Carmen's Soil Investigation Procedures

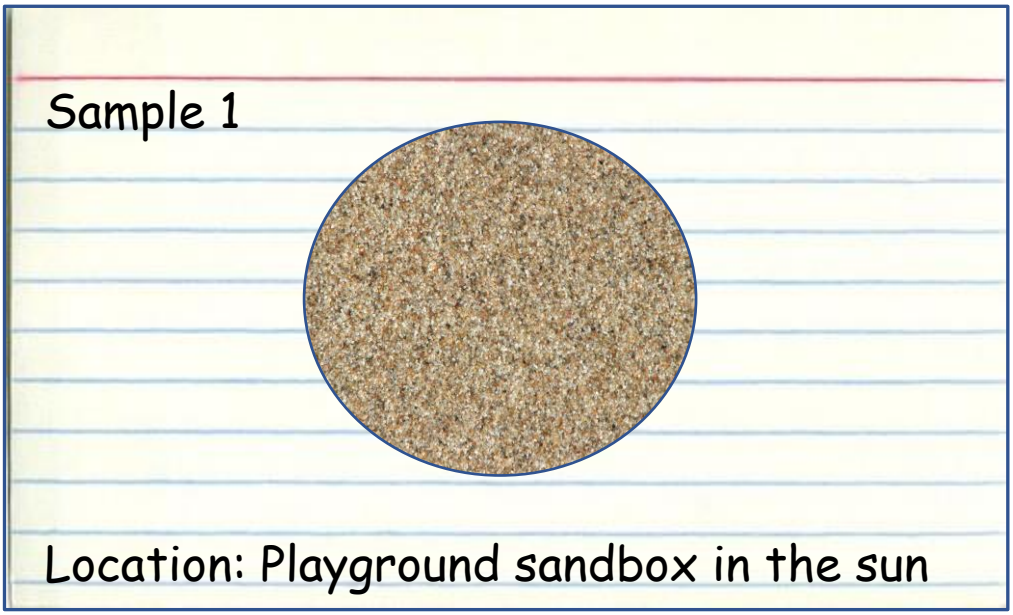
Is there different types of soil in your school yard or neighborhood? Follow Carmen's procedures to find out!

1. Each group will collect 4 different soil samples. Once you are done with this investigation, please return the soil from where you took it. Using a small shovel or spade and a quart size or sandwich size baggie, collect one shovel full of soil carefully noting the place where it was collected and if there were any insects or bugs in the area. **Choose four** of the following areas at your school or neighborhood :
    - A sandbox
    - Under a bush
    - In an area with no plants in the direct sun
    - In an area under a faucet, spicket or water fountain
    - From a house plant
    - Under a tree
    - In the shade
    - From a garden area
    - From an arroyo or place that water collects when it rains
    - In a desert lot or desert area
2. Once the samples have been collected, label each bag with masking tape and sharpie, Number the samples 1-4, noting where they were taken. Bring your soil samples back to class.
3. Brainstorm with your group or class for description words for soil that would describe how the soil looks, sounds and feels. Write these words in the word bank on your soil investigation sheet.
4. Leaving your soil in the bag, note the following about each soil sample on your soil investigation sheet as you pass them from person to person:
    - Describe the color of the soil
    - Note if there are rocks, sand, or powdery dirt in the sample
    - Is there humus in the sample?
    - Are there decomposers in the sample or were around the sample when collecting it?
5. Touch the soil, feel it between your fingers, grind the particles together and listen to the sound
    - Are the particles large, small or a mixture?
    - Does the soil feel gritty, sandy or powdery?
    - Does the soil feel moist?
6. Put a couple of spoonsful of the soil into the dixie cup and add water enough to form a dough like mud and put the soil in your hand. Can you form a ball with the soil? If yes, can you flatten the mud ball into a ribbon without it breaking apart?

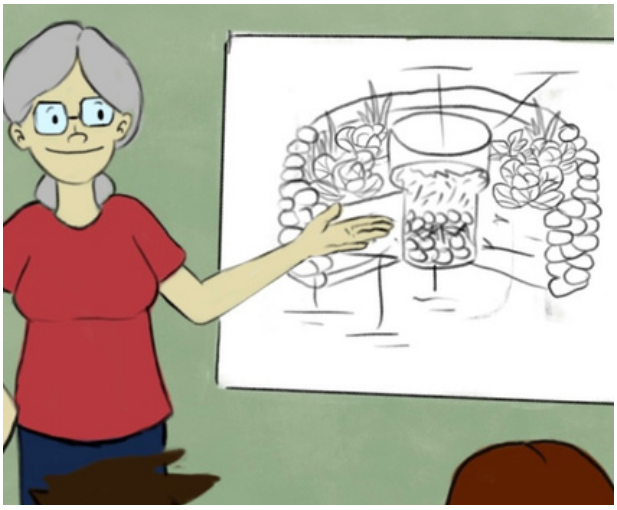
Next: Looking at your soil up close!

Microscope Slide Index Card

1. Fold four index cards in half and using the cardboard tube, trace a half circle on the folded edge of each card. Using the scissors, cut out the half circle. This will leave a full circle cut out in the middle of the index card.
2. Carefully, place a clear piece of packing tape over the circle to create a sticky surface for your soil sample.
3. Take a pinch of soil from your first sample and sprinkle this soil onto the sticky side of the tape so that the soil sticks to the surface.
4. On the top of the index card note the sample number. On the bottom of the Index card note the location with any descriptions such as in the shade, in the sun, etc.
5. Once the card has been labeled, put a second piece of tape over the sample to seal the soil sample.
6. Using your hand lens or student microscope, observe and describe the particles of soil that you see. Be sure to note particle sizes, if you see pieces of plants or insects, etc.
7. Using four dots of glue (one for each corner of the card) glue your index card to your soil observation sheet.



Carmen and Ernie's Guide to Make a Keyhole Garden



A Keyhole Garden is a raised garden developed in Africa to promote home gardens in arid and desert areas.

It is called a "keyhole" because its shape resembles a keyhole of a door.

At the center of the keyhole is a composting basket that contains layers of composting materials. This basket is used to provide nutrients to the soil as well as a type of "compost tea" when watered directly into the basket.

Keyhole gardens can be made out of any recyclable materials found around the yard, including burlap sacks, sticks, wood planks, stones or bottles, but our Classroom Keyhole Garden will be made so that it is collapsible and can be removed at the end of the school year. Here are the materials that you will need in order to construct your collapsible Keyhole Garden:

Container Materials

- 1 package of 6 mil Plastic landscape cloth
- 2-3 2x8 ft vinyl lattice
- 2 2 ft long divider molding for lattice
- 2 Rolls of duct tape
- Weed cloth
- 18 gauge steel wire
- Hot glue gun
- Glue Sticks
- Scissors
- Package of plastic garden stakes

Compost Basket Materials

- 4ft tall roll of chicken wire or garden fence wire
- Wire clippers
- 18 gauge steel wire
- Gloves

Irrigation System (optional)

- 2 3/4-inch wide pvc pipe (10 ft)
- PVC pipe cutter
- PVC elbow
- PVC couplings for water hose
- Adjustable sprinkler head
- Sandpaper
- PVC Primer
- PVC Cement
- Water hose

Keyhole Garden Procedure

Collapsible Keyhole Walls:

1. Attach lattices facing the 2 ft ends together to form a long 16 ft (two lattices) or 24 ft (three lattice) strip. Latices can be attached with lattice divider molding or by taping together with duct tape. Use galvanized wire to reinforce the connections.
2. Roll out the 6 mil plastic cloth and lay the lattice strip over the edge of the plastic. Leave 5 inches of plastic cloth above and below the lattice strip so that the plastic can be glued over the edge.
3. Hot glue the hem of 6 mil plastic over the edge of the lattice. Use the duct tape to reinforce the areas where the plastic was glued to the lattice. The plastic should be hemmed on both the bottom and top of the lattice. This will stop the soil from leaking out of the lattice wall.
4. Find a partially shady place in the school yard that has access to a water spigot to place the keyhole garden. Form the plastic covered lattice strip into the shape of a keyhole if using 3 lattices, for two lattices make into the shape of a circle. Stake the shape in place using plastic stakes.
5. Line the bottom of the keyhole shape with weed cloth or cardboard
6. Once the shape is filled with composted soil, the walls will keep their shape, but before filling place the compost basket and optional irrigation system in place.

Optional Irrigation System:

1. Measure a 4 ft PVC pipe as the tube that will be the sprinkler located in the compost basket.
2. Using an elbow coupling, add another pipe to the bottom of the first pipe. This will act as a path for water to travel under the keyhole garden.
3. Use a coupling to attach a waterhose on the end of the PVC pipe that leads outside of the keyhole garden and add another coupling to attach the adjustable sprinkler on the 4ft end.
4. Once all of the pieces are in place, take apart the pieces and sand the inside of the connecting pieces. Use PVC primer to prime the inside of couplings and use PVC cement to permanently attach the pieces together.

Compost Basket:

1. Roll out chicken wire to create a 1 ½ ft diameter tube that stands at 4 ft.
2. Using the wire cutters, clip the roll so that the tube slightly overlaps.
3. Use galvanized wire strips to wire the ends of the fencing together so that the tube does not open or lose shape.
4. Place the Compost basket at the end of the opening of the keyhole shape so that the gardener has access to the compost basket. If you are using only 2 latices, place the tube against the wall of the garden for easy access.
5. If using an irrigation system, run the system under the keyhole shape and into the middle of the compost basket so that it waters the garden within the basket.
6. Place a pile of large rocks about a foot deep at the bottom of the basket to allow for drainage and to stabilize the pvc pipe in the irrigation system.

Final Step

Fill the Keyhole garden with composted soil.

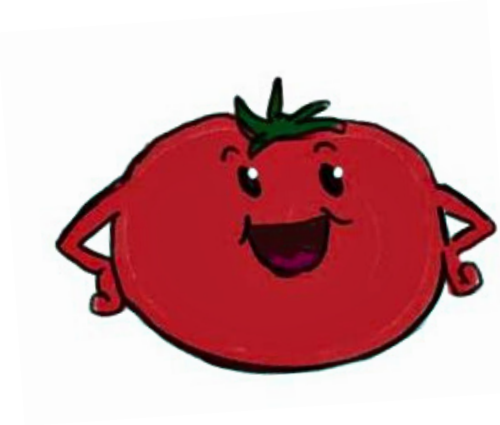
For ideas on how to develop composted soil see: Carmen's Compost Procedure

Keyhole Garden Removal:

To take down the keyhole garden, simply detach the lattices where they are joined by cutting the wire. The composted soil can be added to gardens around the school. The lattices and irrigation system can be stored for the next school year.

Tomato, Pepper, Onion and Cilantro help Carmen to make:

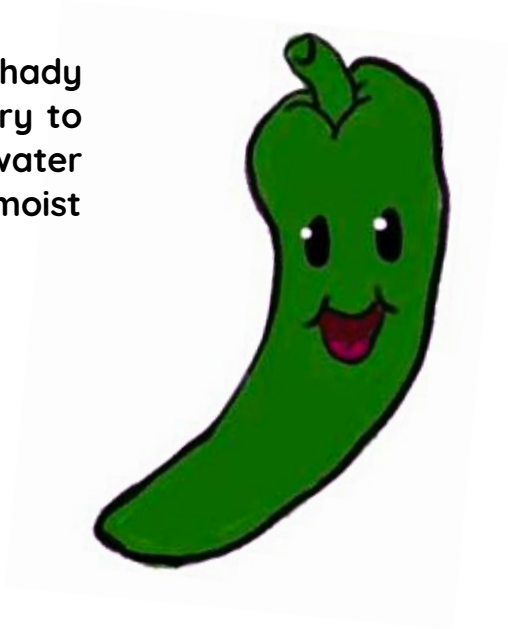
COMPOST

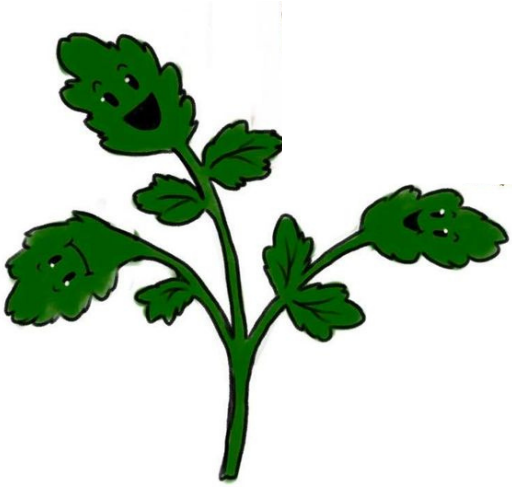


Composting is a great way to change or amend desert soil so that you can grow fruits and vegetables! To compost means to allow organic (or once living materials) to break down and become humus for soil. Desert soil has very small amounts of humus, which is why it is necessary to add it to our soil so that vegetables and fruits can get the water and nutrients that they need. We will show you how to compost within your garden container so that by the springtime your soil will be ready to plant vegetables and fruit. The materials that you will need in order to create your composting soil will be:

- A large boxed area or raised garden planter to create your composted soil. (See Keyhole Garden Instructions if you would like to build your own.)
- Organic green materials such as table scraps, fresh cut grass, etc.
- Organic brown materials such as shredded paper and brown cardboard, dry leaves, dry grass, or branches
- Dirt, (it can be from your area, just make sure to remove any large rocks.)
- A water hose
- Optional: earth worms. You can also add earth worms to your soil but it is not necessary for the process.

The first thing you need to do is find a partially shady spot in your school yard to start your garden. Try to find a place where you will have access to a water spicket (faucet) to help you keep the compost moist and to water your future garden.



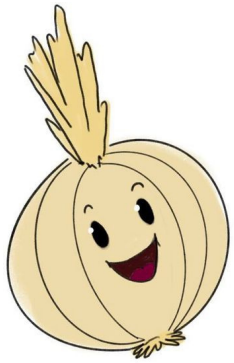


Once you have chosen a spot for your classroom garden you will need to fill your container with layered materials of green organic matter, brown organic matter and soil. You can collect greens from the cafeteria or maintenance staff. You can recycle shredded paper as part of your browns. Here is a chart to help you collect the right greens and browns:

Green Organic Matter (nitrogen)	Brown Organic Matter (carbon)
• Fruit and veggie scraps • Algae • Green leaves • Green shrub or tree trimming • Tea bags • Green hay or alfalfa • Coffee grounds • Animal manure from herbivores (cows, horses, etc.) • Old flower bouquets • Fresh grass clippings • Egg shells • Old bread • Corn husks	• Aged or yellow hay • Brown cardboard that doesn't have stickers on it • Dry leaves, dry branches • Sawdust • Chipped wood • Cardboard egg cartons • Shredded paper • Paper towels • Straw (the grass not plastic straws) • Toilet paper and paper towel rolls • Dried grass clippings • Corn cobs • Pine needles • Nut shells

What to Avoid

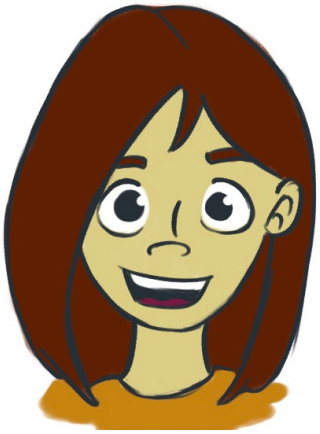
- Animal poop from omnivores or carnivores (dogs, cats, etc)
- Plastic
- Metal
- Dairy, Meat, Bones
- Shiny paper, shiny cardboard or shiny labels
- Weeds



Once you have collected browns, greens and dirt for your garden it is time to build your nutritious composted soil. The best time to start is in either the fall or winter time so that you have time to build up enough soil to fill the container.

1. Line the raised garden bed with weed cloth or cardboard. Either of these will help to stop any weeds from the ground level from growing into your compost pile.
2. The first layer you will add to your compost pile will be a layer of brown, about 5-7 inches thick.
3. The second layer will be a layer of green, about 4 inches thick.
4. The next layer will be a layer of dirt bout 5 inches thick
5. Keep layering brown, green and dirt until you run out of materials. Try not to end with the green on top as it will attract bugs and critters to your compost pile.
6. Moisten the soil with water, but do not soak it. It needs to be damp, not muddy.
7. Monitor the pile keeping it damp throughout the week while you collect more browns and greens.
8. Each week add to your compost pile, alternating layers. Once a month turn the soil (mix it up) with a shovel.
9. Keep adding to the layers each week until you fill the garden bed with materials to create compost. Once it is full try to keep it moist but not soaked.
10. Make sure to turn the soil monthly
11. By Spring the materials in the garden will have created compost.

You can also add worms to your pile to help the process. Red worms can be purchased at a pet store or discount superstore.



Ernie's Guide to making a Mini Recycled Greenhouse

Seed starters are plastic containers that allow you to grow seedlings indoors before spring begins. You can buy these containers at the store, but you can also make your own using recycled plastic clam shell containers.

Clam shell containers are used to store food at restaurants and grocery stores. They are called clam shells because the top and bottom of the container are usually connected like the shells of a clam.

The container is great to grow seedlings because when you keep them closed, they allow the water in the soil to condense on the walls of the container. This will help your seedlings stay warm and moist as they grow in the windowsill.

You will need:

- Clamshell container(s)
- Scissors, drill or something to puncture holes in the bottom of the container for drainage
- Potting soil
- Seeds
- Water
- Masking tape
- Sharpie marker

A greenhouse is an enclosed indoor garden that traps heat and moisture so that plants can survive during the winter months!

Procedure:

1. Carefully drill or puncture holes at the bottom of the clam shell container so that it will drain out water if the soil is over watered.
2. Fill container with potting soil a few inches deep being careful not to overfill the bottom part of the container.
3. Following the sowing directions of the seeds, bury the seeds to depth directions of the seed packet
4. Space the seeds according to the packet directions
5. Close the container and label the top with the type of seeds you are growing.
6. Place the container in a sunny window and monitor the growth of your seedlings
7. When the seedlings reach the ceiling of the container, leave the container open to allow more plant height before transplanting into the Mini Bucket keyhole Garden container.
8. Monitor and water the seedlings more often once the containers are left open.

Ernie's Guide to making a Portable Bucket Keyhole Garden

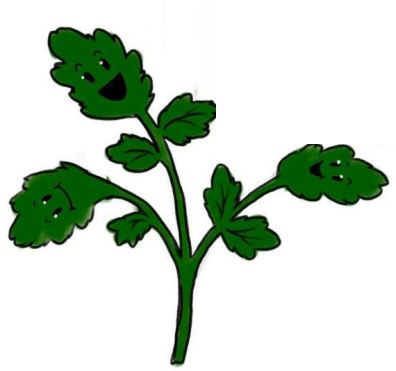
A Keyhole Garden is a raised garden developed in Africa to promote home gardens in arid and desert areas. It is called a "keyhole" because its shape resembles a keyhole of a door. At the center of the keyhole is a composting basket that contains layers of composting materials. This basket is used to provide nutrients to the soil as well as a type of "compost tea" when watered directly into the basket.

As your seedlings get larger you will need to transplant your new plants into a larger container. The Portable Bucket Keyhole Garden will allow you to let your plants get large while providing them with nutritious composted soil.

You will need:

- A large bucket (like those used at home improvement centers)
- Bucket lid
- Styrofoam pieces
- A drill
- Organic Potting soil
- A recycled plastic quart size soup container with lid or plastic quart size container with screw top lid
- green and brown materials for composting
- optional: earthworms

1. Drill 3/4 size holes at the bottom of the bucket to allow the bucket to drain so that the plants do not get over watered.
2. Fill the bucket 1/3 of the way with pieces of Styrofoam to allow for soil drainage and to create a lighter container when transported.
3. Fill the bucket with organic potting soil to about 2/3 full. Organic soil is preferred over commercial potting soil because of insecticides that may harm earthworms.
4. Drill holes along the sides the plastic quart container, being careful not to drill holes at the bottom of the container. This will act as the composting basket for the soil.
5. Pack brown and green materials loosely into the basket.
6. Screw on or seal the lid onto the top of the container to stop flying bugs from getting into the container.
7. Place the compost basket on the soil to one side of the bucket, and transplant your plant to the opposite side of the basket.
8. Add worms to the soil. (optional)
9. Fill the bucket in with more potting soil making sure to fill around the basket and plant.
10. Keep the bucket in a well lighted area, like under a lamp or windowsill. Keep soil moist making sure to refill the compost basket with organic materials and watering the compost basket to keep the materials moist. Use the lid of the bucket to catch the water as the bucket is being watered.
11. The Portable Keyhole Garden can be taken home during winter and spring break so that you can continue to take care of your plants while on vacation.



Once you have transferred your young plant into your bucket, you will need to fill the composting basket with layered materials of green organic matter and brown organic matter. You can collect greens from the cafeteria or maintenance staff. You can recycle shredded paper as part of your browns. Here is a chart to help you collect the right greens and browns:

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What to Avoid

- Animal poop from omnivores or carnivores (dogs, cats, etc)
- Plastic
- Metal
- Dairy, Meat, Bones
- Shiny paper, shiny cardboard or shiny labels
- Weeds

If you add worms to your bucket, they will crawl into the compost basket and help to process the green and brown matter.