

# Exploring Aquaponics in the Elementary Classroom

# National Agricultural Literacy Curriculum Matrix Aquaponics Lessons

Exploring Aquaponics (Grades K-2)

Exploring Aquaponics (Grades 3-5)

National  
Agricultural  
Literacy  
Curriculum  
Matrix  
Aquaculture  
and  
Hydroponics  
Lessons

Overfishing and Aquaculture (Grades 3-5)

Hydroponics Lesson (Coming Soon)



Aquaponics - Pass the Plate

# Engagement

Why might it be beneficial to raise fish and plants together in one system?

- The fish waste is not released into the environment.
- The waste produced by the fish is used as fertilizer for the plants.
- The plants purify the water for the fish.
- Food can be produced using less water than traditional growing methods. This allows food to be produced during droughts or in areas with little water.
- Fish and vegetables can be raised at the same time.
- Food can be produced in a small space and does not require fertile soil.
- Food can be grown in highly populated urban areas where fertile soil is scarce.
- Food can be produced indoors where weather and pests are less of a problem.
- No weeding is required.



## Nutrients

Nutrients, sometimes referred to as fertilizers, are the vitamins and minerals plants need for healthy growth. They come from the decomposition of rocks, dead plants, and animals and are absorbed through the roots of plants.



## Water

Water is made up of hydrogen and oxygen. It is absorbed through the roots and transported to the rest of the plant through the stem. Water helps keep plants rigid and transport nutrients throughout the plant. It is used along with carbon dioxide and light to make sugars and starches (a process called photosynthesis), the food plants use for living and growing.



## Air

Air is made up of oxygen, carbon dioxide, nitrogen, water vapor, and gases. Air enters plant leaves through tiny holes called stomata. The leaves use the carbon dioxide from the air to make sugars and starches for the plant to use as food. The roots absorb oxygen to convert food into energy (a process called respiration).



## Light

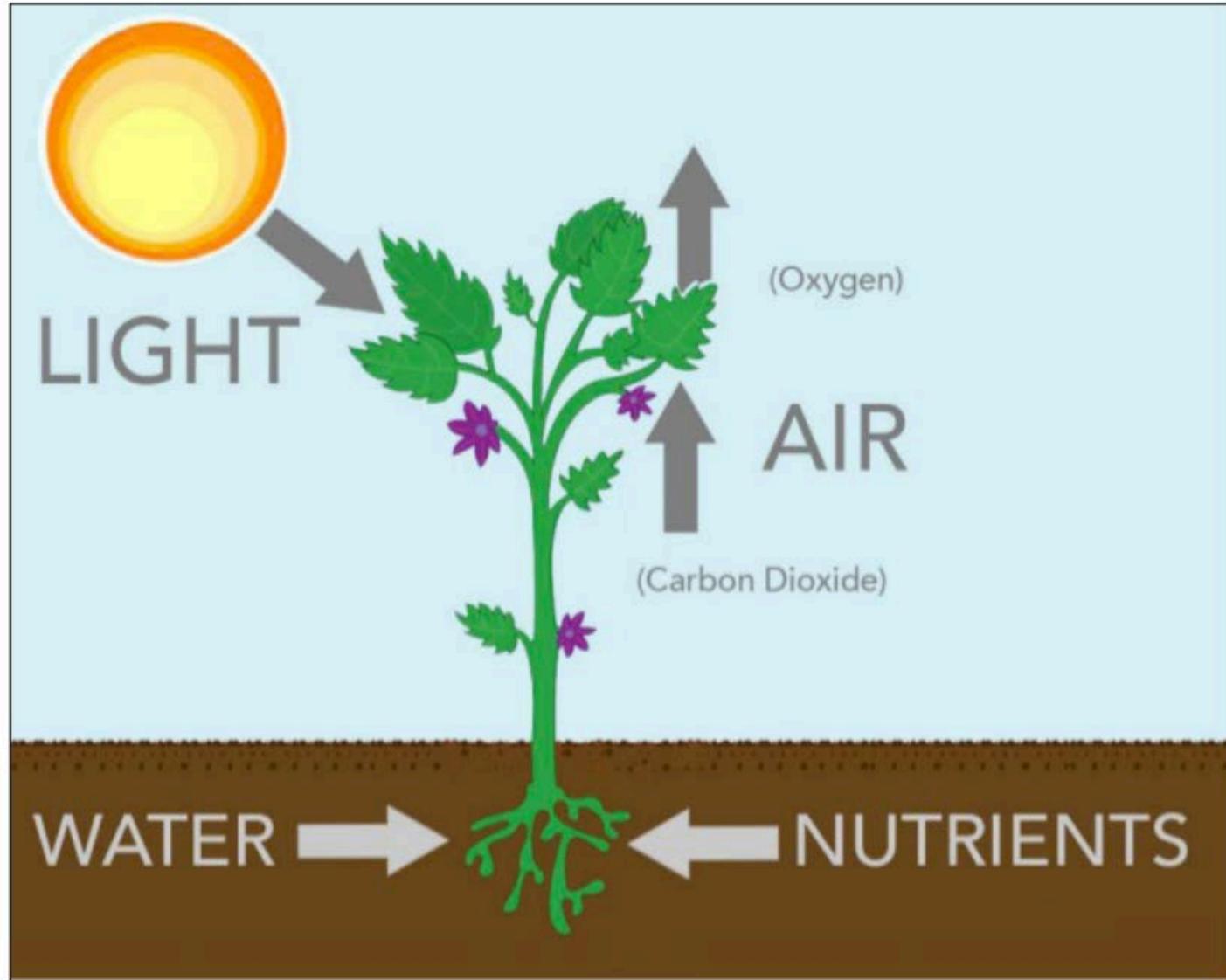
Plants use energy from light to make food. Leaves collect this energy and use it along with carbon dioxide and water to make sugars and starches as part of a process called photosynthesis. The sugars and starches are the food the plant uses for living and growing.

# Needs of a Plant (K-2)

# Plant Observation Sheet

A 6x5 grid for tracking plant growth over 5 days. Each day has a vertical scale from 1 to 6 and a horizontal scale from 1 to 5. Each day also has a small pot icon.

# Needs of a Plant (3-5)



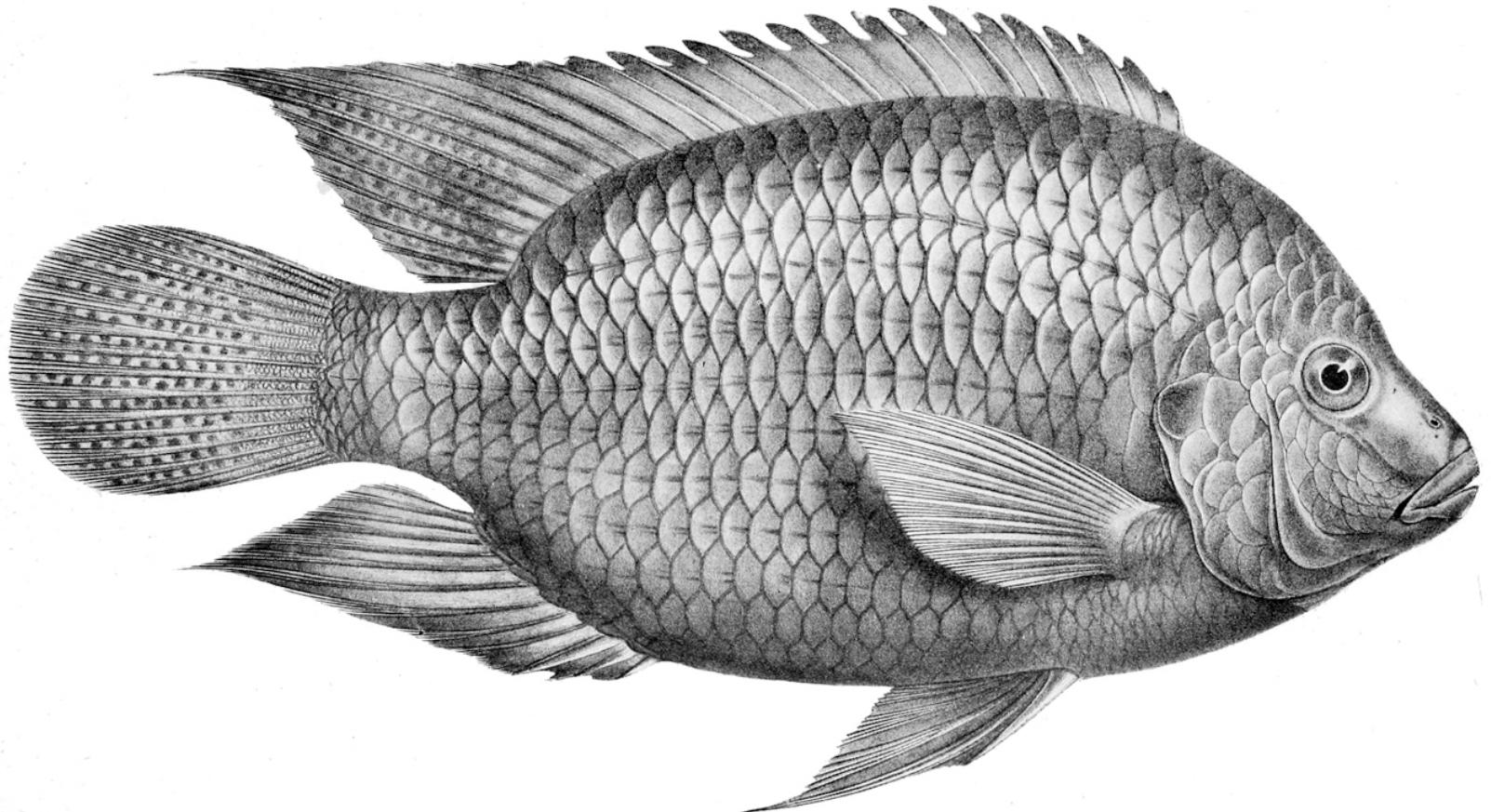
# Needs of a Fish (K-2)



# Needs of a Fish (K-2)



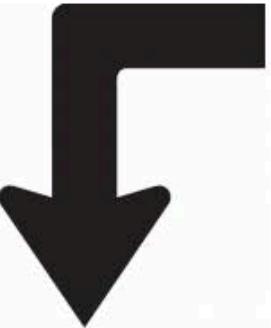
# Needs of a Fish (3-5)



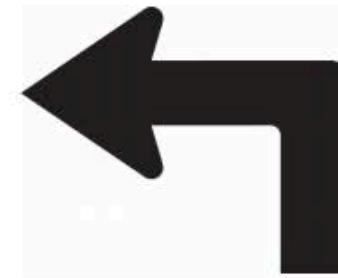
What Is Aquaponics? - Plant Chicago, NFP Explains

# What Is Aquaponics?





Fish produce  
waste.



## The Aquaponics Cycle

Microbes convert  
waste into  
nutrients for plants.



Plants filter the  
water that returns  
to the fish.

# Classroom Aquaponics Kit



# Aquaponics



# Aquaponics System Assembly



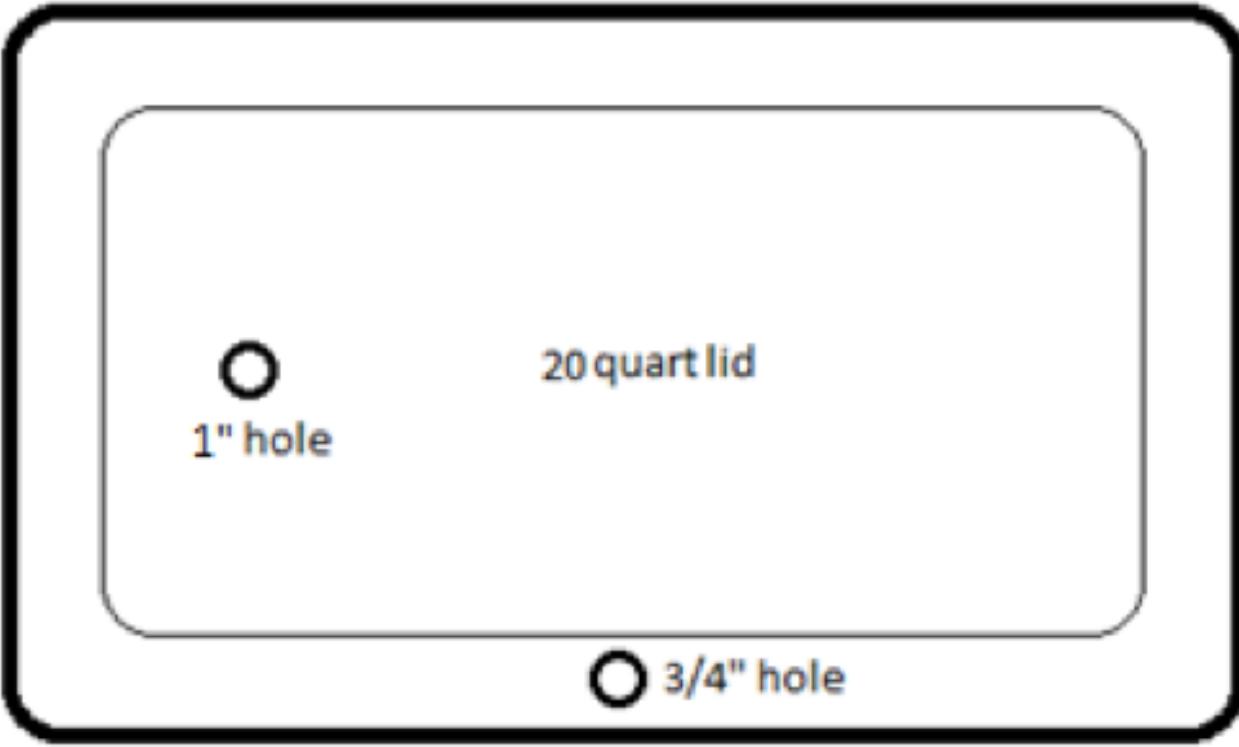
Drill a 1" hole in the bottom of the 12-quart storage tub, 3 inches away from the sides of the tub.

# Aquaponics System Assembly



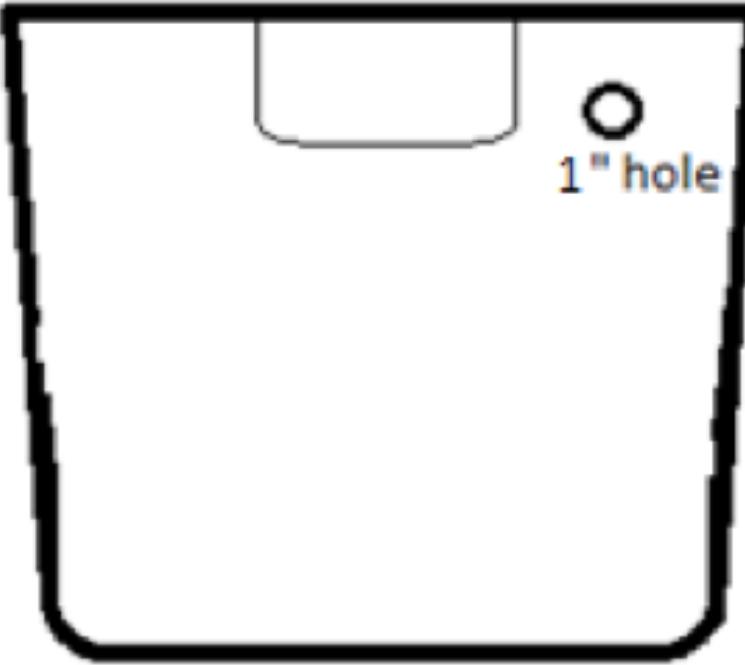
Drill a matching 1" hole in the lid of the 20-quart storage tub, such that the holes line up exactly when the 12-quart tub is nested on top of the lid. These holes are for the drain tube that will allow water to drain from the grow bed to the fish tank.

# Aquaponics System Assembly



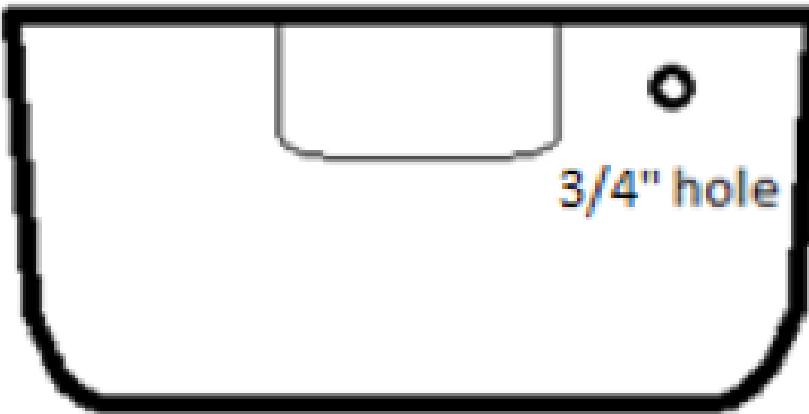
Drill a  $\frac{3}{4}$ " hole approximately  $\frac{1}{2}$ " from the edge of the lid of the 20-quart tub. This hole is for adding fish food.

# Aquaponics System Assembly



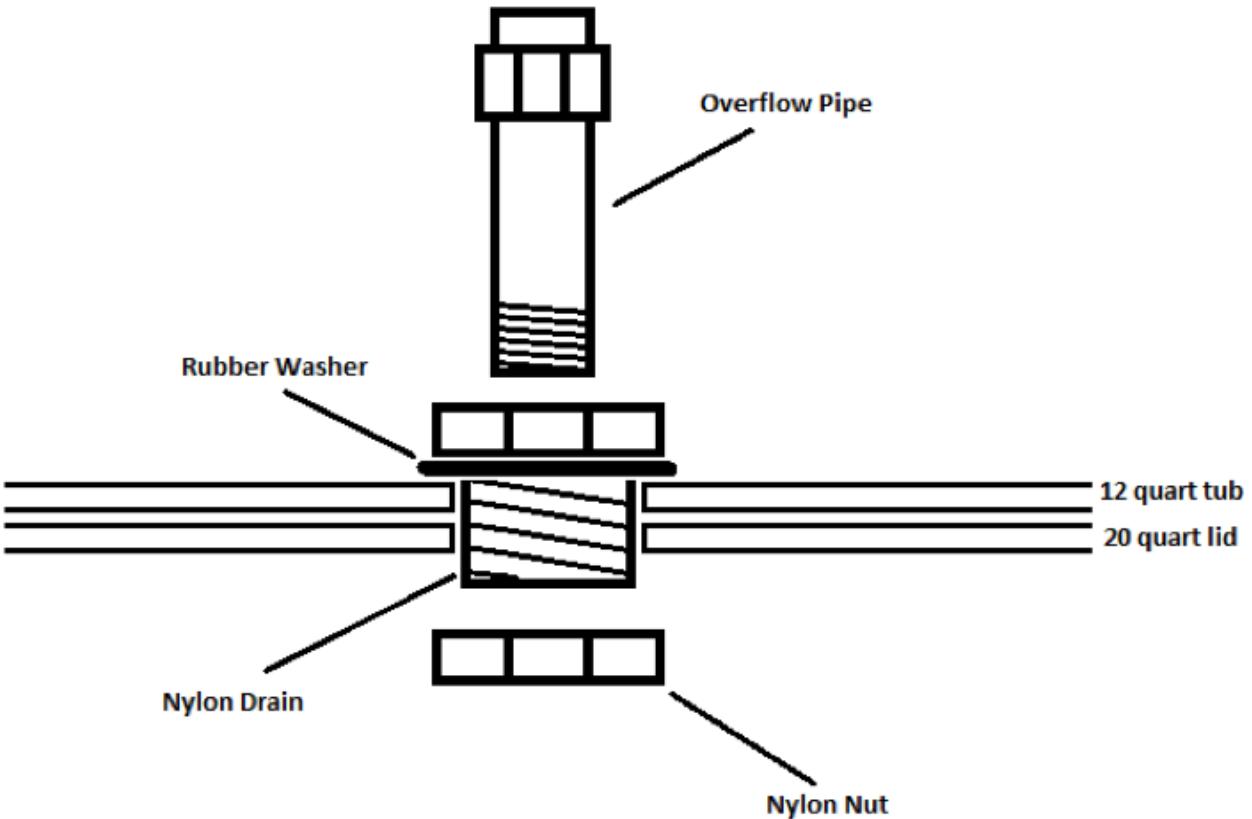
Drill a 1" hole near the top of one side of the 20-quart storage tub. This hole is for the pump cord and the water tube.

# Aquaponics System Assembly



Drill a  $\frac{3}{4}$ " hole near the top of one side of the 12-quart storage tub. This hole is for the water tube and must be located above the level of the drain tube.

# Aquaponics System Assembly

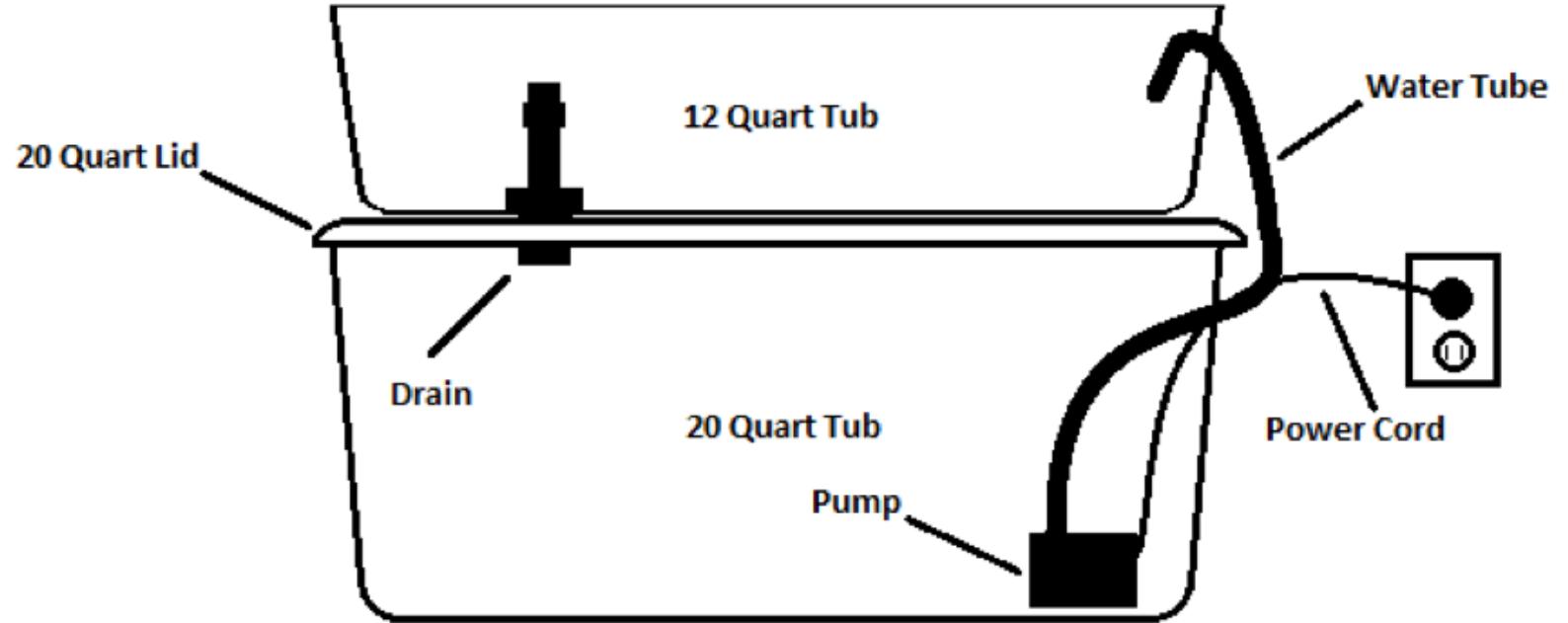


Install the swamp cooler overflow drain tube.

# Aquaponics System Assembly

- Set the 12-quart tub on top of the 20-quart tub lid so that the 1" holes line up.
- Slide the rubber washer onto the threads of the nylon drain from the Swamp Cooler Overflow Drain Kit.
- Thread the nylon drain through both 1" holes, and lightly hand-tighten. The drain should now extend through the bottom of the 12-quart tub and through the lid of the 20-quart tub.
- Thread the nylon nut onto the end of the nylon drain, hand tighten, then tighten securely with a wrench. Do not overtighten, as the nylon nut will deform and break.
- Thread the ½" overflow pipe into the inside threads of the nylon drain and tighten securely with a wrench.
- You should now have a drain tube that sticks up inside the 12-quart tub and a drain through the bottom of the tub and the lid below into the 20-quart tub.

# Aquaponics System Assembly

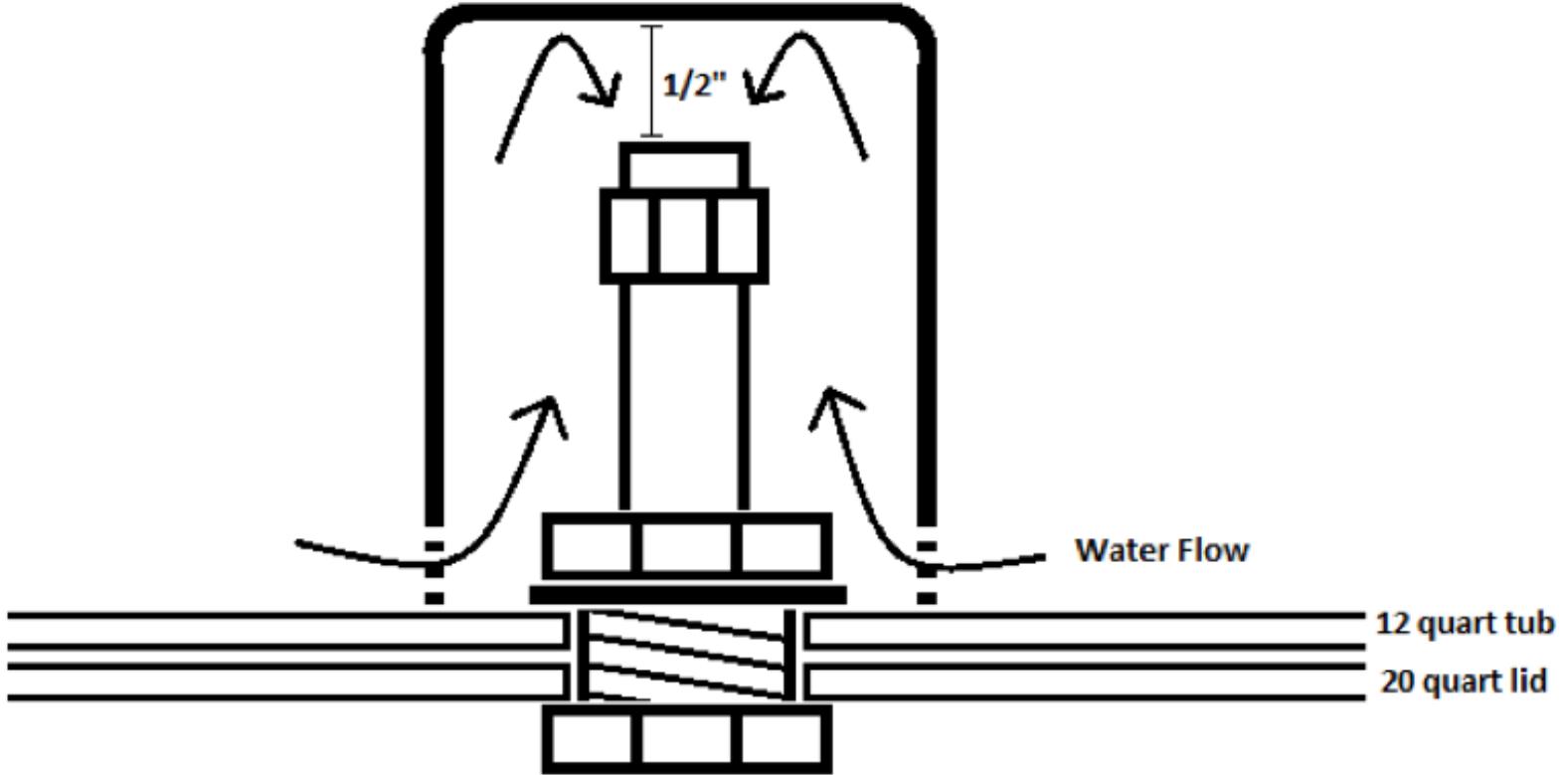


Install the pump.

# Aquaponics System Assembly

- Place the water pump inside the 20-quart tub, either on one side near the bottom or on the bottom. Use the suction cups to attach it to the tub.
- Thread the pump power cord through the 1" hole next to the water tube.
- Thread the flexible water tube through the hole in the side of the 20-quart tub next to the pump power cord. Then thread the tube through the hole in the side of the 12-quart tub. The tube should extend about 3-4" into the 12-quart tub and about 6-8" into the 20-quart tub when they are stacked on top of each other.
- Push the small plastic outlet sleeve into the outlet of the pump.
- Slide the water tube snugly over the outlet sleeve.
- Turn the pump flow adjustment all the way up.

# Aquaponics System Assembly

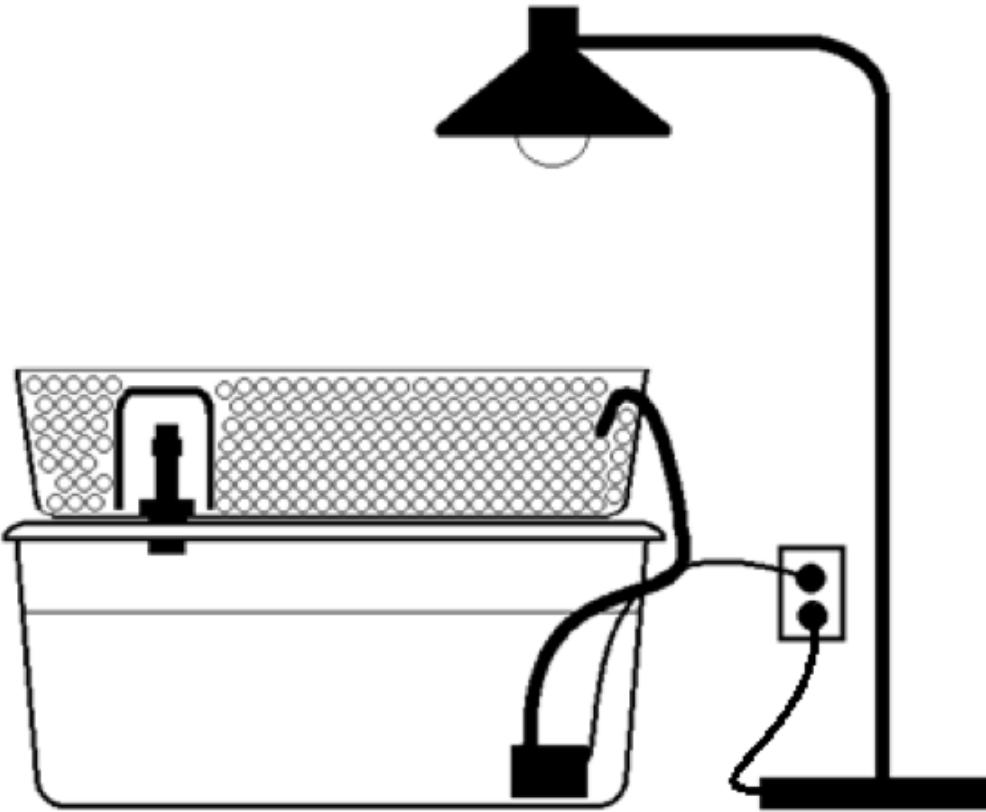


Construct the drain cover.

# Aquaponics System Assembly

- In order to prevent the drain from becoming clogged with clay pellets, plant roots, or other items, construct a drain cover. The cover can consist of any plastic cup-shaped object that is tall enough to leave at least a  $\frac{1}{2}$ " space between the cover and the top of the drain tube when it is inverted over the drain tube. Soda bottles with the top cut off, plastic mayonnaise jars, or plastic cups are all good candidates.
- To construct the drain cover, simply obtain a cup-shaped object that leaves at least  $\frac{1}{2}$ " of head room between the top of the drain and the cover. Drill several  $\frac{1}{2}$ " holes around the rim of the cover so that water can flow inside when it is inverted over the top of the drain tube.
- Place the drain cover over the top of the drain.
- With the drain cover in place, add clay pellets to the 12-quart tub until it is nearly full (about 10 quarts of clay pellets).

# Aquaponics System Assembly



Plug the grow light into the timer. Set the timer so that the light is on for 16 hours during the day and off for 8 hours at night. Keep the bottom tub (where the fish will be located) in the shade to limit algae growth.



# Classroom Aquaponics System (small-scale)



# Meeting Plant and Fish Needs in an Aquaponics System

Plant Needs	Meeting Plant Needs
nutrients	fish waste
water	fish tank
air	classroom
light	grow lamp

Fish Needs	Meeting Fish Needs
food	X
water	filtered by plants
air	present in water
shelter	cave

# Areas of Study Related to Aquaponics

- Basic needs of Plants
- Life cycles
- Food webs
- Photosynthesis
- Water cycle
- Nitrogen cycle
- Water quality
- Nutrient input
- Plant growth rates
- Plant health
- Fish growth rates
- Fish health
- Oxygen transfer
- Gravity
- Volume and area
- Food safety
- Nutrition
- Mechanical systems
- Symbiotic relationships
- Inherited Traits