Engage budding scientists and future pharmacists with this comprehensive list of STEM activities designed to introduce them to the fascinating world of pharmacy. From basic concepts to advanced experiments, these activities cater to various age ranges, time commitments, and material availability. Each activity is accompanied by pharmacy-related talking points, detailed instructions, and a complete list of required materials.
Contents

- MAKING LIP BALM
- BUILD A FUNCTIONING HEART MODEL
- BUILDING CANDY DNA
- DRUG EMULSION
- EXTRACTING DNA FROM A STRAWBERRY
- HOW PILLS DISSOLVE IN THE BODY
- HOW TO READ A PRESCRIPTION DRUG LABEL
- MAKING HAND SANITIZER
- POKEMON OR DRUG
- PROTECT THAT PILL
Lip balm can be found on the shelves of almost any store in a variety of forms and flavors. But did you know that making your own lip balm is fairly simple with just a few ingredients? This guide will walk you through the entire process of making your very own lip balm in less than 10 steps. This activity is a great opportunity to talk about chemical processes used often by pharmacists such as compounding.
OVERVIEW

Quick Look

Grade 9 and up
45 mins +
Demonstration or interactive

This activity requires the use of a hot plate. It's recommended adults always be present. Also, some essential oil flavors, such as peppermint oil, can be a skin irritant for some people.

Pharmacy Connection - Compounding

Introduce the concept of pharmacy compounding, defined by the US Pharmacopeia Convention as “the preparation, mixing, assembling, altering, packaging, and labeling of a drug, drug-delivery device, or device in accordance with a licensed practitioner’s prescription, medication order, or initiative based on the practitioner/patient/pharmacist/compounder relationship in the course of professional practice.” or more simply put, it “is the creation of a pharmaceutical preparation—a drug—by a licensed pharmacist to meet the unique needs of an individual patient (either human or animal) when a commercially available drug does not meet those needs.”1

Talking Points

- Highlight how a compounding pharmacist can customize medications to meet a patient’s needs:
  - Customize strength or dosage.
  - Flavor a medication (to make it more palatable for a child or a pet).
  - Reformulate the drug to exclude an unwanted, nonessential ingredient, such as lactose, gluten, or a dye to which a patient is allergic.
  - Change the form of the medication for patients who, for example, have difficulty swallowing or experience stomach upset when taking oral medication.”(2)
- Make the connection between flavoring a medication and the flavored oils that will be used in this activity. Ask participants what their favorite flavor lip balm is. Then make the point that, for example, a medication may need to be flavored to help a child take it. Similarly, participants of this activity may only use lip balm if it has a certain flavor.
- Although the lip balms being compounded during this activity are not medicated, pharmacists have the ability to add medication to it. Lip balms can contain camphor, phenol or menthol to help relieve pain of severely chapped lips. Although these are available in stores, pharmacists can help compound lip balms if a patient is allergic to an ingredient of the commercially available products.
### INGREDIENTS

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>QUANTITY: 2</th>
<th>QUANTITY: 10</th>
<th>QUANTITY: 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anhydrous Base</td>
<td>4 grams</td>
<td>20 grams</td>
<td>40 grams</td>
</tr>
<tr>
<td>Beeswax</td>
<td>2 grams</td>
<td>10 grams</td>
<td>20 grams</td>
</tr>
<tr>
<td>Lanolin Oil</td>
<td>1.2 mL</td>
<td>6 mL</td>
<td>12 mL</td>
</tr>
<tr>
<td>Almond Oil</td>
<td>3.4 mL</td>
<td>17 mL</td>
<td>34 mL</td>
</tr>
<tr>
<td>Aloe Vera Powder</td>
<td>0.05 grams</td>
<td>0.5 grams</td>
<td>1.0 grams</td>
</tr>
<tr>
<td>Flavored Oil</td>
<td>A few drops</td>
<td>~10 drops</td>
<td>~20 drops</td>
</tr>
</tbody>
</table>

### SUPPLIES

- A hot plate
- Stirring rod or spin bar
- Beakers (we use 250 mL)
- Spatula for anhydrous base
- Graduated cylinder (we use a 10 mL)
- Lip balm tubes
- Scale for measuring anhydrous base and aloe vera powder
- Optional: Lip balm labels

All of the following ingredients are USP grade and 100% pure. They are easily found on Amazon or Bulk Apothecary! The easiest oil to find is pure peppermint extract that you get from the grocery store. Other flavored oils are available on Amazon or Bulk Apothecary.

### INSTRUCTIONS

1. Place beaker containing anhydrous base and beeswax onto a hot plate.
2. Melt the base on a hot plate (using setting 3).
3. Add a spin bar to the beaker and set the stirring speed on low to help disperse the beeswax pellets in the oil mixture. Continue stirring on low until the base and beeswax are fully melted.
4. Using sifter and rubber spatula, carefully sift the aloe vera into the beaker and stir until evenly smooth.
5. Add flavor and mix well.
6. Carefully remove the beaker from the hot plate, remove the spin bar, and allow the mixture to cool on the counter for a few minutes.
7. Turn the bottom dial of the lip balm applicator 2 full turns.
8. Pour melted lip balm into the tubes until full. Allow to cool at room temperature.

### SOURCES


Additional Contributor: Kristen Ahlschwede, PhD, Rosalind Franklin University of Medicine and Science
BUILD A FUNCTIONING HEART MODEL

In this activity, participants build a functioning heart model out of items found around the house. It is a great lesson to talk about the heart, heart health and the role of cardiology pharmacists.

10-30 Participants

Steam Powered Family

Little Bins Little Hands
Cardiology pharmacists are trained to understand the intricacies of cardiovascular medications, their mechanisms of action, and potential interactions with other drugs. They collaborate closely with physicians, cardiologists, and other healthcare providers to optimize medication therapy for patients with various cardiovascular conditions. By assessing patients' medical histories, monitoring medication regimens, and providing comprehensive drug information, cardiology pharmacists ensure that medications are prescribed appropriately, administered correctly, and produce the desired therapeutic outcomes. Cardiology pharmacists play a crucial role in promoting heart health, enhancing patient outcomes, and improving overall quality of life for individuals with cardiovascular diseases.

Talking Points

- Cardiology pharmacists focus on the heart and are part of a team that includes doctors and nurses. They work together to help patients with heart problems. Instead of directly giving out medicines, these pharmacists use their knowledge about medications and the heart to help patients.

- Cardiology pharmacists take care of patients with heart transplants, high blood pressure, uneven heart beats, hearts that don’t pump well, and prevent blood clots.

- Cardiology pharmacists can work in different places, like emergency rooms, intensive care units, and clinics that focus on heart problems.

- Pharmacists need to know about blood flow through the heart because it helps them understand how certain medications can affect the heart and blood vessels.
**INGREDIENTS/Supplies**

<table>
<thead>
<tr>
<th>INGREDIENTS/Supplies</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty soda bottles with caps</td>
<td>3</td>
</tr>
<tr>
<td>Bendy straws</td>
<td>4</td>
</tr>
<tr>
<td>Tape</td>
<td>1</td>
</tr>
<tr>
<td>Drill</td>
<td>1</td>
</tr>
<tr>
<td>Red food coloring</td>
<td>A few drops</td>
</tr>
<tr>
<td>Water</td>
<td>3 cups</td>
</tr>
</tbody>
</table>

**SOURCES**

Remove the labels from the bottles so that participants can see the contents easily.

In this simple model the first bottle is the atrium of the heart, the second bottle is the ventricle, and the third bottle represents either the lungs or body. Our fingers function as the valves of the heart.

**INSTRUCTIONS**

1. In the first bottle cap, drill two holes that are the same size. You want the holes to be just big enough for the straws to slide through. In the second cap drill one hole that is straw sized. The second should be smaller.

2. In a pitcher, mix your water and food coloring to create your “red blood”. The exact amount of water is not important.

3. Take two straws, stretch and bend them to create a 90 degree angle. Slide one straw into the other straw (pinch one to make it smaller so it slides in), then tape up the join. Repeat with the second set of straws.

4. Place your three bottles on the table. Fill the first two with your water to about 80% full. Leave the third one empty.

5. On the first bottle place the cap with one straw hole and one small hole. On the middle bottle place the cap with two straw holes. Leave the third bottle without a cap.

6. Carefully slide the straws through the bottle caps. Place clay or play dough around the straw bases on the middle bottle to make an airtight seal with the bottle cap. You are now ready to put your heart model to work!

7. To make your human heart models work, squeeze the middle bottle only. Start by pinching the straw between the atrium and ventricle bottle. Squeeze the middle bottle and watch your “blood” squirt out into the body.

8. Keeping the middle bottle “squeezed” move your fingers and pinch the straw between the ventricle and body. Now release the middle bottle and watch your blood move from the atrium into the ventricle.

9. Repeat, repeat, repeat to pump blood from the atrium, into the ventricle then out to the body!

10. Once your blood in the atrium gets too low, you can take blood from the “body” and add it back into the atrium. Then start again.

11. **Remove the labels from the bottles so that participants can see the contents easily.**


Additional Contributor: Lisa Richter, PharmD, BCPS, BCCCP

North Dakota State University School of Pharmacy
There are several ways you can make a DNA model project for kids of all ages. Learn about the structure of DNA, and find out how to make your own candy DNA model. This is fun candy science you can eat too!
OVERVIEW

Quick Look

Elementary and up

1 hour

Interactive activity

Some candy may be allergens for some children. It is recommended to check for food allergies before starting this activity.

Pharmacy Connection - Pharmacogenomics

DNA plays a significant role for pharmacists in various aspects of their profession. Understanding the genetic makeup of individuals has become increasingly important in the field of pharmacology, as it allows pharmacists to personalize medication therapies and optimize treatment outcomes. Pharmacogenomics, the study of how an individual's genetic variation impacts their response to drugs, helps pharmacists tailor medication choices and dosages based on a patient's unique genetic profile.

Talking Points

- A pharmacogenomics pharmacist is a healthcare professional who studies how genes affect a person's response to medications. They use this knowledge to help doctors and patients choose the right medications based on a person's genetic makeup.

- By analyzing a patient's genes, the pharmacogenomics pharmacist can predict how their body might react to certain drugs, and recommend personalized treatments that are more effective and safer. Their goal is to improve patient care by tailoring medications to individual genetic characteristics.

- By analyzing DNA, pharmacists can identify genetic markers that influence drug metabolism, efficacy, and potential adverse reactions. This knowledge enables them to make informed decisions regarding drug selection, dosing adjustments, and the prevention of medication-related complications. DNA testing also plays a crucial role in identifying genetic predispositions to certain diseases, allowing pharmacists to implement preventive measures and provide appropriate counseling on lifestyle modifications and medication adherence.

- In summary, DNA analysis empowers pharmacists to deliver personalized and precise pharmaceutical care, leading to improved patient outcomes and a more targeted approach to medication management.
## INGREDIENTS/Supplies

<table>
<thead>
<tr>
<th>INGREDIENTS/Supplies</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twizzlers</td>
<td>~ 1 pack</td>
</tr>
<tr>
<td>Toothpicks</td>
<td>~ 1 pack</td>
</tr>
<tr>
<td>Soft candy</td>
<td>~ 1 pack</td>
</tr>
<tr>
<td>Cups (to separate candy by color)</td>
<td>4</td>
</tr>
</tbody>
</table>

Choose a soft candy that comes in 4 colors but is all the same type of candy to represent the A, T, C, G nucleotides.

### INSTRUCTIONS

1. Start your candy DNA model by sorting the 4 colors of candy into separate bowls.

2. Assign each color to a specific nucleotide. These 4 nucleotides along with the sugars and phosphates make up your double helix candy DNA model.
   1. Adenine
   2. Thymine
   3. Cytosine
   4. Guanine

3. Pierce the candy nucleotides with the toothpicks (2 on each toothpick) and stick them between two Twizzlers.

4. Now begin twisting the Twizzlers into what is known as a double helix. The backbone (Twizzlers) of your candy DNA model is what gives the double helix a specific shape. They also hold together the A, T, C, G nucleotides. There are endless combinations that can be made, but the same pairs of nucleotides must stick together.

### SOURCES
In this lab, students mix polar and nonpolar substances and then add various emulsifiers to encourage the mixing of the two substances. They use ingredients in salad dressing to relate science to real life scenarios. Participants will test a few common household ingredients to identify the most effective emulsifier for making salad dressing.
Quick Look

- Elementary and up
- 30 - 60 minutes
- Interactive activity

Honey is a potential allergen. If participants are allergic to honey (or any other ingredient) omit that ingredient. Dry mustard and vinegar can cause respiratory irritation. Oil may stain clothes. Please wash hands after handling.

Pharmacy Connection - Drug Emulsion

Drug emulsion refers to a formulation in which one or more drugs are dispersed in a liquid medium, resulting in a stable mixture. Emulsions are commonly used in pharmaceuticals to enhance drug solubility, improve absorption, and provide controlled release. Pharmacists play a vital role in the development, preparation, and dispensing of drug emulsions. They also evaluate drug compatibility, perform quality control tests, and provide patient counseling on proper administration and storage of emulsion-based medications. By utilizing their expertise, pharmacists contribute significantly to the effectiveness, safety, and patient compliance of drug emulsions in the field of healthcare.

Talking Points

- Demonstrate drug emulsion and understand polarity: Vinegar contains water making it a more polar compound. Oil is a nonpolar substance. Try shaking the test tube for 30 seconds. No matter what you do, the polar and nonpolar substances will eventually separate.

- Explain pharmacists' understanding of drug properties: Polar molecules are hydrophilic. Hydrophilic molecules have a tendency to dissolve in water. Polar molecules are generally attracted to polar molecules. Nonpolar molecules are hydrophobic. Nonpolar molecules are attracted to other nonpolar molecules. Hydrophobic means a tendency to be repelled by water.

- The oil and vinegar separates no matter how hard you shake it. Some of our medications are nonpolar but our body is roughly 50-65% water. This means that in order for the drug to be effective, it must eventually be able to be dissolved in an aqueous environment. How can we accomplish this? By adding a surfactant/emulsifier. Emulsifiers help bring together polar and nonpolar molecules. Can you think of a common surfactant/emulsifier that you use everyday? Don't add it to salad dressing but soap. Soap is a surfactant!
### INGREDIENTS

<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable or Olive Oil</td>
<td>8 mL</td>
</tr>
<tr>
<td>Vinegar</td>
<td>8 mL</td>
</tr>
<tr>
<td>At least 3 of the following: Honey, dry mustard, garlic paste, tomato paste</td>
<td>2 grams</td>
</tr>
</tbody>
</table>

### SUPPLIES

- Stopwatch
- Scale with weighing trays
- 2 10-mL graduated cylinder
- 4 20-mL test tube
- Scoop
- Test tube rack

Students can repeat the procedure with other herbs or spices, such as salt and pepper, to see how they effect the separation time. They could also experiment with other vinegars or oils to see how separation times differ, or investigate the effect of temperature on separation time.

1. Place beaker containing anhydrous base and beeswax onto a hot plate. Set out four clean 20-mL test tubes in a test tube rack.

2. Use a scale to measure 2 g of each of the emulsifiers you will test.

3. To each of three test tubes, add 2 g of an emulsifier to be tested, putting a different emulsifier in each test tube. Label each test tube with the emulsifier that was added, and label the empty one “control.” Label the data sheet with the emulsifiers you will test.

4. Using a clean pipet, add 8 mL of oil to each test tube and swirl to fully mix in the emulsifier.

5. Using a clean pipet, add 8 mL of oil to each test tube. Take a moment to observe the two layers of oil and vinegar as they avoid mixing with one another. This is what separation looks like, a process you’ll need to be familiar with to collect data in the next step.

6. Using your thumb or a stopper, cover the opening to the control test tube, and shake it up and down for 30 seconds (time it with a clock or stopwatch). At the end of 30 seconds, place it back in the test tube rack and start the stopwatch, watching the sides of the glass for 1-5 minutes for signs of separation. When you see that most of the oil has separated from the vinegar, stop the stopwatch and record how long the process took in your data table in the column marked “separation time.”
Using a clean pipet, add 8 mL of oil to each test tube. Take a moment to observe the two layers of oil and vinegar as they avoid mixing with one another. This is what separation looks like, a process you’ll need to be familiar with to collect data in the next step. Repeat step six for each of the test tubes containing an emulsifier, making sure not to contaminate one test tube with the emulsifier from another. If an emulsion has not separated after 5 minutes, write “> 5 mins” and the time of day in your data table.

After you have mixed and observed all of the emulsifiers, go back and check to see if any of the emulsions that didn’t separate earlier have now separated. Record your observations in your data table.

SOURCES

Additional Contributor: Kristen Ahlschwede, PhD, Rosalind Franklin University of Medicine and Science
Cells are the basic unit of life and make up all plants, animals and bacteria. Deoxyribonucleic acid, or DNA, is the molecule that controls everything that happens in the cell. DNA contains instructions that direct the activities of cells and ultimately, the body. This activity will demonstrate how DNA can be isolated from a strawberry using common household items.
A pharmacogenomics pharmacist is a healthcare professional who studies how genes affect a person’s response to medications. They use this knowledge to help doctors and patients choose the right medications based on a person’s genetic makeup.

By analyzing a patient’s genes, the pharmacogenomics pharmacist can predict how their body might react to certain drugs, and recommend personalized treatments that are more effective and safer. Their goal is to improve patient care by tailoring medications to individual genetic characteristics.

By analyzing DNA, pharmacists can identify genetic markers that influence drug metabolism, efficacy, and potential adverse reactions. This knowledge enables them to make informed decisions regarding drug selection, dosing adjustments, and the prevention of medication-related complications. DNA testing also plays a crucial role in identifying genetic predispositions to certain diseases, allowing pharmacists to implement preventive measures and provide appropriate counseling on lifestyle modifications and medication adherence.

In summary, DNA analysis empowers pharmacists to deliver personalized and precise pharmaceutical care, leading to improved patient outcomes and a more targeted approach to medication management.
**INGREDIENTS**

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>QUANTITY (Per Participant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawberries</td>
<td>2</td>
</tr>
<tr>
<td>Dish Detergent</td>
<td>2 tsp</td>
</tr>
<tr>
<td>Water</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Cold Rubbing Alcohol</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Salt</td>
<td>1 tsp</td>
</tr>
</tbody>
</table>

**SUPPLIES**

- 2 Plastic Cups
- 2 tsp
- 1/2 cup
- 1 tsp
- 1 Re-sealable Plastic Bag
- 1 Coffee Filter
- 1 Coffee Stirrer

---

**INSTRUCTIONS**

1. Pull off any green leaves on the strawberry.

2. Put strawberries into the plastic bag, seal it and gently smash them for 2 minutes. Completely crush the strawberries. This starts to break open the cells and release the DNA.

3. In a plastic cup, make your DNA extraction liquid: mix together 2 tsp of detergent, 1 tsp of salt and 1/2 cup of water.

4. Add 2 tsp of the DNA extraction liquid into the bag with the strawberries. This will further break open the cells.

5. Reseal the bag and gently smash for another minute.

6. Place the coffee filter inside the other plastic cup.

7. Open the bag and pour the strawberry liquid into the filter. You can twist the filter just above the liquid and gently squeeze the remaining liquid into the cup.

8. Pour down the side of the cup an equal amount of cold rubbing alcohol as there is strawberry liquid. Do not mix or stir.

9. Within a few seconds, watch for the development of white cloudy substance in the top layer above the strawberry extract layer. That’s the DNA!

10. Tilt the cup and pick up the DNA using a coffee stirrer or wooden stick.

---

**SOURCES**


Additional Contributor: Lisa Richter, PharmD, BCPS, BCCCP, North Dakota State University School of Pharmacy
In a class demonstration, the teacher places different pill types ("chalk" pill, gel pill, and gel tablet) into separate glass beakers of vinegar, representing human stomach acid. After 20-30 minutes, the pills dissolve. Students observe which dissolve the fastest, and discuss the remnants of the various pills.
OVERVIEW

Quick Look

Grade 9 and up
30 minutes
Interactive activity

⚠ Ingredients may stain clothing

Pharmacy Connection - Pharmacology/Absorption

"Before drugs can be clinically effective, they must be absorbed. Absorption is the process of a drug moving from its site of delivery into the bloodstream. The chemical composition of a drug, as well as the environment into which a drug is placed, work together to determine the rate and extent of drug absorption." (The International Union of Basic and Clinical Pharmacology, n.d.)

Talking Points

- **Pharmacology** is a multidisciplinary science that bridges biology, chemistry, medicine, and technology to optimize the therapeutic potential of drugs while safeguarding human health.

- **Gateway to Healing**: Pharmacology serves as the gateway to understanding how drugs and chemicals interact with the human body, offering insights into the science of healing and disease management.

- **Medication Development**: It plays a pivotal role in developing new medications by examining how drugs are absorbed, distributed, metabolized, and eliminated within the body.

- **Individual Variability**: Pharmacology takes into account individual variability in drug responses due to genetics, age, gender, and other factors, contributing to personalized medicine approaches.

- **Uncovering Mechanisms**: It uncovers the underlying biochemical and physiological mechanisms through which drugs exert their effects, aiding in the understanding of diseases.

- **Educational Front**: Pharmacology education equips pharmacists with the knowledge to make informed decisions about drug prescriptions and patient care.
Gather materials on a table that is visible to everyone in the class.

Fill each beaker with approximately one-quarter cup vinegar (or until beakers are half full).

Place one pill in each beaker. Note the start time on the clock.

After several minutes, pick up the beakers and observe any change in color of the vinegar. Also, look for any changes in the pills.

Consider a pill fully dissolved when the vinegar is clear (this does not include any remaining outer coverings).

Lead a class discussion. Ask students the Investigating Questions.
1. How does medicine get into the bloodstream? (Answer: Common ways are pills, liquids and shots. Medicines that reach the stomach are broken down so they can enter the bloodstream.)
2. How long does it take for a pill to dissolve in the stomach? (Answer: Ranges from 15-30 minutes.)
3. What does this imply about those in liquid form? (Answer: Liquid forms go through the same process as pills once they reach the stomach.)
4. What happens when you receive a shot? (Answer: The medicine bypasses the digestive process and goes directly into a person's bloodstream.)

At this point, students should be able to determine what form of medicine to take (the shot) for speed. For homework, as described in Assessment section, assign students to write three suggestions of how to make the medicine work more quickly.

**INGREDIENTS/Supplies**

<table>
<thead>
<tr>
<th>INGREDIENTS/Supplies</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinegar</td>
<td>2 cups</td>
</tr>
<tr>
<td>Time-Release Capsule</td>
<td>1 piece</td>
</tr>
<tr>
<td>Chalk tablet</td>
<td>1 piece</td>
</tr>
<tr>
<td>Gel Capsule</td>
<td>1 piece</td>
</tr>
<tr>
<td>Solid Capsule</td>
<td>1 piece</td>
</tr>
<tr>
<td>Small glass beakers</td>
<td>3</td>
</tr>
</tbody>
</table>

**INSTRUCTIONS**

1. Gather materials on a table that is visible to everyone in the class.
2. Fill each beaker with approximately one-quarter cup vinegar (or until beakers are half full).
3. Place one pill in each beaker. Note the start time on the clock.
4. After several minutes, pick up the beakers and observe any change in color of the vinegar. Also, look for any changes in the pills.
5. Consider a pill fully dissolved when the vinegar is clear (this does not include any remaining outer coverings).

**Lead a class discussion. Ask students the Investigating Questions.**

1. How does medicine get into the bloodstream? (Answer: Common ways are pills, liquids and shots. Medicines that reach the stomach are broken down so they can enter the bloodstream.)
2. How long does it take for a pill to dissolve in the stomach? (Answer: Ranges from 15-30 minutes.)
3. What does this imply about those in liquid form? (Answer: Liquid forms go through the same process as pills once they reach the stomach.)
4. What happens when you receive a shot? (Answer: The medicine bypasses the digestive process and goes directly into a person's bloodstream.)

At this point, students should be able to determine what form of medicine to take (the shot) for speed. For homework, as described in Assessment section, assign students to write three suggestions of how to make the medicine work more quickly.

**SOURCES**


HOW TO READ A PRESCRIPTION DRUG LABEL

Each time you receive a prescription, it’s crucial to read and adhere to the details provided in the medication’s "label." This step is essential to guarantee your well-being. Acquaint yourself with the various components of your prescription drug labels through this illustrative example.

MANITOBA Pharmacy
204 Manitoba Street
Winnipeg MB M2B 2Y2 Canada
Store # 0001

Rx# 2042042 Ref: 0 Dr. Manitob Man

APR-AMOXI 500MG
AMOXICILLIN 500MG
RED/YEL/ELLIP/APO[500]
30 CAP 14 Oct 2007 Total: 21

Take 1 capsule three times daily until finished (antibiotic)

Important: Take this medication for the prescribed duration.
Pharmacists are highly trained healthcare professionals who play an important role in ensuring safe and accurate medication use by people. Pharmacists receive a prescription from a doctor and review it carefully. They gather information such as a person’s allergy information and then screens the medication for any potential allergic reactions or interactions with other medications, foods, or drinks. When the pharmacist confirms the medication is safe to use for a person, they will dispense the medication and explain the medication to the patient.

Once the pharmacist has dispensed the medication, they label it before giving it to the patient. A prescription label displays important information about a medication prescribed by a doctor and includes the patient’s name, the pharmacy’s information, the prescription number, medication name, instructions for use, potential side effects, any warnings or precautions, and refill information.

Pharmacists use their knowledge and expertise to verify that a medication is safe for a person to use.

Pharmacists help to ensure that people receive the right medication with clear instructions, so they use their medication correctly and safely.
INSTRUCTIONS

INGREDIENTS/Supplies

Sample Prescription Drug Label Worksheet

1. Discuss the importance of responsible medicine use

2. Explain survey findings from the Partnership for Drug-Free Kids show that one in four teens has misused or abused a prescription drug at least once in their lifetime.

3. Explain the various components of the prescription label.

4. Have students look at the sample and fill out the worksheet

SOURCES


Additional Contributor: Jeanne Frenzel, PharmD, PhD, BCSCP, North Dakota State University School of Pharmacy
MAKING HAND SANITIZER

20-30 Participants

When it comes to preventing the spread of infectious diseases like COVID-19, nothing beats good old-fashioned handwashing. But if water and soap aren't available, your next best option, is to use an alcohol-based hand sanitizer that contains at least 60% alcohol and all it takes is three ingredients to make your own hand sanitizer at home. Read on to find out how.
Pharmacists play a vital and multifaceted role in public health, serving as crucial healthcare providers at the intersection of medicine and community well-being. Beyond dispensing medications, they contribute significantly to disease prevention, health education, and patient care. During the height of the COVID-19 pandemic, the FDA encouraged licensed pharmacists to create batches of hand sanitizer to cut back on shortages (Lee, 2020). Additionally, pharmacists provide patients with tips on appropriate hand sanitizer use, as well as product recommendations (Gershman, 2023).

Hand sanitizer plays a crucial role in maintaining personal and public health by providing a convenient and effective way to disinfect hands. In a world where we constantly interact with surfaces and objects that can harbor harmful pathogens, hand hygiene has gained paramount significance.

Hand sanitizers offer a rapid and accessible means of killing or inactivating a wide range of microorganisms, including bacteria and viruses.

Hospital pharmacies are well equipped to compound hand sanitizer to prevent the spread of disease in health care settings (Hansen & Boiallis, 2020).

The main active ingredient in hand sanitizer is alcohol. “Its antimicrobial activity results from alcohol’s ability to denature proteins. Solutions must contain at least a final concentration of 60% alcohol to be effective. Higher concentrations are less effective, as proteins are not denatured easily in the absence of water.” (Hansen & Boiallis, 2020)
### INGREDIENTS

<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>QUANTITY</th>
<th>SUPPLIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropyl alcohol or ethanol (91–99% alcohol)</td>
<td>2 parts</td>
<td>Spoon</td>
</tr>
<tr>
<td>Aloe Vera Gel</td>
<td>1 part</td>
<td>Whisk</td>
</tr>
<tr>
<td>Essential oils such as clove, eucalyptus, or peppermint</td>
<td>A few drops</td>
<td>Container</td>
</tr>
</tbody>
</table>

### SOURCES


### INSTRUCTIONS

1. Make the hand sanitizer in a clean space. Wipe down countertops with a diluted bleach solution beforehand.
2. Wash your hands thoroughly before making the hand sanitizer.
3. To mix, use a clean spoon and whisk. Wash these items thoroughly before using them.
4. Make sure the alcohol used for the hand sanitizer is not diluted.
5. Mix all the ingredients thoroughly until they're well blended.
6. Don’t touch the mixture with your hands until it’s ready for use.
POKEMON OR DRUG

20-30 Participants

Participants guess if they think the name on the screen is a Pokémon or drug name. Correct answers are displayed after a response is selected. This electronic quiz can also be conducted as a large group activity by projecting the name of the drug or Pokémon on a projector screen and having students move to the corresponding side of the room (one side represents drug the other side represents Pokémon).
Pharmacy Connection - Medication Safety

Drug names play a pivotal role in the realm of pharmacists' daily responsibilities and patient care. Pharmacists, as the experts in medication management, rely heavily on the accurate identification and understanding of drug names to ensure the safe and effective use of medications. The precise spelling and pronunciation of drug names are crucial to prevent errors in dispensing, counseling patients, and communicating with other healthcare professionals.

Talking Points

- Pharmacists learn a lot of drug names. Medications generally have two names - a brand name and a generic name. For example you may blow your nose with a Kleenex (brand name) or a tissue (generic name). A similar naming system applies to medications.

- New medications are frequently developed which means pharmacists are continually learning new names and continually learning about new medications.

- Learning the name is just one piece of information, pharmacists also learn what the medication is used for, how much of the medication is appropriate, how the medication works in the body, any unwanted effects it may have, and any medications it should not be mixed with. This means you never get bored as a pharmacist because there is always something new to learn!

- It would be impossible to know everything about every medication so pharmacists frequently use their resources to look up information and are frequently asked questions about medications by doctors, nurses and patients.
20-30 Participants

Students reinforce their knowledge of the different parts of the digestive system and explore the concept of simulation by developing a pill coating that can withstand the churning actions and acidic environment found in the stomach. Teams test the coating durability by using a clear soda to simulate stomach acid.
It is important for a pharmacist to have knowledge about the different parts of the digestive system and medication coatings because it helps them understand how medications interact with and are absorbed by the body. Medication coatings are special coverings that are applied to medications. These coatings serve different purposes and can affect how the medication works in the body.

When you take a medication, it travels through the digestive system, gets absorbed into the bloodstream, and is distributed to different parts of the body. The active ingredients in the medication interact with specific cells or molecules in the body to produce their desired effect. This effect can vary depending on the medication and the condition it is treating.

It is important for a pharmacist to have knowledge about the different parts of the digestive system and medication coatings because it helps them understand how medications interact with and are absorbed by the body. Medication coatings are special coverings that are applied to medications. These coatings serve different purposes and can affect how the medication works in the body.

**Talking Points**

- **Protective Coatings:** Some medications have coatings that protect them from being damaged by stomach acid or other substances in the digestive system. These coatings ensure that the medication remains intact until it reaches the part of the body where it is supposed to have an effect.

- **Delayed-Release Coatings:** Certain medications have coatings that control when and where the medication is released in the body. These coatings are designed to withstand the acidic environment of the stomach and dissolve in the intestines.

- **Extended-Release Coatings:** Some medications have coatings that allow for a slow and gradual release of the active ingredient over an extended period. This helps maintain a steady level of medication in the body and may be used for medications that need to be taken less frequently.

- **Taste-Masking Coatings:** Certain medications, especially those for children, may have coatings to make them taste better or mask their unpleasant taste. This can make it easier for patients, especially young ones, to take their medication.

- **By understanding the different parts of the digestive system and how medication coatings work, pharmacists can ensure that medications are prescribed and dispensed appropriately, taking into account factors such as absorption, drug interactions, and individual needs.**
<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>QUANTITY: 2</th>
<th>SUPPLIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour</td>
<td>1/4 cup</td>
<td>1 paper plate</td>
</tr>
<tr>
<td>Cornstarch</td>
<td>1/8 cup</td>
<td>1 cup clear diet (to avoid stickiness) soda</td>
</tr>
<tr>
<td>Sugar</td>
<td>1/4 cup</td>
<td>4 small paper or plastic bowls or cups</td>
</tr>
<tr>
<td>Vegetable Oil</td>
<td>1/8 cup</td>
<td>1 small plastic spoon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 clear plastic cup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 pieces of color-coated candy per group (Runts or Skittles work well)</td>
</tr>
</tbody>
</table>

Discuss with the class the different properties of each ingredient. Oil helps the dry ingredients stick together, helps make the mixture less sticky, and makes the coating less soluble. Flour and cornstarch are thickening agents with fairly similar properties. They also improve the workability of the overall mixture. Sugar thickens the mixture to some extent and makes the texture grainier, but can also make it less soluble when used in the right proportion, thereby improving its performance as a protective coating.

Before any mixing is done, have student teams decide amongst themselves how much of each ingredient (in spoonfuls) they think they want in their coatings. These become their recipes, which they document on their worksheets.

Following their recipes, direct students to begin mixing their coatings on paper plates. If a team feels that more of a certain ingredient is called for, have them carefully measure it and add it into the mixture, remembering to make the changes to the recipe on their worksheets. Lead a class discussion. Ask students the Investigating Questions.

When a group has finished creating their coating mixture and recipe, have them apply the coating to a piece of candy. Encourage students to make a thin and sleek design so the pill is easy to swallow, inexpensive to ship, and requires less packaging.

When all of the groups are finished, have a representative from each bring their coated candy to the front of the class. For each team, fill a plastic glass half full with clear soda, plus one extra cup of clear soda for an uncoated piece of candy (so students can see their coatings' effect on the dissolving rate of the candy). Label the cups with a marker so each group's cup can be easily identified.

With the timer ready, and at the same time, have students drop their coated candies into their cups of clear soda, while the teacher drops an uncoated candy into its cup of clear soda as a control.
Allow the candy to sit in the soda for 10 minutes. After several minutes, if the coatings do not look like they are dissolving, have one student from each group stir their coated candy in its soda cup until the 10 minutes is over. Ask students: How does this step simulates a pill going through the human digestive tract? (Answer: This simulates the acidic environment of the stomach, as well as its churning and agitating movement.) Why is it better to test the pill in a simulated environment rather than testing it on a human? (Possible answers: The coating could fail and make the person's stomach hurt, it is easier to observe how the pill dissolves in the simulated environment, etc.).

While waiting, keep students busy with another class activity or by having them draw ads that describe the benefits of their pill coatings.

After 10 minutes have passed, have students remove their pieces of coated candy from the soda-filled cups. As a class, make observations about which coating did the best job of protecting the candy "pill" and compare the coating recipes for each group to see what did and did not work. How did the coatings perform, compared to the uncoated control "pill," and compared to the various team recipes?

Have students calculate on their worksheets the fractions represented by each ingredient in their recipes. Compare recipes among teams, and discuss as a class, as described in the Assessment section. What are the relationships between performance and proportion of certain ingredients? What are the advantages and disadvantages of using certain materials?

Using what they learned from analyzing the testing results and original recipes, direct each group to write down a new and improved coating recipe.

Following their new recipes, have each team mix up a new coating batch. Do not allow them to make changes to their recipes during this stage.

Repeat the same procedure for coating and testing, and then compare the results again as a class. What improvements were made?

Conclude by reflecting on the activity in terms of the universal steps of the engineering design process: Ask, Imagine, Plan, Create and Improve, as described in the Assessment section. These are the steps engineers go through in designing new products and processes.

**Sources**

Additional Contributor: Jeanne Frenzel, PharmD, PhD, BCSCP, North Dakota State University School of Pharmacy