

UNIT TITLE: WATER POLLUTION TESTING

TARGETED STANDARDS: Academic Expectations and Kentucky Learner Goals: 2.1, 2.2, 2.3, 5.1, 5.4, 6.2, and 6.3.

MAJOR CONTENT:

- ✚ Students will be able to describe the three phases of water.
- ✚ Students will be able to describe physical and chemical properties of water.
- ✚ Students will be able to distinguish between water samples based on their content and origin.

ESSENTIAL QUESTION(S):

- ✚ Draw and label correctly the three phases of water.
- ✚ Describe why all water is different.
- ✚ Why is water the universal solvent?
- ✚ State the difference between chemical and physical properties of water.

ACTIVITY: Students will walk up to the water samples and examine each sample I have collected. They will make observations by looking at, touching the sample, or smelling the sample. They will write there observations in there science notebook. The students are to try and figure out the source of each of the samples based on the knowledge taught in the lesson.

RESOURCES: www.education.ky.gov
www.che.wsu.edu
www.google.com
www.nwlink.com

PROCEDURE:

1. I will call upon the students and ask them to discuss what water is.
2. I will then ask the students if they think all water is alike. If not then I will let them know that water differs based on what it is made up of.
3. I will then go over the three phases of water and why they are important.
4. The students will copy down the notes and diagrams in there notebook.
5. I will discuss with the students the difference between physical and chemical properties of water.
6. I will next explain to the students why water is the universal solvent.
7. After I have gone over all the notes required for this lesson I will remove the lids from the 5 different water samples that I have collected before the lesson. (1-lake or pond water, 2-Stream/creek water, 3-tap water, 4-dirty dishwater, 5-distilled water with a few drops of food coloring)
8. The students will come up a couple at a time and observe the water samples.

9. They will make observations by looking at the samples, smelling the samples, and feeling the samples.
10. After they are finished making all these observations they will return to their seats and try to identify the water source is by their observations and any previous knowledge they may have.
11. After all students have observed the samples and are finished recording in their notebooks I will go over where each water sample came from to see how accurate the students were.
12. I will then wrap up the lesson by reviewing the physical and chemical properties of water and why it's important to the environment.

EVALUATION: I will evaluate the students on their diagram and labeling of the water cycle. 30 points (10 points for each cycle being diagrammed and labeled correctly). I will grade the students' responses to the questions why is all water different, why is water the universal solvent and to describe the difference between physical and chemical properties. Each question will be worth 10 points. All 4 questions will be worth a total of 60 points.

SCORING GUIDE: NO

LESSON PLAN #2 OF UNIT ON WATER POLLUTION

UNIT TITLE: Water Pollution

TARGETED STANDARDS: Academic Expectations and Kentucky Learner Goals: 1.2, 2.1, 2.2, 2.20, 5.3, 6.1, 6.2, And 6.3

MAJOR CONTENT:

- ✚ Students will be able to recognize the U.S. Safe Drinking Water Act (1974).
- ✚ Students will be able to recognize that the environmental water standards are not as high as the drinking water standards.
- ✚ Students will be able to recall at least three common contaminants that are limited by drinking water regulations.
- ✚ Students will be able to tell the pH range, temperature range, and oxygen level for major types of aquatic species.

ESSENTIAL QUESTION(S):

- ✚ State what the U.S. Safe Drinking Water Act (1974) is and why is it important?
- ✚ List 3 or more common contaminants that are limited by drinking water regulations.
- ✚ Discuss why the environmental water standards are not as high as the drinking water standards.

- ✚ List the pH range, temperature range, and oxygen levels for bass, carp, catfish, and crappie.

ACTIVITY: The students will have 3 worksheets. One for the safe drinking water acts, one with the temperature and pH and dissolved oxygen levels. We will discuss the three worksheets as a class. We will discuss how the various contaminant levels and how they affect drinking water.

RESOURCES: www.education.ky.gov
www.che.wsu.edu
www.google.com
www.nwlink.com
Investigating Water Problems by Dr. Charles E. Renn

PROCEDURE:

1. As a class we will discuss the taste, odor, and any other qualities that the local water has.
2. We as a class will then discuss different locations and how the water is different.
3. I will let the students know that the primary concern for drinking water is abiotic substances that will in turn affect human health and the earth.
4. I will then talk about the four general bases that are established for drinking water quality standards that are there to protect humans and the earth.
5. I will let the students know how the SDWA originated. We will talk about the Environmental Protection Agency and why they came up with maximum contaminant levels.
6. I will review the objectives with the students and see if I need to review any of the major content covered.

EVALUATION: This lesson is a note taking lesson and more of me lecturing to the students. I will grade their notebooks to make sure they copied all necessary information needed for any further lessons. I will give 25 points for the notebook being completed.

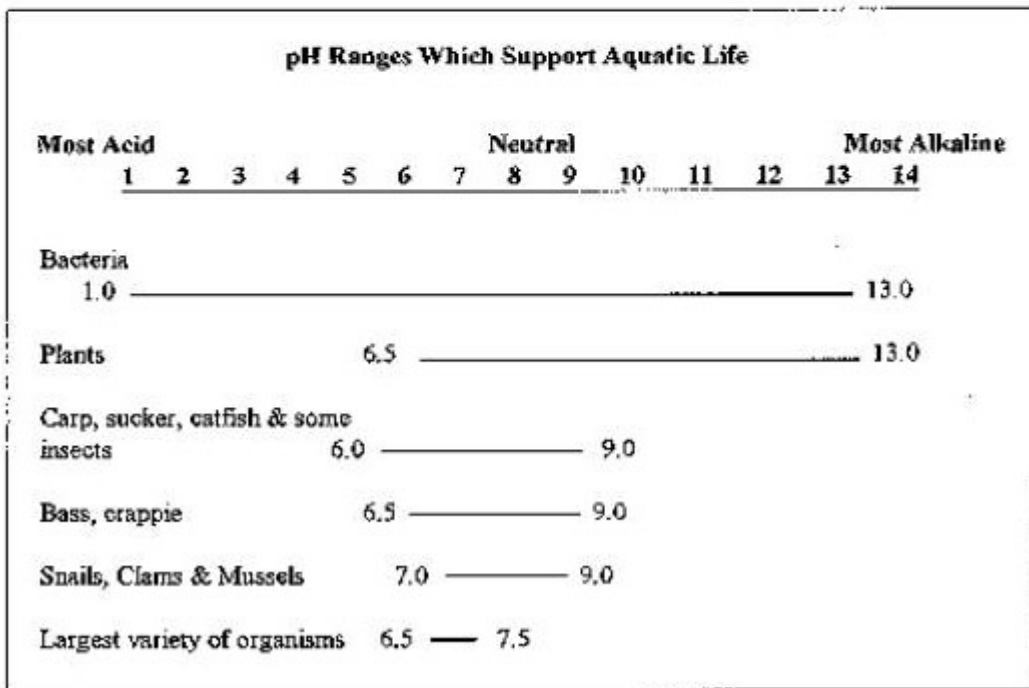
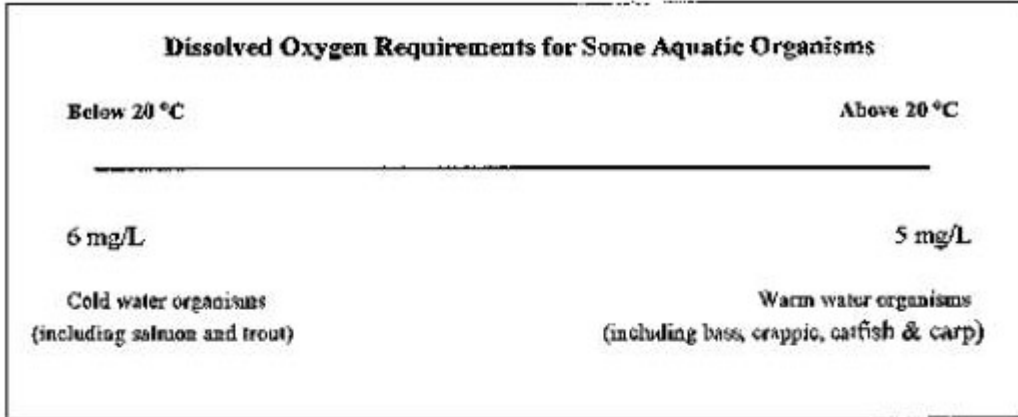
Attached are the three worksheets needed for this lesson

Appendix K
Drinking Water Standards
 (Established by the U.S. Public Health Service unless otherwise noted)

Substance	Max. Allowed
Alkalinity	?
Ammonia	0.31 mg/L
Carbon dioxide	?
Chloride	250.0 ppm
Dissolved oxygen	0.5 mg/L (minimum)
Hardness -- Total	350.3 ppm
Hardness -- Ca	200.0 ppm
Hardness -- Mg	150.3 ppm
Nitrate -- Adults	45.0 mg/L ¹
Nitrate -- Infants	10.0 mg/L
pH	5.0 to 9.0
Phosphates	.02 mg/L
Silica	No recom. limit

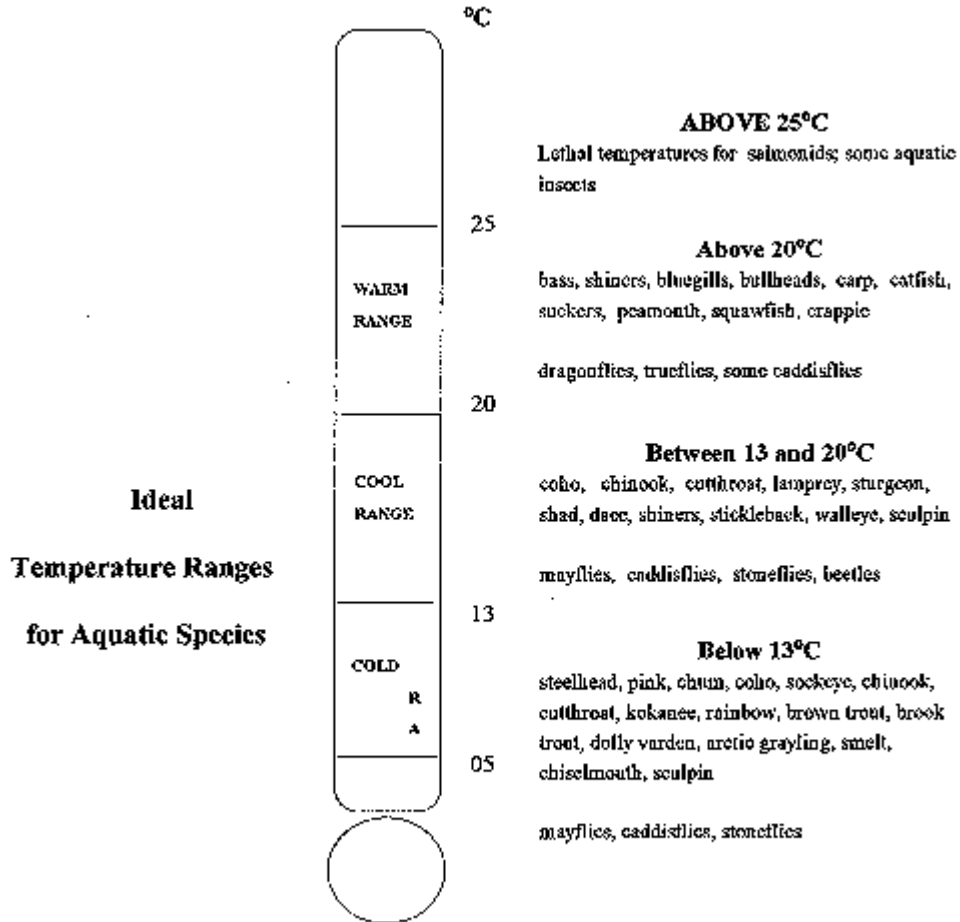
Substance	Max. Allowed
Sulfide	?
Turbidity	?
Chromate	?
Cyanide	0.2 mg/L
Copper	1.0 mg/L
Fluoride	0.7 mg/L
Iron	0.3 ppm
Lead	0.05 mg/L ²
Manganese	0.1 ppm
Mercury	0.005 mg/L ³
Phenols	0.001 mg/L
Sulfate	250.0 mg/L
Zinc	?

Appendix L Dissolved Oxygen and pH Requirements for Selected Species⁶



Appendix M

Temperature Requirements For Selected Species⁷



LESSON PLAN #3 OF UNIT ON WATER POLLUTION

UNIT TITLE: Water Pollution

TARGETED STANDARDS: Academic Expectations and Kentucky Learner Goals:
1.2, 1.11, 2.1, 5.1, 5.3, 6.2, And 6.3

MAJOR CONTENT:

- ✚ Students will understand the effects of leaking tanks and release of contaminants on our groundwater resources.

ESSENTIAL QUESTION(S):

- ✚ What is the cause of the pollution?
- ✚ What is the effect of the contamination?
- ✚ What is the solution to the present contamination?
- ✚ What is a prevention of future contamination listed in the article?
- ✚ Define these terms toxic waste, plume, aquifer, solvents, hazardous chemicals, and underground storage units (USTs)

ACTIVITY: Students will read two articles and fill in the worksheet on cause, effect, solution, and prevention. (Not all circles will be filled in and some may have more than one answer)

RESOURCES: www.google.com

Current Health Magazine October 1992 and March 1993.

PROCEDURE:

1. I will hand out the two articles and the worksheet to be completed.
2. I will then go over what I want the students to do with the articles.
3. I will then ask if there are any questions. If not I will let the students begin the assignment.

EVALUATION: I will collect and grade the graphic organizer on cause, effect, solution, and prevention. I will grade it for accuracy to make sure the students understood what they were reading. I will make the assignment worth 40 points. (10 points for cause, effect, solution, and prevention)

Attached are the two articles and the worksheet needed for this lesson

Article #1

TANKS A LOT!

You can't see them. They're buried underground. But they're ready to cause havoc and fear among the populace. No, "they" are not zombies or the living dead in a horror movie. We're talking about the rusty, leaky, underground oil storage tanks found beneath towns and cities big and small throughout the United States. What's really scary is the fact that no one knows for sure how many of these tanks exist.

Whatever the number, its clear these tanks pose a problem. How big a problem? One Environmental Protection Agency (EPA) estimate says that 11 million gallons of gasoline alone seep into the ground annually. That's the equivalent of the Exxon Valdez oil spill happening every year without our even seeing it!

Because the spills occur underground, it's easier for the pollution to reach sources of drinking water. And it only takes a single gallon of gasoline to make 1 million gallons of water undrinkable.

Fortunately, technology has provided some solutions for the problem. One approach is to use double-walled tanks with special monitoring systems between the walls. If the first wall springs a leak, an alarm goes off. Then, the second wall traps the leak until help arrives. Tank makers are also using fiberglass and other nonmetal materials to eliminate rust and corrosion that could cause leaks.

Replacing old tanks with the new tanks is expensive. But it is one sure way to clean up a continuing source of oil spills.

From Current Health 2, October 1992

Article #2

Danger Below the Sands

Over several decades, millions of gallons of aviation fuel, solvents, and other toxic chemicals were dumped or spilled on the grounds around Otis Air Force Base on Massachusetts' Cape Cod. Leaky underground storage tanks, sewage systems, and other sources of contamination throughout the Cape also released hazardous chemicals into the ground.

These chemicals have now seeped underground into the aquifer, from which cities, towns, and individuals on the Cape draw their water. Cape Cod rests on hundreds of feet of sand left after the last Ice Age. Far below the surface, this sand holds rainwater that has seeped down through the sand. Once in the aquifer, the water travels toward the sea, following underground contours in the aquifer.

Unfortunately for the people of Cape Cod, the underground pollution has reached the aquifer and is on its way to the ocean. This means that municipal and private wells throughout the island are becoming contaminated. What's more, the underground pollution is traveling outward toward the sea in plumes. These plumes are found at different depths, depending on the kind of pollutant. Solvents are heavy and sink deeper in the aquifer before they spread outward. Organic pollutants may stay at shallower levels. So simply changing the depth of wells will not solve the problem.

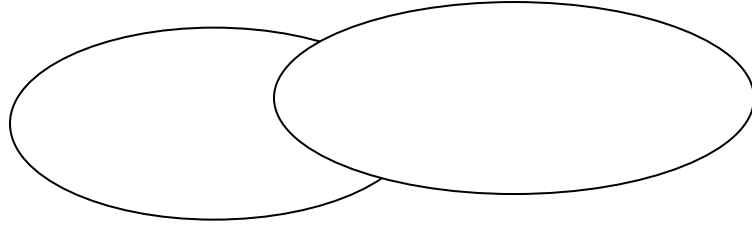
Scientists estimate that it may take 100 years for the toxic materials to work their way through the Cape Cod aquifer.

From Current Health 2, March 1993

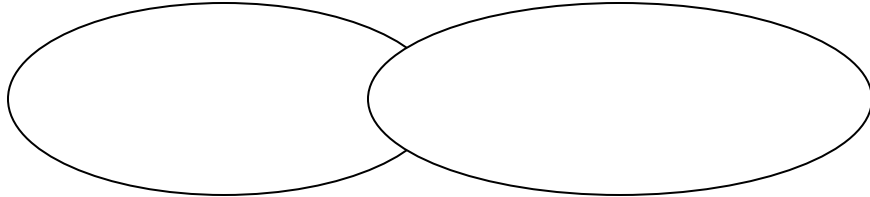
Tanks A Lot - Article #1

Cape Cod Article - #2

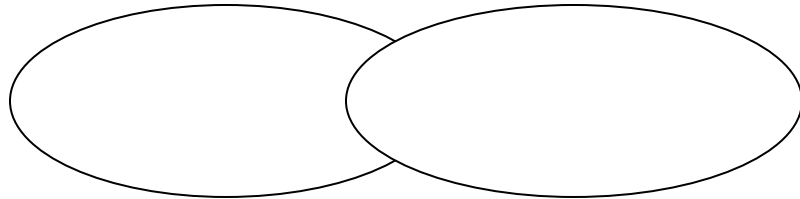
CAUSE



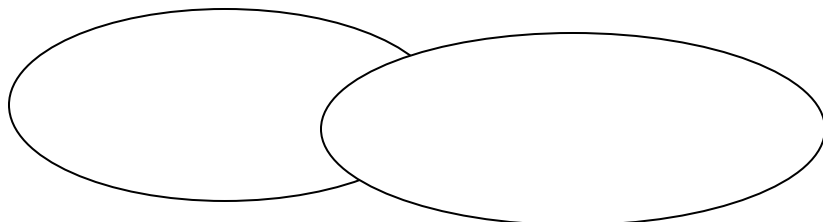
EFFECT



SOLUTION



PREVENTION



These circles are to inter lock so they can put the similarities in the middle. The left circles are for Article #1 and the right circles are for Article #2.

LESSONPALN #4 OF UNIT ON WATER POLLUTION

UNIT TITLE: Water Pollution

TARGETED STANDARDS: Academic Expectations and Kentucky Learner Goals:
1.3, 2.1, 6.1, 6.2, And 6.3

MAJOR CONTENT:

- ✚ Students will be able to collect water samples.
- ✚ Students will be able to run pH test, Dissolved oxygen test, and Turbidity test on water samples.
- ✚ Students will be able to compare the results of the different water samples and discuss why they are different.

ESSENTIAL QUESTION(S):

- ✚ Record the pH, dissolved oxygen, and turbidity for the four different water samples.
- ✚ Compare your results to others in the class and to the standard.
- ✚ Why do you think the water samples are different?

ACTIVITY: The students will work in groups of three. The students will collect four samples in a nearby creek. They will run all three tests at all four sites along the creek. They will record there data to use once back in the classroom.

RESOURCES: www.education.ky.gov
www.che.wsu.edu
www.google.com
www.nwlink.com

PROCEDURE:

1. I will put the students in groups of three.
2. I will go over how to use the two kits to test for pH, dissolved oxygen, and Turbidity.
3. I will then ask if there are any questions on how to use the kits.
4. We as a class will walk down to the near-by creek.
5. I will place the students at four different spots along the creek.
6. Each group will record there data for all three tests at all four spots along the creek.

7. pH Test are as follows
 - i. Fill tube to mark with water.
 - ii. Add 10 drops of reagent and mix.
 - iii. Insert tube and compare.
8. Dissolved Oxygen goes as follows
 - i. Rinse the water sampling bottle with sample water.
 - ii. Tightly cap the bottle, and submerge it to the desired depth.
 - iii. Remove the cap and allow the bottle to fill.
 - iv. Tap the sides of the bottle to dislodge any air bubbles.
 - v. Replace the cap while the bottle is still submerged.
 - vi. Retrieve the bottle and make sure that no air bubbles are trapped inside.
 - vii. Remove the cap from the bottle.
 - viii. Add 8 drops of Manganous Sulfate Solution and 8 drops of Alkaline Potassium Iodide Azide.
 - ix. Cap the bottle and mix. A precipitate will form.
 - x. Allow the precipitate to settle below the shoulder of the bottle.
 - xi. Use the 1.0g spoon to add one level measure of Sulfamic Acid Powder.
 - xii. Cap and gently invert the bottle to mix the contents until the precipitate and the reagent have totally dissolved.
 - xiii. Fill the titration tube to the 20ml line with the fixed sample. Cap the tube.
 - xiv. Depress plunger of the titrator.
 - xv. Insert the titrator into the plug in the Sodium Thiosulfate, 0.025N titrating the solution.
 - xvi. Invert the bottle and slowly withdraw the plunger until the bottom of the plunger is opposite the zero mark on the scale.
 - xvii. Turn the bottle upright and remove the titrator.
 - xviii. Insert the tip of the titrator into the opening of the titration tube cap.
 - xix. Slowly depress the plunger to dispense the titrating solution until the yellow-brown color changes to a very faint yellow.
 - xx. Carefully remove the titrator and cap. Do not disturb the titrator plunger.
 - xxi. Add 8 drops of Starch Indicator Solution. The sample should turn blue.
 - xxii. Cap the titration tube. Insert the tip of the titrator into the opening of the titration tube cap.

- xxiii. Continue titrating until the blue color disappears and the solution becomes colorless.
 - xxiv. Record the test result where the titrator tip meets the scale.
9. The turbidity test is as follows
 - i. Remove the tube from the container and turn on.
 - ii. Make sure tube is at zero before beginning.
 - iii. Place tube in water and wait for reading to appear.
 - iv. Record the turbidity.
 10. After all groups have finished all the tests we will come back to the classroom.
 11. We will put all data on the overhead for all to copy.
 12. Once all have copied and are finished we will discuss why the data is different.
 13. I will make sure all the students understand the objectives and wrap up the lesson.
 14. The students will create a spreadsheet of all the classes' data and write up what they enjoyed or disliked about the unit on water pollution.

EVALUATION: I will collect the spreadsheets and the write up on the unit. This will be graded out of 100 points. 75 for the spreadsheet and 25 for the write up.