Radon Education For B.C. Youth
Teacher Guide

60 minutes

Materials Needed

- "What is radon gas" student handout, 1 copy per student
- "Careers match" student handout, 1 copy per student

- "Radon on the move" experiment materials per group of 2-3 students:

Per person:
- Experiment worksheet "Radon on the move"
- Safety goggles
- Piece of paper 22cm x 14cm (A4 cut in half) to make paper straws
- Tape

Per group:
- 2 beakers
- Gravel or small rocks (enough to fill the beaker)
- Sand (enough to fill the beaker)
- Water in small jug
- Device and internet to access an interactive radon map http://www.bc-cdc.ca/health-info/prevention-public-health/radon.

Teacher Notes

Use this guide and follow along with the Radon Education PowerPoint presentation.

Introduction: What is radon gas?

1. At slide 2 start with a discussion about gases in our troposphere (where we breathe) and learn that some gases are good for us to breathe and others are harmful to our health.
2. At slides 3 to 8 have students guess which of these naturally occurring gases are harmful to human health. If you are teaching a chemistry class, you might want to walk them through the chart on slide 3 or simply move through the slides 4 to 8. Students can answer with a thumbs up (not harmful) or thumbs down (harmful), or designate one side of the room as harmful, one side as not harmful, and have students move to the side they think is correct.
   a. Gases:
      i) Ozone (harmful): ozone occurs in our troposphere when pollution from human activity such as driving cars reacts with sunlight)
      ii) Oxygen (not harmful)
      iii) Carbon dioxide (not harmful)
      iv) Carbon monoxide (harmful)
      v) Radon (harmful)

3. At slide 9 share this video to introduce students to what radon is and how it can affect human health: https://youtu.be/d4fdWKCViBA.
4. Provide each student with a copy of "What is radon gas" handout and have students complete the sentences.
5. At slide 10 and 11 reveal the answers:
    a. When uranium in soil, rock and water breaks down it releases radon gas.
    b. Radon gas escapes from the ground into the air outside or into buildings in contact with the ground.
    c. When radon gas is released into the air outside it doesn't cause a problem as the air dilutes the radon.
    d. When radon seeps into a closed-in space like a building or home, it can be harmful.
    e. Once indoors, radon decays into tiny radioactive particles.
    f. You and your family may be breathing high levels of radon without knowing it.
    g. Inhaling these radioactive particles can damage cells that line your lungs.
    h. If you breathe radon gas over a long period of time, it can lead to lung cancer.

Radon on the move

6. At slide 12 share that students will be working in small groups experimenting to discover the following: (Please note the answers are explained for you below in Step 10 but don't reveal until after the experiment).
    - Where radon is found in B.C.
    - Which soil types allow radon to escape more easily.
    - How ground water can affect the escape of radon.
7. Provide each student with a copy of the worksheet **"Radon on the move".**
8. Put students in groups of 2-3 and provide each group with the **"Radon on the move"** experiment materials: 2 beakers, safety goggles, gravel or small rocks (enough to fill the beaker half full), sand (enough to fill the beaker half full), 3 plastic or re-usable straws, water in small jug and a device to view an interactive radon map http://www.bccdc.ca/health-in-fo/prevention-public-health/radon. If this is not possible, a similar map can be printed to share with groups found at https://www.sfu.ca/radon/Radonmap.html
9. Have students work in groups to discuss and do the experiments but have each student record their answers on their own worksheet.
10. After students have completed the experiment discuss how uranium is found everywhere in the earth's crust and that is why there is some level of radon in all buildings and homes in contact with the ground. As a gas, radon moves more easily through porous or permeable rocks like sandstone and between rocks and gravel and cracks in rocks and soil. Soil types like clay, slate and granite are less porous so it may be more difficult for the radon gas to escape from the ground. Ground water or moist soil slows the movement of radon.
11. You can also point out that uranium decays into several different elements, such as thorium (Th) and radium (Ra) and its final decay product, after millions of years, is lead.
12. At slide 13 ask students to consider how radon gets from the ground into our homes. The answer is revealed on the slide.
13. At slide 14 ask students, based on what they have learned about radon, where they think they would most likely find it in their homes? On click reveal the answer that because radon seeps up from the ground, the most likely places are on the ground floor and basement levels, but home ventilation systems circulate air effectively and higher levels of radon have been found in upper levels of homes as well.

14. At slide 15 discuss with students that the only way to know if a high level of radon is in our homes is through testing.

Health impacts of radon gas

15. At slide 16 ask students what they think can cause lung cancer? Have student "think, pair, share" to list ways. Answers may include smoking, exposure to 2nd hand smoke, radon exposure, asbestos exposure, exposure to other carcinogens like silica and arsenic, poor air quality, radiation to lungs, family history.
16. At slide 17 reveal that in non-smokers long term exposure to high levels of radon is the #1 cause of lung cancer. In Canada it is estimated that more than 3000 Canadians a year die from radon-induced lung cancer. Lung cancer is the most common cancer in Canada and has a low survival rate. Therefore, prevention like quitting smoking, and testing and reducing exposure to radon is important.
17. At slide 18 share with students how radon causes lung cancer.
18. At slide 19 watch this video, summarizing how radon affects health: https://www.youtube.com/watch?v=inG1g9PlqV4

Testing for radon

19. At slide 20 discuss how and when to test for radon. Testing should ideally be done in fall or winter. Ask students why they think that would be the best time to test? Reveal the answer on click that in colder weather, windows and doors are closed, so this is the time of highest concentration.
20. At slide 21 share that radon is measured in Becquerel per cubic meter (Bq/m3). Bq is used to measure radioactivity, which is the amount of ionizing radiation released when an element, like uranium, emits energy through radioactive decay of an unstable atom. The radon level in your home should be below 200 Bq/m3 .
21. At slide 22 discuss that testing can be done at home by buying a radon detector or by hiring a radon measurement professional. Go to http://takeactiononradon.ca. Some libraries have testing kits you can borrow but these are for screening purposes only. It is recommended to follow up screening with a three-month long-term radon test for a more comprehensive assessment.
22. Explain that the do-it-yourself radon test kit include an alpha track detector that has a piece of a special plastic film inside a plastic container. Air diffuses through small openings in the container. When alpha particles from radon strike the detector, they make tracks on the surface of the plastic film, like how they damage the cells in lungs. The radon level is calculated from the number and depth of tracks on the piece of plastic.

DID YOU KNOW?
Alpha particles are emitted by the radioactive gas radon.

23. At slide 23 share that once you have tested levels of radon If your radon level is below 200Bq/m3 no action is required. For radon levels above 200Bq/m3 take action to reduce. Note if your levels are below 200Bq/m3 it does not exceed the Canadian guideline but you should consider re-testing, if you make changes to your homes ventilation system, energy-retrofits or large additions.

Radon mitigation

24. At slide 24 explain to students that if the level is above 200Bq/m3 then mitigation is needed. Ask students what the term 'mitigation' means. It means to reduce the severity or seriousness of something. The goal is to reduce the radon levels as low as possible. Share techniques to lower radon levels are effective and can save lives. A radon mitigation system can be installed in less than a day and in most homes will reduce the radon level by more than 80-90%. The most common radon reduction method is called Active Soil Depressurization (ASD). A pipe is installed through the foundation and connected to an outside wall or up through to the roof line. A small fan is attached which draws air and the radon from below the house and exhausts it outside.
25. At slide 25 show the video about radon mitigation https://www.canada.ca/en/health-canada/services/video/radon-what-you-need-to-know.html.

Careers Connection

26. At slide 26 share that there are opportunities in careers relating to radon and the radon industry is young and dynamic. Provide a copy of the **"Careers match"** student handout. Have students cut out and match the career titles with the descriptions to learn about a variety of careers relating to radon. Refer to the answer key below and share the answers.

Radon Measurement Professional	Completes site visits, records data and interprets the results for indoor air quality testing.
Radon Mitigation Professional	Uses knowledge of building science and construction to design, size, optimise and install systems to reduce radon levels in buildings.
Radon Analytical Laboratory Technician	Technician that is certified to evaluate radon detection devices.
Controlling Radon in New Canadian Homes (CRNCH) Installer	Configures, installs, inspects and maintains radon systems in buildings, complying with all applicable codes, standards and safety requirements.
Mitigation Trainer	Provides education and preparation for radon professionals.
Air Quality Specialist	A scientist who may work at a factory, power plant or municipality to enforce regulations on air pollutants.
Building Scientist	Understands, analyses and improves how buildings are constructed and maintained so they last longer and perform more efficiently.
Construction Manager	Plans, organizes, directs, controls and evaluates the activities of a construction project.
Health Physicist	Investigates principles by which radiation interacts with matter and living systems.

27. Slide 27 shows the designations in Canada and courses available. With increasing awareness of radon as an issue, there is growing demand for skilled technicians in the field.

Review

28. At slide 28 explain to students they will be doing a pop quiz with multiple choice questions. To answer questions, choose one of the following:
    a. Students call out their answers
    b. Students create ABCD answer cards using scrap paper, and hold up their answers
    c. Assign each letter to a corner of the room, and tell students to move to the corner that represents their answer
29. At slide 29-50 take the quiz. The answers are revealed on the slide following the question.

Next steps

At slide 51 ask students to share what they've learned with others in their households and test for radon.

Learning Objectives

- Understanding what radon is.
- Understanding the health impacts of radon in the home.
- Understanding how to test for radon and mitigate when needed.
- Discovering career opportunities related to the radon industry

Extensions

- Explore more information on careers and certification on the Canadian–National Radon Proficiency Program (C-NRPP) website https://c-nrpp.ca/how-to-become-certified/
- Have students create educational posters that can be put around the school or in community gathering spaces
- If located in the BC Interior Health region, participate in the Student Radon Skill Testing Contest https://bclung.ca/radoncontest

Curriculum Connections

These radon resources link to the core competencies of the BC Curriculum.

Relevant core competencies:

Communications
- Connect and engage with others
- Acquire and present information

Thinking
- Creative thinking: generating ideas / evaluate and develop
- Critical thinking: question and investigate

Social Awareness and Responsibility
- Building relationships
- Contributing to community and caring for the environment

The activities also connect to a variety of grade-specific curricular competencies and content in a variety of subjects including Social Studies, Physical and Health Education and Career Education.