

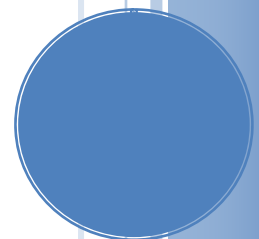
# SCIENCE SESSION 2

*Integrating Life Science, Health  
Literacy, and Math*

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# LIFE SCIENCE

## LIFE SCIENCE – GED TEST

Remember, life questions comprise 45% of the GED Science Test and include information on such topics as:

- The cell
- Molecular basis of heredity
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- Behavior of organisms

## WHAT ARE LIFE SCIENCES?

Life sciences are often defined as all sciences that have to do with organisms, like plants, animals, and human beings. From aardvarks to zebras to man, the living world provides diverse opportunities for learning about natural sciences. Branches of science, such as biology, anthropology, ecology, anatomy and physiology, are part of life sciences.

## TEACHING LIFE SCIENCE CONCEPTS

In order to provide students with opportunities to use their background knowledge in life sciences, teachers should pose open-ended questions for them to answer. Open-ended questions assist students in becoming better critical thinkers. Use such words as: compare/contrast, assess, evaluate, provide examples, etc.

When teaching science concepts, make sure that you always:

- Clearly state the goal of the lesson.
- Assess students' background knowledge and use examples that draw on students' prior knowledge.
- Create a natural learning environment that teaches meaningful, real-world life science problem solving skills.
- Introduce and explain all new science terminology, technical terms, and concepts.
- Model and demonstrate all activities and procedures; use manipulatives, graphics, videos, illustrations, or pictures.
- Have students record vocabulary, new concepts, observations and results in a lab journal or notebook
- Use examples that draw on students prior knowledge and have students share additional examples so that they can apply their learning.

## BASIC EXPERIMENTS FOR LIFE SCIENCE

### How Strong Are You?

The following is an experiment that shows how crumpling paper is not always as easy as it seems and how the disuse of muscles affects the human body.

- Get five full sheets of newspaper.
- Hold your arm out straight and hold one piece of newspaper in just one hand. If you're right-handed, use your left hand. If you're left handed, use your right hand.
- Now crumple up the paper into a tiny ball, using just one hand.
- Do it again with the next piece of paper, until you've crumpled up all five pieces of newspaper.
- What do you notice?

### Life Savers

Have students think about all of the wonderful sensations that taste imparts to them – delicious Thanksgiving turkey and gravy, mashed potatoes, cranberry sauce, and pumpkin pie! Discuss that all of those wonderful tastes are transmitted to our brains through only four types of receptors on our tongues – those for sweet, sour, salt, and bitter.

#### **Materials:**

Life savers or other flavored candies

#### **Experiment:**

Have students work in pairs. One student closes his/her eyes and holds his/her nose, while another feeds the students a life saver without telling the student the flavor. The student should try to guess what flavor the life saver is without letting go of his/her nose. Observations should proceed for a minute or so as the candy dissolves quickly. Have the students assess whether or not there was any change in the taste of the candy from the beginning to the end of the experiment. Have them describe the tastes.

### Pretzel Predictions

Students are challenged to predict how many pretzels they can eat in a minute.

#### **Materials:**

- Pretzels, bow-tie shaped
- Stop watch

#### **Instructions:**

Ask several students to stand in front of the class. Ask them to predict how many pretzels they can eat in a minute. Write the predicted number of pretzels after each student's name.

Before starting the "contest," give each contestant and audience member a small (1") piece of pretzel. Ask them to chew it slowly. After the experience, ask the contestants whether or not they want to change their prediction. Give each student five pretzels. Tell them that you will give them more after the first five are chewed. Start the timer and see if the students met their predictions.

Discussion: Certain chemicals are added to pretzels during the manufacturing process to assure the complete dryness of the interior of the pretzel. Also, only a portion of one pretzel is needed to absorb all of the saliva in one's mouth.

### The Winner Is!

Find out which chewing gum has the longest lasting flavor. You will need:

- 1 piece of fruity flavored bubble gum
- 1 stick of mint flavored gum
- 1 stick of cinnamon flavored gum
- 1 stopwatch

#### Step 1 – Observe

Observe that your three pieces of gum all have different sizes and smells.

#### Step 2 – Hypothesize

Based on your observations, make a guess at which flavor of gum will last the longest.

#### Step 3 – Test the Hypothesis

Conduct an experiment. Have a partner time you while you chew on one piece. Say “stop” when you can't taste its flavor any longer. Record the time that it took for that particular piece of gum to lose its' flavor. Repeat Step 3 with the other two pieces of gum and compare the data.

Which flavor lasts the longest? Was your hypothesis correct? Why or why not?

#### Which Lasts Longer?

Rate each of the types of chewing gum based on flavor, texture, and long-lasting taste based on a scale of 1 to 5. Where 1 is poor and 5 is excellent. Include the length of time each flavor lasted.

Characteristics	Gum #1	Gum #2	Gum #3
Texture			
Smell			
Flavor			
How long did the flavor last?			

## Smell Versus Taste – Experiment I

Have you ever wondered why food loses its flavor when you have a cold? It's not your taste buds' fault. Blame your stuffed-up nose. Seventy to seventy-five percent of what we perceive as taste actually comes from our sense of smell. Taste buds allow us to perceive only bitter, salty, sweet, and sour flavors. It's the *odor molecules* from food that give us most of our taste sensation.

When you put food in your mouth, odor molecules from that food travel through the passage between your nose and mouth to *olfactory* receptor cells at the top of your nasal cavity, just beneath the brain and behind the bridge of the nose. If mucus in your *nasal passages* becomes too thick, air and odor molecules can't reach your olfactory receptor cells. Thus, your brain receives no signal identifying the odor, and everything you eat tastes much the same. You can feel the texture and temperature of the food, but no messengers can tell your brain, "This cool, milky substance is chocolate ice cream." The odor molecules remain trapped in your mouth. The pathway has been blocked off to those powerful perceivers of smell--the olfactory bulbs.

Of all of our senses, smell is our most primal. It is so important that in the animal world that smell is needed to survive. A rat or mouse uses smell to mate and find food. Without the sense of smell, a rodent would die. In humans, the sense of smell communicates such things as the aroma of good food or a lovely rose. Smells can also signal danger or fear.

Let's go back to why food loses its flavor when you have a cold. Your taste buds are little organs all over your tongue that interpret or pick up the sense of what flavors are in your foods and liquids. There are four basic types of taste buds: bitter, sour, salty, and sweet. If you didn't have taste buds, everything would taste the same. However, we also sense flavors by using our sense of smell. Seventy to seventy-five percent of what we perceive as taste actually comes from our sense of smell. When you put food in your mouth, odor molecules from that food travel through the passage between the nose and mouth to olfactory receptor cells at the top of your nasal cavity, just beneath the brain and behind the bridge of the nose. It's the odor molecules from food that give us most of our taste sensation. When you have a stuffed-up nose, these odor molecules can't reach your olfactory receptor cells and food just doesn't "taste."

Today, we are going to test our senses of taste and smell to see which sends the clearest message to the brain. We are also going to test which part of our mouth is most sensitive to certain tastes, such as bitter, sweet, sour, and salty.

### Materials

- 6 small paper bags
- 6 scoops of mini jelly beans in different flavors (lemon, grape, cherry)
- Marking pen
- Data sheet
- Paper cups and water

**Objective:** Have the students hypothesize which of the following – taste or smell – will send the clearest message to the brain.

With the marking pen, identify the bags as either taste or smell. Write "taste #1," "taste #2," and "taste #3" on three of the sacks and "smell #1," "smell #2," and "smell #3" on the other three sacks.

Divide the jelly beans among the bags so that you have a “taste” bag and a “smell” bag for each of the three flavors. Taste #1 and smell #1 jelly beans should be the same, taste #2 and smell #2 should be the same, and so on. Crush a few of the “smell” jelly beans so that the odor molecules can escape into the bag. Close the bags by folding down the top.

Before the test, choose three students as testers and provide them with the data sheet on the following page.

**Taste Test:** Instruct the testers to close their eyes and plug their noses. Choose one of the taste bags and instruct each tester to chew on a sample from this bag. In five seconds, ask each tester to record on their data table what flavor they believe the sample to be. Repeat the procedure for the remaining taste bags. A small sip of water between samples will help clear away the previous flavor and provide a more accurate test. If students cannot tell the flavor, have them record “unknown.”

**Smell Test:** Choose one of the “smell” sample bags. Have testers close their eyes, open the bag, and inhale the aroma for 10 seconds. Remove the bag and close the top tightly. Have the testers record the flavor of the sample on the data table. Make sure that each student repeats this procedure for the other two samples.

**Smell and Taste Test:** Use the “taste” bags again. Repeat the procedure as in step #4, “Taste Test,” but do not have the testers hold their noses shut. Be sure, however, that they have their eyes closed. Ask each student to record their guesses in the appropriate column on the data table.

#### Debriefing Questions

- Which sense, taste or smell, identified the correct flavor most often?
- How were the “taste” messages your brain received different from the “smell” messages?
- How do you think candy makers simulate fruit flavors?
- Why do you taste more flavor when you chew a jelly bean than when you suck on it?
- If you took the Smell and Taste Test with your eyes open, do you think you could recognize the flavor of a purple jelly bean that has an orange flavor? What data from your tests support your conclusion?

#### Smell and Taste Data Table

	Smell Only	Taste Only	Smell and Taste
Flavor 1			
Flavor 2			
Flavor 3			

*Where's the Flavor?* Newton's Apple. Retrieved from the World Wide Web at:  
<http://www.newtonsapple.tv/video.php?id=1176>

## DNA Profiling

### Objective:

Solve the crime with DNA profiling.

### Materials:

- water
- a squirt of dishwashing liquid
- 1/2 a teaspoon of salt
- 1 teaspoon of ice cold ethanol or methylated spirits or rubbing alcohol (isopropanol)
- two cups and a clear container with a lid

### To Do and Observe:

1. Dissolve half a teaspoon of salt in half a cup of water. Add a squirt of dishwashing liquid. This liquid will be used to break up the cells and release the DNA.
2. Take about a tablespoon (20 - 25 mls) of plain water into your mouth. Don't swallow! Swish the water around your cheeks vigorously for about 30 seconds. This removes some cheek cells. Spit the water into a clean cup or glass.
3. Add about 1 teaspoon (5 mls) of this fluid to a small clean container with a lid (a 20 ml test-tube or a clear plastic film canister would work). Add about half a teaspoon (2.5 mls) of the salt/dishwashing liquid (saline/detergent) solution. Put the cap on the container and tip it up and down gently 3 or 4 times to mix (but you don't want a lot of froth so don't shake it). This will break up the many hundreds of cheek cells, releasing the DNA from the nucleus.
4. Gently run a teaspoonful of ice-cold ethanol into the tube. Methanol or rubbing alcohol - isopropanol - should also work; make sure they are ice cold by placing the bottle in the freezer for a few hours before the experiment. Watch the point where the two layers meet. You may see strands of DNA forming, as cloudy filaments stretching up into the top (ethanol) layer. DNA is not soluble in ethanol, so when the ethanol meets the DNA solution it starts to precipitate (form a DNA salt).
5. You may be able to hook out the strands of DNA with a glass hook (or one made from a plastic twist-tie) by slowly dipping up and down through the two layers. If this doesn't work, gently invert the tube several times until the alcohol is mixed in. The precipitated DNA will look like a small ball of white thread.

### What's Going On?

Every cell in your body has the same DNA in it! You used cheek cells because they're easy to collect. DNA is found in the nucleus of a cell, which is the "control center" for the cell. To get the DNA out, you needed to break open the cell, detergent will burst the cell membrane (the outer layer of a cell) and let the DNA and other cell "innards" float out. Adding the ethanol (or alcohol) separates the DNA strands from the other stuff inside your cells. Scientists actually use a similar technique in their laboratories to isolate DNA for further experiments, like DNA profiling.

**Teacher Tips:**

Research true-crime cases in which a verdict was based on DNA evidence. How solid was the evidence? How old were the cases? How much has DNA profiling changed over the past decade?

**Discussion Points*****Pre-Experiment Questions:***

- Have you ever seen a movie or TV show that talked about DNA?
- Do identical twins have the same DNA?
- What else is determined by your DNA?

***Post Experiment Questions:***

- How would you describe your DNA?
- Does it look like/feel like what you expected?
- What kind of jobs work with DNA?

Retrieved from the World Wide Web at:

[http://www.tryscience.org/experiments/experiments\\_dna\\_athome.html](http://www.tryscience.org/experiments/experiments_dna_athome.html)

## Taking a Pulse

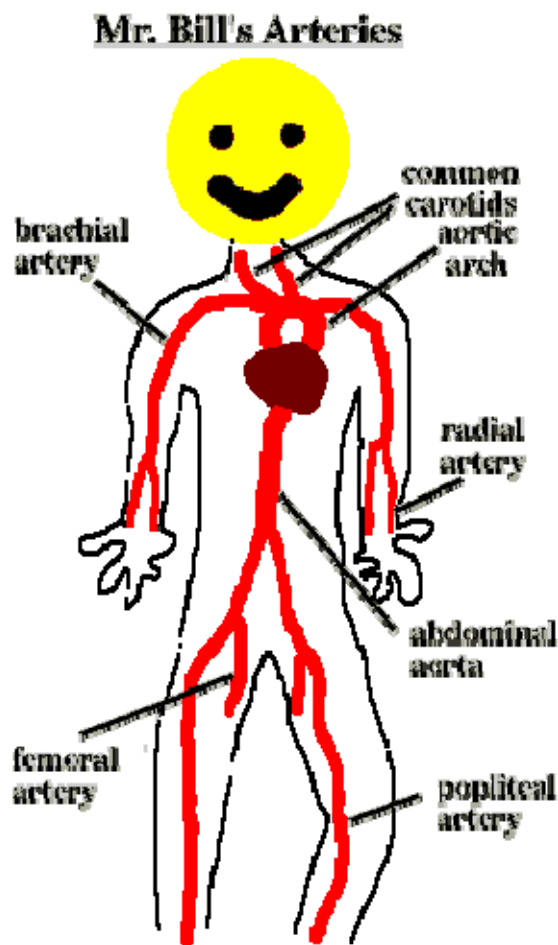
**Objective:** Take your pulse at multiple sites. Relate your pulse to your heartbeat. Use the information to chart and graph your heart rate.

### Materials:

- Chart paper
- A diagram of the body may be helpful

### Experiment

Take your pulse at the following sites (see the picture). Make sure that when you take the carotid pulse in the neck, you take one side at a time.



**Radial Pulse:** This is probably what we're most familiar with when visiting the doctor's office. Take two fingers, preferably the 2nd and 3rd finger, and place them in the groove in the wrist that lies beneath the thumb. Move your fingers back and forth gently until you can feel a slight pulsation - this is the pulse of the **radial artery** which delivers blood to the hand. Don't press too hard, or else you'll just feel the blood flowing through your fingers! You can even use your thumb.

**Carotid Pulse:** The carotid arteries supply blood to the head and neck. You can feel the pulse of the **common carotid artery** by taking the same two finger and running them alongside the outer edge of your trachea (windpipe). This pulse may be easier to find than that of the radial artery. Since the carotid arteries supply a lot of the blood to the brain, it's important not to press on both of them at the same time!

**Femoral pulse:** The **femoral artery** carries blood to parts of the leg. Aside from the carotid artery, it is another common site to check for a pulse in an emergency situation. Think of an imaginary line running from your hip to the groin. The approximate superficial location of the femoral artery lies 2/3 of the way in from the hip.

**Facial artery:** Gently run a finger along the lower edge of the jaw bone. Just beyond the 'chin' on either side, you might be able to feel the pulse of the facial artery.

**Brachial artery:** Flex your biceps muscle. Press your thumb or a few fingers into the groove created between the biceps and other muscles, approximately 5cm from the armpit. You should be able to feel the pulse of the brachial artery. This is the major artery supplying blood to the arms.

**Abdominal aorta:** Very thin individuals may be able to note a slight pulsation beneath the stomach when lying down in a relaxed position. This pulsation is caused by the abdominal aorta, the continuation of the aorta from the heart. At the level of the umbilicus (belly button), the aorta splits into the left and right **common iliac arteries** which deliver blood to the legs.

**Popliteal artery:** This artery lies behind the knee. Bend your knee slightly and feel in the soft area behind the knee.

**Explanation:**

The pulse represents the beating of the heart, specifically the ejection of blood from the left ventricle to the general circulation of the body. The ventricles (right and left) have two phases: **diastole** or the time when the ventricles “rest” so they can fill with blood, and **systole**, the time when the ventricles contract to send blood either to the lungs (from the right side of the heart), or to the rest of the body (from the left side of the heart). Blood from the left side of the heart first enters the **aorta**, the largest artery in the body. The aorta branches into smaller arteries which carry blood to all part of the body.

The pulse represents the variation in blood pressure from diastole to systole. During diastole blood pressure falls, but increases after systole as the heart pumps more blood into the arteries. You feel this difference when taking your pulse. Doctors use a device called a **sphygmomanometer** (blood pressure cuff) to measure the systolic and diastolic blood pressures. The average adult has a systolic blood pressure ~120-150 mm mercury, an average diastolic blood pressure ~80 mm mercury, and an average pulse of 72 beats/minute.

If you have a stethoscope, try listening to your heart while taking your pulse. Your heart produces two sounds, often called "lub" and "dub." The second "dub" sound coincides with the ejection of blood from the ventricles. In actuality, the sound is produced by the aortic and pulmonic valves closing behind the ejected blood. The aortic valve opens from the left ventricle into the aorta; the pulmonic valve from the right ventricle into the pulmonary artery.

When does the pulse occur with respect to the second heart sound? The first heart sound?

**Extension Activity:**

- Take your heart beat for one minute while sitting quietly. Jot down your heart rate.
- Next, walk in place for a minute and then take your heart rate for a minute. Jot this number down.
- Now, speed walk around the room. Stop and take your heart rate. Jot this number down.
- Finally, jog in place or do jumping jacks for a brief period of time. Stop and take your heart rate. Jot this number down.
- Using the four rates, create a graph, chart, or table that best depicts the different heart rates. Share the graphic information with the class and discuss the pros and cons of each type of graphic. Discuss that the heart beats faster after exercise in order to pump more blood (oxygen) to the working muscles.

## Lung Capacity

### Objective:

To measure how much air your lungs can hold by making a spirometer.

### Materials:

- 2 or 3 liter plastic bottle
- Large, deep bowl or plastic dishpan
- Water
- Masking tape
- Measuring cup
- 30 cm (1 foot) long piece of flexible tubing (aquarium tubing works well)

### Experiment:

1. Vertically attach a strip of masking tape to the plastic bottle, from the bottom to the top of it. Fill the measuring cup with 60ml of water. Pour the water into the bottle. Mark the water level on the tape. Repeat until you've marked to the top of the bottle.
2. Fill the dishpan about 10cm (4 inches) high with water.
3. Fill the plastic bottle to the top with water, and hold your fingers over the mouth of the bottle so the mouth is completely covered.
4. Invert the bottle into the pan of water. Make sure you do not remove your fingers until the mouth of the bottle is completely submerged. Insert one end of the tubing into the mouth of the bottle.
5. Take a breath and exhale completely into the open end of the tubing.
6. Measure how much air is now in the bottle (count the marks). To calculate your lung capacity, multiply the number of marks by 60ml. If your pan is not too full of water, you can repeat without filling the bottle back up.

### What's Going On?

The amount of air you can hold in your lungs is called lung capacity, and can be measured with a spirometer. Blowing air from your lungs into the bottle forces a measurable amount of the water out of the bottle, which adds to the volume of water in your pan. This method of measuring uses displacement—you're displacing a volume of water with a volume of air. Displacement is often used when something can't be measured directly. What else could you measure using displacement?

### Teacher Tips

Check for variations in lung capacity in people of different sizes. Look for a correlation between body size and lung capacity. Have each participant test for a difference between a "normal" breath of air and an "expanded" deeper breath



## Food Labels!

Food labels help you make smart decisions about what you eat. They also make good reading and math practice.

Food stores are filled with delicious things to...read. Labels on food have become such a part of our lives that we may not even notice them. But reading food labels can change your life.

What's in the food you are eating? The food label tells you. The amounts of each of the ingredients in a food are listed in order—from most to least.

Which lemonade is more healthful? Yummy Lemonade is made with sugar, water, and lemon concentrate. Good Lemonade is made with lemons, water, and artificial sweetener. The Good brand may not be as yummy as Yummy. But, suppose you have diabetes and shouldn't eat sugar? The information on the label tells you what you need to know to make a decision.

Hmm. Should you buy real ice cream with double chocolate-chips and 30 milligrams of cholesterol? Or should you choose marble fudge frozen yogurt with 16 milligrams of cholesterol? If your cholesterol count is too high, which should you buy? Which do you actually buy? Now, that's a whole other story!

Here's a label for a typical breakfast cereal.

**CRUNCHY CEREAL**

**Nutrition Facts**  
Serving Size 1/2 cup (35g)

Amount/serving	
Calories 130	Fat 10g
%DV*	
<b>Total Fat</b> 1.0g	<b>2%</b>
Saturated Fat 0g	<b>0%</b>
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 310mg	<b>13%</b>
<b>Potassium</b> 40mg	<b>1%</b>
<b>Total Carb.</b> 30g	<b>10%</b>
Fiber 1g	<b>4%</b>
Sugars 12g	
<b>Protein</b> 2g	

Vitamin A 15% • Vitamin C 25%  
Calcium 0% • Iron 10%  
Vitamin D 10% • Thiamin 25%  
Riboflavin 25% • Niacin 25%

\*Percent Daily Values (DV) are based on a 2,000 calorie diet.

**INGREDIENTS:** MILLED CORN, SUGAR, ALMONDS, HONEY, SALT, HIGH FRUCTOSE CORN SYRUP, MALT FLAVORING, ASCORBIC ACID (VITAMIN C), NIACINAMIDE, REDUCED IRON, PYRIDOXINE HYDROCHLORIDE (VITAMIN B 2), VITAMIN A PALMITATE, THIAMIN HYDROCHLORIDE (VITAMIN B 1), BHT (PRESERVATIVE), FOLIC ACID (FOLATE)

**Callouts:**

- The food uses up 130 calories of the 2,000 the average person needs a day.
- The label tells the percentage of each vitamin or mineral the food provides.
- g = grams (Those little packets of sugar substitute are each one gram.)
- Size of Serving
- mg = milligrams (a tiny amount)
- Sodium is Salt
- Carb. = Carbohydrates
- The first three ingredients tell what this product is mostly made up of.

**YOU TRY IT**

Look through your kitchen cabinets and refrigerator, and gather three types of foods with nutritional labels on them. Using the labels on the packages, fill in this chart:



Name of Food	Serving Size	First Three (Main) Ingredients	My Comments Based on the Label
<i>Big Eat Cookies</i>	<i>2 cookies</i>	<i>bleached enriched flour, sweet chocolate, sugar</i>	<i>8 grams of fat in 2 cookies! That's a lot!</i>
1.			
2.			
3.			



**How Much Can a Little Mouth Eat?**

Pay close attention to the serving size on a food label. Often the listed serving size is very small. So the salt, sugar and amount of fat and calories seem reasonable. But not many people can stop with two pretzels or four potato chips!

**Sugar Watch**

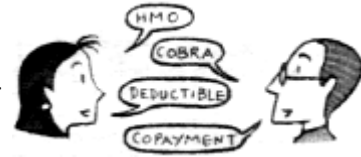
On a food label, sugars include...

- |                         |                          |                       |
|-------------------------|--------------------------|-----------------------|
| brown sugar             | glucose (dextrose)       | maltose               |
| corn sweetener          | raw sugar syrup          | molasses              |
| corn syrup              | high-fructose corn syrup | table sugar (sucrose) |
| fructose                | honey                    |                       |
| fruit juice concentrate | invert sugar             |                       |

A food is likely to be high in sugars if one of the above items appears first or second in the ingredients list, or if several of them are listed.

## LEARN ABOUT YOUR HEALTH!

Knowing the special terms used by health insurance companies is important. So how do you find the definitions for such special words? One way is to use a glossary. Often there is a glossary at the back of your health plan. A glossary is like a little dictionary of special words and terms. Check out this page from the glossary of a health plan.



### Health Plan Glossary

**Copayment:** Depending on the kind of insurance you have, you may have to pay something each time you visit a doctor or get a prescription filled. The amount you have to pay is your copayment. Your health insurance pays the rest. For example, you might pay \$15 for each prescription that you have filled, or you may have to pay \$10 each time you visit the doctor.

**Deductible:** This is the amount you pay before your health insurance kicks in. For example, if you have a \$250 deductible, you have to pay for the first \$250 of medical bills out of your own pocket. After that, the insurance company helps pay your medical bills.

**Generic Medicine:** This medicine has the same ingredients as brand-name medicine but is usually cheaper. When you get a prescription from your doctor, ask if you can get it filled with generic medicine. If you can, make sure to tell your pharmacists that you want generic medicine.

**Health Maintenance Organization (HMO):** An HMO (Health Maintenance Organization) is an organization that provides one type of health insurance. The HMO has agreements with certain doctors and hospitals to give members of the HMO medical care at a reduced cost. An HMO will give you a list of doctors, and you must choose one. With some HMOs, you will pay nothing when you visit a doctor. With other HMOs, you may have to pay a copayment.

**Out of Plan:** Most insurance plans provide you with a list of doctors who are part of the plan. If you want to see a doctor who is not on the list, you are going “out of plan.” You may have to pay the entire cost of the visit yourself if you go “out of plan.”

**Pre-existing Condition:** This is an illness or a condition that you had before you joined the health plan.

**Primary Care Provider (PCP):** Your PCP (Primary Care Provider) is your main doctor, the one you go to first. Sometimes your PCP will refer you to a specialized doctor, such as a foot doctor or a skin doctor.

### TRY THIS

A copayment is:

- a. a health plan that gives you free insurance.
- b. the amount you have to pay each time you visit a doctor or get a prescription filled.
- c. the amount you pay each year for health insurance.

Out of plan means:

- a. staying in the hospital overnight.
- b. your health insurance has been cancelled.
- c. seeing a doctor that is not in your health plan.



A pre-existing condition is:

- a. a company you worked for a while ago.
- b. the person who had your job before you did.
- c. a medical condition you had before your insurance started.

Your deductible is:

- a. the amount you must pay before your health insurance begins to pay out toward your medical bills.
- b. the amount a hospital charges for an overnight stay.
- c. the amount you must pay your doctor after each visit.

Your primary care provider is:

- a. a doctor who is a specialist in foot care.
- b. your main doctor.
- c. your insurance company.



Generic medicine:

- a. is usually more expensive than brand-name medicine.
- b. is usually cheaper than brand-name medicine.
- c. always costs the same as brand-name medicine.

An HMO is:

- a. the amount you pay each time you visit the doctor.
- b. a condition that you had before.
- c. a type of health insurance.

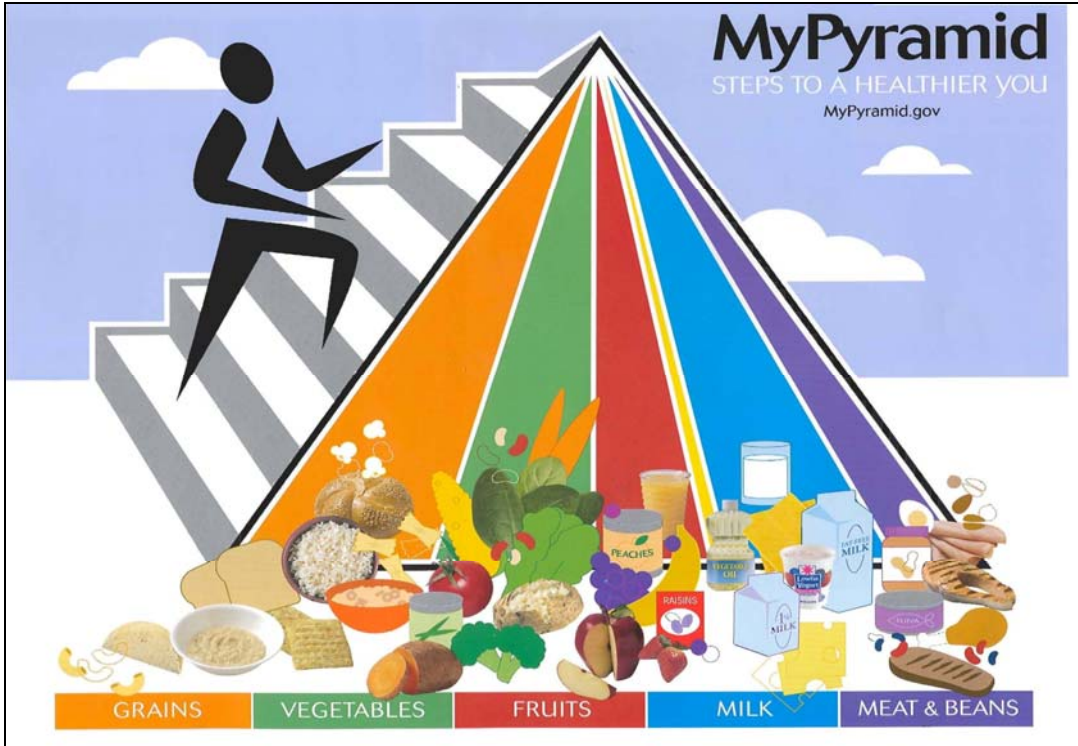
**IT'S A FACT!**

About 16 PERCENT OF ALL  
AMERICANS have NO health insurance.

Answers: 1. b; 2. c; 3. c; 4. a; 5. b; 6. b; 7. C

Education Development Center, Inc.

# Food Pyramid



<b>GRAINS</b> Make half your grains whole	<b>VEGETABLES</b> Vary your veggies	<b>FRUITS</b> Focus on fruits	<b>MILK</b> Get your calcium-rich foods	<b>MEAT &amp; BEANS</b> Go lean with protein
Eat at least 3 oz. of whole-grain cereals, breads, crackers, rice, or pasta every day  1 oz. is about 1 slice of bread, about 1 cup of breakfast cereal, or 1/2 cup of cooked rice, cereal, or pasta	Eat more dark-green veggies like broccoli, spinach, and other dark leafy greens  Eat more orange vegetables like carrots and sweetpotatoes  Eat more dry beans and peas like pinto beans, kidney beans, and lentils	Eat a variety of fruit  Choose fresh, frozen, canned, or dried fruit  Go easy on fruit juices	Go low-fat or fat-free when you choose milk, yogurt, and other milk products  If you don't or can't consume milk, choose lactose-free products or other calcium sources such as fortified foods and beverages	Choose low-fat or lean meats and poultry  Bake it, broil it, or grill it  Vary your protein routine – choose more fish, beans, peas, nuts, and seeds
For a 2,000-calorie diet, you need the amounts below from each food group. To find the amounts that are right for you, go to <a href="http://MyPyramid.gov">MyPyramid.gov</a> .				
Eat 6 oz. every day	Eat 2 1/2 cups every day	Eat 2 cups every day	Get 3 cups every day; <small>for kids aged 2 to 8, it's 2</small>	Eat 5 1/2 oz. every day
<b>Find your balance between food and physical activity</b> <ul style="list-style-type: none"> <li>Be sure to stay within your daily calorie needs.</li> <li>Be physically active for at least 30 minutes most days of the week.</li> <li>About 60 minutes a day of physical activity may be needed to prevent weight gain.</li> <li>For sustaining weight loss, at least 60 to 90 minutes a day of physical activity may be required.</li> <li>Children and teenagers should be physically active for 60 minutes every day, or most days.</li> </ul>		<b>Know the limits on fats, sugars, and salt (sodium)</b> <ul style="list-style-type: none"> <li>Make most of your fat sources from fish, nuts, and vegetable oils.</li> <li>Limit solid fats like butter, stick margarine, shortening, and lard, as well as foods that contain these.</li> <li>Check the Nutrition Facts label to keep saturated fats, <i>trans</i> fats, and sodium low.</li> <li>Choose food and beverages low in added sugars. Added sugars contribute calories with few, if any, nutrients.</li> </ul>		



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# MyPyramid

## Food Intake Patterns

The suggested amounts of food to consume from the basic food groups, subgroups, and oils to meet recommended nutrient intakes at 12 different calorie levels. Nutrient and energy contributions from each group are calculated according to the nutrient-dense forms of foods in each group (e.g., lean meats and fat-free milk). The table also shows the discretionary calorie allowance that can be accommodated within each calorie level, in addition to the suggested amounts of nutrient-dense forms of foods in each group.

Daily Amount of Food From Each Group												
Calorie Level <sup>1</sup>	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Fruits <sup>2</sup>	1 cup	1 cup	1.5 cups	1.5 cups	1.5 cups	2 cups	2 cups	2 cups	2 cups	2.5 cups	2.5 cups	2.5 cups
Vegetables <sup>3</sup>	1 cup	1.5 cups	1.5 cups	2 cups	2.5 cups	2.5 cups	3 cups	3 cups	3.5 cups	3.5 cups	4 cups	4 cups
Grains <sup>4</sup>	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	6 oz-eq	6 oz-eq	7 oz-eq	8 oz-eq	9 oz-eq	10 oz-eq	10 oz-eq	10 oz-eq
Meat and Beans <sup>5</sup>	2 oz-eq	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	5.5 oz-eq	6 oz-eq	6.5 oz-eq	6.5 oz-eq	7 oz-eq	7 oz-eq	7 oz-eq
Milk <sup>6</sup>	2 cups	2 cups	2 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups	3 cups
Oils <sup>7</sup>	3 tsp	4 tsp	4 tsp	5 tsp	5 tsp	6 tsp	6 tsp	7 tsp	8 tsp	8 tsp	10 tsp	11 tsp
Discretionary calorie allowance <sup>8</sup>	165	171	171	132	195	267	290	362	410	426	512	648

1 Calorie Levels are set across a wide range to accommodate the needs of different individuals. The attached table "Estimated Daily Calorie Needs" can be used to help assign individuals to the food intake pattern at a particular calorie level.

2 Fruit Group includes all fresh, frozen, canned, and dried fruits and fruit juices. In general, 1 cup of fruit or 100% fruit juice, or 1/2 cup of dried fruit can be considered as 1 cup from the fruit group.

3 Vegetable Group includes all fresh, frozen, canned, and dried vegetables and vegetable juices. In general, 1 cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens can be considered as 1 cup from the vegetable group.

Vegetable Subgroup Amounts are Per Week												
Calorie Level	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Dark green veg.	1 c/wk	1.5 c/wk	1.5 c/wk	2 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk
Orange veg.	.5 c/wk	1 c/wk	1 c/wk	1.5 c/wk	2 c/wk	2 c/wk	2 c/wk	2 c/wk	2.5 c/wk	2.5 c/wk	2.5 c/wk	2.5 c/wk
Legumes	.5 c/wk	1 c/wk	1 c/wk	2.5 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3.5 c/wk	3.5 c/wk	3.5 c/wk	3.5 c/wk
Starchy veg.	1.5 c/wk	2.5 c/wk	2.5 c/wk	2.5 c/wk	3 c/wk	3 c/wk	6 c/wk	6 c/wk	7 c/wk	7 c/wk	9 c/wk	9 c/wk
Other veg.	3.5 c/wk	4.5 c/wk	4.5 c/wk	5.5 c/wk	6.5 c/wk	6.5 c/wk	7 c/wk	7 c/wk	8.5 c/wk	8.5 c/wk	10 c/wk	10 c/wk

4 Grains Group includes all foods made from wheat, rice, oats, cornmeal, barley, such as bread, pasta, oatmeal, breakfast cereals, tortillas, and grits. In general, 1 slice of bread, 1 cup of ready-to-eat cereal, or 1/2 cup of cooked rice, pasta, or cooked cereal can be considered as 1 ounce equivalent from the grains group. At least half of all grains consumed should be whole grains.

5 Meat & Beans Group in general, 1 ounce of lean meat, poultry, or fish, 1 egg, 1 Tbsp. peanut butter, 1/4 cup cooked dry beans, or 1/2 ounce of nuts or seeds can be considered as 1 ounce equivalent from the meat and beans group.

## What's My Food Group?

Directions: Give the food group for each of the foods listed.

Popular Food	Food Group
Bagel	
Cream Cheese	
Potato Chips	
Turkey	
Corn	
Mashed Potatoes	
Margarine	
Brownies	
Frozen Yogurt	
Pancakes	
Green Beans	
Black Beans	
Macaroni	
Pretzels	
Tangerines	
Tomatoes	
Steak	
Shrimp	
Whole Wheat Bread	
Cantaloupe	

## I Can Make It Better For Me!

Directions: For each high fat food, identify a substitute food with lower fat or sugar content.

High Fat	Low Fat Substitute
Cheddar Cheese	
Regular Ground Beef	
2% Milk	
Croissant	
Ice Cream	
Butter	
Cream Sauce	
Coca Cola	
Lard	
Buttered Popcorn	
Potato Chips	

## What's My BMI?

### Overview:

Adults need to combine sensible eating with regular exercise or physical activity to ensure a long and healthy life. Dependant on the person, this may mean that he/she needs to gain weight, lose weight, or just maintain a present weight. There are different ways to determine if a person weighs the right amount for his/her height and body type, but the most common is the Body Mass Index (BMI). Armed with information about good nutrition through the Food Guide Pyramid and information about health risks associated with various levels on the BMI, students can begin to make informed decisions about what they wish to do to improve or maintain their health.

The BMI is generally calculated using metric measures. Before working on the BMI calculations, review with students how to convert from standard to metric measure and vice versa. Explain to the students that most people around the globe use the metric system. Emphasize that it is important that they understand how the system works as well as how to convert between the standard measure used in the United States and the metric system not only for the GED Tests, but for real-life applications as well.

### Materials:

- Copies of the NIST Metric Pyramid for each student
- Copies of the Food Guide Pyramid and Recommended Servings

### Procedure/Guided Practice:

Have students construct the Metric Pyramid from the handout. Students may use the Metric Pyramid to convert from standard to metric measure and vice versa. Provide students with a list of measurements to convert. If students are having difficulty, you may wish to refer them to websites, such as Metric Conversion at the Federal Consumer Information Center at:

[http://www.pueblo.gsa.gov/civ\\_text/misc/usmetric/tometric-conv.htm](http://www.pueblo.gsa.gov/civ_text/misc/usmetric/tometric-conv.htm) which provides approximate conversions to metric measures from standard measures; or

[http://www.pueblo.gsa.gov/civ\\_text/misc/usmetric/frommetric-conv.htm](http://www.pueblo.gsa.gov/civ_text/misc/usmetric/frommetric-conv.htm) which provides approximate conversions from metric measures to standard measures. When students are comfortable with the basic conversion, have them compute their own Body Mass Index. Students may use the Casio fx260 Solar Scientific Calculator to assist in their calculations.

### Determining BMI

Convert weight in pounds (without clothes) to kilograms (*have student identify the procedure needed to convert from pounds to kilograms*)

Divide pounds by 2.2 = \_\_\_\_\_ kg

Convert height in inches (without shoes) to meters (*have students identify the procedure for converting from inches to meters*)

Divide inches by 39.4 = \_\_\_\_\_ meters

Square the meters = \_\_\_\_\_

Divide body weight by height squared = \_\_\_\_\_ Body Mass Index ( $\text{Kg} \div (\text{m})^2 = \text{BMI}$ )

You may wish to put the following table on the board or overhead so students can evaluate their own BMI calculations and the associated health risks.

**Relationship of Body Mass Index to Health Risk**

BMI	Health Risk
Less than 25	Very Low
25-30	Low
30-35	Moderate
35-40	High
Greater than 40	Very High

Have students use the Internet to research health risk associated with each level of BMI. You may wish to use some of the sites included with this lesson or have students conduct their own searches for health risks and BMI by using search engines, such as AltaVista, Google, Dogpile, or Yahoo. When students have completed their research, have them refer back to the Food Guide Pyramid. Have them use the information to identify ways to reduce, maintain, or increase their food intake to obtain a healthy weight and BMI.

**Evaluation:**

Check student calculations to ensure that they have made the correct conversions. For further practice and evaluate student skills, have them calculate BMI for the following:

1. Adult male, 175 lbs., 6'2" (BMI – 22.54)
2. Adult female, 110 lbs., 4'11" (BMI - 22.22)
3. Adult male, 245 lbs., 5'9" (BMI – 36.39)
4. Adult female, 175 lbs., 5'11" (BMI – 24.55)
5. Adult male, 180 lbs., 5'9" (BMI – 26.74)

## Forensic Science

Students will do the following:

1. Learn how science is used to help solve mysteries and crimes.
2. Become familiar with two chemical tests that can be used to identify unknown substances.
3. Draw deductions based upon observations and the results of two scientific experiments.

### Materials:

- Baking soda and cornstarch (1 measured cup of each should suffice)
- Water and vinegar
- Paper cups (six for each pair of students)
- Teaspoons (one for each pair of students)
- Coffee stirrers or toothpicks
- Paper towels
- Internet access (optional but very helpful)

### Procedures:

Tell students that they have been asked to help the local crime-fighting unit solve a fictional mystery. Here's what happened:

The chef at a prize-winning restaurant found his kitchen ransacked. He was furious, especially because he had been preparing for a big banquet. In fact, he had been working so frantically that he had spilled flour and baking soda all over the counter. As soon as the chef reported the crime, the police got right on the job. They have narrowed the search to two suspects. One suspect is the local caterer, a man who is competitive with the chef. He was known to be baking a cake for the banquet to try to steer some attention away from the chef. The second suspect is the woman who owns the banquet hall. Even though she hired the chef, she has never really liked him for reasons no one really knows.

The police have collected important evidence: samples of different white substances found throughout each suspect's house. Police officers think that whoever committed this crime tracked the substance home. For this reason, police want to determine what the substances are and deduce whether they might have come from the chef's kitchen. They have labeled the substance at the caterer's house "substance 1" and the substance at the banquet hall owner's house "substance 2."

Tell students that they will help figure out what each substance is by performing tests to identify the substances. Have students work in pairs to conduct the tests. You will need to prepare for the lesson as follows:

- Do not reveal to the class that substance 1 is baking soda and substance 2 is cornstarch. Before class, fill one cup with baking soda and another cup with cornstarch. Label the baking soda "substance 1" and the cornstarch "substance 2."
- Put in a prominent place two paper cups for each pair of students, a jug of water, vinegar, measuring cups, and coffee stirrers or toothpicks.
- Have one person from each pair come to the table, measure 2 tablespoons of each substance, and put them in separate paper cups. Then tell students to take a few moments to observe both substances. Suggest that they note the color of the substances, the textures, and the odors.

(When smelling an unknown substance, students should move their hands over the top of the container to create a diluted but distinguishable odor.) Make sure that students do not taste the substances. After observing the substances, students can record their findings on a chart such as this one:

Substance	Color	Texture	Odor
Substance 1			
Substance 2			

After students have completed their charts, tell them to mix each substance with water. Have one student from each pair measure 2-1/2 tablespoons of water to pour into a small cup. Then tell students to put 2 tablespoons of substance 1 into the water. Have students stir the mixture with a coffee stirrer or a toothpick.

Have students repeat the steps for the second substance. Then have them record their findings on a chart such as this one:

Substance	What Happens When Mixed with Water
Substance 1	
Substance 2	

*(Substance 1 (baking soda) dissolves in water; the liquid turns white, but there are no particles in the water. Substance 2 (cornstarch) does not dissolve in water; the liquid is thick, white, and cloudy.)*

Explain to students that this test reveals physical properties of the substances. In this case, physical properties refer to what happens when the two substances are mixed together; the basic composition of each has not been changed. Tell students that the next test will reveal chemical properties of the two substances. The basic composition of one substance will change when it is mixed with another material. An example of this occurs when iron comes into contact with oxygen and a new substance—rust—forms. Rusting is a chemical property of iron. For the next test, explain that students will mix vinegar with the unknown substances to reveal something about their chemical composition.

Have students follow these steps:

- Measure 2-1/2 tablespoons of vinegar into a small paper cup.
- Add 2 tablespoons of substance 1 to the cup.
- Stir the mixture.
- Repeat these steps for substance 2.

After students have completed the test for both substances, have them record their findings on a chart such as this one:

Substance	What Happens When Mixed with Vinegar
Substance 1	
Substance 2	

*(Substance 1 (baking soda) fizzes and bubbles while dissolving in vinegar. Substance 2 (cornstarch) does not dissolve; the liquid becomes cloudy.)*

After students have completed both tests, tell the class to examine two tables: “Physical Properties of Three Materials” and “Chemical Properties of Three Materials.” Using the tables and their own test results, students should be able to determine the identity of each substance. Print out the following tables or put them on an overhead projector.

PHYSICAL PROPERTIES OF THREE MATERIALS

Substance	What Happens When Mixed with Water
Sugar	Dissolves; liquid is clear
Baking soda	Dissolves; liquid is clear
Cornstarch	Does not dissolve; liquid is milky

CHEMICAL PROPERTIES OF THREE MATERIALS

Substance	What Happens When Mixed with Vinegar
Sugar	Dissolves
Baking soda	Dissolves; makes fizzing and bubbling sounds
Cornstarch	Does not dissolve; liquid is cloudy

Ask students whether they can identify each substance. Using their own observations and both tests, students should deduce that substance 1 is baking soda and substance 2 is cornstarch. With this information, ask students who ransacked the chef's kitchen. *(The local caterer. He had a motive; he wanted to outshine the chef. Also, the police said the chef had spilled flour and baking soda, so the person who ransacked the kitchen would have tracked either one of those substances into his or her own house. Signs of baking soda were found in the caterer's home, while cornstarch was found in the banquet hall owner's house. It is not exactly clear why the banquet hall owner was using cornstarch, but one theory is that she mixes it with baby powder and puts it on after taking a bath. Even though the caterer had baking soda in his kitchen, too, the fact that it was found throughout the house, even at the front door, indicates that he tracked it in after ransacking the chef's kitchen. The presence of baking soda in his house is strong evidence that the caterer most likely committed the crime.)*

### Discussion Questions

1. Were you able to deduce what the substances were and who ransacked the chef's kitchen? If so, what evidence did you find the most compelling? Would you have been able to make an educated deduction without performing the two tests?
2. How do you think police detectives use chemical tests to help them solve crimes? Try to give at least two examples. *They analyze residue from gunpowder and determine a suspect's blood type from a small sample of blood.*
3. Based on what you learned about how liquids and solids interact, what do you think performing the tests used in this lesson with any solid or liquid would tell you about the properties of the substance? Do you think such a test is a good way to identify a substance?

### Extension Areas

How else would you use this activity to expand students' knowledge of science?

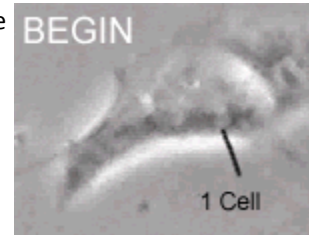
## Where Do Cells Come From?

Sometimes you accidentally bite your lip or skin your knee and you can see that in a matter of days, the wound heals. Is it magic, or is there another explanation for what happens?

Every day, every hour, every second one of most important events in life is going on in your body- cells are dividing. The ability of cells to divide into two living cells is unique for living things.

The process of cell division is called **mitosis**. A single cell divides to make two cells. These two cells then further divide to form 4 cells and so on.

You and I began as a single cell, or what you would call an egg. By the time we are adults we have trillions of cells. Take a look at the movie on the right to see a single animal cell divide into two cells.



If think it would take a long time to build all those cells try this out. Let's pretend a single penny is a cell. Calculate the number of days it would take to reach a million dollars if you double the amount of pennies each day. The answer can be found here.

*Do cells know when they have to divide?*

All cells follow a routine. Cells know when they have to take in food, when to grow and in the same way they know when it is time for them to divide. This routine is called the **cell cycle**.

The life of a cell begins when a parent cell divides by mitosis. This process is very well controlled by the cell. When they are dividing, cells produce special proteins that help them in this process. These special proteins are called **cyclins**. They are called by this name because these proteins are produced only during a particular time of the cell cycle.

Sometimes cells lose control over their cell cycle and they start dividing uncontrollably and end up with a huge number of cells in a very short amount of time. This type of unusual behavior by cells is called **cancer**.

*What happens to old cells?*

Just like us, cells grow old and die. When old cells die, new ones replace them. For example, a blood cell in our body lives for about 120 days. Another example is our skin cells. We shed our skin cells about every 35 days. Don't worry, we do not shed all our skin cells at the same time like snakes do. In human beings, only the skin cells that are old are shed, others are not.

Here is a amazing fact for you, if your skin cells are replaced every 35 days, by the time you are 20 years old you would have replaced your skin cells roughly about 200 times. You can see how we solved this puzzle below.

### ***How'd you figure that?***

In each year there are 365 days (except for leap year when there are 366 days).

If we divide the number of days it takes to replace your skin cells (35) into the number of days in a year (365) you can see that the skin is replaced about 10 times.



$$365/35 = 10.428$$

Now if you replace your skin on average 10 times each year for 20 years you find that you have worn about 200 skins!

$$10 \times 20 = 200$$

Now it's your turn. How many skins have you had? How many skins will you have had by the time you are 35 and 50 years old?

Retrieved from the World Wide Web at:

<http://askabiologist.asu.edu/research/buildingblocks/cellsdivide.html#skin>

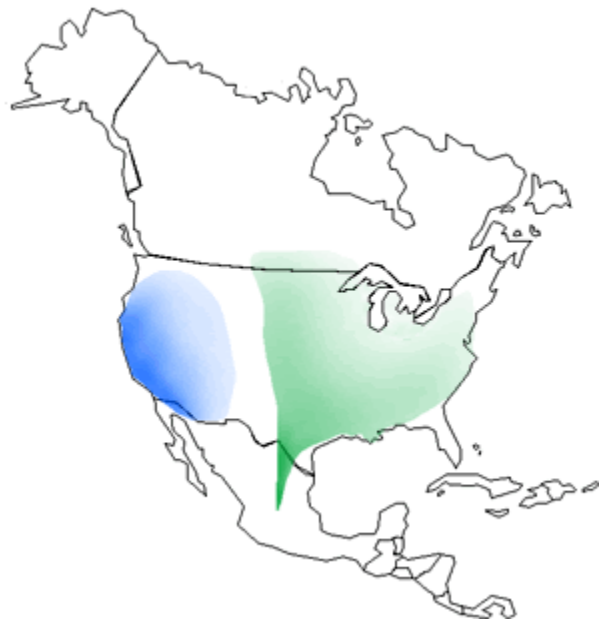
### **How Far Do Monarchs Travel?**

Butterflies on the west side of the Rocky Mountains travel to the north central coast of California, about 300 kilometers (500 miles).

Monarchs from the eastern population travel all the way to to the Sierra Madre mountains in central Mexico. A monarch born in Canada would have the farthest journey of all, nearly 4,000 kilometers.

Think how very tiny the butterfly is and how far it has to travel. In comparison, a 150 pound person would have to travel more than 16,300 times around the Earth to do what the monarch does!\*

Such a long migration requires lots of energy. Not only do the butterflies have to fly, they have to eat. During each day of the trip, the monarchs must visit hundreds of flowers to get enough nectar for their trip.



### How'd you figure that?

Let's say the average butterfly weighs 415 milligrams and the distance they will fly from Canada is about 4,000 kilometers.



For every milligram of body weight, the monarch would have to fly 9.6 kilometers.

$$4000 / 415 = 9.6$$

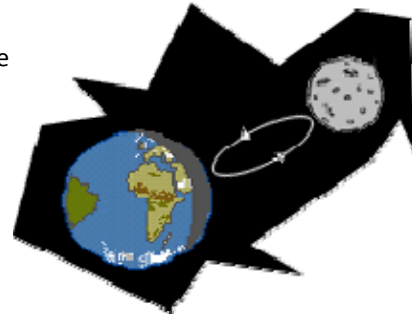
Now, if we take our 150-pound person (68,000,000 milligrams) and have them travel 9.6 kilometers for every milligram of body weight, they would travel 652,800,000 kilometers.

$$68,000,000 \times 9.6 = 652,800,000$$

The circumference of the Earth is around 40,030 kilometers. When you divide total travel distance by the circumference of the Earth, you get 16,308.

$$652,800,000 / 40,030 = 16,308$$

So, how many trips could the same person take from Earth to the moon and back to equal what a monarch does? We will give you one hint: the average distance from the Earth to the moon is 384,403 kilometers.



Retrieved from the World Wide Web at:

<http://askabiologist.asu.edu/research/monarchs/migrate.html>