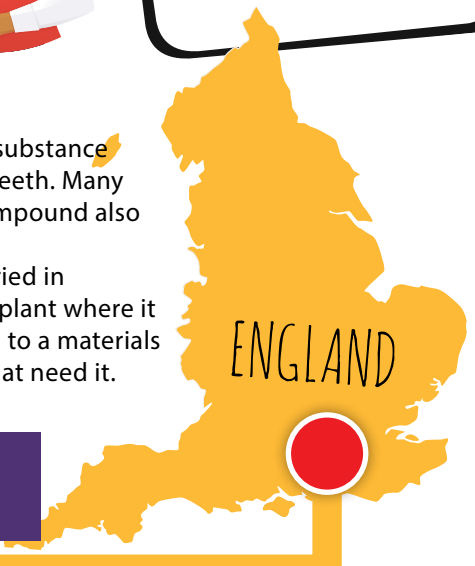
"Hello, is this Royal Chalk Supply Company? Smile Slime would like to order a shipment of calcium carbonate."

"Let's talk rock chalk . . ."

Calcium carbonate

Every toothpaste needs an **abrasive** – a gritty substance to scratch food particles from the hard surface of teeth. Many toothpastes use calcium carbonate, a chemical compound also used to make the chalk used on chalkboards.

Smile Slime purchases calcium carbonate quarried in England. After mining, the material is trucked to a plant where it is filtered and ground into a powder. It is then sold to a materials supply company that sells it to other companies that need it. The shipment to Smile Slime goes by sea freighter.



Martian colonists might one day use calcium carbonate in their teeth care. The compound has been identified on the red planet.

Carrageenan

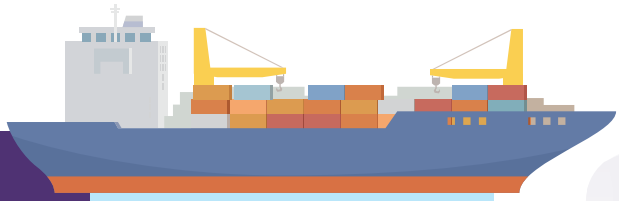
PHILIPPINES

Seaweed farms dot the coastline in the Philippines, employing hundreds of thousands of people. Red seaweeds are a great source of carrageenan, a **thickener** used in toothpastes (such as Smile Slime) and foods (such as chocolate bars). Its gel-like consistency holds the abrasive and the other ingredients together.

Extracting the carrageenan from the seaweed takes a combination of cooking, washing, bleaching, and grinding the plant matter.

Hydraulic arms and cranes use fluids to move heavy cargo. Explore the world of hydraulics with the T-Bot® II from Pitsco.

LEARN MORE!



More than 90% of global shipping is by sea – more than 10.7 billion tons per year!

SHIP ENGINEER

These professionals keep a ship's propulsion system in working order.

Xylitol

Though bamboo shoots can stretch nearly 100 feet tall, bamboo is not a tree but a type of grass. And it can grow incredibly fast – often more than one inch per hour!

Bamboo from Japan is a great source of xylitol, a sugar alcohol used as a **sweetener** in some foods, gums, and toothpastes – including Smile Slime. Xylitol can't be directly extracted from the plant. Yeast cultures are used in fermentation tanks to break down the plant matter into xylitol.

"Labor costs have gone up. We'll need to renegotiate our price arrangement with Smile Slime for xylitol."

JAPAN

MICHIGAN

Propylene glycol

Propylene glycol is a clear liquid used to deice the wings of aircraft and to make polyester. It is also used as a **humectant** in toothpastes. Humectants help retain water.

Smile Slime purchases propylene glycol from a supplier who purchases it from a chemical plant in Michigan. It is then shipped by truck to the Smile Slime manufacturing facility.

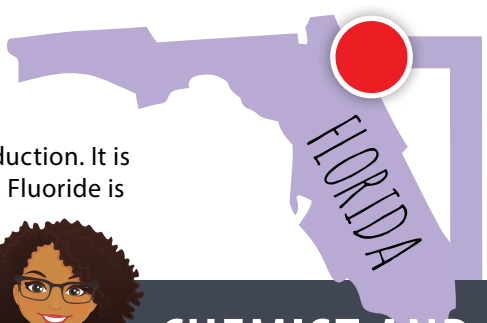
"Tell me about the impact of propylene glycol."

"The FDA says it is safe in foods and breaks down quickly in the environment."

Supply chain managers have a duty to look out for human health and environmental safety. Some materials are toxic or are produced in a harmful way. The supply chain manager safeguards consumers and the good reputation of his or her company.

Fluoride

The fluoride used by Smile Slime begins as a byproduct of fertilizer production. It is processed into a pharmaceutical-grade product for safe use in toothpastes. Fluoride is the **active ingredient** in most toothpastes. This is because it fights tooth decay. It can even reverse tooth decay in some cases by encouraging enamel crystals to grow and fill small cavities!



Fluoride is a chemical with a controversial reputation. Some people believe fluoride poses unknown health risks. However, most scientists declare fluoride to be a safe – even beneficial – chemical in small amounts. That is why it is added to the water supply in many locations in a ratio of less than one part fluoride to one million parts water. And the American Dental Association gives its seal of approval only to toothpastes containing fluoride.

But in high quantities, fluoride can stain teeth. This is how its cavity-prevention powers were discovered. A dentist in Colorado noted that his patients had stained teeth but few cavities. The water in the region was found to contain high levels of fluoride.

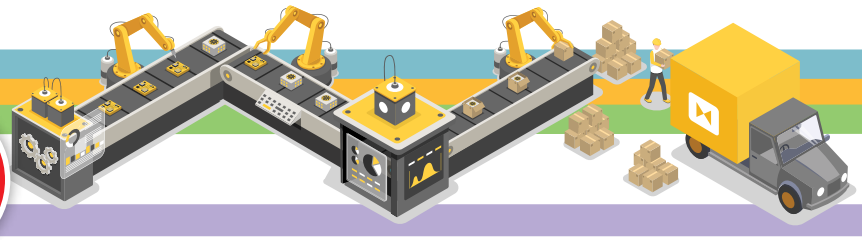
CHEMIST AND CHEMICAL TECHNICIAN

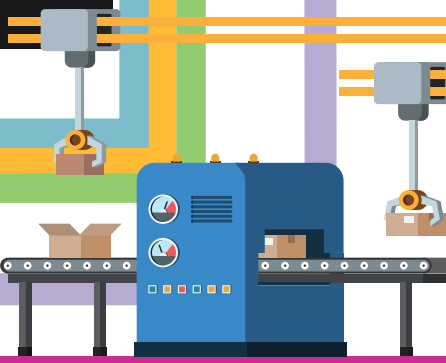
Working in labs or manufacturing environments, these workers use knowledge of atoms and molecules to create new products.

"Don't blame us for the fees! Customs agents detect security threats and enforce international laws."

CUSTOMS

When international shipments arrive at port, they are subject to **inspection** and **import duties** (fees) by US customs agents.





MANUFACTURING

Arriving from many places, ingredients at last come together at a manufacturing facility. Here, workers use machines to create the final product. Manufacturing processes are well-defined and repeatable.

This is where Smile Slime is created and packaged. (In some cases, packaging might happen at a different location.)

Automation is the use of machines to replace human workers. Studies show that manufacturing and agriculture are two career fields that have seen many job losses.

"I've been crunching the numbers, and we will waste less xylitol with this new inventory process."

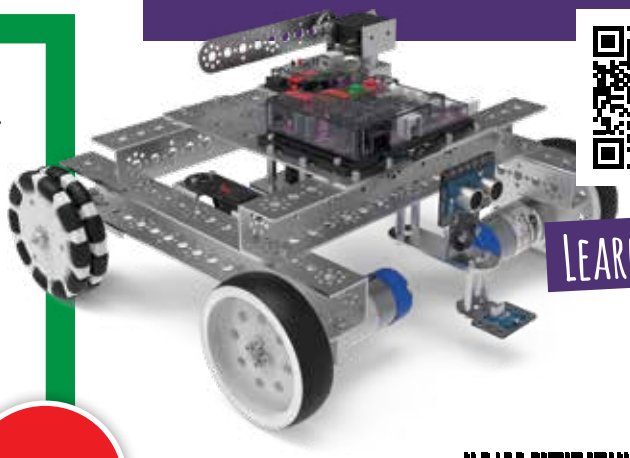
"You just saved me a headache!"

MANUFACTURING ENGINEER

A manufacturing engineer has the job of designing the process used to manufacture a product. His or her goal is to make the process efficient, the product high quality, and, of course, the workers safe.

A TETRIX® Line-Finder Robot

Challenge: With the TETRIX building system, create a line-finder robot that can follow a dark line like what you might find on the floor of a modern warehouse. Can you create a robot that delivers product from a bin to a package across the room?



LEARN MORE!

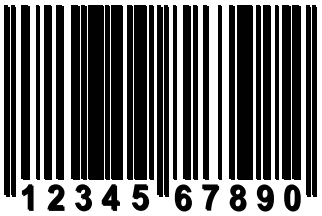
WAREHOUSE

The manufactured product is sent to distribution centers. Here it is warehoused until it is ready to be sent to stores.

Forklifts are often used to place items on high shelves and retrieve them. Workers must be certified to use such specialized heavy equipment. However, some modern warehouses use automated forklifts such as the Seegrid GP8 Series 6. These require no driver. Some warehouses are almost completely automated.

RETAIL

Retail stores order product from distributors to sell to their customers. Supply chain managers monitor the distribution networks to make sure that orders are fulfilled. After Smile Slime is stocked on the shelves, the toothpaste is ready to entice customers.



Closely tracking the supplies and the finished product is key to managing the whole chain. With RFID (radio-frequency identification), whole pallets of product can be scanned in a moment. Bar codes, another tracking technology, use patterns of black and white bars to represent numbers. Light sensors scan the bars, and a computer references the encoded number to identify the product.

RETAIL BUYER

These people make their living purchasing goods for resale to customers in stores.

Volume 8, No. 1

SySTEM ALERT!

Tomorrow is almost here.

Vice President, Education & Executive Editor:
Matt Frankenbery, mfrankenbery@pitsco.com

Communications Manager & Editor:
Tom Farmer, tfarmer@pitsco.com

Writer & Assistant Editor:
Cody White, cwhite@pitsco.com

Lead Graphic Artist & Layout:
Jodie Sutton, jsutton@pitsco.com

SySTEM Alert! is published by Pitsco, Inc. Information and articles are geared to middle-level students.

Visit **Pitsco.com/SySTEMalert** to download a printable PDF of this or past issues of ***SySTEM Alert!*** courtesy of Pitsco, Inc.

Student name: _____ **Class/Hour**: _____

SySTEM Alert! Quiz (Volume 8, Number 1)

1. _____ managers oversee the path raw materials take to become a finished product.
    A. retail
    B. manufacturing engineer
    C. supply chain
    D. warehouse

2. What is the name of a common thickener used in toothpaste?
    A. xylitol
    B. carrageenan
    C. fluoride
    D. Smile Slime

3. Bamboo can grow up to one inch per _____.
    A. minute
    B. hour
    C. day
    D. week

4. What agency inspects shipments that arrive from international destinations?
    A. FBI
    B. US Customs
    C. US Treasury
    D. National Parks Service

5. What can fluoride do to teeth in high quantities?
    A. stain them
    B. prevent tooth decay
    C. both A and B
    D. none of the above

6. Manufacturing and agriculture have lost many job positions to _____.
    A. drone technology
    B. self-driving cars
    C. automation
    D. Chuck Norris

7. Propylene glycol helps retain water in toothpastes. What else is it used for?
    A. motorboat fuel
    B. aquarium cleaner
    C. sanitizing surgical tools
    D. deice the wings of airplanes

8. Toothpaste requires an abrasive. Some brands use _____, a compound that is also used to make chalkboard chalk.
    A. carrageenan
    B. calcium carbonate
    C. fluoride
    D. xylitol

9. Whole pallets of product can be scanned in a moment using _____.
    A. radio-frequency identification
    B. xylitol
    C. pressure sensors
    D. line-finding technology

10. Retail stores order from _____ and sell to _____.
    A. US Customs, manufacturing facilities
    B. Japan, England
    C. manufacturing engineers, retail buyers
    D. distributors, customers

Bonus:
Think of a food that you enjoy. List every ingredient you can think of that goes into that food. (Come up with at least five.) For each ingredient, write a location you think that ingredient might have been shipped from and then research the verified locations.