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Paper in Journal of Geoscience Education gives an overview of the lesson and how to use the cards. A brief synopsis is presented below.

Overview of Lesson

1) Before engaging in lessons, students attempt to draw a diagram of a nitrogen cycle and add as many components as they can. This allows them to self-assess (and the teacher to assess) what they know about the nitrogen cycle.

2) Students research some of the nitrogen cycle components online at various websites or read printouts from websites provided by the teacher. They choose three or facts of interest about their component and report to the rest of the class. Suggested nitrogen websites are provided in **Web sites for nitrogen information.pdf.**

3) Each small group of students is given a set of materials including the 20 objects (black and white), 20 picture-cards, 20 nitrogen cycle component explanation cards, the 20 title cards for each nitrogen cycle component, heading cards for different environments such as the atmosphere, soil, water, etc., and many small arrows. (**Cards for Cutting Out Nitrogen cycle 2008.pdf**)

4) The students work together to pair each object with its corresponding title card, description card, and picture card. Then these are all arranged to form a possible nitrogen cycle with various components clustered around heading cards and arrows used to show movement of nitrogen from one object to another. An example of a possible N-cycle is presented with the pdf of the cards to be used for cutting out (**Card Associations and Example N Cycle.pdf**).

5) Students then write humorous (limerick, couplet) poems or more serious poems (haiku) or structured poems (cinquain, diamante) to tell several facts about a component of the nitrogen cycle. They share their poems with the class.

6) Students may also engage in experiments with nitrogen fertilizer. Typing in **classroom experiments nitrogen fertilizer** in a search engine such as Google provided a number of experiments that would work in or out of a classroom to illustrate the effects of too much versus enough fertilizer on plant growth; other topics that showed up were dealing with composting which helps deal with organic fertilizer.

Use the pre-test/post-test for evaluation purposes (**Pretest Posttest.pdf**) if you wish. Directions concerning how to use the test are provided with the test.