TEACHER'S NOTES 3

WHAT IS RADON?

BACKGROUND

Students may have some difficulty understanding the relationship among the isotopes in the uranium-238 decay series (Figure 1). Each time an alpha particle is emitted during the series, the number of protons decreases by 2 and the number of neutrons decreases by 2. This is because an alpha particle consists of 2 protons and 2 neutrons. The atomic number is the number of protons. The mass number (i.e., the 238 in uranium-238) is the number of protons *plus* the number of neutrons.

When a beta particle is emitted, the mass number stays the same because no protons or neutrons are emitted. A beta particle is an electron, with very slight mass and a negative charge, and is formed when a neutron breaks apart into a proton and electron. The atomic number increases by one when a beta particle is emitted. This can be thought of as a conversion of one neutron into one proton to compensate for the loss of the negatively-charged beta particle. Thus, even though the atomic number changes, the mass number stays the same during beta emission.

The half-life of each isotope is given below its symbol in the figure. Half-life is an important characteristic of each isotope, and can be a difficult one for students to grasp (see Lesson Plan 2).

MINIMUM RECOMMENDED TIME ALLOCATION

One class period.

STUDENT RESPONSES

Question 3: Radon would be a *lesser* health threat if the half-life was either very short (it would not make its way out of the soil before being transformed from a gas to a solid) or very long (it would escape from the house before it decayed to polonium).

Question 4: Answers may vary.

Question 5: Use the same reasoning as in Question 3. The polonium would likely be cleared from the lungs prior to emitting its radioactivity if the half-life was as long as 20 days. Remember that it is the radioactive emission *inside the lungs* that causes the problem.

Question 6: The properties of radon that contribute to its importance as a health concern include:

- it is a gas and can escape from soil into the house
- it has a medium-length half-life relative to the movement of gas (air) into and out of the house
- it decays to form a solid that can lodge in the lungs
- its immediate decay product has a high-energy (potentially damaging) alpha emission
- its immediate decay product has a short half-life, and therefore has a high probability of decaying while inside the lungs.

Question 7: Radon is a gas and as such can move through cracks and fissures in rock materials. In order to move 100 feet within radon's half-life of 3.8 days, the rocks would have to contain major cracks or faults.

EXTENDED ACTIVITIES

1. Have students research the origin of key terms used in this lesson plan and throughout the teacher's guide (e.g., radon, radioactivity, isotope, curie, electron, etc.)

2. Have students compute an estimate of how long it would take to form lead-206, starting with a quantity of uranium-238. Have students explain what factors influence this time estimate (e.g., statistics and probability) and the limitations caused by the few very long-lived isotopes such as U-238, U-234, Th-230, and Ra-226. Students will need to use the data presented in Figure 1. to evaluate this problem.

3. Have students conduct an electronic (computer) literature search for an aspect of the radon issue, such as mitigation techniques, measurement devices, or health effects.

Radon Alert
Lesson Plan Evaluation Sheet
and FREE POSTER AND STORYBOOK offer

The New Jersey Department of Environmental Protection is happy to provide these lesson plans for use by teachers. In order to evaluate the use of the lesson plans, we would greatly appreciate your response to the following questions. All teachers who return these forms will receive a FREE RADON POSTER depicting information about radon in a colorful format and a STORYBOOK about a Native American child and his experience with radon in his home.

1. Which Radon Alert lesson plan(s) did you use?

_____

2. How useful did you find it/them (check one) ?

___ Not useful
___ Slightly useful
___ Moderately useful
___ Very useful
___ Extremely useful

3. Do you plan to use them again in the future? ___Yes ___ No

4. In your view, what would make the lesson plans MORE useful:

Your name:_____ Phone Number: _____

Subject area: _____Grade:_____

Mailing address:

_____

_____

To receive your FREE RADON POSTER and STORYBOOK, mail or fax this completed form to:
NJDEP Radon Program, P. O. Box 415, Trenton, NJ 08625
Fax: 609-984-5595.

(Questions? Call the Radon Program at 1-800-648-0394.)