

Nitrates and Nitrites

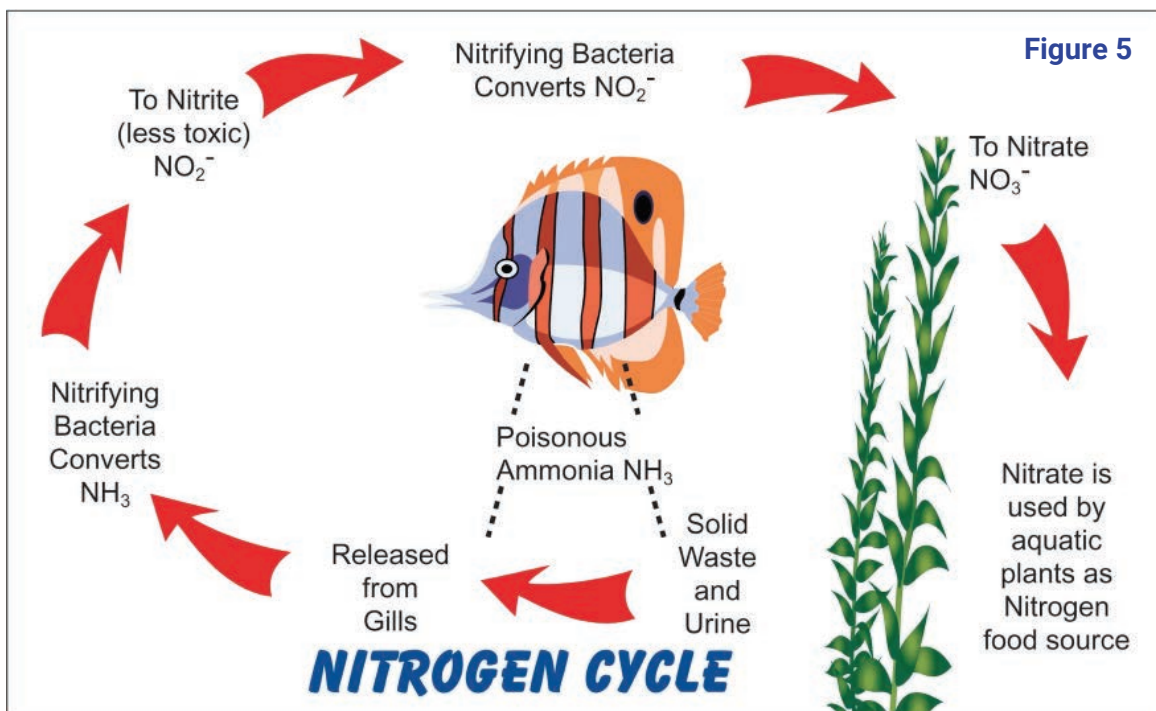
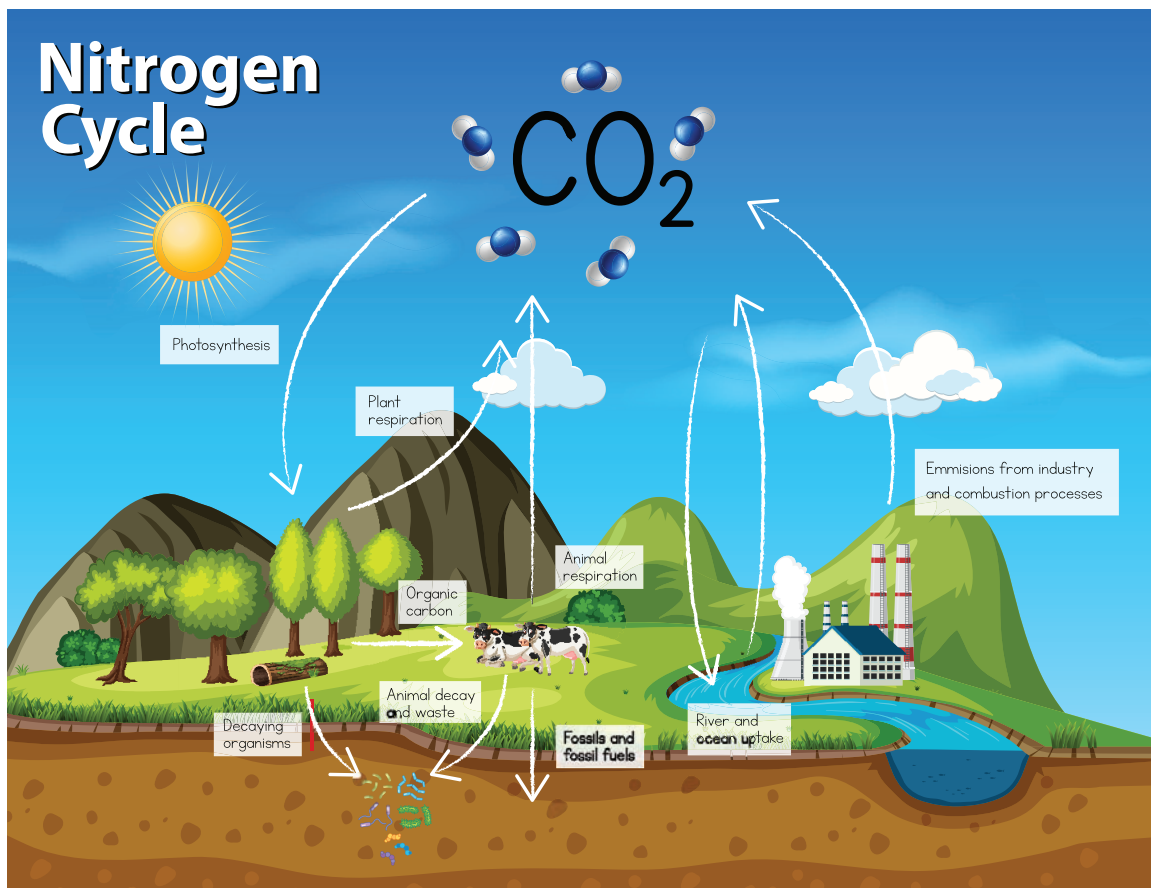
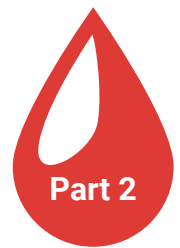
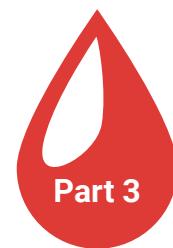


Figure 5

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Nitrates and Nitrites



USING THE TEST STRIPS:

The Water Works™ School Test Kit contains strips that combine 2 separate tests for nitrogen on one strip. The end pad tests for nitrogen combined in nitrates and nitrites (N in $\text{NO}_3^- + \text{NO}_2^-$). The pad nearest the handle tests the nitrogen in nitrites (NO_2^-) only. To get the level of nitrogen in nitrates alone, do the math:

Total nitrate ($\text{NO}_3^- + \text{NO}_2^-$) – nitrite (NO_2^-) = Nitrate (NO_3^-) only.

For example: if Total nitrate (N) measures 10.0 ppm and Nitrite (N) measures 1.0 ppm, the Nitrate only (N) level is 9.0 ppm.

Note: Some other nitrate tests, particularly those commonly used by aquarists, express results in parts per million of NITRATES or NITRITES. The WaterWorks™ School Kit uses the EPA method of expressing results as the NITROGEN (N) contained in nitrates and nitrites. Confusion (and alarm) may occur if the hobbyist measures nitrogen levels in ppm of NITROGEN (N), and tries to interpret it using the scale expressed in ppm of NITRATES ($\text{NO}_3^- + \text{NO}_2^-$). To convert nitrate nitrogen (N) readings given on the test strip to nitrate ($\text{NO}_3^- + \text{NO}_2^-$) readings, multiply the test strip result by 4.4. To convert nitrite nitrogen (N) to NO_2^- readings, multiply by 3.3. NOW! You can compare apples to apples.

OBJECTIVES:

1. Using test strips, measure the nitrate and nitrite concentrations in various water samples.
2. Demonstrate the effect of excess nitrate on a body of water.

Vocabulary:

Nitrogen – (N_2) a stable gas making up 79% of the atmosphere

Nitrogen cycle – the process by which nitrogen is made available to living things and recycled (see figure 5)

Nitrate – (NO_3^-) an ion composed of a nitrogen atom and three oxygen atoms

Nitrite – (NO_2^-) an ion composed of a nitrogen atom and two oxygen atoms

Ammonia – (NH_3) a gas composed of a nitrogen atom and three hydrogen atoms.

Aerobic – oxygen-loving

Anaerobic – capable of living in the absence of oxygen

Eutrophication – “enrichment with nutrients” A natural process by which nutrients, especially nitrates, build up in a body of water, leading to increased support of plant and animal life.

MATERIALS:

School Test Kit Materials:

Total Nitrate and Nitrite (as N) test strips School Kit Color Chart and Instruction card Data collections sheet, copied for number of students

Equipment:

Clean Glass Jars

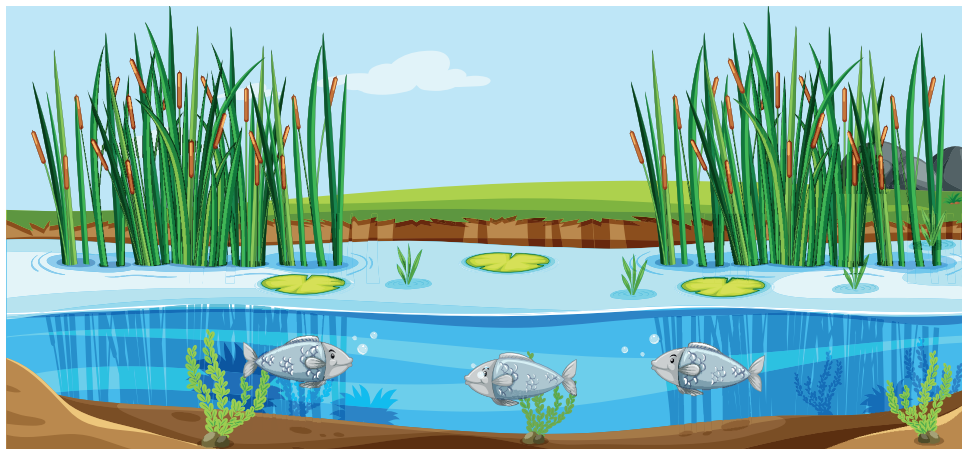
Shopping list:

Lawn fertilizer or liquid plant food containing nitrogen as nitrate (check the package label)

Pond water

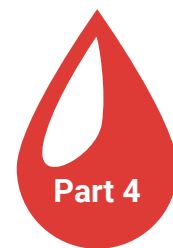
Aquarium water

Tap Water



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Nitrates and Nitrites



SAMPLE PREPARATION:

Fertilizer solution preparation: If using liquid plant food, prepare according to package directions. For granular fertilizer, dissolve 5 g in 200ml of tap water. (Note: all solids may not dissolve.) Important: Nitrate is very soluble. To create a slow-release product, fertilizer manufacturers may use ammonium phosphate and urea. These nitrogen compounds are not detected by the nitrate test strip, but will be broken down by bacteria to nitrate over time.

Collect all samples in very clean glass jars. Label with Sample # and contents, cover and protect from light. Use immediately or as soon as possible.

PROCEDURE:

1. Demonstrate the effect of nitrate fertilizer on pond water. Fill 2 jars with equal volumes of the pond water sample. Label the first jar "Sample #1 Pond Water / Control." To the second jar, add 1 teaspoon of the fertilizer solution. Label it "Sample #2 Pond Water + N." Set both jars in a sunny (not hot) place for 5-7 days. [Note: At the conclusion of this activity, save the Sample #2 for use in the copper and chlorine testing activities.]
2. Using the Total Nitrate and Nitrite (as N) test strips, test each sample, using a clean strip for each sample. Dip the test strip into the sample for 2 seconds and remove immediately. Wait 1 minute (2 minutes if the water temperature is very cold or below 55oF). Match colors to the Color Chart and record results on the data table.
2. Identify possible sources of high nitrate levels in a body of water.
3. Locate water with excessive algae growth and/or high levels of nitrates. Collect and test samples from points upstream to locate the source of the contaminants. Some possible sources may be seeping septic tanks, animal waste from farms, or fertilizer runoff from golf courses. Notify the groundwater management agency in your area.
4. Test nitrate levels in soil. Add the soil sample to tap water in a glass jar. Cover, shake, and let settle for 24 hours. Pour off the clear water and test for nitrates. (Account for the nitrates provided by the tap water.) Repeat the soil test with legumes; prepare the soil sample by collecting the dirt from the roots of peas, clover or soybeans.
5. Test for nitrites used to preserve bacon and other processed meats. Chop bacon, bologna, or salami into small pieces, and soak in water for 1 hour. Test the water for nitrites.
6. Explore alternatives to the use of nitrate fertilizers in farming. In the Mississippi River watershed alone, an estimated 4.2 metric tons (9.2 billion pounds) of nitrogen-based fertilizers are applied to croplands each year, much of which finds its way into the groundwater, rivers and streams.

ANALYSIS AND APPLICATION

1. After 5-7 days, compare the pond sample with fertilizer added to the control. Describe the results on your data table.
2. Calculate nitrate (NO_3^-) levels using the Total nitrate (end pad) and Nitrite (pad nearest the handle) measurements. Enter results on the data table.

EXTENSION

1. Explore your home, garage, grocery store and school for possible sources of nitrate contamination in water. Collect package labels; circle the ingredient that provides nitrate. Suggest strategies for reducing nitrates that enter the water system.

