

Mission 1: Midwest Crop Disaster

AGENT 9 ::

Come in, Agent 9! This is Col. Maranta. Several of our Mole field agents from the Midwest indicate that there is soil contamination among the region's corn crops. I've sent Agent Jasmine to investigate.

Get over to Agent Gingko's lab, pronto! I need you to learn more about soil nutrients. We must understand the nature of this contamination and get that information to Agent Jasmine so she can determine its cause.

Soil color, texture and structure play a vital role in determining soil health, Agent 9. You must complete your training quickly! Queen Flora has slipped into a coma! Please hurry! ►►

Mission 1: Midwest Crop Disaster

Soil Color, Texture and Structure

Options Accomplished

The Feel of Soil

Soil Jewelry

Mystery Web Option

Date:

Option 1

Agent Gingko has developed a clever exercise to teach you about the feel of different types of soil samples. Make sure you wash your hands when you finish this time—we can't afford to buy new lab equipment!

The Feel of Soil

Imagine holding soil in your hand. How does it feel between your fingers and thumb?

There are three types of soil particles—sand, silt and clay—and they all come from larger, weathered rock that is the soil's parent material.

Sand: The largest soil particles. They allow water to easily drain through.

Feel: Rough and gritty to the touch.

Clay: The tiniest of the soil particles. They retain moisture and contain nutrients for plants.

Feel: When wet, these particles clump together and become sticky.

Silt: Much smaller than sand but larger than clay particles.

Feel: Smooth to the touch when wet or dry.

You can use a few items from your kitchen to teach someone at home about soil texture and the three types of soil particles.

Follow these easy steps to create three soil-feel bags:

1. Pour 1 tablespoon of sugar into a bag and seal it (sand).
2. Pour 1 tablespoon of flour into another bag and seal it (silt).
3. Pour 1 tablespoon of flour and 1 tablespoon of water into the third bag. Then mix the flour and water, and seal the bag (clay).

Explain the three types of soil particles to an older family member. Then challenge that person to close his or her eyes and use a finger and thumb to identify each texture.

Col. Maranta here, Agent 9. I'll be guiding you through your mission. I'll contact you when you reach the lab.

Option 2

Agent 9, you might consider getting on Agent Jasmine's good side by making her a gift she can use in the field. Soil sample jewelry might do the trick!

A happy team is a successful team. I always say. Make her something nice, Agent 9, and see if you can't pass along information about soil condition during the process. Get going!

Soil Jewelry

What color is soil? Most people think soil is just brown or black. But soil can actually come in many colors, including white, orange, gray, black, brown, yellow and red.

The soil's color can tell us much about the condition of the soil or the type of rock it came from. Usually, darker colors mean that the soil is full of rich organic matter; lighter colors mean a low organic content. Beneath the surface, red and brown soils show good movement of air and water through the soils. Yellow beneath the surface can mean problems with water drainage.

Show off different soil colors you find by creating unusual soil jewelry. First, make some soil beads:

1. Collect in small plastic bags at least three colors of soil from your neighborhood. You'll need about 1/2 cup.
2. Pour the dry soil through a screen and into a cup to filter away the clumps and larger particles. You can borrow something from your house to use as a screen, such as a colander or some window screen.
3. Put 1 teaspoon of soil into the palm of your hand and pour a dime-sized amount of school glue over the soil.
4. Use a toothpick to mix the soil and glue in your hand. Keep stirring until the glue is absorbed by the soil.
5. Place the palms of your hands flat together and move them in small circles to form the sticky soil into a ball.
6. Press the ball between your thumbs and pointer fingers of both hands to create a triangle shape.
7. Allow the bead to dry for 30 minutes.
8. Use a straightened paper clip to poke a hole in the middle of each bead.
9. Allow the beads to dry overnight.
10. String the beads together with thin thread or dental floss.

Take the beads to your next JMG group meeting. Be prepared to share where you collected the soil of each bead. If you are feeling generous, present your first soil bead jewelry as a gift to your teacher!

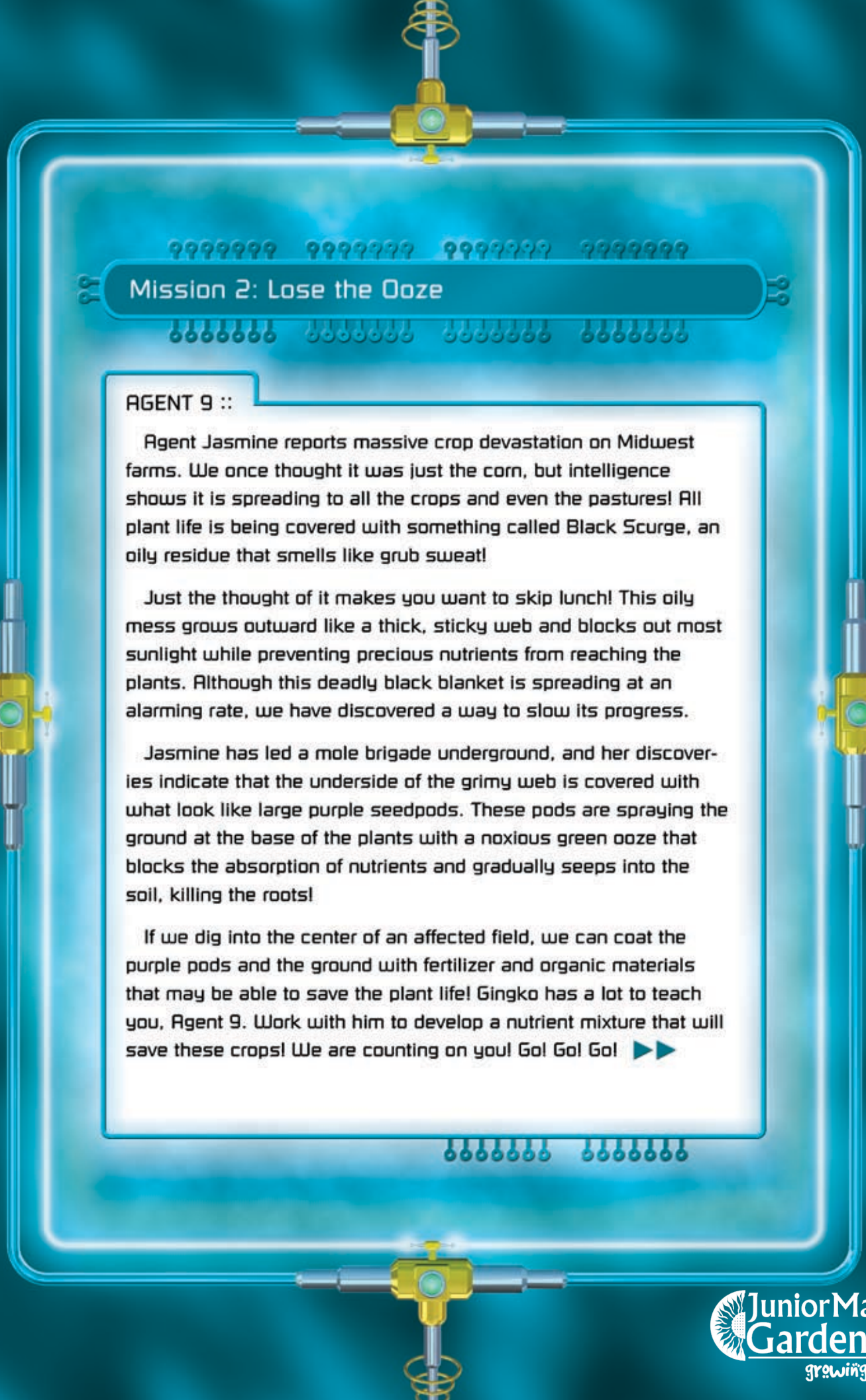


Soil Jewelry



Want more, Agent 9?

Complete a third mission option at www.jmgkids.us/thistle

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Mission 2: Lose the Ooze

AGENT 9 ::

Agent Jasmine reports massive crop devastation on Midwest farms. We once thought it was just the corn, but intelligence shows it is spreading to all the crops and even the pastures! All plant life is being covered with something called Black Scurge, an oily residue that smells like grub sweat!

Just the thought of it makes you want to skip lunch! This oily mess grows outward like a thick, sticky web and blocks out most sunlight while preventing precious nutrients from reaching the plants. Although this deadly black blanket is spreading at an alarming rate, we have discovered a way to slow its progress.

Jasmine has led a mole brigade underground, and her discoveries indicate that the underside of the grimy web is covered with what look like large purple seedpods. These pods are spraying the ground at the base of the plants with a noxious green ooze that blocks the absorption of nutrients and gradually seeps into the soil, killing the roots!

If we dig into the center of an affected field, we can coat the purple pods and the ground with fertilizer and organic materials that may be able to save the plant life! Gingko has a lot to teach you, Agent 9. Work with him to develop a nutrient mixture that will save these crops! We are counting on you! Go! Go! Go! ▶▶

Mission 2: Lose the Ooze

Nutrients

Options Accomplished

Fill in the
Macro Blanks

Nutrient
Nest

Mystery
Web
Option

Date:

Option 1

Fill in the Macro Blanks

To live and to grow, you need certain nutrients. You get these nutrients primarily from the food you eat. Plants also need nutrients, but they must get most of their nutrients from the soil. They can get them when the nutrients are dissolved in water and absorbed by the roots.

Plants need three nutrients in large amounts, and each of these serves a critical function in plants. They are called the primary macronutrients:

N: Nitrogen (for greening and leafy growth)

P: Phosphorus (for growth of roots)

K: Potassium (for fruit/flower development, helps strengthen plants and prevent disease)

Because plants require much more of these nutrients than the others, we often need to add them to the soil. They can be incorporated into the soil by adding fertilizers. Any fertilizer you buy has three numbers printed on the container that tell how much nitrogen, phosphorus and potassium is in that package of fertilizer. These numbers are connected by dashes. Examples are 10-15-20 or 29-10-3.

Your task is to visit a local business that sells fertilizer, find three different types of fertilizer and look for those numbers on the package. Write the numbers in the blanks below:

These numbers tell the percentage of each nutrient in the bag. If one number is the largest, circle it. Be ready to share at your next JMG meeting what the primary ingredient in each of these fertilizers would do to help plants.

Option 2

There is another way to stop this menace, Agent 9. It's something my Grannykins taught me. Yes, I call her Grannykins. Stop laughing, Agent 9. She said to ... really, Agent 9, it's not that funny. Oh, never mind. Just follow the instructions below and you'll see what I mean. Get to work!

Nutrient Nest

Most plants get the nutrients they need naturally. For example, plants growing in a forest would get their nutrients from bits of organic material such as dead leaves, twigs or other plant parts. When organic material decomposes, its nutrients are deposited back in the soil, where other plants can use them.

You can help your houseplants get some of the nutrients naturally, too. Collect a few large handfuls of green grass or leaves in a small grocery bag. Tear them into small pieces about the size of a dime.

At home, sprinkle a 1-inch layer of those leaf bits into the soil of your plants. Every time that plant is watered, the nutrients in those bits of dead leaves will flow into the soil and then be soaked up by the roots of the plant.

Plants need many different nutrients from the soil. One nutrient that plants need the most of is nitrogen. Nitrogen is unique because it is easily "lost" from the soil and needs to be replaced more frequently than other nutrients. Once a month, add a nutrient nest of shredded green grass to your houseplants to provide a shot of needed nitrogen.

Thanks for the assist,
Agent 9. Let me know what
you come up with!



Want more,
Agent 9?

Complete a third
mission option at
www.jmgkids.us/thistle



Mission 3: Thistle's Return!

AGENT 9 ::

Our worst fears have been realized, Agent 9! The water sources near the queen's palace are showing signs of the green ooze pollutants! The queen grows more and more fragile! Black Scurge is now spreading across the country!

Even more shocking is the cause. Our friends, the Battle Slugs of the Black Spore Swamp, have uncovered a horrifying secret. The Evil Dr. Thistle has been cloned! From what we can determine, Grubby, Dr. Thistle's faithful servant, used the shattered remains of the pollination chamber we destroyed from his old laboratory to build a cloning chamber! Thistle must have hidden clippings of his leaves from us when we advanced on the Black Spore Swamp.

This is an even more twisted Thistle than the first—he is grotesquely formed and dripping with a smelly black goo. From what we can determine, Grubby didn't have enough plant material to make a full clone, so he mixed in leaves from the deadly Black Spores of the swamp to create a Black Scurge Thistle. Eeww, nasty!

We must find out what he is up to, Agent 9! Agent Jasmine and the Mole Brigade have discovered acres and acres of polluted compost that has been mixed with an oily, black liquid. We need you to figure out why Thistle is making contaminated compost and how he is using it to cover the plants and crops with Black Scurge!

If we don't stop this soon, Agent 9, the queen will not survive. I know you can do it! Over and out! ▶▶

Mission 3:

Thistle's Return

Soil Improvement

Options Accomplished

Buried Treasure

Composting Homework

Mystery Web Option

Date:

Option 1

Time to take out the trash, Agent 9! Grab a shovel and the kitchen scraps and use the following instructions to test our theories on composting. Report your findings to Agent Gingko. Get moving and quit complaining about the smell!

Buried Treasure

Millions of tons of food scraps are thrown away each year. Did you know that trash could be turned into treasure if we just let nature do its work?

Leftovers and other food scraps from your kitchen are organic matter. Organic matter decomposes in nature, creating compost that adds nutrients to the soil and improves soil structure.

An easy and unusual way to compost your treasure of kitchen scraps is to bury it. This technique, called compostholing, allows you to bury small amounts of scraps in a garden area that could use some soil improvement.

To start, choose an area that will not disrupt the roots of an actively growing plant. The ideal place is where you could plant something next season. Use a shovel to dig a hole 12 inches deep there.

After dinner, collect your family's food scraps and leftovers in a small container. Pour the scraps into the hole and cover them with a layer of soil about 1 inch thick. Once the hole is full, cover it with soil and begin digging another hole nearby.

Most food scraps will easily transform into a healthy compost treasure. The only leftovers to avoid are dairy products, meats and oily foods. When you composthole in your garden, you are recycling food wastes, improving the soil and growing healthier plants!

It could sprout if not thrown out!



Option 2

I hope you like getting dirty! Complete the following exercise and bring a soil sample to Agent Gingko. He is developing some interesting ideas that may help us battle the Black Scurge. Be sure to remove your shoes before going into the lab, or you'll be mopping as well!

Composting Homework

Have you ever heard someone tell a teacher, "My dog ate my homework"? Have you ever had something happen to your homework? What if you composted your homework and your teacher was actually happy you did?

If you don't already have a compost pile near your garden area, now is the time to start one. Adding compost to your garden will make the soil better and your plants healthier. A compost pile can start as a bunch of leaves or lawn clippings piled out of the way near the garden. To help get the decomposition started, sprinkle the area with garden soil and water. Add green lawn clippings (a source of nitrogen) and occasionally turn over the pile to speed up the composting process.

So, how can you compost your homework and keep your teacher happy? After your homework has been graded and returned, tear it into pieces about the size of a credit card. Stuff the pieces inside the compost pile and wet it. Homework that is on paper is organic matter that can provide a source of carbon to your compost. Any other paper scraps can be added as to the compost pile too.



Want more, Agent 9?

Complete a third mission option at www.jmgkids.us/thistle

Mission 4: Erosion Scuroasion

AGENT 9 ::

Great work, Agent 9! Your experiments with compost have helped us discover how Thistle is spreading scurge from farm to farm! He is contaminating the surface water with a technique called Scuroasion. Scuroasion is a process of polluting soil with tainted compost near natural areas of erosion. Water washes away the polluted soil and carries it downstream, spreading scurge everywhere!

Once enough of the scurge has been deposited in a given place, it will begin to seep into the soil, affecting the roots of all the nearby plants. The plants will grow normally at first. Then, suddenly, the uppermost leaves and stems will melt into a sticky, black goo that attaches itself to other plants and continues to bubble and ooze until a thick, smelly canopy covers everything!

This doesn't explain the contamination near the Waterlily Palace. There is something else we are missing, Agent 9. We believe it may involve the purple pods on the underside of the black scurge that spray the green, oozy liquid. We don't understand how it affects the roots and soil of these poor plants.

Hurry, Agent 9! Meet me at the Waterlily Palace! I have some tests I need you to run. ▶▶

Mission 4: Erosion Scurosion

Soil Conservation

Options Accomplished

Option 1

We need to understand how water soaks into the soil, Agent 9. Use a sponge to complete the exercise below. Let me know what you discover!

Sponge Run

Place a dry sponge in a pie or cake pan. Lay one edge of the sponge on the edge of the pan so that the sponge slopes down to the middle of the pan.

Quickly pour a cup of water over the sponge and watch to see if the water runs off the sponge or if the water soaks into (infiltrates) the sponge. What do you think will happen? Try it!

Whenever we water plants in the garden or even a grassy lawn, the water will either run off from or infiltrate into the soil. If you want to make sure water is getting to the roots of the plant you are watering, be sure to water slowly enough for the soil to absorb the water.

Wring out the sponge and try it again. This time, pour the cup of water slowly over the sponge. What happens?

Show an adult how water can run off the soil and the sponge if applied too quickly. Slow, thorough watering is the best way to make sure plants get the water they need.

Don't make a mess, Agent 9!



Option 2

Here's a quarter, a nickel and a dime. No, Agent 9, you can't buy candy with it! Use these coins to complete the following mission. What you discover may save the queen!

Get going! No, Agent 9, you can't keep the money. Go! NOW!

Quarter Cover

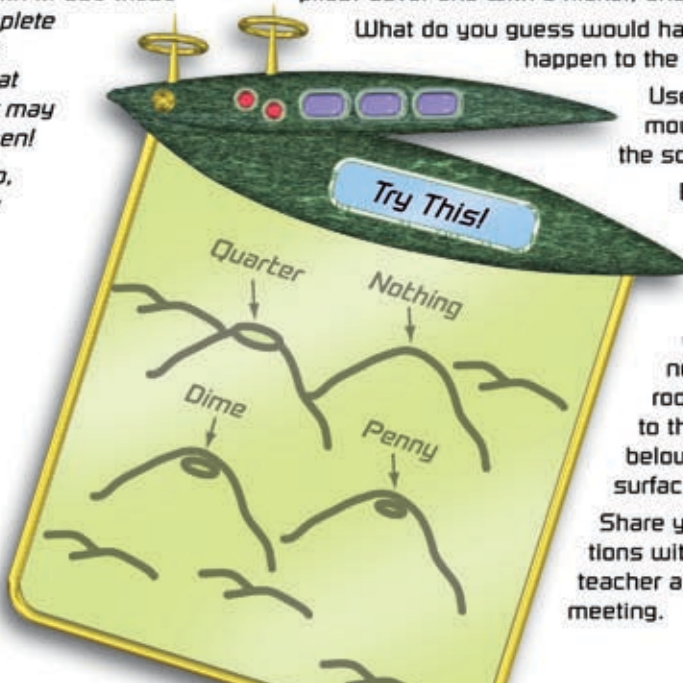
Use a large spoon to scrape together a handful of topsoil from near your home. Pack down the soil to form a small mound. Place a quarter on top of the mound. Do the same with three more piles. Cover one with a nickel, one with a dime and leave one exposed.

What do you guess would happen if rain fell on the coin-capped mounds? What would happen to the unprotected mound?

Use a watering can or sprayer to gently "rain" down on the mounds. Then check them. Are the coins at a higher level than the soil around them? Why did this happen?

Every time it rains, valuable topsoil is washed away. Topsoil can easily be protected with mulch, plants or some other type of covering. The best covering to prevent soil erosion is provided naturally with plants. A simple ground cover of grass offers a great defense against erosion. The blades of grass protect the soil from the impact of the raindrops, and the network of roots holds tight to the soil just below the surface.

Share your observations with your JMG teacher at your next meeting.



Want more, Agent 9?

Complete a third mission option at www.jmgkids.us/thistle

The page is framed by a blue, rounded rectangle with a glowing effect. At the top, bottom, left, and right centers, there are yellow valve-like mechanisms connected to blue pipes. The top and bottom valves have a green light in the center. The left and right valves have a green light and a small yellow coil. The title "Mission 5: Thistle Thicket" is centered at the top of the page, enclosed in a blue rounded rectangle with a glowing effect. The text "AGENT 9 ::" is followed by four paragraphs of text. The first paragraph is about finding Thistle. The second paragraph is about a dense wooded area. The third paragraph is about Jasmine and the Dragonfly Squadron. The fourth paragraph is about purple pods. The fifth paragraph is about the water cycle. The sixth paragraph is about the ecosystem. The text is in a white, sans-serif font. The background is a dark blue, textured surface.

Mission 5: Thistle Thicket

AGENT 9 ::

We've found him! Thistle's hidden in a small thicket miles away from any of the Black Scurge. We got lucky, Agent 9.

A dense, wooded area surrounds the thicket, making it impossible to see much from the air or on foot. Agent Jasmine was leading a search when she noticed birds and squirrels suddenly fleeing the area. Although Thistle was not seen, squirrel scouts have confirmed that he was there recently!

As we speak, Jasmine and the Dragonfly Squadron are airlifting a battalion of Battle Slugs from the Black Spore Swamp. As soon as they are in position, we will advance on the thicket and capture this stinky weed for good.

I have even more important matters for you to resolve, Agent 9. The purple pods from the underside of the Black Scurge are surfacing in many of the waterways around Waterlily Palace. Once they mature, they will burst, sending green ooze everywhere and enabling new areas of Black Scurge to thrive! If the palace ecosystem is compromised, I fear the queen will not survive!

We've learned that for Black Scurge to spread, it must remain moist—even far from the water that carried the green ooze from which the Black Scurge sprang. Get out there and discover more about the water cycle! We need to know how to restore balance to the ecosystem. Hurry! ▶▶

Mission 5:

Thistle Thicket

The Water Cycle and You

Options Accomplished

Water Cycle
Germinator

Fried
Ice

Mystery
Web
Option

Date:

Option 1

Agent 9, the following exercise will help you understand all the ways that Black Scurge could get moisture without being watered directly. All the contaminated areas containing this black menace are near water sources. See if you can find a connection.

Water Cycle Germinator

Pour 1 inch of soil into a clear glass or plastic cup. Plant a few seeds just below the soil. How can you water the seeds without sprinkling them with water? Try the water cycle!

Place a plastic capful of water onto the surface of the soil. (A good size cap would be from a spice bottle or other small container.) Next, seal the cup by covering the top with plastic wrap and securing the wrap tightly with tape or a rubber band.

What do you think will happen? How will the seeds get the moisture they need to germinate, or begin to sprout? Observe the container for the next week.

Tell your JMG teacher what happens.

Purple Ooze Pods
of the Black Scurge

Option 2

We froze Dr. Thistle once; maybe we can use ice again to trap him. Agent Gingko is working on a solution. Complete the test at right and send your results to his lab, pronto! You can do it!

Fried Ice

Water is always moving. If you set an ice cube on your kitchen counter, you could watch the solid water change physical states to become liquid water and then evaporate into water vapor, an invisible gas. How long would it take for water to make these physical changes between the three states?

The warmth of your kitchen counter will cause the water molecules in ice to begin moving faster. In time, they will break away from their solid structure to become fluid and then will fly apart as water molecules in a gaseous form. These physical changes might take hours to occur.

You could accelerate the changes in state by speeding up the movement of molecules with heat. Follow these steps:

1. Have an adult help you choose an uncoated metal pan from your kitchen.
2. Place the pan on the stove and set a small ice cube in the center of the pan.
3. Set the burner to medium heat for 1 minute and then turn off the heat.

Use a clock to measure how long it takes the ice to change through the different states.

Ice Melter 350
Prototype: XJ7

WARNING, AGENT 9!
AN ADULT MUST ASSIST DURING
THE FRIED ICE EXERCISE!



Want more,
Agent 9?

Complete a third
mission option at
www.jmgkids.us/thistle

Mission 6: Finding The Source

AGENT 9 ::

Great Job, Agent 9! Your work has revealed how the Black Scurge is spreading! Thistle is using the palace watersheds and aquifers to carry the ooze pods throughout the ecosystem!

Watersheds are large sections of land that naturally carry water to the major water sources in the area. Dr. Thistle dumps the pods throughout the watershed, and nature does the rest. The scoundrel! The aquifers, which hold large amounts of water underground, are also contaminated. We must find a way to reverse this imbalance and restore the purity of our water!

Hang on—word just came in that Thistle has gone underground! The Battle Slugs have breached the thicket, only to find it abandoned! Well, not exactly. We did discover someone quivering behind a large tree root—he turned out to be none other than Grubby, Thistle's right-hand grub!

Oh! Great news! I've just been told that Grubby has revealed Thistle's hiding place! A little encouragement and a handful of sweetroot is all it took! Grubby says that Thistle has buried himself in the sand in an underground tunnel.

Thistle thinks he'll wait there patiently until the Black Scurge has engulfed the area, and then he'll resurface and claim the queen's throne. We have moles tunneling in the area now. They'll be able to pinpoint that smelly weed! Trust me—he won't get away!

I need you to chart the area's aquifers and watersheds and work with Agent Gingko to invent a way to clean up the waters of the palace. Hurry, Agent 9! Queen Flora's vital signs are fading! ▶▶

Mission 6:

Finding the Source

Aquifers, Watersheds and Wetlands

Options Accomplished

Percolation Soda

Foiling Watersheds

Mystery Web Option

Date:

Option 1

Percolation Soda

Place 1 inch of water in a tall, clear glass and freeze it. Fill the glass to 1 inch from the top with ice cubes (crushed ice works best).

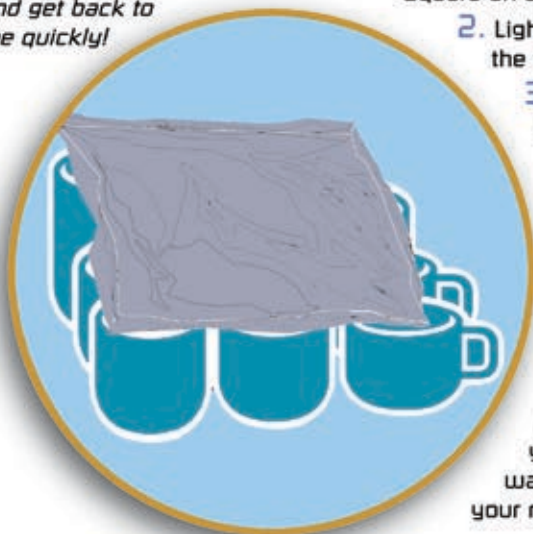
When rain falls to the ground, some water runs off and some infiltrates into the surface of the soil and continues to percolate through the soil. Take the glass and some juice or soft drink to a friend or a member of your family. Follow and explain each step:

1. Solid rock, called bedrock, exists deep in the surface of the soil. Point to the ice at the bottom.
2. Above the bedrock are layers of soil made of rock, organic matter, air and water. Point to the area of crushed ice.
3. When it rains, some water infiltrates into the surface of the soil. Pour a few teaspoons of the juice or soft drink onto the top of the crushed ice.
4. As water percolates, or moves down through the soil, some of it becomes trapped in the spaces between the soil particles. Point to drops of the juice or soft drink trapped around the crushed ice in the middle of the glass.
5. As more rain falls, the surface will be saturated until gravity pulls the water deeper into the soil. Pour in more juice so it rises above the ice surface, then seeps in.
6. An aquifer is a large area of rock, sand or gravel underground that stores water. Point to the juice on top of the ice block and between the spaces of the crushed ice.
7. People pump groundwater from far below the surface. Place the straw in the glass. Invite the other person to take a sip of the juice through the straw!



Option 2

Find out how the area's watersheds work, Agent 9. Try the following experiment and get back to me quickly!



Foiling Watersheds

When rain falls, some water flows over the land to rivers, lakes and other bodies of water. These are sources of drinking water. A section of land that carries rainfall to a body of water is called a watershed. Complete the steps to make a tiny watershed in your kitchen:

1. Find nine glasses and mugs of different sizes. Arrange them touching each other to form a square on a table.
2. Lightly crumple a sheet of foil and spread it over the tops of the cups. Fold the edges of the foil up to form a short wall to prevent water from spilling over the side.
3. Slope one part of the foil so that it drains to a shorter cup at one of the corners. The cup that the water flows into represents a source of drinking water.
4. Place a drop of food coloring in two places on the foil. The food coloring represents pollution from an overuse of pesticide.
5. Sprinkle a small mound of pepper in two other areas of the foil. The pepper represents pollution from an overuse of fertilizer.

Use a spray bottle to spray water over the entire surface of the foil. Continue spraying water until it begins to flow over the surface. Some of the water will form little pockets of water; these represent ponds and lakes in a watershed. Some of the water will drain all the way to the lowest point, into the cup.

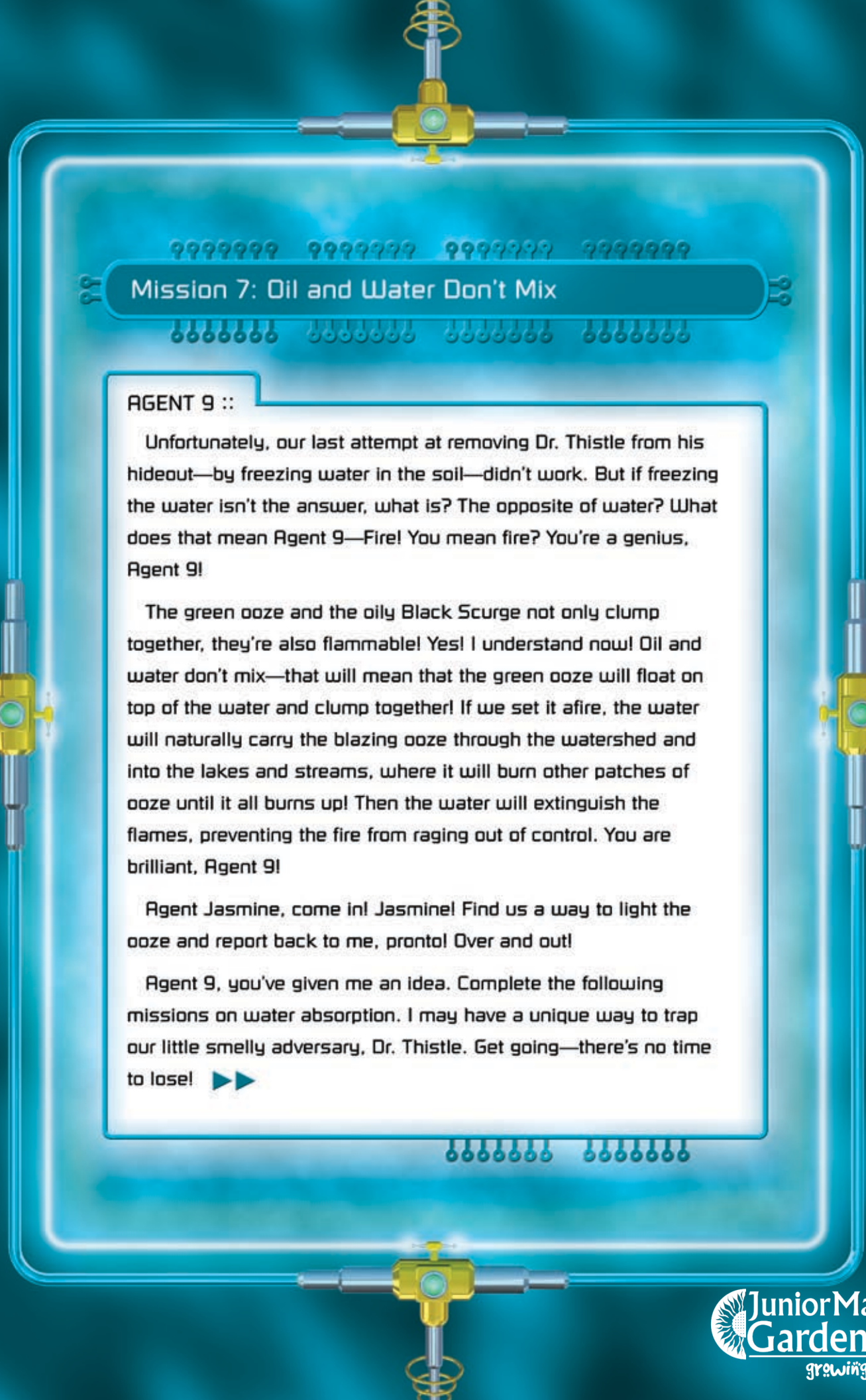
What happened to the "pollution" in your watershed? Look closely at the water in the last cup. Be ready to share your results with your JMG group leader.

It will look something like this, Agent 9.



Want more, Agent 9?

Complete a third mission option at www.jmgkids.us/thistle

The page is framed by a blue, metallic-looking border with yellow valves and pipes at the top, bottom, and sides. The title "Mission 7: Oil and Water Don't Mix" is centered at the top in a blue rounded rectangle. The text is contained within a white box in the center. The background is a light blue gradient with faint cloud patterns.

Mission 7: Oil and Water Don't Mix

AGENT 9 ::

Unfortunately, our last attempt at removing Dr. Thistle from his hideout—by freezing water in the soil—didn't work. But if freezing the water isn't the answer, what is? The opposite of water? What does that mean Agent 9—Fire! You mean fire? You're a genius, Agent 9!

The green ooze and the oily Black Scurge not only clump together, they're also flammable! Yes! I understand now! Oil and water don't mix—that will mean that the green ooze will float on top of the water and clump together! If we set it afire, the water will naturally carry the blazing ooze through the watershed and into the lakes and streams, where it will burn other patches of ooze until it all burns up! Then the water will extinguish the flames, preventing the fire from raging out of control. You are brilliant, Agent 9!

Agent Jasmine, come in! Jasminel Find us a way to light the ooze and report back to me, pronto! Over and out!

Agent 9, you've given me an idea. Complete the following missions on water absorption. I may have a unique way to trap our little smelly adversary, Dr. Thistle. Get going—there's no time to lose! ▶▶

Mission 7:

Oil and Water Don't Mix

Water Movement

Options Accomplished

Perky Soil

Disappearing Water

Mystery Web Option

Date:

Option 1

This exercise will help you determine the water absorption rate of different types of soil in the area. This will help us capture Thistle once and for all, Agent 9. Gol Gol Gol

Perky Soil

Is your soil perky? Make a simple instrument to find out how quickly your soil allows water to percolate into the ground:

1. Remove the bottom of an empty metal can to form a metal cylinder. Clean and dry the cylinder.
2. With a ruler and a permanent marker, make a small dash every centimeter along the inside and outside of the can. This can be tricky, Agent 9!
3. Find an area of bare ground to test. Using a twisting motion, push the can 3 centimeters into the soil. If the ground is too hard:
 - Spray the ground with water and allow the water to seep into and soften the ground and try again.
 - Set the can on the ground, place a piece of wood over the top and use a hammer to help drive the can into the soil.
 - If neither idea works, try finding a softer area of soil!
4. Count 10 centimeters from the mark at the ground level. Draw a small circle around that mark.
5. Fill the can with water to the 10-centimeter mark and observe. How long does it take for the water to begin to disappear?

Some soils allow water to seep into the soil in just a few minutes; other soils would still hold water in the can after a full day. Plants do not grow well in soil that prevents water from seeping in over a few hours or that allows water to seep in too quickly, such as a few minutes.

Observe the can long enough to answer these questions:

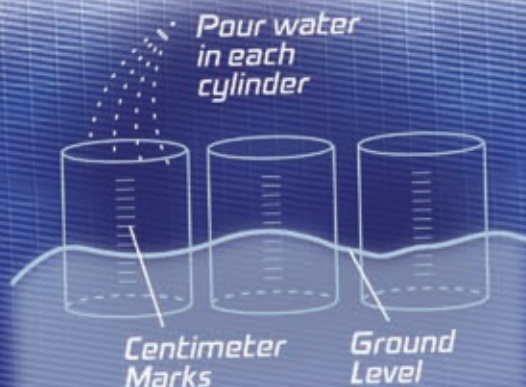
How long did it take for the water level to go down 1 centimeter?

How about 5 centimeters?

How long did it take for the water level to go down 10 centimeters?

Be ready to share this information with your JMG teacher.

Mission Sketch



Option 2

Disappearing Water

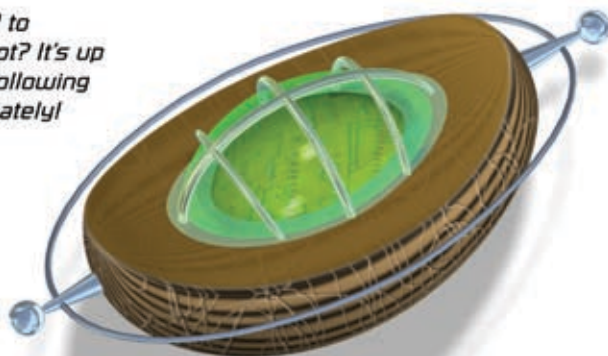
Fill one measuring cup with sand. Pour 1 cup of water into another measuring cup. Show the cup of sand to a friend or a member of your family. Ask that person if the cup is full.

Explain that garden soil, like the sand in the cup, is made up of soil particles and countless tiny open spaces. As water moves into and through soil, it is moving through those spaces.

Pour a small amount of water into the cup of sand. What happened to the water? Did the level of the sand rise? Continue pouring the water into the sand until it reaches the level of the sand. Were you surprised at how much water could move into the open spaces in the sand?

Sand particles are the largest of all soil particles and have the largest open spaces around them. Clay particles are the smallest and have the smallest open spaces. Consequently, water moves much more quickly through sandy soil than through clay.

Can we get enough liquid into the sand to quickly surround Dr. Thistle's hiding spot? It's up to you to find a way, Agent 9. Try the following experiment and get back to me immediately!



Ground-Penetrating Thistle Thwarter J900



Want more, Agent 9?

Complete a third mission option at www.jmgkids.us/thistle

Mission 8: Waxed Thistle and Lightning Bug Fireworks

AGENT 9 ::

Do you like fireworks, Agent 9? Look over the horizon and you'll see the last of the Black Scurge destroyed for good! Agent Jasmine has friends among the Lightning Bug Colonies of the Midwest. Who knew? See the bright purple lights in the sky? Those are the purple pods exploding!

Jasmine discovered that it takes only a small spark from a lightning bug to set the green ooze ablaze. If that green ooze happens to be in a purple pod under a canopy of nasty Black Scurge, a chain reaction occurs, setting all the pods on fire and sending them shooting into the air.

As the pods rocket skyward, they pull up all the Black Scurge with them. Far above the earth, they explode into a thunderous purple shower of sparks with green flecks. There goes another! Ha! It's better than the Fourth of July!

Thanks to you, the palace waterways are pure again, and Queen Flora is regaining her strength!

This just in, Agent 9! The moles have helped us capture Dr. Thistle at his underground hideout! Your experiments with sand proved that water can easily fill the spaces around sand, but we thought we'd use wax instead. I won't ruin the surprise. He'll be on display for you in the fountain hall during the medal ceremony—I'll see you there!

I knew we could count on you. Great work! As a final mission, I need you to test the waters around Waterlily Palace to ensure that purity has been restored.

Don't take too long, Agent 9. Thistle will be waiting for you in the Fountain Hall! ▶▶

Mission 8:

Waxed Thistle and Lightning Bug Fireworks

Water Conservation

Options Accomplished

Water Taste Test

Clear Gold

Mystery Web Option

Date:

Option 1

As a precaution, run some taste tests as described below and log your results. Hurry! We're saving you a seat at the medal ceremony!

Water Taste Test

Is water just water? Although water is described as odorless and tasteless, many people spend lots of money for water that comes in bottles. Even though water from your faucet costs less than a penny per gallon, people will pay much more for bottled water if they think it tastes even slightly better.

Try a taste test with family or friends to find if there really is a difference worth paying for!

1. Find three different sources of water. Two should be different brands of bottled water and one should be water from the faucet of your house.
2. Find three identical cups and label the bottom of each with the type of water being used for your taste test.
3. Pour enough of each type of water into the correct cup to allow for a couple of sips.
4. Invite someone to taste each type of water and select a favorite and least favorite.

If possible, test a few people. Did everyone determine that the most expensive water tasted best? Share the results of the test with the people you tested and your JMG group.

Whether it's from a faucet or a bottle, clean water is a necessity. Although water prices can range from less than a penny a gallon to several dollars a gallon, all of it is valuable. If we are really thirsty and the water is clean, we usually don't care where it comes from!

Thank you, Agent 9!
You have saved us all!
Please join us soon at
the ceremony.

Option 2

Queen Flora wants everyone to appreciate the value of the ecosystem entrusted to us. Try the following exercise and share your results at the medal ceremony.

Clear Gold

Although water is inexpensive, it's also very valuable. But because it is so inexpensive, we often waste it. Your family likely pays less than a penny for every gallon of water that flows into your home.

Look at a water bill or a bill from your utility company (ask a parent or adult to help find the information) for answers to these questions:

1. How many gallons of water does your family use a month? _____
2. What is the cost for just the water? _____
3. Now, imagine a gallon of water cost the same as a gallon of gasoline. What would your total water bill be? _____

Multiply:

Number of gallons of water used X current price of a gallon of gas = _____

This amount tells you how much your water bill would be if it cost the same as gasoline. If the price of water were to rise significantly, do you think your family and friends would be more careful of how you use water?

Be ready to share what your family's water bill would be if water cost as much as gas.



Water Calculator and
Portable Music Player
PXM 2007



Want more,
Agent 9?

Complete a third
mission option at
www.jmgkids.us/thistle