

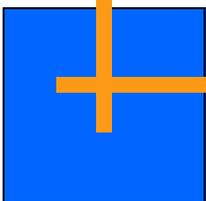
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Fish in the Classroom



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Fish in the Classroom Education Program

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Fish in the Classroom Education Program Program Overview

Teacher Workshop

At the teacher workshop, you will receive a binder with the Fish in the Classroom lessons, background information, and FAQs.

The teacher workshop will focus on:

- Increasing your knowledge of water chemistry, fish biology, and aquarium care
- Providing first-hand experience setting up and maintaining an aquarium
- Modeling and sharing classroom lessons
- Scheduling an Aquarium visit

Aquarium Materials

Each teacher will receive:

- Instructions to receive your \$250 reimbursement for aquarium supplies
- The Fish in the Classroom Curriculum
- A list of reliable retailers to contact for support

Classroom and Onsite Lessons

Eight classroom and onsite lessons were developed for the Fish in the Classroom Outreach Program, based on Sunshine State Standards and the requirements of classroom aquarium care. Lesson topics include setting up an aquarium, water testing, fish observations, and experiments.

The Fish in the Classroom lessons focus on:

- Increasing student knowledge of water chemistry, fish biology, and aquarium care
- Preparing students to care for live animals in an aquarium
- Skills such as reading, recording observations, graphing, building models, and critical thinking

Onsite Visit

Once you've set up your tank, and completed lessons 1-6, you will be able to make arrangements with The Florida Aquarium for your Aquarium visit. It is recommended that the onsite visit be scheduled in coordination with other teachers at your school. Register as early as possible for this visit.

The onsite visit will focus on:

- Math and reasoning skills
- Troubleshooting fish behavioral problems
- Teaching skills such as observation, experimentation, and critical thinking

Your Aquarium Contacts:

Tessie Offner
toffner@flaquarium.org
813-273-4000 x4250

Lauren Tyler
lyler@flaquarium.org
813-367-4017

Fish in the Classroom Education Program Aquarium Contacts:

For Fish in the Classroom curriculum questions, contact:

Lauren Tyler
lt Tyler@flaquarium.org
813-367-4017
(Monday through Friday)

Tessie Offner
toffner@flaquarium.org
813-273-4000 ex 4250
(Tuesday through Saturday)

To schedule your Aquarium visit, contact:

Education Reservations Office
education@flaquarium.org
813-273-4015
(Monday through Saturday)

Fish in the Classroom Education Program Planning Sheet

Teacher Workshop

- Schedule your onsite visit as soon as possible. You may wait until later in the year to schedule your Aquarium visit, but keep in mind that the Aquarium's Education Programs fill up as the year progresses.

Thanksgiving Holidays

November 22 – 26

- If you do not plan on setting up and cycling your aquarium right away, you may wish to wait until after this holiday to begin.
- Your aquarium should be OK over this holiday break. Feed fish extra food the day before you leave.
- Make sure the water chemistry levels are stable BEFORE you leave!

Winter Holidays

Varies according to your county

- You will need to make arrangements for aquarium care over this 2-week period.
- Options discussed in your teacher guide include 1) caring for the aquarium every 3 or 4 days during the break or 2) giving the fish to the students to take home or 3) providing an automatic feeder for your aquarium. You may want to keep a snail or a pleco (sucker fish) in the tank to eat algae while you're gone.
- Make sure the water chemistry levels are stable BEFORE you leave!

Spring Holidays

Varies according to your county

- You will need to make arrangements for aquarium care over this period (see Winter Holidays).

General Fish Keeping Tip

- Remember to have students test water quality regularly, especially after the addition of new fish, to ensure a safe habitat for the fish.

Aquarium Visit

- All requirements in the teacher contract must be completed prior to your trip date including the completion and mailing of your student pre-tests.
- Prepare students for their trip to the Aquarium by discussing proper museum etiquette and Aquarium group guidelines.

Aquarioria Education Outreach Lesson Planning Sheet

Lessons	Who Teaches?	Lesson Date	Date Scheduled with Aquarium?
1: Paper Aquarium	Teacher		N/A
2: What's the Procedure?	Teacher		N/A
3: Water Testing	Teacher		N/A
4: Your New Fish	Teacher		N/A
5: Water Testing & Graphing	Teacher		N/A
6: Parts of a Fish	Teacher		N/A
ONSITE VISIT	Aquarium Instructor		
7: What Fish is Next?			
8: Experimenting with Fish	Teacher		N/A

To schedule your Florida Aquarium visit, contact the Education Reservations Office:

Telephone: 813-273-4015

Fax: 813-209-2067

Email: education@flaquarium.org

Tips for scheduling:

- Schedule your visit as soon as possible.

Fish in the Classroom Education Program

Aquarium Basics

Before You Begin

An aquarium in a classroom is a doorway to scientific, creative, and critical thinking. Setting up and maintaining an aquarium can be easy with the right amount of knowledge. Aquariums shouldn't be hard work; they should be fun and interesting. Understanding how an aquarium functions is the first step in keeping your fish alive and well. The fundamental parts of an aquarium include the tank, filter, gravel, lights and water. Let's explore each part individually and discover their role in a healthy aquarium.

Tank

Without the **tank** there couldn't be an aquarium. Early fish tanks were made of slate with a glass front, but today's tanks are usually four walls and a bottom made of glass or acrylic. The tank, of course, holds the water and animals, and the walls and seams are rigid and sturdy. A hood is usually included to keep water from evaporating and fish from jumping out of the tank. Tanks are also designed to support lighting and filtration.

Filter

Filters come in many different shapes and sizes and clean the tank using many different methods. All filters are used to improve water quality and make long term fish care possible. There are three basic methods of filtration.

Mechanical filtration is the simplest and most common. Filter floss or pads trap small debris and keep them from floating around in the water. This prevents the debris from decaying and polluting the aquarium and clouding the water.

Chemical filtration employs chemicals or chemical compounds to remove small dissolved organic particles from the water that cause discoloration, odor and other more serious problems. Activated carbon is the most common form of chemical filtration. Carbon binds to some organic compounds and, like a sponge, absorbs them and removes them from the water.

Biological filtration is arguably the most important form of filtration when it comes to long term fish care. Biological filters grow beneficial bacteria, which remove ammonia and nitrite from the water through a process called the Nitrogen Cycle. Please see *The Nitrogen Cycle* for more information. For the bacteria to stay alive it must stay in constant water conditions and be fed a steady diet of ammonia and nitrite. Luckily, this isn't hard with fish around.

Water quality is most easily maintained when all three filtration methods are used simultaneously. Many filters today incorporate all three methods of filtration.

Gravel

Believe it or not, **gravel** actually does more than make the tank look pretty. In a healthy aquarium, each tiny piece of gravel is home to thousands of beneficial bacteria that work alongside the filter to keep the water clean. **It is extremely important to keep these bacteria alive, so never remove the substrate to wash it or let it dry.** Doing so will destroy the bacteria, and fish will have a hard time surviving without it. Porous gravel provides the greatest amount of surface area for the bacteria to colonize. Marbles and other smooth glass or plastic stones should be avoided or added only as accent pieces

Fish in the Classroom Education Program

Aquarium Basics

because they do not provide an adequate amount of space for the bacteria to grow.

Lights

Lighting is an important aspect of daily life for a fish. Just like people, fish need to experience regular cycles, or **photoperiods**, of light and dark. Fish do sleep; however some fish are more active at night. It is recommended to keep the fish on a 12/12 light/dark cycle, though any range from 8/16 to 14/10 is acceptable. Ambient light should be considered when calculating the photoperiod.

Excess light from classroom lights, windows and tank lights can encourage the growth of algae. The best way to limit the amount of light an aquarium is exposed to is to keep the blinds closed on the windows close to the aquarium, or to place the aquarium in a spot away from any windows. **Turn the lights on in the morning just before the aquarium will be viewed, and shut them off as you leave for the day.** Setting a timer to turn the lights on and off makes it easier to ensure a regular photoperiod for the aquarium. Fish are fine with the ambient light in a classroom, though they look their best when viewed under aquarium lights.

Water

The most important factor for fish is **water quality**. The fish used in this program come from a **freshwater** environment, which contains almost no salt. Freshwater fish can be found all over the world in rivers, streams, lakes, ponds, swamps, and practically anywhere there is a sustainable source of water. Therefore, different fish prefer different **water chemistry** depending on their origin. Freshwater community fish, the kind of fish you will be

using in this program, enjoy neutral water conditions. **It is important to maintain the water at a pH between 6.5 and 7.5 and a temperature of about 75° Fahrenheit.** Furthermore, for fish to survive, **the dissolved ammonia and nitrite levels in the tank must remain at or very close to 0** (see *The Nitrogen Cycle*). This may sound like a challenge, but with the help of the filter and gravel, routine care, and a little vigilance, it is quite easy.

A neutral **pH** of 7 is perfect for a freshwater community tank. Fresh from the tap, the pH value of water can vary widely based on location, so **it is recommended that you check your tap water and adjust the pH accordingly.** Most pet stores sell convenient liquid pH adjusters to help correct this problem. **Water also contains dissolved chlorine or, in some areas, chloramine.** This keeps the water clean and safe for people to consume, however it can be fatal for sensitive aquarium animals. It is essential to add **dechlorinator** to the tap water to neutralize the chlorine. **Not all dechlorinators are able to neutralize chloramine** (which breaks down into ammonia and chlorine when regular dechlorinator is used). If you suspect you have chloramine in your tap water, make sure to use a dechlorinator appropriate for removing chloramine, chlorine and ammonia. Follow the instructions on the bottle, but note that dechlorinator is not toxic to fish. Most dechlorinators work instantly, and after the water is dechlorinated it is safe to add to the aquarium.

Fish and other organisms living in the tank will negatively affect the quality of the water. **For this reason it is important to**

Fish in the Classroom Education Program

Aquarium Basics

test the water regularly and perform a water change once a week (see *Tank Maintenance*). If left unchecked, **ammonia** and **nitrite** levels will rise and **pH** will slowly fall over time. This is harmful for fish, and will make them vulnerable to stress and disease.

As you can see, aquariums consist of several parts all working together to keep the fish alive and make your job easier. Read on to learn about the nitrogen cycle, a must for any aquarium, and to find out what sort of routine maintenance will be required to keep the tank in tip top shape. Feel free to do more research on your own using books or a reliable internet source. Above all, have fun watching your fishy friends. Enjoy!

Fish in the Classroom Education Program

Basic Fish Care

Keeping your Fish Alive and Well

Some fish are described as delicate while others can be considered hardy, but the truth is that all fish are sensitive to changes in their environment. Keeping fish alive and well is a simple matter of keeping their environment stable. Follow these guidelines and you fish should live a long, happy life.

Feeding

In the wild fish eat when they can. Sometimes there is an overabundance of food and they will eat until the food is gone. Other times there is no food to be found. Most fish experience seasons of famine in the wild, and may sometimes go a week or more without eating.

In captivity, where fish have a controlled diet, it is important to remember their eating habits in nature. Here at The Florida Aquarium we feed most of our fish once a day, and fast them one day a week. This allows them to clear out their digestive tract and it keeps them from becoming overweight.

In the classroom the fish should be fed twice a day, once in the morning and once in the late afternoon. Consider Saturday and Sunday as fasting days. It is ok to withhold food on three or four day weekends, as long as the fish appear healthy and they have not fasted longer than normal in the last month.

When feeding in the morning, wait for 15 minutes after turning the aquarium lights on. This will ensure that the fish are active, fully awake and ready to eat. In the evening, feed at least 15 minutes or more before turning off the lights.

To avoid overfeeding (which may lead to water quality issues) it is important to determine how much to feed your aquarium. Remember, a one inch fish has a very small stomach. A good rule to follow is to **feed fish only as much as they will eat in 3 minutes.** Start by feeding a small pinch of food and watch the fish. If they eat it all within the first minute, offer another small pinch. Keep track of how much food you are offering each time. Eventually you will get a feel for how much food to offer the fish at every feeding.

Overfeeding is the #1 cause of poor water quality, which in turn leads to fish illness. As food decays, it releases phosphorous, nitrite and ammonia. Though not toxic to fish, phosphorous can cause problems by encouraging the growth of algae. Nitrite and ammonia can lead to problems as well. While the beneficial bacteria can take care of the ammonia and nitrite from the fish waste, the bacteria may not absorb all of the extra ammonia and nitrite from decaying matter. This excess of toxic compounds can build up in the tank and cause stress and harm to the fish.

If a fish refuses food for more than a day it may be ill. Run a water quality test and observe the fish. Refer to books about fish health or talk to a person with experience to find out what the cause of an illness could be. It may be necessary to medicate the aquarium to prevent other inhabitants from becoming ill.

In addition to flake food, fish enjoy a variety of frozen, freeze-dried and fresh food supplements, and some fish may require special vegetarian tablets. Avoid live food, which may harbor parasites or spread disease. Good frozen and freeze-

Fish in the Classroom Education Program

Basic Fish Care

dried treats include brine shrimp, blood worms, tubifex worms and plankton. Some herbivorous fish enjoy a small amount of fresh, washed dark green lettuce, zucchini or squash. Organic varieties are the best as they are free of chemicals. Wash all fresh vegetables thoroughly before adding them to the aquarium, and remove them at the end of the day. Not all vegetables are appropriate for aquarium inhabitants, and most should be avoided. **Always consult a professional before trying a new food for your fish.**

Lighting

Most people aren't aware that fish sleep. Though they lack eyelids, fish will rest for several hours at a time, often wedged close to a plant or another decoration. **Never leave tank lights on overnight.** Fish need regular light and dark cycles to remain healthy and stress free. Most fish enjoy a 12/12 photoperiod.

Water quality

Fish are very sensitive to even small differences in water quality and do not tolerate abrupt change in their environment. Please refer to *Water Quality* for more information.

Fish in the Classroom Education Program

Aquarium Maintenance

Cycling the tank

After the tank has been assembled and before fish can be added, the tank must be "cycled". This means that the nitrogen cycle must be an established continuous process in your tank. Simply put, the nitrogen cycle keeps toxic ammonia and nitrite from building up in the tank and harming the fish. For more on the nitrogen cycle please read *The Nitrogen Cycle*.

Aquarium Care Log

Keeping a record of maintenance tasks and test results will help you monitor the long term health of your aquarium, and will help diagnose any problems that might occur. **The *Aquarium Care Log* contains *Care Sheets* which are to be filled out every week.** Write the date at the top in the space provided and check off each task as it is done. Record the ammonia, nitrite and pH test results as well as the water temperature on that day.

You should check filter pads every week to ensure they are functioning properly. If the filter pad is clogged with debris it is best to wash it in a small bowl of aquarium water (never use soap and do not allow the filter to dry). Replace filter pads every three weeks. Do not vacuum the gravel on the same week the filter is cleaned or replaced to prevent an excessive loss of beneficial bacteria.

There is a space provided for additional notes and observations. Write down any unusual fish behavior, problems with the aquarium and anything else that might be useful to reference later. Feel free to attach additional pages with notes. For more *Care Sheets*, simply photocopy one that is provided.

Cycling graph

During the first month after adding fish, the aquarium will go through a stage that is referred to as "cycling". This comes from the term "nitrogen cycle". Begin monitoring the progress of the nitrogen cycle after your first fish have been added.

Make a line graph using poster board and hang it in an area that is visible to all students. Every day, test the ammonia, nitrite and pH of the water and record it on the graph. Choose a different color for each test and create a line graph to show the progression of the cycling process. Let students take turns daily testing the water and recording their results. When ammonia and nitrite reach 0 and remain there for at least a week, it is ok to add more fish (see *Introducing New Fish*).

Aquarium Care

Cleaning an aquarium is simple and easy if done correctly. The biggest hazard is a water spill. **Take care when moving water, and clean up any spills, no matter how small, right away.** Before performing any maintenance around the aquarium, **make sure to unplug the lights and filter to prevent the possibility of electrical shock.**

If you are using the help of your students, allow the rest of the class to quietly work on a project (such as a creative writing assignment) while the tank care is performed. Supervise each activity as much as necessary. **Always rinse hands in tap water (no soap) before putting them in the aquarium water, and wash hands with soap after all cleaning is done.**

Fish in the Classroom Education Program

Aquarium Maintenance

Test the water quality first, using the test strips provided. **Record the ammonia, nitrite and pH levels in the log book, along with the aquarium temperature.** If any of the levels are abnormal, refer to the *Fish Care* section and take appropriate steps to solve the problem. If readings are unusually high, continue checking the water quality daily until they are back to normal.

To remove algae, use a scraper or a sponge made specifically for aquariums. Remove the decorations and wash them in warm tap water, rubbing them gently to remove algae. Never use soap to wash decorations! Rub the walls of the aquarium with the scraper or sponge. Replace the decorations and rinse the sponge in the sink.

It's a good idea to vacuum after the decorations are removed. To vacuum the gravel you will need a bucket and a gravel vacuum (and possibly a stepping stool). Place one end of the hose in the bucket and the other in the aquarium. Hold the vacuum chamber upside-down under water and slowly move it up so that the water flows down the length of the hose. As the water flows down the hose but before it leaves the vacuum chamber, submerge the vacuum chamber in the aquarium. When suction is created, the water will flow down the hose. It may be necessary to pinch off a short length of hose, fill the vacuum with water and release the pinched end of the hose into the bucket. Any air trapped in the hose will prevent suction from forming.

Slowly move the siphon around the bottom of the tank, being careful not to clog the vacuum with gravel. It is a good idea to have someone watch the bucket to make sure the hose doesn't fall out and that the

bucket does not overflow. When the bucket is 3/4 full, remove the siphon from the aquarium and let the water in the hose drain into the bucket. Carefully move the bucket to a sink (or outside) and dump the water.

To add new water, fill the bucket with an appropriate amount of water and add **dechlorinator**. Carefully bring the bucket to the tank and slowly pour in the water. To avoid disturbing the decorations, it's wise to wait until the water has been added before putting them back in the tank.

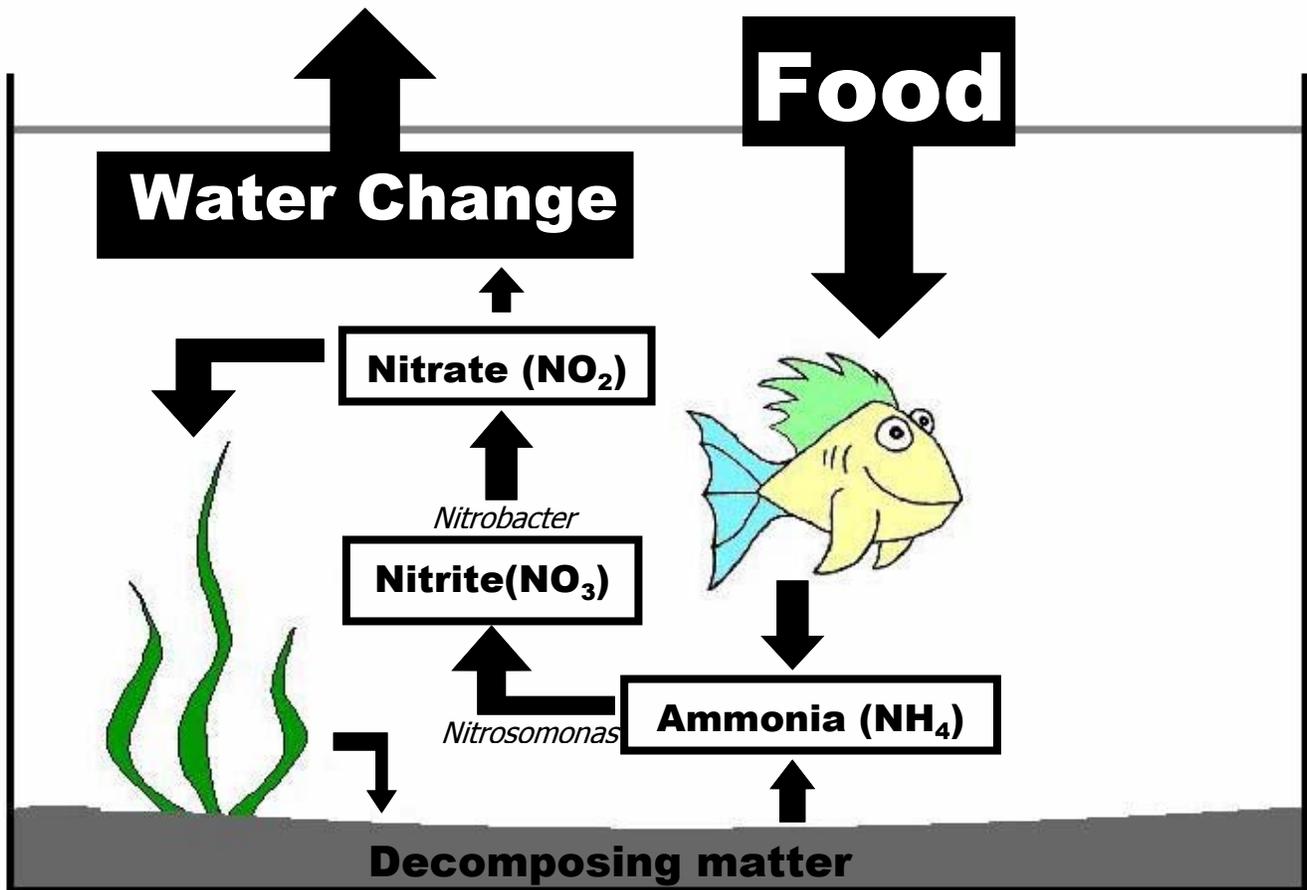
If you have a filter with a sponge or a refillable carbon bag it may be necessary to perform additional maintenance. **Every three weeks the sponge filter must be rinsed to remove buildup, and the carbon in the carbon filter bag must be replaced.** Simply shut off the filter and remove the sponge and carbon bag. Gently rinse the sponge and replace it in the tank. Empty the used carbon media into a trash can and rinse the bag. Fill the bag half full of carbon media and rinse it under running tap water to remove any dust. Place the bag in the space provided in the filter.

You may choose to wipe down the outside of the tank, including the hood, with a damp cloth or paper towel. Use a dry towel to wipe off moisture from the tank glass. **Never use cleaning supplies (such as Windex or soap) on the aquarium.** Double check the tasks performed, look for spilled water and plug in the aquarium with dry hands.

Fish in the Classroom Education Program

The Nitrogen Cycle

The Nitrogen Cycle



Water at a glance appears to be pretty boring stuff. However, many small chemical and biological reactions are constantly taking place in even a small drop of water. In a fish tank, where animals eat, sleep, reproduce, and go to the bathroom, the condition, or quality, of the water is constantly changing.

The waste produced by a fish causes the water to become toxic. In nature, plants, worms, beneficial bacteria, and other

organisms work together to break down the waste created from fish, leftover food, and dead matter. In a healthy, well-established aquarium, the fish waste is consumed in a process called the nitrogen cycle by billions of tiny beneficial bacteria that colonize the gravel and filter media. These bacteria make long term fish care possible. In a new aquarium the bacteria must grow and colonize the tank before many fish can be added. Hobbyists refer to this process as "cycling".

Fish in the Classroom Education Program

The Nitrogen Cycle

About the Nitrogen Cycle

Fish produce ammonia in their waste. Even in small amounts, ammonia can burn gills, irritate the skin and eyes and cause internal tissue damage. This ammonia will quickly pollute the water and can kill the fish if it is not eventually removed. In nature, the **ammonia** (NH_4) is converted into **nitrite** (NO_2), and then into **nitrate** (NO_3), by naturally occurring bacteria in a process called **nitrification**. This process can be recreated in the home aquarium, and is necessary for the health of the fish.

Here's how it works: A fish eats some food and goes to the bathroom, producing *ammonia*. Toxic ammonia is oxidized by Nitrosomonas bacteria and converted to *nitrite*. With fish around to produce more ammonia, Nitrosomonas will never run out of food, and will continue to produce nitrite.

Nitrite can also irritate the skin, burn gills, and have a negative effect on the circulatory system, making the fish more susceptible to parasites and disease. Nitrobacter bacteria consume the *nitrite* and produces *nitrate* as an end product. Nitrate is much less toxic to fish, and some aquariums use anaerobic bacteria to convert nitrate into harmless nitrogen gas. Nitrate is eventually removed from most aquariums during a water change.

Getting Started

To get the bacteria to grow in your tank you will need ammonia to feed the bacteria. One technique, called fishless cycling, uses bottled ammonia to start the colony; however it is much easier for a beginner to cycle a tank using a few hearty live fish, especially when used in conjunction with bottled liquid bacteria found in most pet stores.

Your first fish should be hearty fish that can tolerate poor water conditions for extended periods of time. These fish will add the ammonia to the water to jumpstart the nitrogen cycle. Feed these fish sparingly during the first month, and watch them closely for signs of disease. The fish will be exposed to dangerous levels of ammonia and nitrite which will make them more susceptible to parasitic, fungal and bacterial disease. Following the proper methods for cycling a tank will reduce fish stress and illness.

What Happens Next

On the second or third day after adding fish, begin testing the water for ammonia. You should notice it starting to rise (regular tap water has an ammonia reading of 0). **Have students take an ammonia test every day and record the results in your log book and on your graph.** Perform water changes as needed.

Feed your fish sparingly and watch for anything that may indicate health problems, such as rapid breathing, swollen red skin, ragged fins, erratic swimming or attempts to jump out of the water. **If the fish appear to be suffering, perform a water change or add an ammonia-removing aquarium product to the water.** This will slow or halt the cycling process, but it could save the lives of your fish.

Within a week, ammonia levels should still be on the rise. You may notice the water becoming cloudy. This discoloration is caused by the bacteria growing at a rapid rate and is a sign that things are progressing as planned.

Fish in the Classroom Education Program

The Nitrogen Cycle

On the seventh day, test the water for nitrite, which should start to form as the Nitrosomonas bacteria use the ammonia and convert it to nitrite. **Continue testing for ammonia and nitrite once a day, and have students record their results on the graph and log book.**

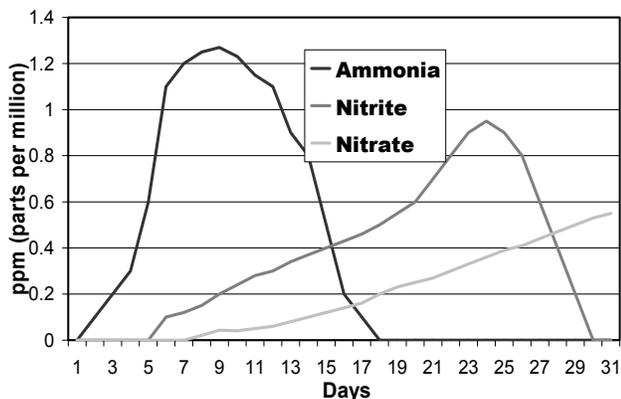
As the days pass you will begin to notice a decline in ammonia levels and a rise in nitrite levels. During this time the Nitrosomonas has grown to keep up with the current amount of fish waste in the tank. The Nitrobacter, however, is just beginning to grow. Over the next few weeks as the Nitrobacter colonizes the tank the nitrite level will rise and then drop. A drop in nitrite indicates that the nitrite is successfully converted into nitrate by the bacteria and that the cycling process is almost complete. Some aquariums will take longer than others to complete this step.

ammonia and nitrite levels once a week. Reasons for any abnormal readings should be uncovered immediately; however the tank will go through "mini cycles" as more fish are added.

Future Maintenance

To keep bacteria levels in your tank healthy, remember that the bacteria colonize the gravel and filter media. When you clean your aquarium by performing a gravel vacuum or a filter change, you are depleting some of the bacteria in the tank. To avoid problems, always keep your gravel wet and never bleach your gravel or rinse it in tap water. Also, never perform a filter change and a gravel vacuum in the same week. If you have to remove the gravel, keep it covered with water from the tank, and if you wish to change the gravel completely, you will have to re-establish the bacteria colonies on the new gravel and re-cycle the tank. Keeping these common sense practices in mind will help to ensure that you will have a beautiful, healthy aquarium.

Nitrogen Cycle Graph



Continue to test and record ammonia and nitrite levels daily until both remain at 0 for at least a week. Now your tank has been cycled and you are ready to add more fish. Begin testing

Fish in the Classroom Education Program

Water Quality

Water quality is very important to fish health. A fish will become stressed in poor water conditions, and stressed fish are more likely to become ill. The following are guidelines to follow to ensure that proper water quality is maintained.

Temperature

✓ **How Often:** Every day

Possible harm to fish: Stress leading to illness, sudden death

Fix it: New heater, adjust heat controls on existing heater

Tropical freshwater fish prefer warmer water of 72-80° F. Use a thermometer designed for aquariums placed as far away from the heat source as possible to get an accurate reading. If the temperature is abnormal, check the heater and the ambient room temperature. Replace a broken heater right away, or adjust the heat as necessary to maintain a constant, comfortable temperature.

pH

✓ **How Often:** Once a week and after a death or illness

Possible harm to fish: Stress leading to illness, sudden death

Fix it: Water change, liquid buffers

Testing the pH level lets you know how acidic or basic your water is. Fish live in many environments with many water parameters and it is important to know what your fish prefer.

Most tropical freshwater fish prefer a neutral pH of 6.5-7.5. Tap water usually has a pH around this level, but depending on your location this may not always be

true. Always test the pH of your tap water when setting up a new aquarium.

Fish are very sensitive to a sudden change in pH, and even a shift as small as 0.2 is enough to cause them stress. The pH scale is logarithmic and so a pH of 6.5 is 10 times more acidic than a pH of 7.5 even though the change may seem minute. This is one reason why it is important to acclimate fish slowly when introducing them into your aquarium.

The pH will drop slowly over time, so unless there is a sudden jump in pH it is not necessary to adjust it as long as the fish seem unstressed and healthy. Regular water changes and gravel vacuuming are enough to regulate the pH most of the time. If you do need to adjust the pH, there are several liquid buffers sold at pet stores that will restore the proper balance to the water.

Ammonia

✓ **How Often:** Once a week and after a death or illness

Possible harm to fish: Stress leading to illness, sudden death

Fix it: Water change, ammonia eliminating products

Ammonia is produced when fish go to the bathroom. It is predominant in a new tank, but is quickly consumed by beneficial bacteria in an established tank. Because it is extremely toxic to fish, ammonia levels should be addressed right away. Perform a water change and check pH levels, or add an ammonia eliminating product, which can be found at most pet stores. Try to identify the source. It may be that there are too many fish in the tank and not enough bacteria to eat all the waste. If ammonia

Fish in the Classroom Education Program

Water Quality

levels are moderately above normal, perform a 25% water change and test again. If ammonia levels are well above normal, perform a 50% water change and test again.

Nitrite

✓ **How Often:** Once a week and after a death or illness

Possible harm to fish: Stress leading to illness, sudden death

Fix it: Water change

Nitrite levels will be high when establishing a new tank, but should level off and recede once a tank is cycled. Nitrite levels can rise during mini-cycles your tank may go through. A rise in nitrite indicates trouble in the tank, and should be addressed immediately. Commonly, nitrite levels are high in an overcrowded tank. If nitrite levels are moderately above normal, perform a 25% water change and test again. If nitrite levels are well above normal, perform a 50% water change and test again.

Nitrate

✓ **How Often:** Once a month

Possible harm to fish: Stress leading to illness

Fix it: Water change

Nitrate is not as toxic to fish as nitrite or ammonia, but high levels can cause stress to fish which can lead to fish loss. Nitrate is the end product of the nitrogen cycle, and its concentration can be controlled by regular water changes.

Phosphate

✓ **How Often:** Monthly in planted aquariums or if algae is a problem in other aquariums

Possible harm to fish: None (except in extreme cases)

Fix it: Phosphate-absorbing filter media, water change

Phosphates are not toxic to fish and are helpful in a planted tank, but can serve as a nutritional source for algae. For this reason it is not necessary to test for phosphate levels in a tank with no live plants, unless there is an algae problem. Over-feeding any dry food, especially low quality fish food that contains high levels of phosphates, is the leading cause of high phosphate levels. There are filter media on the market that can help remove excess phosphate, and water changes can also be done to curb the problem.

Fish in the Classroom Education Program

Introducing New Fish

Adding New Fish

Adding new fish to an aquarium is very exciting. Many people, however, have problems introducing new friends. Remember that the sudden change in water chemistry for the new fish could make it sick, and the added stress of a new environment and new tank mates can result in illness and fish loss. There are many ways to safely introduce fish. Read on to learn about one of the safest.

Step 1 – Think: Water Quality

Before going to the pet store to purchase a new fish, test your water to make sure it is in top shape. Adding a new fish to bad water is asking for failure. If you have just changed the filter or vacuumed the gravel, wait a few days to let the bacteria in the tank repopulate.

If ammonia or nitrite levels are high, do not add any more fish until the levels drop to zero. If nitrate is high, perform a water change to reduce it.

Step 2 – Read!

Make sure you know all about your new fish before making a purchase. Grab a book and read up on a few fish you'd like to keep. The fish may be extra sensitive to stress, a picky eater, grow to monstrous proportions, require special care, or may pick on or even eat your other fish. As with the water quality, buying a fish without knowing anything about it is asking for failure.

Step 3 – Pick a Healthy Fish

Knowing about the fish you're buying doesn't ensure success. A sick fish can mean disaster for a healthy aquarium. At the pet store, look closely at all the fish. Pay attention to their eyes, body, fins and

respiration rate as well as their overall appearance and the appearance of the water in which they are housed. Is the water yellow, brown, or murky? If so, the tank may have water quality issues that can lead to problems at home. Are the fish in good health? An unhealthy fish might:

- Breathe too rapidly.
- Hide in corners or float at the surface.
- List to one side, struggle to stay upright.
- Have cloudy eyes, missing scales or ragged fins.
- Have white bumps on the body and fins which may be from ich, lymphoma or another disease.

If any fish in the tank appear unhealthy, do not buy any fish in the tank with it. If you are unsure of the condition of the fish, ask an employee for advice. Most pet stores choose to treat sick fish in view of the public, and a good pet store won't allow sick fish to be sold.

After you have decided on a fish, find an employee and ask any questions you have before the fish is caught. It isn't necessary to be too choosy about which fish in the school you bring home. The more the employee chases the fish, trying to catch the exact one you'd like, the more stress the fish experiences.

Step 4- A New Home

The air in the bag the fish comes home in does not last forever. **After buying a new fish, go straight to the aquarium and begin the introduction process.**

Fish are very sensitive to abrupt changes in temperature and water chemistry. **Introduce the fish slowly to the water in its new environment.** Start by

Fish in the Classroom Education Program

Introducing New Fish

floating the unopened bag in your aquarium for 10-15 min to ensure the temperature in the bag equals the temperature in the tank.

After the temperature has adjusted, you can open the bag and add a little water from the tank to the bag. After 5-10 minutes take a little water out of the bag and pour it down the sink (to avoid contamination). Add a little more water from the tank to the bag. Repeat this 3-5 times, making sure more than half of the original water has been replaced this way.

While you are doing this, **rearrange the decorations in your tank.** This will cause the fish that already live there to set up new territories, giving the new fish a chance to make one for its own.

To prevent possible parasitic infestation, do not allow the water from the pet store to mix with the water in your tank. Many parasites have free-swimming larvae, and although your new fish might not be sick, the water may contain unseen problems. Dip a net into the bag and catch your new fish. Gently place him in the tank and discard the bag and water. Fish have a protective slime coat that can easily rub off and some animals have sharp spines or can sting if you touch them. Always use a net to catch fish to avoid injury.

For an extra soothing atmosphere, turn off the aquarium lights. Leave room lights on or open a window to allow some light in. Several products on the market can help reduce fish stress and promote healthy slime coats. The natural slime coat helps protect a fish from illness, but in stressful situations the slime coat can suffer.

Do not add more than 2-3 fish every other week. The bacteria living in your tank need a chance to grow and catch up with the added fish waste. Also, do not overcrowd your aquarium. An overcrowded tank can cause serious problems that often lead to total fish loss. **To prevent overcrowding, find out how large your fish will get as an adult.** A good rule of thumb is one inch of fish for every gallon of water. This does not apply to taller, disk-shaped fish or fatter fish. These fish are overall larger and thus take up more space and produce more waste. Goldfish in particular need about 10 gallons of water per fish to be happy and healthy. Don't forget to include all aquatic animals in your final count. Even snails produce waste.

Fish are not the only aquarium critters that benefit from slow introduction. Snails, frogs, crabs and other animals need the same treatment. Even plants can be sensitive to sudden change.

Carefully monitor the health of your new fish after introduction. Make sure it is eating and is not getting picked on by its tank mates. Check the water quality and look for signs of illness. **If problems start to arise, address them immediately.** Eventually even the most careful people experience the loss of a new fish. Most pet stores have a return policy and will replace the fish if you bring it and a water sample. Many will accept the return of a newly purchased live fish if it becomes ill or is picked on by other tank mates.

With a little knowledge you can successfully add fish to your aquarium. Though it may seem like a slow process, eventually you can have a tank full of happy, healthy, beautiful fish.

Fish in the Classroom Education Program

Fish on Vacation

Going on vacation?

The school year has several three-day weekends, holidays and short breaks that may interfere with normal aquarium care and maintenance. However, there are several options available to keep fish healthy and alive when everyone is gone.

For long weekends...

- Fish do enjoy a regular light cycle of night and day. Use a timer to help regulate the lighting cycle. If a timer is not an option, it is best to leave the lights off. Generally, as long as daylight can reach the aquarium, the fish can still experience a natural light cycle.

- Remember, fish have very different metabolic needs when compared to mammals, like humans. They don't eat much, and in fact it is healthy for most fish to be fasted for at least one day a week.

- Check to make sure the water quality is in top form before an extended leave. If the water quality is poor, address the situation immediately. **Always leave the fish in a clean, safe environment.**

- Carefully **examine the fish for signs of disease.** If you leave for vacation with one sick fish in the tank, you may return to an aquarium full of sick and dying fish. Address all health issues immediately.

- Feed the fish a little extra for a few days before you leave for an extended break. Do not feed more per feeding; rather, **offer the fish an extra feeding at lunch.** Uneaten food can quickly lead to a drop in water quality, which can cause major problems while you are away.

For vacations longer than 4 days, consider other fish care options:

- Research your fish. It may be that they have herbivorous tendencies and may graze on aquarium plants while you are away.

Consult a reliable source and purchase live aquarium plants for them to eat.

One or two live plants in a two week period would be enough. Do not crowd the tank with vegetable matter as decaying plants can lead to a decline in water quality.

- **Come in once every two days to feed the fish** and make sure they are healthy. You may wish to work with the other teachers on your team to divide the responsibility.

- **Purchase an automatic feeder.**

Program the feeder to feed the fish once a day. Look for automatic feeders that can hold enough food for the duration of the break. Be aware that battery operated feeders have the potential for failure if the batteries die. Use granulated fish food, or be sure flake food is small enough to be dispensed properly.

- Many pet stores sell vacation food in the form of white plaster blocks. If you chose to feed the fish with these blocks while you are away, be aware that the dissolved plaster can potentially cause water quality issues. It is best to avoid this means of feeding the fish if other options are available. Be ready to siphon the dissolved plaster out of the aquarium, test the water quality and possibly perform a large (25%-50%) water change the day that you return from vacation.

Finally, you may wish to give the fish away to students or faculty. Leave snails in the

Fish in the Classroom Education Program

Fish on Vacation

aquarium to support the beneficial bacteria while the other fish are away. They will eat the algae that grows in the tank and should be fine unattended for up to two weeks. This way, the tank will be ready for a new batch of fish when you return (don't forget to restock slowly over a few weeks).

Fish in the Classroom Education Program

Addressing Algae Problems

Algae growth can be a major cause of anxiety for aquarium owners. Some algae growth is normal in a healthy aquarium, and snails, algae-eating fish and regular cleaning will keep a tank looking its best. However, sometimes algae can overcome an aquarium and cause problems.

Too much algae?

Treating algae overgrowth starts with knowing why the alga is growing out of control in the first place. There are two major issues that influence the growth of algae: lighting and water quality.

Algae are plant-like organisms that lack a true vascular system, but, like plants, algae photosynthesize. Algae growth is most prolific in an aquarium that receives too much natural light. **To limit algae growth, keep aquariums away from direct sunlight and only turn on aquarium lights for 10-12 hours a day.**

Phosphate acts as a fertilizer for algae, and an aquarium with an overabundance of phosphate will undoubtedly have major algae growth. Phosphate can be found in aquarium plant fertilizers and in fish food. **To limit the amount of phosphate in the water, feed high quality fish food, and do not overfeed.**

Getting rid of algae

If you are experiencing an algae problem there are several steps to take to address the issue. First, check the aquarium's lighting situation. Are there many windows in the room (especially those facing east or west)? If so, are the windows covered with blinds or curtains? Are the aquarium lights on for more than 12 hours a day? Are the room lights on for more than 12 hours a

day? Limit the amount of lighting a tank receives as much as possible.

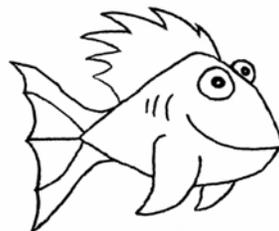
If lighting isn't the source of the algae growth, it may be phosphate. Purchase a phosphate test kit and test the water. If phosphates are very high, perform a 25% water change and test again daily. Pay attention to the amount of food the fish are offered and make sure all the food is consumed. It may be necessary to feed them a little less than you would normally offer. Remember that most fish will always act hungry and will eat beyond what is healthy.

Try to scrape off as much algae as possible on a daily basis. Wash the tank decorations thoroughly and stir the gravel to bury any algae growth on top (it should die without exposure to light). Purchase a few small snails (or one large snail) and a fish known to eat algae to help keep the algae growth in check. Routine water changes and cleaning will keep your tank looking great.

Fish in the Classroom Education Program

Avoiding Future Problems

- Always add dechlorinator to tap water before adding it to the aquarium.
- Do not overfeed.
- Do not overstock the tank.
- Slowly acclimate all new fish.
- Keep the aquarium out of direct sunlight to avoid algae growth.
- If an animal dies, do not replace it immediately. Find out the cause of death of the animal. Did it have parasites or disease? Was the water quality poor? If so, replacing the dead animal may cause the new animal to suffer the same fate. Test all water parameters and check the health of the other fish. If, after a week, the other fish seem healthy and the water chemistry is stable, it is safe to add a new animal.
- Keep insecticides, glass cleaner and other chemicals away from the aquarium.
- Metals affect water chemistry. Keep all metals from contacting aquarium water.
- Rocks found outside may contain metals such as iron or other compounds that affect water quality. Never add a rock to an aquarium unless you know for sure it is safe for the fish.
- Remember to record all problems in the log book for future reference!



Fish in the Classroom Education Program

Lesson 1: Paper Aquarium

Time Allotment

50 minutes

Materials

- Sample paper aquarium

Per group:

- Scissors
- Glue
- Crayons, markers, colored pencils, etc.

Per student:

- Aquarium Equipment Pages

Advance Preparation

Make copies of Aquarium pages on white paper or cardstock.

Make sample paper aquarium.

Lesson Objectives

- Identify necessary parts of a freshwater aquarium.
- Learn how models can be used to learn about systems.

Sunshine State Standards for Late Elementary

Science:

Interactions: SC.G.1.2.7

Science/Models: SC.H.1.2.5

Vocabulary

Aquarium	Gravel
Beneficial Bacteria	Heater
Decorations	Hood
Filter	Thermometer

Background Information

An **aquarium** is a container in which underwater animals and plants can live. Aquaria can hold less than a gallon of water, or more than a million. Most home

aquaria range from 10 gallons to 55 gallons. A 20 gallon aquarium is an ideal size for beginners. In fact, a larger tank is better for beginners than a smaller tank, because temperature and water chemistry will fluctuate less in a larger tank than it would in a smaller one.

All aquariums require specific equipment to keep fish alive and well. The tank holds water, in which the fish eat, sleep, breed, play, breathe, and produce waste. **Gravel** at the bottom of the tank grows microscopic "**beneficial**" **bacteria** that eat the fish waste and make the water safer for fish. The **filter** aids in cleaning the water by removing large pieces of food and waste. **Decorations** are necessary and make the fish feel safe. The **heater** and **thermometer** help to monitor water temperature. The **hood** houses the lights and helps slow water evaporation.

Initial Discussion

1. Ask students if they have fish at home or have seen a home aquarium. Ask them to name the kinds of fish they've seen and the sizes of the aquaria.
2. Tell students that they will soon be receiving an aquarium to set up in the classroom.

Hands-On Activity

3. Ask students to brainstorm any equipment used in an aquarium. Record their answers on the board. Discuss why each part is important in an aquarium.
4. Hand out the Aquarium Equipment Pages. Have students read the definitions for each part, and add any new parts to the list on the board.

Fish in the Classroom Education Program

Lesson 1: Paper Aquarium

5. Demonstrate how to assemble the paper aquarium.
 - a) Fold the Aquarium Page along the solid line and cut along the dotted line. Unfold the page and push the cut pieces forward to form a 3-dimensional form.
 - b) Have students select, color, and cut out the components of the aquarium.
 - c) Some parts (such as the gravel) the students must draw onto the paper aquarium.
 - d) Have students place and glue the parts on their paper aquarium with the correct labels (10 total).

Relate Activity to Concept

6. Display the paper aquariums. Discuss with students how the aquaria look different – different fish, different plants, etc. – but still have the same parts. When you set-up the classroom aquaria, refer to the parts learned in the paper aquaria.

Assessment

Use the Paper Aquarium Rubric to grade the students' work.

Extension Activity

Aquarium Diorama

Build the aquarium in a shoebox to make an aquarium diorama.

Building a Paper Aquarium

Directions:

1. Read each definition carefully.
2. Fold and cut the paper aquarium along the marked lines. To create a 3D aquarium, fold and glue strips on the aquarium where shown.
3. Color and cut out each piece of equipment for your aquarium. Choose only one decoration and one plant for your aquarium.
4. Glue the equipment where it belongs on front, back, or top of the aquarium.
5. Label each piece of equipment in the aquarium.

Definitions:

Aquarium – A container that holds water where plants and animals can live underwater. Also called a tank.

Aquarium Hood – A lid for the top of the aquarium that holds the aquarium lights. It helps keep water from evaporating out and keeps fish from jumping out of the tank.

Aquarium Light – Usually found on the hood, the light lets us see the inside of the aquarium. Like the sun, it helps fish find food and know the day from the night.

Beneficial Bacteria – Good bacteria that eat fish poop. Bacteria are microscopic (too small to be seen with the human eye alone.) Beneficial bacteria are found in nature in both salt and fresh water, and do not hurt people. Beneficial bacteria will grow on gravel, filters and decorations in an aquarium and are needed to make the water safe for fish. Beneficial bacteria must stay wet in the aquarium to stay alive.

Decorations – Plants, rocks, and other objects placed in the aquarium to make it more beautiful. Decorations are important because they are used by fish as a place to hide and sleep.

Filter – A machine to clean the water. It has a sponge to trap floating dirt, a carbon filter to get rid of bad smells, and a biological (living) filter to grow beneficial bacteria.

Fish – Animals that live underwater, have a back bone, and breathe using gills. Most fish also have scales and fins.

Gravel – Small rocks, glass, or plastic at the bottom of an aquarium. Gravel can come in any color of the rainbow and it is home to millions of tiny beneficial bacteria.

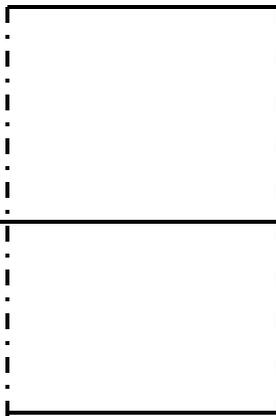
Heater – A machine used to heat the water in an aquarium. This keeps the water temperature comfortable for the fish.

Thermometer – A tool used to measure the temperature of the water.

Glue
Thermometer
Here

Fold ↓

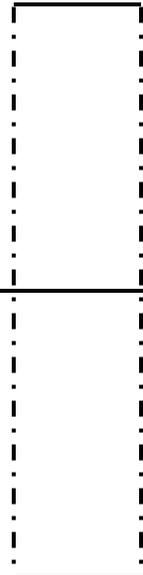
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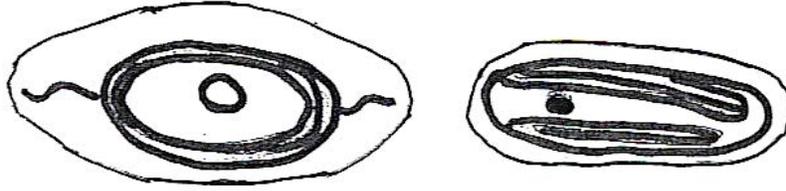
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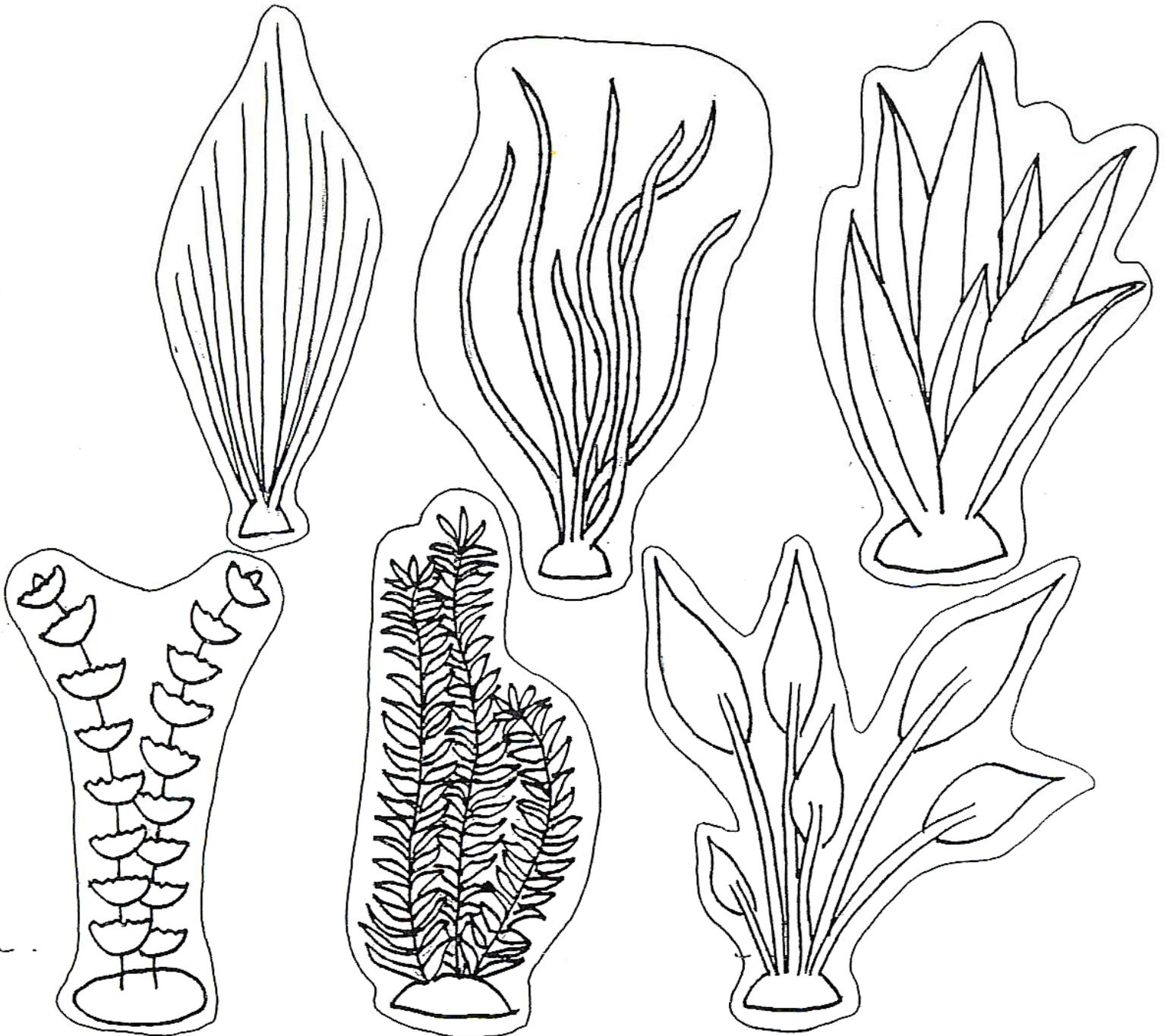
Fold ↑

Color and cut, and glue to aquarium

Beneficial Bacteria (choose one)

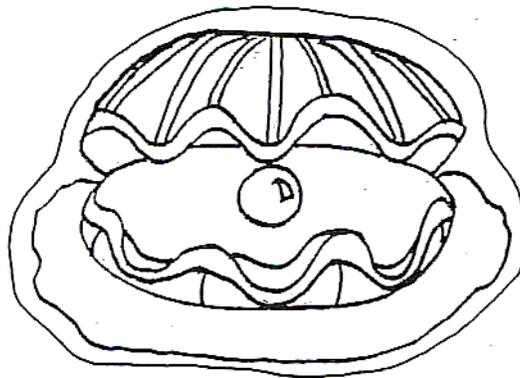
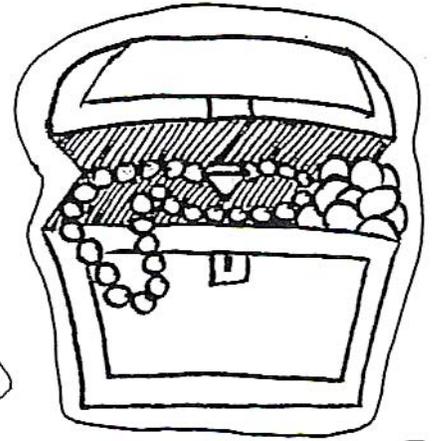
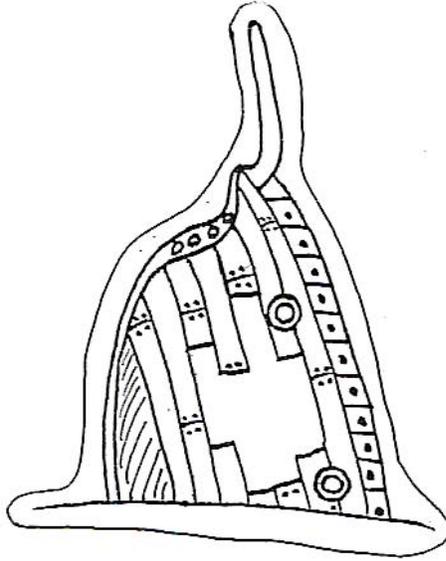
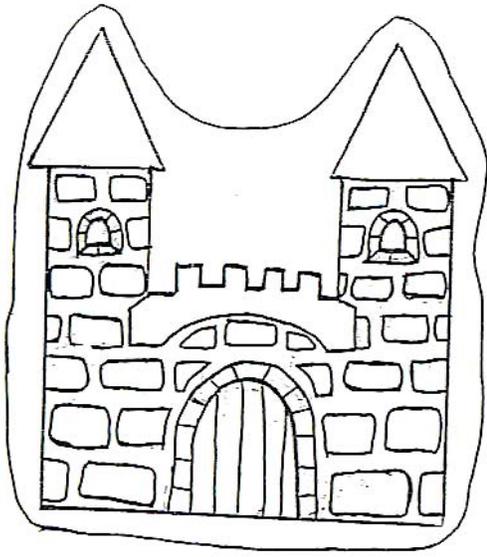


Decorations (choose one)



Color, cut and glue in aquarium

Decorations (choose one)

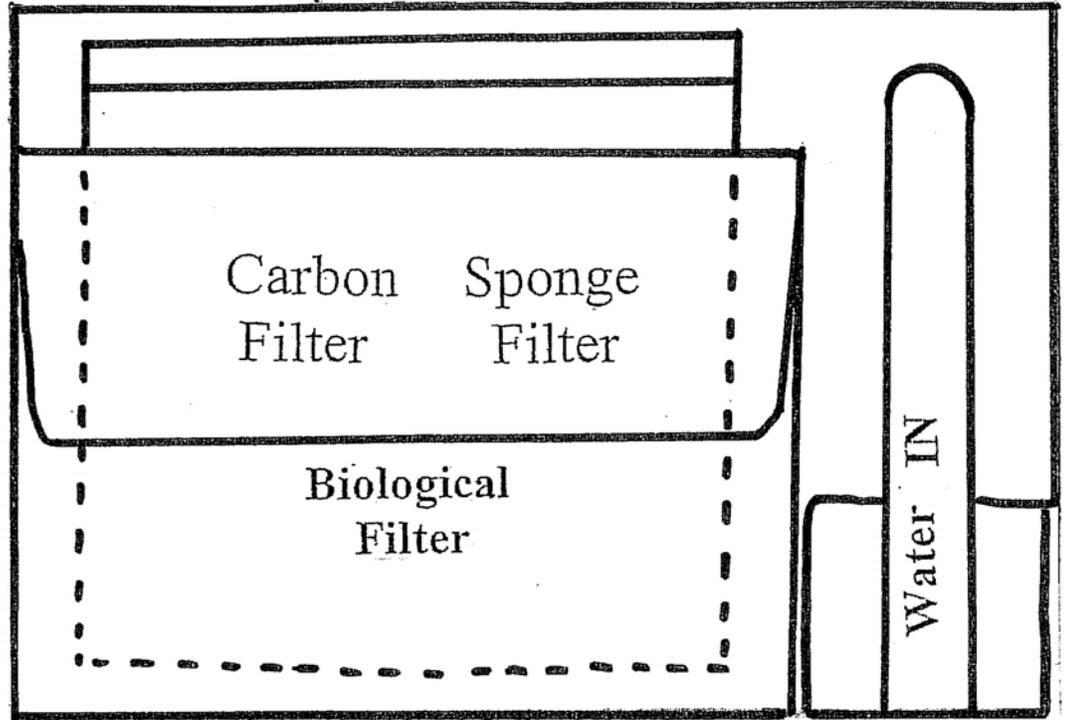


Aquarium Hood

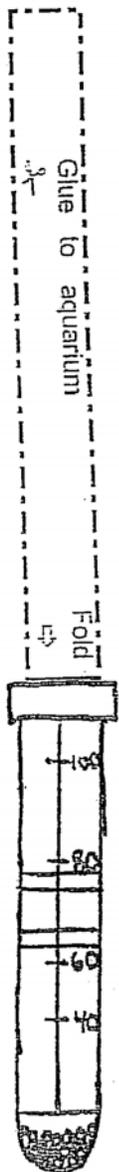


Color, cut and glue to aquarium

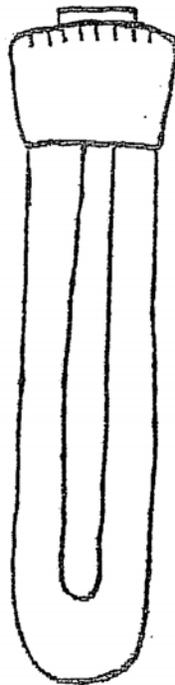
Filter



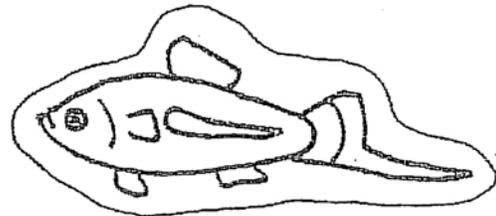
Thermometer



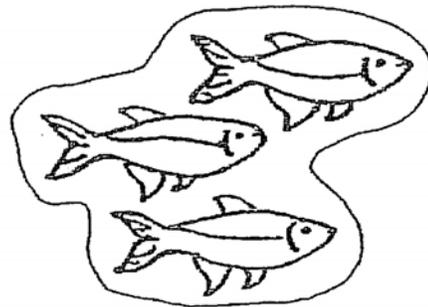
Heater



Fish



Swordtail



Neon Tetra



Lesson 1: Paper Aquarium

Paper Aquarium Rubric:

Student Name: _____

Followed directions	5 pts
Neatness (color, glueing, etc.)	5 pts
All parts correctly labeled and placed (2 pts each)	20 pts
Hood	Lights
Gravel	Beneficial Bacteria
Filter	Water
Heater	Thermometer
Decorations	Fish
TOTAL	_____ / 30 pts

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Heater	Thermometer
Decorations	Fish
TOTAL	_____ / 30 pts

Fish in the Classroom Education Program

Lesson 2: What's the Procedure? (Aquarium Set-up)

Time Allotment

50 minutes

Materials

- Aquarium
- Buckets with water
- Dechlorinator
- Gravel
- Colander for washing gravel
- Decorations
- Heater (75-100 watt for a 20-30g tank)
- Thermometer
- Towels/ paper towels

Per student:

- Paper and pencils

Keep towels on hand for any spills.

Lesson Objectives

- Identify necessary parts of a freshwater aquarium.
- Record and describe the procedures for setting up a freshwater aquarium.

Sunshine State Standards for Late Elementary

Science:

Interactions: SC.G.1.2.1

Science: SC.H.1.2.2, SC.H.3.2.4

Language Arts:

Writing: LA.B.2.2.1

Listening: LA.C.1.2.1

Advance Preparation

Select a location for the aquarium.

Carefully unpack the tank and make sure you have all the equipment. If the aquarium came in a box, keep it for storing the equipment during the demonstration.

Remove the filter cartridge from the filter compartment or packaging and set aside with other equipment. Rinse the filter cartridge under tap water to remove any dust.

Fill the aquarium 2/3rds full of water. Add dechlorinator.

The following steps you may do with students or ahead of time:

Wash the gravel in the colander in a sink, bathtub, or outside to remove dust. Be sure to prevent the gravel from spilling! It is best to let the gravel dry before class.

Unpack and rinse the decorations. Unpack and rinse the thermometer and heater.

Vocabulary

Aquarium	Gravel
Beneficial Bacteria	Heater
Decorations	Hood
Filter	Thermometer

Background Information

Setting up and caring for an aquarium may seem challenging, but by following the proper steps and using the right equipment it can be very easy.

Beneficial bacteria (which break down fish waste) grow on the gravel and biological filter. The sponge filter reduces the amount of particulate and organic chemicals in the water, thus keeping the water safe for fish. Activated carbon reduces odor. The heater, lights and decorations are used to provide a comfortable atmosphere, while the dechlorinator and food are essential for fish health. The thermometer is used to monitor water temperature.

Fish in the Classroom Education Program

Lesson 2: What's the Procedure? (Aquarium Set-up)

Run the aquarium for at least 24 hours to make sure all the equipment is working properly before adding fish.

Initial Discussion

1. Review the parts of an aquarium with the students.
2. Tell students that they will learn the procedure for setting up an aquarium. Part of the scientific method is correct procedure. As you set up the tank, they will need to observe what you do and record the procedure. (You may choose to select students to help with the various steps.)

Hands-On Activity

3. Have students observe the tank and suggest what steps in the procedure have already been done. (You may choose to do some of these steps with the class, or ahead of time.)
4. Describe the steps you took so far, and have them record the following steps:
 - a) Wash the gravel in the colander to remove dust.
 - b) Unpack and rinse the decorations.
 - c) Unpack and rinse the thermometer and heater.
 - d) Fill the aquarium 2/3rds full of water.
 - e) Add the dechlorinator to the water.
5. Ask the students to quietly observe the next step and record the procedure.
 - f) Use a cup to slowly add the gravel.
6. Select several students to read what they recorded for step f. Remind students that there are several correct ways to describe the same procedure.

They do not have to have the same answer.

7. After each step, discuss with the students why the step is important. For example, gravel is important because beneficial bacteria will grow in the gravel and bacteria eat fish waste.
8. Ask the students to quietly observe the next steps and record the procedure. You may review each step one at a time, or review after several steps.
 - g) Add the filter.
 - h) Add the heater.
 - i) Add the thermometer.
 - j) Add the decorations.
 - k) Add extra water to fill the tank.
 - l) Add dechlorinator.
9. If you would like to include any of the optional equipment for the tank (check the attached list), add and explain these to the students.

Relate Activity to Concept

10. Review the entire procedure with the students, reviewing the importance of each piece of aquarium equipment.
11. Dry your hands, plug in the aquarium and turn on the lights.
12. Let the students know that the fish will arrive soon, but before adding live animals it is best to wait to be sure all the equipment is functioning properly (especially the filter and heater).

Assessment

Collect the students' procedures, and check for accuracy, spelling, and grammar.

Fish in the Classroom Education Program

Lesson 2: What's the Procedure? (Aquarium Set-up)

Aquarium Equipment Checklist

Primary Equipment:

- Tank
- Hood
- Lights
- Stand (or a suitable place to put the heavy tank)
- Dechlorinator
- Gravel
- Filter
- Heater
- Thermometer
- Decorations

Maintenance supplies:

- Water testing kits: pH, ammonia, and nitrite
- Algae scrubber
- Bucket or pitcher (for water changes)
- Siphon or gravel vacuum
- Net
- Food

Optional:

- Background
- Air Pump w/ airline tubing and airstones
- Timer for lights
- Aquarium-safe cleaning supplies
- Stress-reducing additives
- Clips for holding vegetables
- Live beneficial bacteria culture

Fish in the Classroom Education Program

Lesson 3: Water Testing – Why and How?

Time Allotment

75 minutes

Materials

- Transparency of data sheet
- Overhead projector

Temperature Station (two sets):

- 3 beakers, plastic cups, or jars (~8 oz)
- Warm, cold, and room temperature water – one cup each
- Thermometer (one or three per set)

pH Station (two sets):

- 3 beakers, plastic cups, or jars (~8 oz)
- Distilled water – three cups
- Lemon juice
- Baking soda
- Eye dropper
- pH test strips

Ammonia Station (two sets):

- 3 beakers, plastic cups, or jars (~8 oz)
- Distilled water – one cup + 2 liters
- 2 one-liter bottles
- Ammonia
- Eye dropper
- Ammonia test strips

Per student:

- Water Testing Data Sheet
- Copies of "Maxine and her New Aquarium"

Advance Preparation cont.

For the **pH station**, add 10-12 drops of lemon juice to 8 oz distilled water in one container in each set. In the second containers, add 1 tbsp baking soda to 8 oz of distilled water and stir to dissolve.

For the **ammonia station**, add one drop of ammonia to one liter of distilled water. Shake gently to mix the solution and fill one 8 oz container from each set. Add two drops of ammonia to one liter of distilled water, shake, and fill the second 8 oz containers.

Caution! Ammonia is harmful if inhaled or swallowed. Follow safety guidelines on the bottle.

Lesson Objectives

- Read a short story and identify relevant messages about aquarium care.
- Learn ways to measure and compare properties of materials (temperature, pH, presence of ammonia).
- Understand that bacteria play an important role in decomposing waste materials.
- Understand that changes in the chemistry of a fish tank are predictable and logical.

Sunshine State Standards for Late Elementary

Science:

Matter: SC.A.1.2.1, SC.A.1.2.4

Interactions: SC.G.1.2.1, SC.G.1.2.4, SC.G.2.2.3

Science: SC.H.1.2.2, SC.H.1.2.4, SC.H.2.2.1

Language Arts:

Reading: LA.A.2.2.1

Advance Preparation

Make copies of the data sheet.

Prepare materials for each set of the measurement stations.

For the **temperature** station, use warm, cold, and room temperature water to fill the cups in each set.

Fish in the Classroom Education Program

Lesson 3: Water Testing – Why and How?

Vocabulary

Acid	pH
Ammonia	Temperature
Base	

approximately 6.5 to 7.5; and basic substances have a pH of 7.1 to 14. The ideal pH of a freshwater aquarium is between 6.5 and 7.5.

Background Information

Many factors can affect the health of aquarium fish, including water chemistry. In this lesson, students will learn to measure 3 important parameters of water quality: temperature, pH, and ammonia.

Ammonia is a waste product found in the urine of most animals. Even in small amounts, ammonia can burn gills, irritate fish scales and eyes, and cause internal tissue damage. Ammonia will quickly pollute water, and can kill fish if it is not removed.

Most common freshwater aquarium fish prefer temperatures between 70°F and 80°F. If an aquarium heats up or cools down rapidly, it can create a stressful environment for fish. Aquaria will heat up as room temperature increases, and with exposure to direct sunlight. Aquarium temperature can be warmed using a heater, but cooling can be more difficult. Monitor temperature on a regular basis to make sure that the tank is not experiencing rapid fluctuations.

In nature, ammonia is consumed by bacteria and is converted to nitrite (NO_2); nitrite is consumed by different bacteria and is converted to nitrate (NO_3). This process can be recreated in the home aquarium, and is necessary for healthy fish. Measuring the ammonia content of the water is a way of determining the balance of nitrogen-consuming bacteria and toxins in the water.

Acids have a tangy or sour taste and are often corrosive. Many foods are somewhat acidic: examples are citrus, vinegar, and soft drinks. Stronger acids can be found in battery acid and chemicals such as hydrochloric acid and sulfuric acid.

Initial Discussion

1. Tell the students that before they can add fish to the aquarium, they will need to know how to maintain the aquarium so that the fish stay healthy.
2. Begin by introducing the short story, "Maxine and Her New Aquarium". Have students read the story on their own, in pairs, or as a class.
3. As a class or in pairs, have students identify the relevant messages about aquarium care that were found in the story. (*Ideas can include the role of bacteria, nitrogen cycle, where bacteria grow, change over time in aquaria, etc.*)

Bases generally have a bitter taste. Mild bases such as baking soda are used in cooking. Many cleaning products, such as laundry detergent, dish soap, and drain cleaners, contain much stronger bases.

pH is a way of measuring the strength of acids and bases. The pH scale ranges from 0-14: the lower the number, the higher the acidity. Acids have a pH of 0 to 6.9; neutral substances such as water register in the middle of the scale, with a pH of

Fish in the Classroom Education Program

Lesson 3: Water Testing – Why and How?

4. Tell the students that there are several ways to measure the water in an aquarium. Hand out data sheets.
5. Write terms: temperature, pH, and ammonia on the board. Define these terms, and have students record these definitions on the data sheet beside the term.
11. Assign students to take measurements on each day, and explain logistics to the class.

Assessment

Collect student data sheets.

Hands-On Activity

6. Have students read the directions on the data sheet. Demonstrate how to take measurements at each station.
7. Each group will measure each of 3 different stations, using the different tools. Each student will record observations and data on their own data sheet.
8. You may set up stations around the room and have the groups rotate through the stations or you may pass the samples from group to group.

Relate Activity to Concept

9. After all the data has been collected, write class results on the data sheet transparency. Have the class compare and contrast the different samples and parameters.
10. Relate activity to aquarium care. Beginning today, students will take daily measurements of temperature, pH, and ammonia, and will record data in the class aquarium chart. Once the fish arrive, these elements will change, and later students will be graphing the change over time.

Maxine and the New Aquarium

Maxine sat on her bedroom floor and tugged on her pajamas. She put her dirty clothes in her hamper and gathered her stuffed animals around the foot of her bed.

On the opposite end of the room, her new aquarium glowed brightly. Maxine had received the 20 gallon aquarium two weeks ago as a gift for her 10th birthday. She had always loved the fish at the Florida Aquarium, and in her uncle's 150 gallon tank which she saw every Thanksgiving. Uncle George had the best aquarium she had ever seen. It held beautiful crystal clear water and bright, colorful fish. At first, her aquarium looked just as wonderful, with bright blue gravel and fish of every color of the rainbow. Now everything was different.

Maxine glanced across the room at her fish tank. It seemed to glare at her. The water had turned from crystal clear to murky white. Her fish swam slowly, barely moving even when she came to feed them. Frustrated, she growled at the tank and marched over to shut off the lights.

Her mother had told her to clean the aquarium, but Maxine had already cleaned it twice that week. She had washed the gravel in the sink. She even replaced most of the murky water with fresh water. Nothing seemed to help. Every time, the water would become cloudy again after a few days. Maxine hated it. She could tell that her fish didn't like it either. They gazed up at her with sad, tired eyes.

Sighing, Maxine switched off the light. She regretted asking for the birthday gift, and hoped her fish weren't going to get sick. She was sad that she couldn't provide a better home for her aquatic friends, which she had carefully picked from the store. Most of all Maxine wished she knew why her tank wouldn't stay clean. She thought about this as she climbed into bed and fell asleep.

~~~~~

A few minutes later Maxine was awake again. She was sitting on a strange boulder. It was smooth and blue. She could hear a motor humming in the distance. Confused, she looked around.

A thick fog surrounded her. The fog was so dense that she could barely see her toes. Maxine looked up. Monstrous shadows hung in the white sky above her, moving slowly.

"Psst."

Maxine thought she heard a voice.

"Hey, down here," said the voice.

"Oh!" Maxine shouted in surprise.

"Don't be alarmed," said the voice "I'm down here by your hand."

Maxine looked closely at the boulder and saw a tiny white dot. She stared in confusion. She thought she saw it wave to her.

"Hello there! My name is Nitro," said the speck, "Who are you?"

"M-Maxine. But who are *you*, and where *am* I?" Maxine asked.

"You are in an aquarium. Your aquarium to be exact. And I'm a bacterium."

"Bacteria!" Maxine quickly moved her hand away and made a face.

"Oh don't worry, I won't hurt you. Actually, I'm here to help!" exclaimed Nitro.

"Help? With what?" asked Maxine.

"Your aquarium, silly! I'm going to help fix it."

"You can fix my aquarium? But how? You're so small."

"You're right, I can't fix it alone. I need a little help from my family," said Nitro.

The little bacterium hopped up on Maxine's shoulder.

Nitro spoke: "Take a close look at the water around you and tell me what you see."

Maxine looked around. She squinted at the fog. At first she thought she saw tiny snowflakes dancing in the water. As she watched them move she realized that the snowflakes were small dots just like Nitro, and they were swimming. She gasped in surprise.

"Those are baby bacteria, my brothers and sisters," said Nitro.

"There's so many!" exclaimed Maxine.

"Of course! They have a big job to do. But that's a long story, so why don't we take a ride?"

Nitro whistled and a large shape appeared out of the cloud. It was a fish! He swooped down and plucked Maxine and Nitro off the rock.

"My family is part of a biological process called the Nitrogen Cycle. After a fish eats a piece of food it goes to the bathroom. This waste contains toxic chemicals called ammonia and nitrite. If the fish is exposed to ammonia and nitrite for too long, he can get sick. Luckily for the fish, he has bacteria! We're his best friends."

"Why is that?" asked Maxine.

"Because we get rid of the ammonia and nitrite by eating it."

"So ammonia and nitrite are your food. Sort of like hamburgers and watermelon for me?"

"Exactly. Right now the water looks cloudy because there is a lot of food for us to eat. When the bacteria grow up in a few weeks they will live in the gravel with me."

"So the water won't stay cloudy forever? But what happens when I wash the gravel?"

"We all wash away. Then we have to start growing all over again to eat the ammonia and nitrite and help the fish."

"Wow! I never knew I had so much stuff living in my aquarium. I just thought I had fish."

Maxine yawned a huge yawn.

"Maybe I should let you go back to sleep" said Nitro.

"No, it's ok," said Maxine, "I'm having fun."

She yawned again, lay down on the back of the fish and closed her eyes.

Maxine awoke to find herself in her own bed. She sat up and looked at her fish tank. The water was still cloudy, but for some reason she thought it was ok. Then she remembered Nitro. She remembered that he had said that the cloud was bacteria, and that later the bacteria would live on the rocks. She also remembered that Nitro said the bacteria eat fish waste and make the water safe for fish.

Maxine couldn't believe her dream. Later that day she called Uncle George to ask him about the bacteria. Uncle George told Maxine that the Nitrogen Cycle is an important part of taking care of fish. Maxine also found out that her white, cloudy tank was normal! Uncle George reminded her to never wash her gravel, and told her that the tank would clear up in a few weeks. Maxine thanked her uncle.

A few weeks later, like magic, her aquarium water turned crystal clear. Maxine could watch her colorful fish swim and play. She never forgot about Nitro and the bacteria that lived in her tank. Sometimes at night, she would visit them again and ride the fish.

## **Reading Questions:**

At the beginning of the story Maxine was sad. Why?

Why was Maxine's aquarium's water white?

What do the bacteria eat?

Nitro told Maxine about a biological process where fish produce ammonia and nitrite, the bacteria eat the ammonia and nitrite, and the aquarium water is clean.

What is the name of this biological process?

Should Maxine wash her gravel? Why or why not?

## Data Sheet

Name: \_\_\_\_\_

### Temperature: \_\_\_\_\_

Place the thermometer into the sample. Wait one minute before reading the temperature.  
Most freshwater fish require water temperatures between 20° and 27°C (70° and 80°F).

| Sample | Description of Sample | Temperature | Is this sample good for fish? |
|--------|-----------------------|-------------|-------------------------------|
| 1      |                       |             |                               |
| 2      |                       |             |                               |
| 3      |                       |             |                               |

### pH: \_\_\_\_\_

Dip the pH strip into the sample for 30 seconds. Compare the color to the chart to find the pH.  
Most freshwater fish require pH between 6.5 and 7.5.

| Sample | Description of Sample | pH | Is this sample good for fish? |
|--------|-----------------------|----|-------------------------------|
| 1      |                       |    |                               |
| 2      |                       |    |                               |
| 3      |                       |    |                               |

### Ammonia: \_\_\_\_\_

Dip the ammonia strip into the sample for 30 seconds. Compare the color to the chart to find the measurement. Most freshwater fish require water with NO ammonia.

| Sample | Description of Sample | Ammonia | Is this sample good for fish? |
|--------|-----------------------|---------|-------------------------------|
| 1      |                       |         |                               |
| 2      |                       |         |                               |
| 3      |                       |         |                               |

---

# Aquarium Care Guide

Follow this list for a happy, healthy aquarium!

## **Every Day:**

- ✓ Feed fish
- ✓ Observe fish
- ✓ Check temperature

## **Every Week:**

- ✓ Remove algae
- ✓ pH test
- ✓ Ammonia test
- ✓ Nitrite test
- ✓ Record temperature
- ✓ Check the filter\*
- ✓ Vacuum gravel\*
- ✓ Add new water\*

## **Every 3 Weeks:**

- ✓ Clean the filter\*
  - Do not vacuum the gravel that week
  - Never use soap or cleaning products when cleaning the aquarium.

\* should be performed by the teacher

## Weekly Aquarium Care Sheet

| Week Number | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------|---|---|---|---|---|---|
| Date        |   |   |   |   |   |   |

### Student Duties

|               |  |  |  |  |  |  |
|---------------|--|--|--|--|--|--|
| Student Names |  |  |  |  |  |  |
| Remove Algae  |  |  |  |  |  |  |
| pH Test       |  |  |  |  |  |  |
| Ammonia Test  |  |  |  |  |  |  |
| Nitrite Test  |  |  |  |  |  |  |
| Temperature   |  |  |  |  |  |  |

### Teacher Duties

|                  |  |  |  |  |  |  |
|------------------|--|--|--|--|--|--|
| Check the filter |  |  |  |  |  |  |
| Vacuum Gravel    |  |  |  |  |  |  |
| Clean the Filter |  |  |  |  |  |  |
| Add Water        |  |  |  |  |  |  |

# Fish in the Classroom Education Program

## Lesson 4: Your New Fish

### Time Allotment

45 minutes

### Materials

- 5 or 6 small fish in individual, oxygen-filled baggies or an open container (recommended species include platys, white cloud minnows, or swordtails)
- 5 or 6 small bowls (to set bags in)
- Plastic cup for water changes

Per student:

- Your New Fish Observation Sheet

### Advance Preparation

Test water quality in the tank for several days before introducing the fish. Make sure that temperature, pH, ammonia, and nitrate are within acceptable limits.

Make copies of the data sheet.

Arrange students in groups of 3 to 5, with one group per fish.

### Lesson Objectives

- Record observations of live fish.
- Learn basics of fish care, including habitat maintenance, feeding, and tank cleaning.

### Sunshine State Standards for Late Elementary

Science:

Processes of Life: SC.F.1.2.3

Interactions: SC.G.2.2.3

Science: SC.H.1.2.2

### Background Information

See "Adding New Fish" and "Fish Care" in the Teacher Background Information section.

### Initial Discussion

1. Begin with a review of aquarium parts and water quality issues.
2. Tell the students that they will be adding fish to their class aquarium, but first they will observe their fish up-close.

### Hands-On Activity

3. Hand out data sheets to each student and one fish (in its bag or container) to each group. Students should not move the fish bag during the observation exercise.
4. Have students complete the data sheet, drawing and recording their observations.
5. Encourage students to ask questions or make closer observations. Ask prompting questions, such as "How many fins does the fish have?", "What does the skin covering of the fish look like?", etc.
6. Have the class compare and contrast their observations.

### Relate Activity to Concept

7. Place the fish bags in the aquarium, to acclimate the fish to the aquarium temperature. They will need about 10 minutes to adjust and 15 minutes to acclimate to the new water conditions.
8. Review water testing procedures, as you test the water quality in the tank. Make sure the temperature, pH, ammonia, and nitrate are within acceptable limits before adding the fish. If desired, test the water in the bag the fish is in for

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## Fish in the Classroom Education Program

### Lesson 4: Your New Fish

pH, ammonia and nitrate and compare the two water sources.

9. Discuss fish care with the students, reviewing feeding, lighting, and water quality testing.
  
10. Once the fish have adjusted to the aquarium temperature, open the baggies, remove a half a cup of water (pour it down the drain) and add a half a cup of aquarium water to the bag. Wait 5 minutes and repeat. After 3-4 cycles it is safe to scoop the fish out the bag using a net and add it to the aquarium. Never allow water from the bag to contaminate the aquarium water.
  
11. Remind students that they will need to test the water daily and record their measurements for at least 3 weeks. This is a good time to discuss other logistics of classroom fish care with the students (Who feeds the fish?, When do they feed the fish?, Who cleans the tank? etc.). Answer any questions.

#### **Assessment**

Collect student data sheets.

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## Lesson 4: Your New Fish

### Observation Sheet

Name: \_\_\_\_\_

Draw your new fish. Label any parts you know.

What do you notice about the fish?

What questions do you have about the fish or the aquarium?

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## **Lesson 4: Your New Fish**

# Fish in the Classroom Education Program

## Lesson 5: Water Testing (Part 2)

### Time Allotment

Varies

### Materials

- Water testing kit (pH, ammonia, and nitrate test strips)
- Thermometer
- Set of class data sheets
- Posters with graphs
- Transparency of data sheet
- Overhead projector

Per student:

- Data Sheet
- Graphing Sheets

### Advance Preparation

Make copies of the data and graphing sheets.

If desired, make enlarged copies of the data sheets for the class data sheet. Post data sheets near the aquarium.

Make posters to graph the class data.

### Lesson Objectives

- Learn to keep accurate records to explain the changes that occur in an aquarium over time
- Collect, analyze, and communicate measurements, such as temperature, pH, and ammonia, in the aquarium.
- Display data, such as changes over time, using a line graph.
- Understand that changes in the chemistry of a fish tank are predictable and logical.

### Sunshine State Standards for Late Elementary

Science:

Matter: SC.A.1.2.1

Interactions: SC.G.2.2.3

Science: SC.H.1.2.1, SC.H.1.2.2, SC.H.2.2.1, SC.H.3.2.2

Mathematics:

Measurement: MA.B.1.2.1, MA.B.1.2.2, MA.B.4.2.2

Geometry: MA.C.3.2.2

Data Analysis: MA.E.1.2.1

### Vocabulary

Ammonia

Nitrate

Axis

pH

Graph

Temperature

### Background Information

Many factors can affect the health of aquarium fish, especially water chemistry. In this lesson, students will measure and graph several important parameters: temperature, pH, nitrate, and ammonia.

See Lesson 3 for more background information.

### Initial Discussion

1. Review lesson 3's story, "Maxine and her New Aquarium", and messages of the story (*changes in the tank over time, the role of bacteria in balancing water chemistry, etc.*).
2. Once the new fish have been introduced into the tank (Lesson 4), ask students to predict what will happen in the tank. Students can record their predictions for temperature, pH, ammonia, and nitrate on the graphing sheets. They will save these for later.
3. Explain the data sheet using the transparency, the class data sheet, and/or the graphing poster.

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## Fish in the Classroom Education Program

### Lesson 5: Water Testing (Part 2)

#### Hands-On Activity

4. Review the techniques for measuring temperature, pH, ammonia, and nitrate. Schedule students to test the water daily for 3 weeks (in pairs or groups of three). Have them record their findings on the class data sheet.
5. After one to two weeks of data collection, begin graphing with the students. Make sure that all the students record the class data onto their data sheets.
6. Depending on the level of your students, you may want to graph as a class, have students work in pairs to graph the data, assign the graphs for homework, etc. You may want to have students work in small groups, assigning each group a different parameter to measure.
7. Explain that line graphs are used to show how something changes over time. The changes in temperature, pH, etc. are continuous over time.
8. Explain the set-up of the graph. Have students note the axis and scale of each graph. Explain what the students should do to graph a number in between the numbers on the scale.
9. Model how to graph using one of the parameters. Stress how important it is to use a straight edge to connect the points.

#### Relate Activity to Concept

10. Have students look at the graphs for temperature. What is the pattern shown in this graph? What might be a reason for this pattern? How did the results

compare to their predictions? (Remind students that this is only a sample of the data, and that they will be collecting data for 3 weeks total.)

11. Look at each of the graphs, and discuss as above.
12. Each week, add data points to the graph. Compare these data points to previous measurements and to the students' predictions.
13. After 3 weeks, you may continue testing daily, or you may test weekly instead. Assign students to the new schedule.
14. When you add new fish, test the water daily for 2 weeks to demonstrate that the tank is equilibrating. Graphing is optional, but is a good way to display and check the changes over time. Comparing new graphs to previous graphs will help students understand that changes in the tank are mostly predictable.

#### Assessment

Collect student data sheets.

---



# Water Testing Data Sheet

Name: \_\_\_\_\_

| Day # | Temperature | pH | Ammonia | Nitrate |
|-------|-------------|----|---------|---------|
| 1     |             |    |         |         |
| 2     |             |    |         |         |
| 3     |             |    |         |         |
| 4     |             |    |         |         |
| 5     |             |    |         |         |
| 6     |             |    |         |         |
| 7     |             |    |         |         |
| 8     |             |    |         |         |
| 9     |             |    |         |         |
| 10    |             |    |         |         |
| 11    |             |    |         |         |
| 12    |             |    |         |         |
| 13    |             |    |         |         |
| 14    |             |    |         |         |
| 15    |             |    |         |         |

# Water Testing

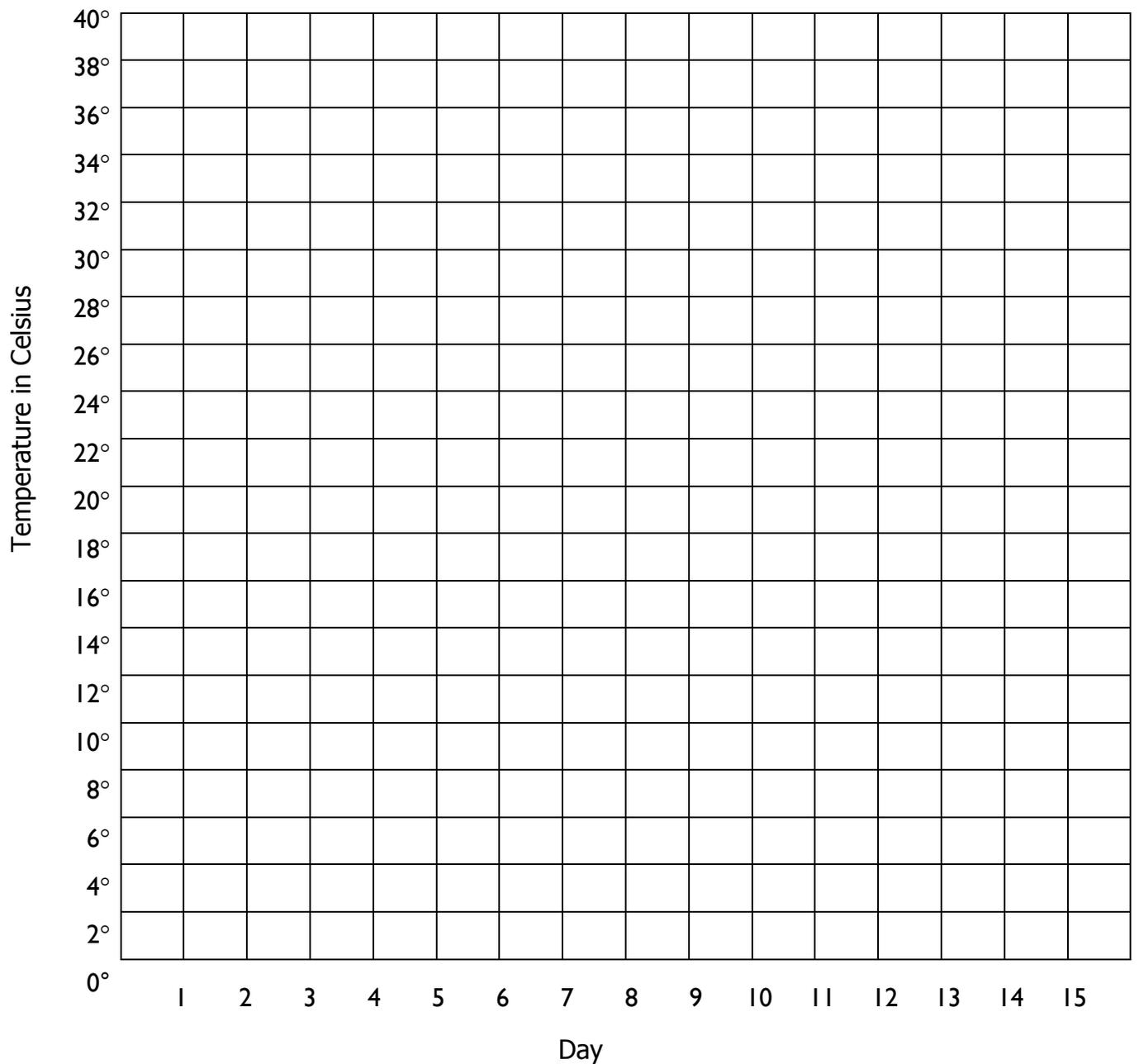
## Graphing Sheet: Temperature

Name: \_\_\_\_\_

How will the temperature change over time?

**Your prediction:**

**Your conclusion:**



## Water Testing

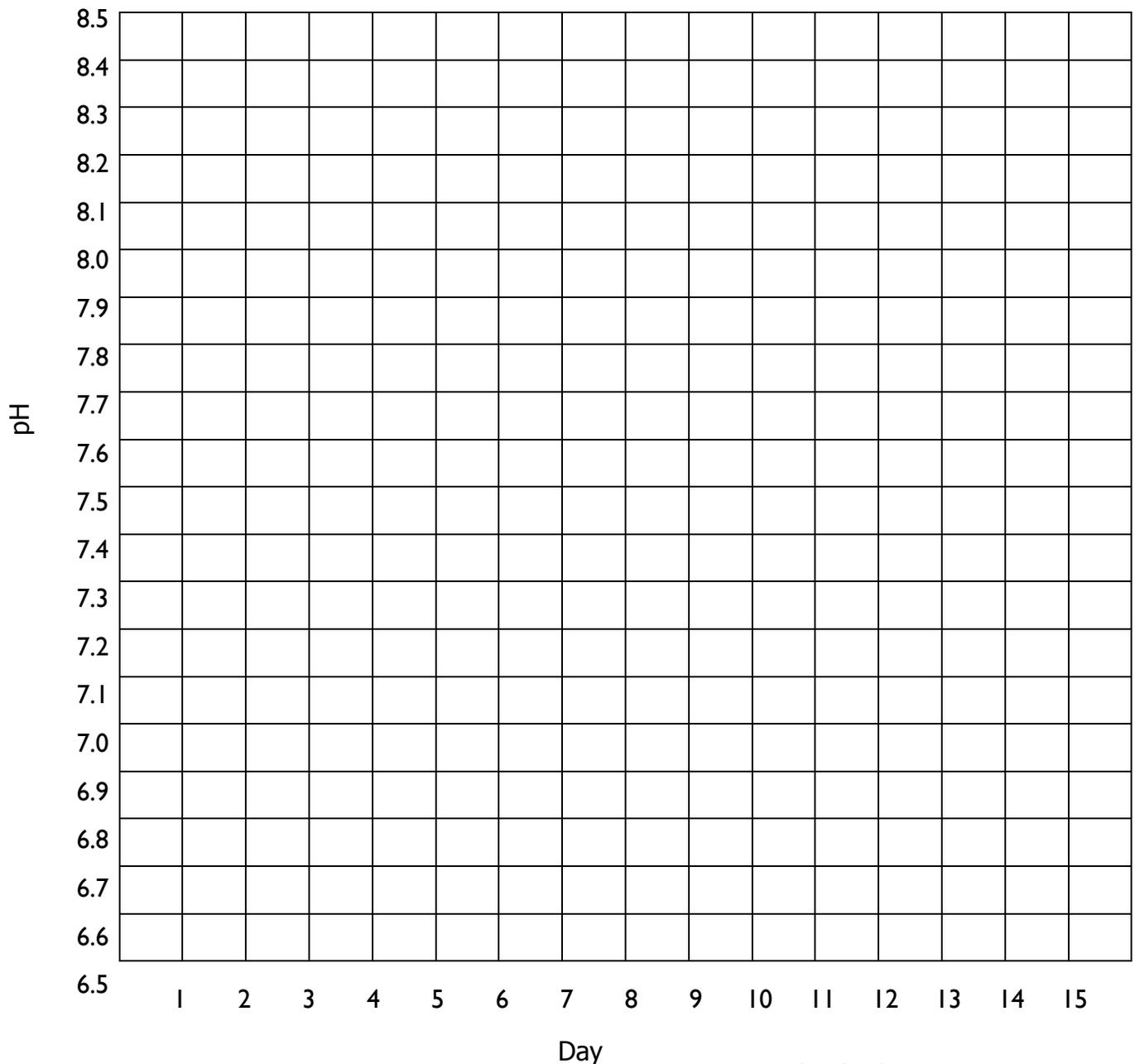
### Graphing Sheet: pH

Name: \_\_\_\_\_

How will the pH (acidity) change over time?

**Your prediction:**

**Your conclusion:**



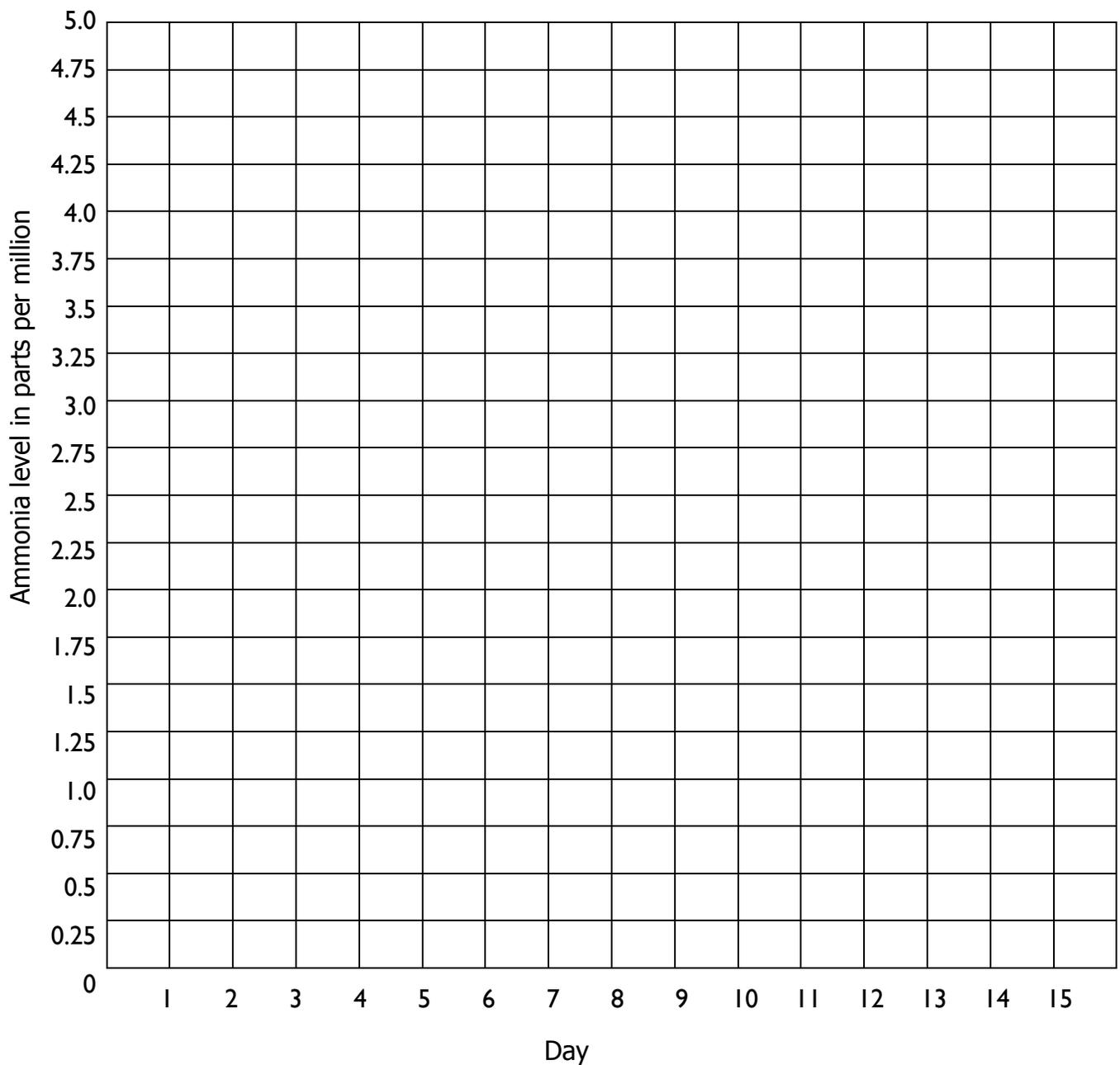
## Water Testing Graphing Sheet: Ammonia

Name: \_\_\_\_\_

How will the ammonia change over time?

**Your prediction:**

**Your conclusion:**



# Fish in the Classroom Education Program

## Lesson 6: Fishy Anatomy

### Time Allotment

75 minutes

### Materials

Per group:

- Fish Feature Guide

Per student:

- Fish Picture
- Fish Diagram
- Pencil and notebook paper

### Advance Preparation

Make copies of all the handouts.

Cut out the Fish Pictures. Outline the fish with marker (if necessary).

### Lesson Objectives

- Learn that all fish share common features.
- Compare and contrast structural adaptations of fish.

### Sunshine State Standards for Late Elementary

Science:

Processes of Life: SC.F.1.2.3

Interactions: SC.G.1.2.2

Science: SC.H.1.2.4

### Vocabulary

|            |              |
|------------|--------------|
| Anal fin   | Lateral line |
| Caudal fin | Mouth        |
| Dorsal fin | Nostril      |
| Eye        | Pectoral fin |
| Gill       | Pelvic fin   |
| Gill cover |              |

### Background Information

Fish have several adaptations that allow them to live in water. All fish have **gills**, which absorb oxygen from the water. Gills

are feather shaped structures which provide a large surface-area-to-volume ratio for absorbing oxygen. The hard **gill cover** (or operculum) protects the gills from damage.

Most fish have **eyes** located on the sides of the head, and most fish can see in color. The **nostril** of a fish is an important organ that allows a fish to smell and locate food. The **mouth** of a fish can vary in shape depending on what the fish eats. Some fish even have teeth.

Most fish have fins, which come in many shapes and sizes. The fins can be used to attract a mate or scare predators, but fins also help a fish balance and steer in the water. The **dorsal fin** is the top fin and the **pectoral fins** are on the sides. The **caudal fin** is another name for the tail. Most fish have several fins along the bottom of their bodies. Two of these fins are the **pelvic fins**, found in the middle, and the **anal fin**, found near the tail.

The **lateral line** is a feature of all fish. This specialized organ is made of tiny pores along the side of the fish. It can be used to sense vibrations in the water, avoid collisions with school-mates, orient in a current, avoid predators and detect prey (ex: the struggling of an insect on the surface of the water).

Though most fish share similar features, they can have different shapes and positions which give the fish different advantages. Mouth position, fin size, tail shape, body shape and pattern all play an important roll in the life of a fish. Refer to the *Fish Feature Guide* to find out more about the function of each structure.

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# Fish in the Classroom Education Program

## Lesson 6: Fishy Anatomy

### Initial Discussion

1. In pairs, have students brainstorm 5 specific ways that they are different from their partner, then 5 ways they are the same (Pair Share).
2. Tell students that all fish have similar anatomy, or body parts, even though they look different. Have students brainstorm parts of a fish's body. Write their answers on the board.
3. Begin to discuss how some body parts might differ from one fish to another.

### Hands-On Activity

4. Hand out a Fish Picture to each student. Explain that they will play a game where each student will be a fish in a school of the same type of fish. Then, each school needs to find another school of fish that has a similar feature.
5. Remind students that they need to walk, NOT RUN, around the room to find their first school. Once they have found the school of same fish, they should stand with their school until all the schools have been matched.
6. In schools, have students describe their fish and its features. Select a few groups to share their fish and features.
7. Now have students find a bigger school – each new school needs to have at least 2 different types of fish that share a similar feature – tail shape, mouth shape, fin shape, etc.
8. Have each big school share their "shared feature". If there is time, have the mini-schools find another grouping.
9. Collect cards and have students return to their desks.

### Relate Activity to Concept

10. Hand out the Fish Diagrams. Using the diagram as a guide, draw a fish on the board.
11. Have students read the definitions and correctly label the diagram. You may wish to do this as a class or individually.
12. Review the parts of the fish with the class, and review the concept that even though fish look different they have similar features. Remind students to think about their fish from the fish matching game.
13. Hand out the Fish Feature Guides. Using the Guide as a reference, draw the three different mouth shapes and briefly discuss what advantages each mouth shape has.
14. Draw and discuss the following structures: fins, tail shape, body shape and pattern.
15. Have students take out a piece of notebook paper and instruct them to design their own fish using the features they discussed in class. They should label their diagram with the correct vocabulary.
16. Instruct students to write a short essay to describe the five features they chose.

### Assessment

Collect the fish drawings and essays.

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### Extension

Have students look at the classroom fish and discuss their features and anatomy. Using the Fish Feature Guide, have students determine the names for the fish on the matching cards.

## Fish Feature Guide

**Mouth Position:** A fish with a mouth on **top** can eat bugs from the water's surface. A fish with a **terminal** (end) mouth can eat plants or other fish. A fish with a mouth on the **bottom** can eat algae and feed on the bottom.

**Fin Length:** Fish with **short** fins are fast and agile. Fish might use **long** fins to attract a mate. People have bred fish in captivity to have long fins for their beauty.

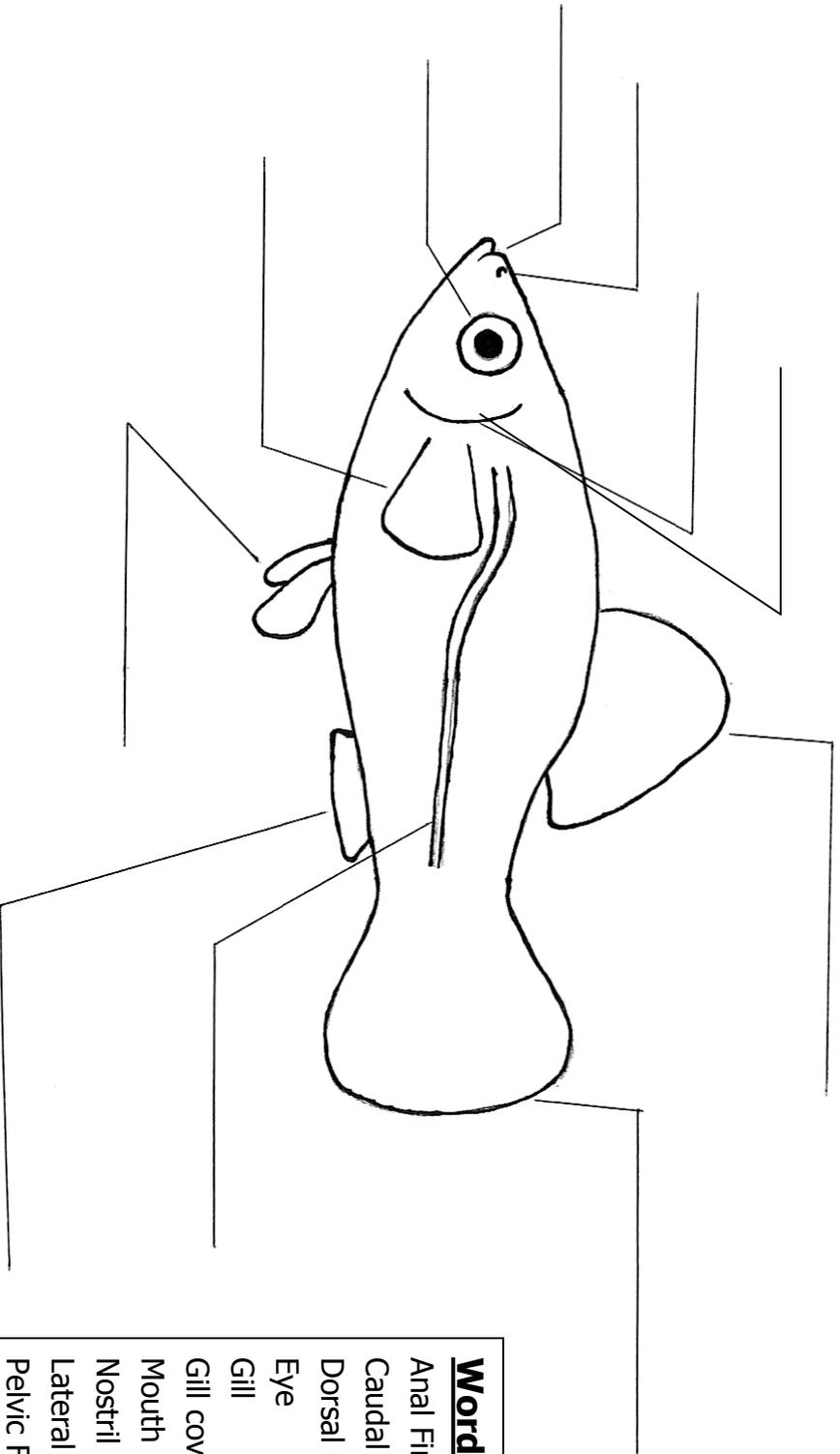
**Tail Shape:** A **forked** tail is used by fish that swim constantly. Both **wedge** and **round** tails are good for short bursts of speed.

**Body Shape:** **Round** fish are slow swimmers and rely on camouflage to escape predators. **Oval** fish are streamlined and can swim fast through the water.

**Pattern:** Fish use their colors and patterns for a variety of reasons. Fish may have **stripes** or **spots** that camouflage them. Some fish are **two-toned**, with their top side dark and bottom lighter. It makes the fish harder to see from above and below. Some fish swim in schools and use their colors to confuse other predatory fish.

|                | Angel Fish | Goldfish | Discus            | Tetra     | Danio   | Guppy     | Betta     | Pleco  | Clown Loach | Cory Catfish |
|----------------|------------|----------|-------------------|-----------|---------|-----------|-----------|--------|-------------|--------------|
| Mouth Position | Terminal   | Terminal | Terminal          | Terminal  | Top     | Top       | Top       | Bottom | Bottom      | Bottom       |
| Fin Length     | Long       | Long     | Short             | Short     | Long    | Long      | Long      | Long   | Short       | Short        |
| Tail Shape     | Wedge      | Forked   | Wedge             | Forked    | Forked  | Round     | Round     | Wedge  | Forked      | Round        |
| Body Shape     | Round      | Round    | Round             | Oval      | Oval    | Oval      | Oval      | Oval   | Oval        | Oval         |
| Pattern        | Solid      | Solid    | Spots and Stripes | Two-toned | Striped | Two-toned | Two-toned | Spots  | Striped     | Spots        |

Name \_\_\_\_\_



**Word Bank**

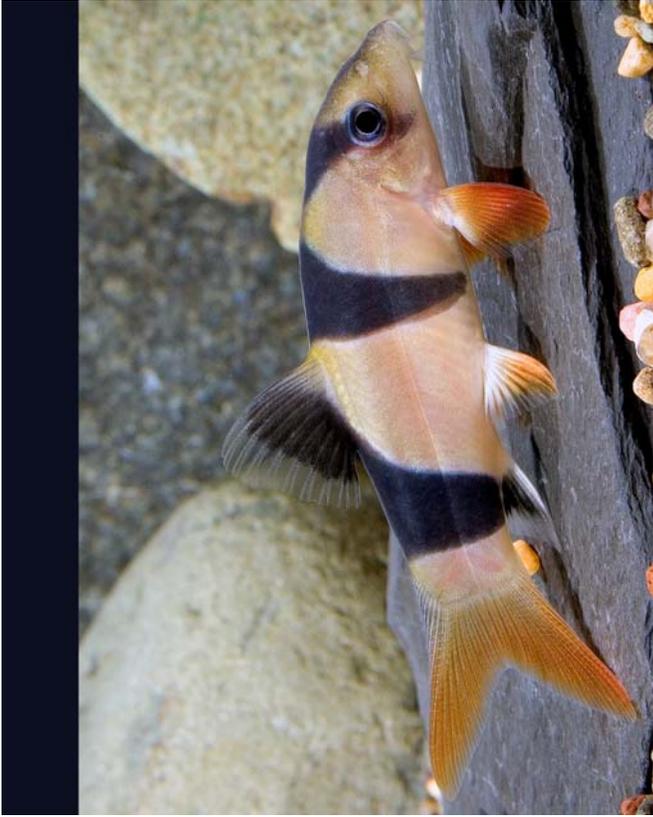
- Anal Fin
- Caudal Fin
- Dorsal Fin
- Eye
- Gill
- Gill cover
- Mouth
- Nostril
- Lateral Line
- Pelvic Fin
- Pectoral Fin



Betta Crowntail



Discus Royal Blue



Clown Loach



Gold Veiltail



Guppy



Cardinal Tetra



Cory Catfish



Danio



Angelfish



Pleco



# Fish in the Classroom Education Program

## Lesson 7: Which Fish Next?

### Time Allotment

60 minutes

### Materials

- Book of freshwater aquarium fish
- List of appropriate fish to add

Per pair:

- Set of 6 Fish ID cards

Per student:

- Compatibility Chart
- Pencil

### Advance Preparation

Make copies of Fish ID cards (one set per pair) and Compatibility Charts

### Lesson Objectives

- Learn to research and analyze the number and types of fish can be safely added to an aquarium.
- Learn the value of planning ahead.
- Use math to solve practical, real-life problems.

### Sunshine State Standards for Late Elementary

Science:

Interactions: SC.G.1.2.1, SC.G.1.2.2

Science: SC.H.1.2.4, SC.H.3.2.4

Language Arts:

Reading: LA.A.1.2.4

Math:

Measurement: MA.B.1.2.2, MA.B.3.2.1

### Vocabulary

|              |                 |
|--------------|-----------------|
| Aggressive   | Oscar           |
| Angelfish    | Piranha         |
| Cory Catfish | Plecothamous    |
| Neon Tetra   | Semi-Aggressive |

### Background Information

Most people own aquariums because they enjoy the fish. So far you have learned to set up and maintain an aquarium. Now you and your students will learn how to properly choose a new fish to add to the tank.

Not all fish get along, and not all fish are appropriate for every aquarium. It is important to take a look at the temperament, adult size, feeding requirements and special needs of a fish before deciding to bring it home.

At a pet store and in most books, fish are considered to have 3 basic temperaments or behavior types: peaceful, semi-aggressive and aggressive.

Peaceful fish are often small, schooling community fish and rarely cause problems in the aquarium. Semi-aggressive fish may be more territorial and nip fins or harass other fish that come too close. Aggressive fish will fight with other fish and even kill weaker opponents. Some fish are only aggressive towards fish of the same species, and many will eat smaller fish. Tank size is an important factor for a semi-aggressive or aggressive fish, because in a small tank it may decide that it owns the entire space.

### A common myth is that fish will only grow to the size of their aquarium.

This may be why adult size is a characteristic that is often overlooked by most people. Fish at a pet store are almost always sold as juveniles and will grow quickly. **As a rule of thumb, it is safe to have one inch of fish for every gallon of aquarium water.** Knowing the adult size of your fish will save you from buying 10 one-inch fish which grow to three inches as adults, thus overstocking the aquarium

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## Fish in the Classroom Education Program

### Lesson 7: Which Fish Next?

and putting the lives of the fish at risk. Some fish that are commonly sold at pet stores, like the arowana, can reach sizes of 2 feet or more in just a few years!

In the wild, fish have a variety of foods available to them. Some eat insects, others eat plant matter, and some eat other fish. Pet stores feature fish from around the world, and each fish has a preferred diet. Most fish will accept and thrive on flake food; however there are always a few exceptions. Bettas, for example, eat insects in the wild and will slowly starve on a diet of flake food or plant matter. Another example is the plecostomous, which requires a diet of algae wafers. Be prepared to offer your fish the appropriate food.

Because tropical fish come from around the world, they may have specific needs that must be met aside from feeding. Freshwater environments can have different water chemistry, such as lower pH, that directly affects the fish that live there. Discus, for instance, require a pH of 6.0 or lower to survive. Other fish come from brackish water environments that have a medium salt content. Often, these fish do not do well in freshwater aquariums.

Researching a fish before adding it to the aquarium will help avoid fish death. It will ensure a stable environment for the other fish in the aquarium, and will prepare you for any changes that may need to occur before adding a new tank mate.

#### Initial Discussion

1. Discuss the current environment of the classroom aquarium (small, freshwater, community aquarium with peaceful fish).

2. Introduce the idea of researching fish before adding them to the aquarium. Have students brainstorm to come up with reasons why it may be good to know about a fish before adding it to the aquarium. Write their answers on the board.

#### Hands-On Activity

3. Explain that the students will research some possible fish to add to their classroom aquarium. Tell the students that once they have selected the best fish for the aquarium, you may be able to bring some of them into the classroom.
4. Have students work in pairs. Hand out Compatibility Charts to each student and a set of 6 Fish ID cards to each pair.
5. Have students work together to fill out the Compatibility Chart. Students should read the ID cards, complete the information in the chart, and decided which fish would make a good choice for the classroom aquarium.
6. After the students have completed the chart, go over the Fish IDs with the class. Discuss each fish and have students share ideas about whether or not it would be a good choice for the aquarium.
7. Discuss the rule "one inch of fish per gallon of water" to determine how many fish can be added to the aquarium. Calculate the number of fish that can be added to the classroom aquarium.
  - a) Starting with the total gallons of water the aquarium can hold, subtract the approximate amount of

# Fish in the Classroom Education Program

## Lesson 7: Which Fish Next?

- water taken up by decorations and gravel ( $20\text{ gal} - 3\text{ gal} = 17\text{ gal}$ ).
- b) Subtract one gallon for every inch of animals already living in the aquarium, including all fish, snails etc. ( $17\text{ gal} - 7\text{ gal} = 10\text{ gal}$ )
  - c) The remaining number is the approximate amount of space left for new fish.
8. Have students decide how many of each fish they could add to the aquarium if they only added that kind of fish.
- a) Have students look at the total adult size of each fish. Write this number next to the name of the fish.

| Name           | Adult Size |
|----------------|------------|
| Veil Angelfish | 6 inches   |
| Cory Catfish   | 2.5 inches |
| Cardinal Tetra | 2 inches   |

- b) If the students can do the math, divide the size of the fish into the total remaining space to determine the number of each fish that can be added to the aquarium. (If the students are unable to do division, ask what fish they would like and instead subtract the size of the fish from the total.) Invite a student to come to the board to work the math problem.

For example, with 10 gallons of water available, how many veil angelfish could you have?

$$10\text{ gallons} / 6\text{ inches} = 1.7\text{ fish}$$

Therefore, you could have 1 angelfish and a few smaller fish.

Remind students that some fish need to be kept in groups – such as the cory catfish and the tetra.

Some good combinations to suggest for 10 gallons of water would be:

- 1 angelfish (6") + 2 tetras (4")
- 5 tetras (14")

9. Use fish reference books to show other possible choices and present a list of appropriate fish to the class for review.

### Relate Activity to Concept

10. As a class, decide what fish to add to the aquarium using their Compatibility Charts and a freshwater aquarium book as a guide.

11. Remind the students to always add new fish slowly (once a week) and only add a few fish at a time.

### Assessment

Collect the Compatibility Charts and check to make sure they have been filled out correctly.

### Extension Activity

#### 1. Math and Fish

Create word problems using gallons and adult fish size or have students develop word problems on their own.

#### 2. Choose a Fish

Have students conduct research on their own to determine what fish should go in the aquarium. Allow students to present their idea to the class and have the class vote to decide the next fish.



**Compatibility Chart** Name: \_\_\_\_\_

Which fish are a good choice for your classroom aquarium?

| Name of Fish | Size of Adult Fish | Behavior | What does it eat? | Is it a good choice for your classroom aquarium? Why or why not? |
|--------------|--------------------|----------|-------------------|------------------------------------------------------------------|
|              |                    |          |                   |                                                                  |
|              |                    |          |                   |                                                                  |
|              |                    |          |                   |                                                                  |
|              |                    |          |                   |                                                                  |
|              |                    |          |                   |                                                                  |
|              |                    |          |                   |                                                                  |



**Name:** Veil Angelfish

**Adult Size:** 6 inches

**Behavior:** Semi-Aggressive

**Diet:** Omnivore; flake food.

**Special Care:** Angelfish will sometimes nip the fins of other fish. Aggressive fish will sometimes nip the fins of an angelfish. Adults will become aggressive to protect their eggs.

**Similar Species:** Altum Angel, Discus



**Name:** Peppered Cory Catfish

**Adult Size:** 2.5 inches

**Behavior:** Peaceful

**Diet:** Omnivore; sinking algae wafers and flake food.



**Special Care:** Cory Catfish like to school in groups of 3 or more. Provide plenty of hiding places and open space at the bottom of the tank. Use smooth gravel to avoid damaging the sensitive barbells on their mouth, which they use to find food.

**Similar Species:** Panda Cory Catfish, Bronze Cory Catfish

**Name:** Cardinal Tetra

**Adult Size:** 2 inches

**Behavior:** Peaceful

**Diet:** Omnivore; flake food.



**Special Care:** Tetra like to school in groups of six or more. Cardinal Tetra can be shy and sensitive and need plenty of hiding places. Do not keep tetras with aggressive fish. A close relative, the Neon Tetra, is less sensitive and can be easier to keep.

**Similar Species:** Neon Tetra, Rummy-nose Tetra, Black Neon Tetra

**Name:** Sailfin Pleco

**Adult Size:** 18 inches

**Behavior:** Peaceful

**Diet:** Omnivore; sinking algae wafers and algae growing on the aquarium.



**Special Care:** The sailfin pleco is one of the largest pleco fish, but they are often sold when they are small two-inch fish. Keep them in a tank of 150 gallons or more. Provide driftwood as a place to hide. Plecos will not eat other fish, but they may be aggressive towards other plecos.

**Similar Species:** Zebra Pleco; Bushy Nose Pleco

**Name:** Red Belly Piranha

**Adult Size:** 14 inches

**Behavior:** Aggressive

**Diet:** Carnivore; meaty foods or pellets.



Mike Innibeli

**Special Care:** Piranhas can live with a school or alone. Piranha can be aggressive towards other animals and will kill or eat smaller fish. Piranhas are illegal to keep in Florida because they can be dangerous to people and can easily survive if released into the wild.

**Similar Species:** Silver Dollar, Pacu, African Cichlids

**Name:** Red Oscar

**Adult Size:** 14 inches

**Behavior:** Aggressive

**Diet:** Carnivore; meaty foods or pellets.



**Special Care:** Oscars are large fish found in the lakes and rivers of South America. Oscars will eat smaller fish and will fight and possibly kill other fish in the tank. Oscars will regularly dig up decorations in the aquarium.

**Similar Species:** Tiger Oscar, South American Cichlids



# Fish in the Classroom Education Program

## Lesson 8: Fish Observation

### Time Allotment

30 minutes the first day  
5-15 minutes once a day for 20 school days

### Materials

- Classroom aquarium with fish
- Grease pen or painter's tape

Per student:

- Fish Observation Worksheets
- Pencil
- Graph paper
- Ruler

### Advance Preparation

Make copies of Fish Observation worksheet.

Use the grease pen or painter's tape to divide the front of the aquarium into four equal boxes. Label each box with a number (1-4).

Choose a time of day where you know your students will be in the classroom for observations. The same time period should be used every day for the experiment to be accurate and truly follow the scientific method.

### Lesson Objectives

- Understand that habitat influences an organism's behavior.
- Learn how to conduct a scientific experiment.
- Plot data on a bar graph.
- Explore how bar graphs help us to compare information.

### Sunshine State Standards for Late Elementary

Science:

Nature of Matter: SC.A.1.2.1, SC.A.1.2.2

Interactions: SC.G.1.2.2

Science: SC.H.1.2.1, SC.H.1.2.2, SC.H.1.2.3,  
SH.H.1.2.4, SC.H.3.2.2, SC.H.3.2.4

Math:

Data Analysis: MA.E.1.2.1, MA.E.1.2.3

### Vocabulary

|                   |            |
|-------------------|------------|
| Scientific method | Data       |
| Hypothesis        | Conclusion |

### Background Information

The habitat of a fish in captivity can greatly differ from its natural habitat. Because of this, fish in a classroom setting do not always exhibit the same behavior as "wild" fish.

In a natural setting, fish may use different locations within a single habitat to sleep or hide from predators, hunt or forage for food and reproduce. Classroom fish may choose different locations in their habitat for similar reasons.

Different species of fish prefer different habitats. Some may enjoy open water and a fast moving current, while others prefer still water with many tall plants near the surface. In captivity, when a fish is placed in a habitat it prefers, it feels comfortable and will exhibit natural behaviors. If a fish is placed in a habitat that is the opposite of its preference, it will become stressed and scared and will not thrive.

Freshwater aquatic habitats have many characteristics which may influence fish behavior. A fish which prefers tall plants, for instance, may school when swimming through open water in its habitat.

Behaviors may also be influenced by the time of day (or, with reproduction, the time

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## Fish in the Classroom Education Program

### Lesson 8: Fish Observation

of the year). As with other animals, fish may be nocturnal, diurnal or crepuscular (awake during dawn or dusk).

In this experiment students will observe the location preference of fish in the classroom aquarium habitat. It is important to evaluate the features of the four locations into which the tank will be divided. Does one area contain more plants? Is one closer to the filter where the current is faster?

Field researchers and animal behavior scientists use habitat evaluation along with the scientific method to help them understand why certain areas of an animal's habitat may be preferred over other areas for various activities.

#### Scientific Method:

To answer questions, scientists conduct experiments. The scientific method is a way of experimenting based on evidence that can be observed or seen. The scientific method should not be considered strictly linear; it is a tool for systematically conducting an experiment.

Before starting an experiment, a scientist asks a question, and then uses logic to predict the answer to the question. This answer is called the **hypothesis**. A hypothesis is an educated guess of the outcome of an experiment.

The experiment is then developed to find out if a hypothesis is correct or not. Often times, scientists will disprove their hypothesis. It is important to remind students that it is OK for a hypothesis to be wrong. It is a starting point for a new experiment. If a hypothesis was always

right, there wouldn't be a need to conduct experiments.

The scientific method also includes researching the question, developing and conducting an **experiment**, collecting and analyzing **data**, and developing a **conclusion**.

#### Initial Discussion

1. Ask students if they can describe different aquatic habitats. Have students identify characteristics of the individual habitats. Where would fish hunt in each habitat? Where would fish hide in each habitat?
2. Ask students to describe the natural habitat they think their classroom fish prefer. If the natural habitat is known, ask students to compare features of the classroom aquarium to those of the natural environment.
3. Discuss the scientific method and why it is important.
4. Pass out the worksheets and describe the experiment to the students. The purpose of the experiment is to see if fish prefer one area of the aquarium over the others.
5. Remind students that fish may use different areas of their habitat for different reasons and instruct students to write a hypothesis in the space provided.

#### Hands-On Activity

6. Divide students into groups or have them work alone. Each student or student group should observe a different fish.

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## Fish in the Classroom Education Program

### Lesson 8: Fish Observation

7. Have students record the features of each of the four areas of the aquarium.
8. Review the procedure and data sheet for the experiment. Depending on the level of your students, you may want to go through the experiment step-by-step with the whole class.
9. Have students observe the fish, writing down the location of the fish at the time it was observed. Make sure all students can see their fish. If it is difficult for all students to observe the aquarium at once, send students or student groups to the aquarium one at a time.
10. Continue to collect data over a one month period or longer. You may want to set up a clock with an alarm to make sure you start your observation on the same time every day.
11. After all the data has been collected, have students calculate the percentage of time each fish spent in each area (if appropriate for the age group).
12. Have students compare their results with others from their class. If observing multiple species of fish, have students compare the preferred location of their fish with those of a different species.
13. Write the average amount of times each fish was in each area on the board. Work out a class average for each fish.
14. Have students create a bar graph for their results. You may also want each student to graph the class' results, using a different color for each fish.

#### Relate Activity to Concept

21. Talk about the hypothesis and explain the results.
22. Discuss how habitat features affect the fish. Ask the students what other factors could affect the fish's location at the time of observation.
23. Discuss why it is useful to take a group and a class average.
24. Discuss the following: Why might the fish have stayed in one area (or constantly moved around)? Why was the same time of day always used? How might changing the time of day the observation was done affect the results?

#### Assessment

Collect the data sheets.

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# Fish Observation Experiment

## Data Sheet

Name: \_\_\_\_\_

### Where do fish spend their time?

The natural home, or **habitat**, of a fish looks very different from the classroom aquarium. Fish do many things in their habitat, like search for food, or hide from predators. Fish in aquariums are happiest when their aquarium looks like their natural habitat.

Different kinds of fish might like to live in different habitats, or different parts of the same habitat. Some fish may have special features or **adaptations** for living at the bottom of their habitat, hiding in plants or swimming fast through open water. Fish also might spend time in one place in their habitat looking for food, then swim to another area to rest.

In this experiment we will make observations and collect data to see where fish like to spend time in your aquarium. You will also keep track of what they are doing when you observe them. Do you think your fish likes one spot in the aquarium better than others? Do you think it likes to sleep in the same spot? Why? Write your answer, or **hypothesis** in the space below. At the end of the experiment, write your results.

### Hypothesis

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What did you find out at the end of the experiment? Was your hypothesis right?

### Results

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# Fish Observation Experiment

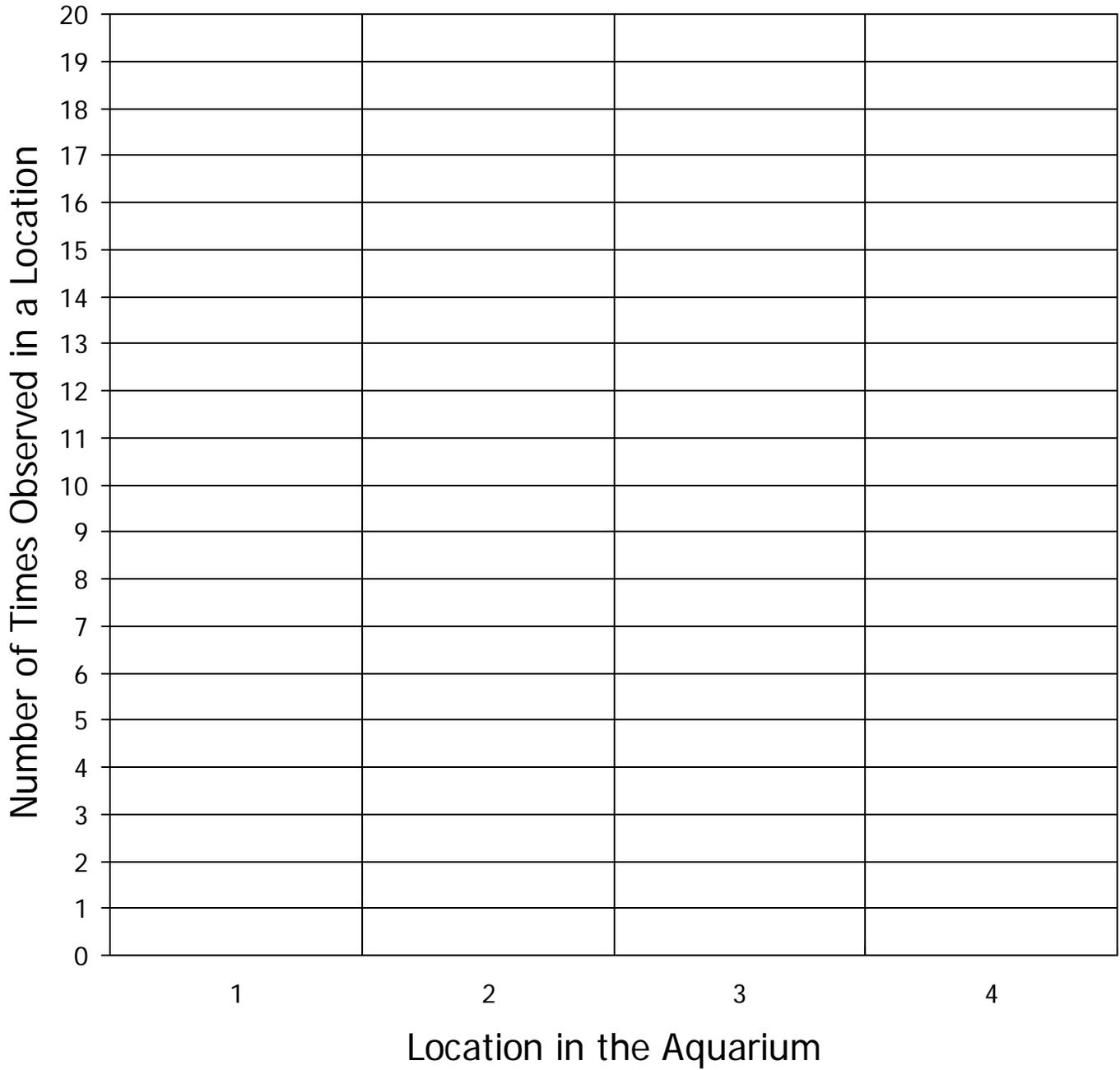
## Data Sheet

Name: \_\_\_\_\_

| Day | Location in aquarium | Behavior Observed<br>(What was your fish doing?) |
|-----|----------------------|--------------------------------------------------|
| 1   |                      |                                                  |
| 2   |                      |                                                  |
| 3   |                      |                                                  |
| 4   |                      |                                                  |
| 5   |                      |                                                  |
| 6   |                      |                                                  |
| 7   |                      |                                                  |
| 8   |                      |                                                  |
| 9   |                      |                                                  |
| 10  |                      |                                                  |
| 11  |                      |                                                  |
| 12  |                      |                                                  |
| 13  |                      |                                                  |
| 14  |                      |                                                  |
| 15  |                      |                                                  |
| 16  |                      |                                                  |
| 17  |                      |                                                  |
| 18  |                      |                                                  |
| 19  |                      |                                                  |
| 20  |                      |                                                  |

# Fish Observation Experiment Graph

Name: \_\_\_\_\_



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## Fish in the Classroom Education Program Terms

### **Activated Carbon**

A form of carbon specially formulated for filtration. It is made of an organic carbon source, usually wood, which has been heated under special conditions to remove any non-carbon elements and leave behind a carbon "sponge". Activated carbon collects organic chemicals in the holes left behind from the process which cleans the water. Because the holes will eventually fill up, activated carbon must be replaced on a regular basis (once every 3-4 weeks).

### **Air Line Tubing or ALT**

A small diameter flexible plastic hose which is used to connect an air stone to an air pump.

### **Air Stone**

A stone in which air is pumped through one end and diffused into the water through small holes, creating bubbles. These bubbles provide more surface area and thus allow for more oxygen to be dissolved into the water.

### **Alkalinity**

The capacity of water to buffer against a drop in pH. High alkalinity produces more stable water pH, and reduces pH swings. Alkalinity can be raised by adding a carbonate buffer material.

### **Ammonia**

NH<sub>4</sub>, a toxic substance that builds up in the aquarium. It is released by fish through their gills and as a result of waste buildup. Ammonia is the first step in the nitrogen cycle, and is removed by bacterial action where it is transformed into nitrite, or by mechanical filtration.

### **Bacterial Bloom**

A sudden growth of beneficial bacteria often associated with overstocked or new aquariums. The extra waste encourages the bacteria to grow quickly and causes the water to become cloudy white. If experiencing a bacteria bloom, do not perform a water change as the condition is necessary for the health of a tank and should subside after a few days.

### **Bio Balls**

Small, round plastic balls that are placed in the filter and manufactured to have a large surface-area-to-volume ratio. This allows more beneficial bacteria to grow in the filter.

### **Biological Filtration**

A method of natural filtration that uses bacteria to break down waste substances by means of the nitrogen cycle. These include undergravel filters, trickle filters, and sponge filters. Trickle filters and sponge filters are sometimes incorporated into power filters, which can combine chemical, mechanical, and biological filtration into one unit.

### **Buffer**

A substance added to the aquarium water to raise the alkalinity or adjust the pH. Several different types of buffering materials are available. Some can be used to raise or lower pH, and some can raise alkalinity without affecting pH.

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## Fish in the Classroom Education Program Terms

### **Carbon**

A substance used for filtration. See *activated carbon*.

### **Chemical Filtration**

A method of filtration that uses chemical processes to clean the water. Examples of this type include activated carbon and protein skimmers.

### **Chloramine**

A chemical added to municipal water supplies to kill bacteria. Chloramine is highly toxic to fish and invertebrates and more difficult to remove than chlorine. There are products on the market that are able to remove chloramine from tap water. Find out from your city if your water supply contains chloramine before purchasing fish.

### **Chlorine**

A substance used in municipal water supplies to kill bacteria. Chlorine is toxic to fish and invertebrates and must be removed from water before they can be added to the tank. A number of products are available for this purpose.

### **Cycle/Cycling**

See *nitrogen cycle*.

### **Dechlorinator**

A solution used to neutralize chlorine.

### **Detritus**

Waste material that accumulates in gray piles in the aquarium. Detritus is high in nutrients and should be removed when possible to help prevent the growth of unwanted algae.

### **Diffuser**

see Air Stone

### **Filter**

Any device used to remove unwanted particles or compounds from aquarium water. Filters come in a variety of styles, but most fall into three main categories: biological, chemical, or mechanical. Today, many filters offer two or three of these filtering techniques in one system. All three filtration methods are important for maintaining the health of an aquarium.

### **Filter Medium/Media**

Any substance used in water filtration systems to remove organic wastes and impurities from the water. Examples include activated carbon and filter floss.

### **Freshwater Biome**

Aquatic habitats that contain little or no salt.

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# Fish in the Classroom Education Program

## Terms

### **Gills**

The membranes through which fish absorb dissolved oxygen from the water during respiration.

### **Gravel**

Small rocks, glass or plastic at the bottom of the aquarium. This substrate forms the basis of the nitrogen cycle because beneficial bacteria live on the surface. Gravel is most commonly made of rock and comes in many different colors.

### **Gravel Vacuum**

A siphoning system where a length of wide plastic hose is used via gravitational pull to draw water out of a tank (on a high surface) and into a bucket (on a low surface). Often, it is used near the bottom of the tank to suck up waste and detritus that collect in the gravel.

**Hang on Back (HOB) Filter** see Power Filter

### **Heater**

A device used to heat the water in an aquarium. Heaters vary in size and style including drop-in types and submersible sump types. They feature an adjustable thermostat to maintain the water at a constant temperature. The size and wattage of a heater required will depend on the water volume of a tank.

### **Impeller**

An electrically operated propeller that causes water to flow through a pump or filter. It is often wise to clean the impeller in a power filter during routine cleanings to ensure it is functioning properly. Ask a pet store employee how to do this.

### **Internal Filter**

A filter that sits inside an aquarium. Internal filters can be simple sponge filters or complex power filters.

### **Mechanical Filtration**

A water filtration method that uses filtering medium to remove particles from the water. Canister filters, undergravel filters, and wet/dry prefilters are examples of mechanical filters.

### **Nitrate**

NO<sub>3</sub> the final product in the nitrogen cycle. It is not toxic, but can be dangerous at high levels. Nitrate is created by the oxidation of nitrite by nitrobacter bacteria. In a reef tank, nitrate levels should be kept below 10 ppm.

### **Nitrification**

The process by which bacteria converts ammonia into nitrite and then nitrite into nitrate. This is the basis of the nitrogen cycle.

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## Fish in the Classroom Education Program

### Terms

#### **Nitrite**

NO<sub>2</sub> the second product in the nitrogen cycle. Nitrite is a highly toxic substance that is produced by the oxidation of ammonia by nitrosomonas bacteria. It is easily removed with biological filtration.

#### **Nitrobacter**

The bacteria in a biological filtration system that converts nitrite into nitrate.

#### **Nitrogen Cycle**

The nitrogen cycle describes how wastes are broken down by bacteria in the aquarium. Animal waste breaks down into toxic ammonia (NH<sub>3</sub>). The ammonia is oxidized by nitrosomonas bacteria into nitrite (NO<sub>2</sub>), another highly toxic substance. Another bacteria called nitrobacter oxidizes the nitrite into nitrate (NO<sub>3</sub>), a much less toxic substance. Some systems are capable of taking the process one step further, by using anaerobic bacteria to convert the nitrate into harmless nitrogen gas.

#### **Nitrosomonas**

The bacteria in a biological filtration system that converts ammonia into nitrite.

#### **Osmosis**

The process by which a liquid passes from an area of low concentration through a semi-permeable membrane to an area of high concentration.

#### **Parasite**

An organism that feeds on the tissues of another organism. Parasites are one of the major causes of disease in aquarium fishes.

#### **pH**

A measure of the concentration of hydrogen and hydroxide ions. The pH of a solution measures how acidic or alkaline water is. pH values range from 0 to 14. A neutral solution has a pH of 7. A pH less than 7 indicates an acidic solution while a pH greater than 7 indicates an alkaline solution. A unit change in pH is equal to a tenfold change in hydrogen ion concentration: a pH of 2 is ten times more acidic than a pH of 3, and a pH of 2 is a hundred times more acidic than a pH of 4. With that in mind it is easy to see why a fish is sensitive to even a small change in pH.

The pH can be regulated in the aquarium by using buffering materials or regular water changes. Freshwater aquarium fish come from many different parts of the world and different fish prefer different pH values. Freshwater pH preferences can range from 6.0-8.0. In contrast, saltwater fish generally prefer a pH of 8.2-8.4.

#### **Phosphate**

A nutrient used as fertilizer for a planted tank that can cause uncontrolled growth of algae in an aquarium. It can also be toxic in high concentrations and must be kept to a minimum in reef

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## Fish in the Classroom Education Program Terms

aquariums. Phosphate can be easily removed by a number of commercially available filter media.

### **Photoperiod**

The length of time that the aquarium lights remain on.

### **Power Filter**

A common filter that is usually box-shaped and is designed to hang on the back of an aquarium. An intake tube sucks water into the filter using an impeller. The water passes through a special filter pad that removes particles from the water before returning to the tank.

### **Sponge Filter**

A type of filter that provides both mechanical and biological filtration. As water passes through the sponge, particles are removed. Bacteria growing on the surface of the sponge also remove toxic substances from the water.

### **Siphon**

A length of tube that uses gravity to move water from one location to another. Also, the organs used by some mollusks to inhale and exhale water. See also Gravel Vacuum.

### **Substrate**

Any sand, rock, plastic or glass placed at the bottom of the aquarium. See Gravel

### **Tank**

A container that holds water and is used to house and view aquatic plants and animals.

### **Vac/Vacuum**

see *gravel vac*

### **Water Change**

The process of replacing a portion of aquarium water with new, conditioned water. It is recommended that 20-25% of the water be changed each month or 10-15% of the water be changed each week in a freshwater tank.

### **Water Chemistry**

The concentration of dissolved chemicals in the water such as ammonia, nitrite, nitrate, pH and temperature.

### **Water Quality**

Water quality is the measure of the health of the aquarium water. Dissolved ammonia, nitrite, nitrate, phosphate, oxygen, carbon dioxide, organic particulate, pH, temperature and many other factors contribute to the quality of water. Proper ammonia, nitrite, pH and temperature tests should be done on a regular basis to ensure that the water is safe and healthy for fish.

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# **Fish in the Classroom Education Program Terms**

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## Fish in the Classroom Education Program Frequently Asked Questions

### Can I put rocks from outside in my aquarium?

- It depends on the kind of rock. Calcareous rocks, like limestone and marble, will affect the pH of the water. Rocks with metal fragments may also have a negative impact on the aquarium water.
- To test to see if the rock is calcareous, place a few drops of hydrochloric or muriatic acid on the rock. If it foams, the rock is calcareous.
- Check the rock for dark, shiny specks which may be metal.
- Place the rock in a bucket of water from the tank for a week. If the pH, nitrite, phosphate, and ammonia levels do not change in the water, the rock is probably safe to use.

### Can I use live plants?

- Live plants can be a healthy addition to any aquarium.
- Research any plant before purchasing it to make sure it is compatible with your aquarium. Some fish will nibble on live plants.
- Live plants require extra maintenance and specific water parameters to grow.
- Live plants may harbor parasites or other pests.

### What do I do with my unwanted fish?

- Never release it into the wild!
- Ask students to adopt a fish, but be sure they can care for it before sending it home.
- Ask a co-worker to adopt a fish.
- Ask a pet store to take the fish. You will not receive money for it, and they will probably sell it to another customer.
- Donate the fish to a nursing home, care facility or office.

### How should I dispose of a dead fish?

- Do not flush the fish down the toilet. Parasites and bacteria that may have been on your fish can contaminate the water.
- Wrap the fish in a tissue or paper towel and place it in a trash receptacle or bury the fish in a small hole outside. The fish will naturally decompose.

### Why is my water cloudy?

- A white cloud may be a bacteria bloom because the tank is cycling.
- A green cloud may be an algae bloom. Test the water and discover the cause.

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## **Fish in the Classroom Education Program Frequently Asked Questions**

- There may be too much particulate matter in the water from unwashed gravel or another source. Wait several minutes to see if the particulate settles. It may be necessary to vacuum or perform a water change to eliminate the particulate matter.

### **Do fish need air?**

- Fish absorb dissolved oxygen from the water using their gills. The oxygen enters the aquarium water from the surface.
- Using an air pump and air stone will increase the amount of oxygen in the water by creating more surface area for gas exchange to occur. This is beneficial to most fish, especially if the aquarium contains live plants.

### **Will my fish have babies?**

- Most fish usually don't reproduce in home aquariums, however several egg laying fish and live bearing fish are prolific parents.
- Breeding fish can require a lot of commitment to ensure the survival of the baby fish.
- Livebearers, such as guppies, mollies and swordtails, will readily reproduce in a normal aquarium environment. These fish may eat their babies if the aquarium is too crowded.
- Some fish need a special environment with specific items or environmental conditions to encourage them to spawn.
- If you would like to spawn your fish, do some research and find out what you would need to do to encourage a male and female to mate and how to feed and care for the fry (baby fish) when they hatch.

### **Can I keep brackish water fish in my aquarium?**

- Brackish water contains a little bit of salt, and many interesting fish such as scats, puffers, mollies and others enjoy brackish water environments.
- Some brackish water fish, like mollies, can tolerate freshwater conditions, however, others, such as puffers, can not.
- It is best to keep freshwater fish, at least for the duration of the Fish in the Classroom program.

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## Fish in the Classroom Education Program Websites

Aquariums are a popular topic on the internet and it can be difficult for a beginner to know what sources to trust. Following is a list of reputable websites composed by experienced individuals and professionals.

### **[www.fishdoc.co.uk](http://www.fishdoc.co.uk)**

A wealth of information about fish health, disease and treatment, instructions on how to perform a skin scrape, amazing video footage of magnified fish parasites, information on how to use a microscope for viewing skin scrapes, and a useful FAQ page.

### **[www.freshaquarium.about.com](http://www.freshaquarium.about.com)**

Many accurate articles about aquariums, fish species and care, and a variety of other topics and links.

### **[www.fishedz.com](http://www.fishedz.com)**

A great site for kids! Fun facts, coloring pages and kid-friendly information. Sponsored by the Florida Tropical Fish Farms Association.

### **<http://puzzlemaker.school.discovery.com>**

Create your own fishy word games!

### **[www.glofish.com](http://www.glofish.com)**

Discover why scientists genetically modified these fish and what they can do to help save the environment in Southern Asia. Also includes care and display tips.

### **[www.aqua-fish.net](http://www.aqua-fish.net)**

Contains ideas for setting up a biotype aquarium.

### **[www.flaquarium.org](http://www.flaquarium.org)**

Learn more about The Florida Aquarium.

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## **Fish in the Classroom Education Program Reading Suggestions**

Following is a list of great books about fish, aquarium care and aquatic habitats.

### **Reading List for Students:**

Fish (DK Eyewitness Books) by DK Publishing

My Pet Fish by Lori Coleman

Caring for Your Fish by Adele Richardson

The Fascinating Freshwater Fish Book: How to Catch, Keep, and Observe Your Own Native Fish by John R. Quinn

Quick & Easy Freshwater Aquarium Setup & Care by Brian M. Scott

Extremely Weird Fishes by Sarah Lovett

### **Reading List for Teachers:**

Setting up a Tropical Aquarium Week by Week by Stuart Thraves

Manual of Fish Health: Everything You Need to Know About Aquarium Fish, Their Environment and Disease Prevention by Chris Andrews, Adrian Exell, Neville Carrington

Aquarium Designs Inspired by Nature by Peter Hiscock

500 Freshwater Aquarium Fish: A Visual Reference to the Most Popular Species  
by Greg Jennings

American Aquarium Fishes by Robert J. Goldstein, Rodney W. Harper, Richard Edwards

The Simple Guide to Fresh Water Aquariums by David E. Boruchowitz