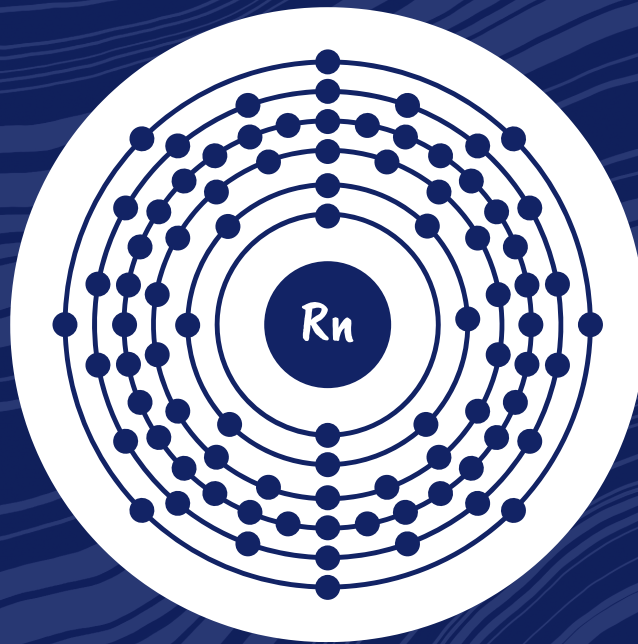


# GEOSCIENCE FOR LEAVING CERTIFICATE TEACHERS

Continuing Professional Development Course 2024



## UNDERSTANDING RADON AND ITS ENVIRONMENTAL EFFECTS LESSON PLAN

Maram Alnaimat O'Reilly (Coláiste na Ríochta),  
Pablo Rodriguez Salgado and Savannah Devine  
(both UCD, iCRAG)



# Geoscience for Leaving Certificate Teachers CPD programme

## About the Geoscience for Leaving Certificate Teachers CPD programme

Geoscience is vital for our sustainable future, and geography is the key gateway to geoscience for most students. Additionally, the new Climate Action and Sustainable Development (CASD) subject provides a brilliant opportunity to engage students with the geosciences through a new lens. The Geoscience for Teachers CPD programme has been developed by iCRAG and Geological Survey Ireland to create an opportunity for teachers of geography and CASD, and geoscience professionals to come together to increase the awareness of geoscience within the Leaving Certificate curriculum.

During the CPD course, teachers and geoscience professionals from both research and industry are paired together to co-create curriculum facing resources that are freely available for use. Over the course of six evening sessions, teachers learn more about the cutting-edge geoscience being undertaken by their partnered geoscientists, before working together to develop a curriculum-facing resource using their interests, teaching expertise and the knowledge of the geoscientist. In 2024, the resources produced have included lesson plans and module plans and the accompanying teacher notes and slides/activities for each resource.

The resources link the most recent advances in geoscience to the curriculum in a way that is both understandable and relevant. The resources are freely available to be used for classes anywhere in the world. We hope that you and your students enjoy using them.

## This Resource

This resource has been developed by teacher Maram Alnaimat O'Reilly alongside geoscientists Pablo Rodriguez Salgado and Savannah Devine. It is a fantastic interactive escape room which delves deep into Radon and its role as a geohazard. Included in this resource pack is the full lesson plan and associated teacher notes, and the escape room (both online access and the written-out version). This resource is suitable for both Leaving Certificate and TY students.

Sincerely,



Elspeth Sinclair, Fergus McAuliffe, Siobhán Power  
Programme Managers – Geoscience for Leaving Certificate Teachers

**Geological Survey Ireland**, a division of the Department of Environment, Climate and Communications, has been mapping Ireland since 1845. They continue to map the Irish land and marine territories, as well as mineral and groundwater resources. They have responsibility for actions in the current Climate Action Plan including monitoring coastal change, the Just Transition in the midland counties, and providing data for de-risking offshore renewable energy. Irish geoscience research, particularly as it contributes to the development of government policy, is an important part of their work and they fund and co-fund many research projects, including some of the iCrag research work. Their data and maps are freely available to all at [www.gsi.ie](http://www.gsi.ie).

**iCrag** is the Research Ireland Centre for Applied Geosciences hosted by University College Dublin. We are a team of researchers creating solutions for a sustainable society.

We develop innovative science and technologies to better understand the Earth's past, present, and future and how people are connected to it.

We drive research in areas that are critical to society and the economy, including:

- Sustainable discovery of energy resources and raw materials required for decarbonisation.
- Securing and protecting groundwater and marine resources.
- Protecting society from Earth's hazards such as flooding and landslides.

The iCrag Research Ireland Centre for Applied Geosciences hosted by UCD, comprises 150 researchers across ten universities and institutions. iCrag is funded by Research Ireland, Geological Survey Ireland and industry partners.

Further information is available at: [www.icrag-centre.org](http://www.icrag-centre.org)

*Disclaimer: Every effort has been made to ensure that the information in this book is accurate. Data, links, and maps are accurate as of January 2025. The publishers cannot accept responsibility for any consequences arising from the use of this resource. The publishers are in no way liable or responsible for any injury or loss to any person using this resource.*



# Lesson plan: Understanding Radon and Its Environmental Effects as a Geohazard

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# Lesson plan:

## Links to Curriculum

### i. *Links with Climate Action and Sustainable Development:*

#### **Strand 1: Earth Systems, Life, and Environment:**

- Learning Outcome 9: “Describe how a chosen local ecosystem and human wellbeing are interdependent.”
- Learning Outcome 10: “Investigate the impact of an environmental factor on a chosen local ecosystem, gather and use primary data to support conclusions.”

### ii. *Links with Physics (Modern Physics – The Nucleus):*

- Understanding the **properties of nuclear radiation** (alpha, beta, gamma).
- Using **radioactive decay and half-life equations** to calculate activity and persistence.
- Applying radioactivity knowledge to **societal and environmental contexts**, including safety and mitigation.

### *Key competencies of Literacy and Numeracy*

The senior cycle aims to create greater student engagement in subject material while developing their knowledge, skills, values, and dispositions towards the subject concurrently.

<b>Skill</b>	<b>Learning outcomes</b> Students should be able to:	<b>Attributes</b>
<b>Thinking and solving problems</b>	Develop and use a range of thinking strategies to respond to difficult and challenging problems that they encounter. This prepares them for approaching lifelong challenges in the correct manner.	Thinking and solving problems by making connections across different subjects and between prior and new knowledge.
<b>Being creative</b>	Be creative and develop a range of strategies and processes which support their creativity, encourage innovation and self expression.	-turning ideas into actions, creating new ideas, innovative designs, creative works, performances, processes, and products. -brainstorming sustainable futures and taking steps to achieve their visions.
<b>Communicating</b>	communicate meaningfully and effectively, using various tools and formats to express their views to a wide audience for different purposes while working collaboratively to achieve this.	-using a variety of tools to communicate, including languages, instruments, equipment, materials and technology.
<b>Working with others</b>	work co-operatively in pairs, groups and teams to achieve a group goal, while providing insight,	-evaluating the work collectively as it progresses and collaboratively changing the approach if necessary.

	feedback and actively listening to others' ideas.	
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## Learning Outcomes

*By the end of the lesson/project, students will:*

### Cognitive

1. Radon Overview
  - Identify radon as a natural geo-hazard in Ireland's geology.
  - Understand its health risks as an indoor air pollutant.
2. Physics and Radioactivity
  - Define radioactive decay, radiation types, and half-life.
  - Use real-world data to analyse radon levels in Ireland.
  - Perform decay-related calculations.
3. Mitigation Strategies
  - Explore radon safety measures, including testing and barriers.
  - Develop public awareness materials (e.g., posters, infographs, announcements).
4. Sustainability and Geo-Hazards
  - Link radon to sustainable development and climate-related health risks.
  - Highlight strategies for managing natural hazards like radon.

### Affective

- Appreciate scientific contributions to radioactivity research.
- Recognize radon as a public health hazard.
- Value sustainable development in reducing geo-hazards.
- Commit to promoting radon safety through effective communication.
- Foster responsibility for climate action and health-focused solutions.

### Psychomotor

- Collaborate with fellow students to escape from the virtual escape room by solving puzzles that teach students about radioactivity and sustainability using digital skills and hands-on activities.

## Keywords and Definitions

Geohazard	A natural occurrence or phenomenon that poses a risk to life, property, or the environment.
Radon	A radioactive gas from uranium decay in soil and rocks, considered a geo-hazard.
Radioactive Decay	The breakdown of unstable atomic nuclei releasing radiation.
Half-life	Time for half of a radioactive substance to decay.
Remediation	Actions taken to reduce or eliminate a hazard, such as radon barriers in buildings.
Alpha, Beta, Gamma Radiation	Types of nuclear radiation with varying properties and penetration powers.
Radon Barrier	A construction feature installed in properties to prevent radon seepage into homes and buildings.

## Linkage and Integration

### *Linkage*

- Geography: Geological maps and radon distribution.
- Physics: Radioactive decay and half-life calculations.
- Chemistry: Connections to elements like uranium and decay processes.
- Health Education: Understanding lung cancer risks and preventive measures and awareness of lung cancer risks.

### *Differentiation*

- Utilize multimedia tools to cater to diverse learning styles.
- Scaffold complex concepts, such as radioactive decay, using visual aids and examples.
- Provide advanced calculations and extension activities for higher-level and high-achieving students.
- Employ OneNote's immersive reader for students with literacy challenges and offer additional scaffolded materials for those needing extra support.
- UDL Guidelines within the lesson
  - Multiple Means of Engagement
    - 8.5 Provide feedback that encourages action
  - Multiple Means of Representation
    - 2.5 Demonstrate using various media
  - Multiple Means of Action & Expression
    - 5.3 Develop fluencies with incremental support for practice and performance

# Teacher Notes

## *General notes*

- Highlight the importance of geological factors in determining radon levels.
- Relate radon mitigation to broader environmental sustainability efforts (e.g., healthy indoor environments).
- Provide differentiated support for students with literacy or numeracy challenges.
- Encourage collaboration and active participation.
- Highlight relevance by connecting radon studies to real-world examples (e.g., radon detection in homes).
- Use formative assessments during escape room activity to gauge understanding.

## *Learning Activities*

### **Escape Room Sequence Activities:**

This is [the link for the escape room activity](#) that would be provided to students in class.

The concept of the escape room is to increase curiosity, competition, and introduce an element of fun to the class. It aims to enhance literacy, numeracy, digital literacy and working with others which are all key skills of the curriculum. The OneNote app will also assist students with literacy difficulties due to the built-in immersive reader option.

- **Room 1: The Mystery Case: Introduction to radon as a geo-hazard through a case study of lung cancer in the west of Ireland.**  
The first room introduces the students to the case they will be investigating and sets the stage for the path they will follow to solve it. The medical mystery is based on a [case study investigation based in the US for medical students](#) and the [case study lung cancer mystery by the AACT](#). Inspiration was also taken from the smoking ban in 2004 implemented by Michael Martin to show other steps that were taken to prevent lung cancer.
- **Room 2: The Source: Identify radon origins through evidence analysis.**  
Students will apply their investigative skills in this room to determine where the pollutant causing the illness is coming from by using the information provided. This step enables students to narrow down the cause and direct them towards the source that the project examines without showing the students directly. The information was taken from the [EPA](#) website.
- **Room 3: Diversity in science: Explore Marie Curie's contributions to radiation.**  
Appreciating the work of Maire Cuire will show diversity in the science field and how one person can make such a difference even in the face of adversity. It will also assist with gaining knowledge concerning radiation. The information was taken from the [Nobel Prize](#) website.
- **Room 4: Types of Radiation: classify alpha, beta, and gamma radiation with data tables and visuals /PowerPoint.**

The students will learn about the three types of radiation using the PowerPoint and the table provided. They can then solve the question needed using this information and their new understanding of the concept. Information was taken from this [website](#).

- **Room 5: Geo-Origins: Investigate uranium's natural occurrence in Ireland's geology.**

The examination of uranium will be carried out by students to determine where it comes from and its relationship to the Irish countryside. Many students will be familiar with uranium due to history, movies and other forms of media but this study will aid with dispelling any misconceptions.

- **Room 6: Decay Processes: Understanding radioactive decay and natural radiation.**

By investigating the radioactive decay reactions/ processes, students will determine how harmful radiation is and how this occurs in nature: Information was taken from this [website](#).

- **Room 7: Half-life: Calculating radon's half-life.**

With the knowledge gained previously, students will now be able to determine the half-life of radon and understand how quickly it can become a problem for people in the area.

- **Room 8: Detection Methods: Watch a demonstration video on radon testing and data interpretation.**

The students will now watch a video and learn how to test for the presence of radon in homes. Information was taken from the [EPA](#) website.

- **Room 9: Risk Mitigation: Calculate the effectiveness of radon barriers and ventilation systems.**

The concept will now be reinforced through a calculation activity for students to practice their understanding and calculation of radioactivity.

- **Room 10: Radon Levels: Use EPA radon maps to identify high-risk areas in Ireland.**

Students will examine [this map](#) of Radon levels in Ireland and gain a wider understanding of which areas in Ireland are most at risk and how radon occurs naturally there using the [following link](#).

**Final Project:**

Create a campaign poster to raise awareness about radon, focusing on risk assessment through EPA maps. Students will design a public service announcement poster emphasizing radon and its mitigation strategies.

This will enable students to show what they have learned and explain it in a manner that is approachable to the wider school and local community. A rubric and resourceful links are provided to show students what is expected and to assist them with their work.

Resource section: [EPA documents](#)

Recommended: Information leaflet to assist with their poster on radon in the home with this [link](#).

**List of materials required**

- Computers/devices with OneNote access and immersive tools.

- Rubric and resources for the PSA poster project
- Supplies for poster-making (digital/physical).

If you are not using the virtual/digital escape room, then print the escape room, place it in envelopes with the documents required for each room.

### *Detailed instructions*

- Set up escape room activities.
- Ensure digital tools (videos, maps) are preloaded and accessible.
- Introduction (5 min): Brief students on objectives and divide into groups.
- Escape Room Activities (45-60 min): Students progress in small groups, completing tasks and gathering information. Guide them through each escape room activity in sequence. Use OneNote and immersive tools for literacy support. Monitor and assist during group activities and discussions as needed.
- Poster Creation (30 min): Guide students in synthesizing their findings into an informative, visually engaging poster. Hand out the rubric and guide students on how to structure their PSA.
- Discussion and Reflection (15 min): Students present posters and reflect on radon's impact on health and sustainability.

### *Methodologies*

- Inquiry-Based Learning: Exploring radon through investigation and problem-solving.
- Collaborative Learning: Group activities, discussions, and escape room activities.
- Real-World Applications: Case studies and PSA poster creation.
- Problem-Based Learning: Utilizing case studies and escape room setups.
- Digital Literacy Tools: OneNote for accessibility.
- Active Learning: Interactive investigations and hands-on activities.

### *Assessment*

- Formative: Observe student engagement during escape room activities and monitor participation and discussions.
- Summative: Evaluate posters with a rubric for accuracy, creativity, and clarity.
- Peer Assessment: Encourage students to assess each other's work during the activities.
- Reflection: Conduct peer reviews of posters and hold class discussions on lessons learned.



## Extra information

### Resources:

Find the worksheet attached to the [virtual escape room](#)

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