GEOSCIENCE FOR LEAVING CERTIFICATE GEOGRAPHY

Continuing Professional Development Course 2023

HUMAN INTERACTION WITH THE ROCK CYCLE LESSON PLAN

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iCRAG
SFI RESEARCH CENTRE IN APPLIED GEOSCIENCES

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

Geoscience for Leaving Certificate Geography Teachers CPD programme

About the Geoscience for Leaving Certificate Geography Teachers CPD programme

Geoscience is vital for our sustainable future, and geography is the key gateway to geoscience for most students. The Geoscience for Leaving Certificate Geography Teachers CPD programme has been developed by iCRAG (the Science Foundation Ireland Centre for Research in Applied Geosciences) and Geological Survey Ireland to create an opportunity for teachers and geoscience professionals to come together to increase the awareness of geoscience within the Leaving Certificate geography 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 2023, the resources produced have included lesson plans and module plans, and the accompanying teacher notes and slides/field booklets for each resource.

The resources link the most recent advances in geoscience to the geography 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 Maryann Callinan, a geography teacher at St Oliver Post Primary and iCRAG researcher Rioko Moscardini, alongside Russell Rogers from Geological Survey Ireland. The resource is a deep dive into human interaction with the rock cycle, specifically through Geothermal Energy. Included in this resource pack is a full module plan and associated teacher notes, a PowerPoint of slides and copious further information and learning activities. It is suitable for Leaving Certificate Students.

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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.

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

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 2024. 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: Human Interaction with the Rock Cycle

Contents

Lesson plan:

Links to curriculum

Core Unit 1 Patterns and Processes in the Physical Environment

The human interaction with the rock cycle, paying particular attention to **one** of the following: mining, extraction of building materials, oil gas exploitation, geothermal energy production.	Appropriate national examples.	Appropriate international examples.

Core Unit 2: Regional Geography

- **two contrasting European regions. Students can choose one region from Scandinavia and/or one from western/central Europe (including the United Kingdom) and / or one from the Mediterranean. The study of the region should include**
  - physical processes e.g. climate, soils, relief, and drainage
  - economic processes
    - primary activities e.g. agriculture, forestry, fishing, mining/energy

Elective unit 4: Patterns and Processes in Economic Activities

Students should study

- the use of renewable and non-renewable resources in the economy
- the impact of the burning of fossil fuels and the use of alternative energy sources
- environmental pollution at a local/national and global scale
- sustainable economic development so as to control its environmental impact. Students should examine past experiences, future prospects and the necessity for environmental impact studies
- conflicts that may develop between local and global economic interests and environmental interests. Students should be familiar with the issues relating to at least two examples.

Other Areas:

Optional Unit 6: Global Interdependance

Optional Unit 9: The atmosphere-ocean environment

Specific Teaching objectives

- To give students an understanding of the principles of geothermal and the geological processes involved.
- To give students an understanding of how to identify the advantages and challenges of using geothermal energy.
- To give students an understanding of technological advancements related with geothermal energy sources.
- To determine the suitability of geothermal energy in different settings in Ireland.
- To compare geothermal energy use in Iceland and Ireland.
- To examine Ireland's future potential for geothermal energy production.

Learning Outcomes

Students should be able to:

- Understand how geothermal energy works.
- Compare the advantages and disadvantages of using geothermal energy.
- Explain how geothermal energy is currently harnessed in Ireland.
- Understand how Ireland can/will invest in future geothermal systems.

Keywords and definitions

Geothermal	Geothermal is a low carbon, renewable heat that comes naturally for the Earth.
Geothermal Gradient	The rate of increase of temperature with depth into the ground.
Porosity	Is a measure of a rocks ability to hold a fluid such as water.
Permeability	Is a measure of the ability of water to move through a rock.
Open loop system	Cold water can be pumped into the earth through one hole, while hot water will be pumped out from another hole.
Closed loop system	Water can be pumped into the earth to be heated up and taken back out through another hole.

Linkage and Integration

Linkages

- English: Oral discussion, debating, memory maps, note taking.
- Team building: Group tasks, discussion, problem identification, solutions.
- Geography/Science: Placing discussions with the wider context of environmental issues.

Differentiation

- Encourage students to ask questions and seek clarification on any aspects of the article they find challenging. The reading age and vocabulary can be challenging. Students should highlight or record any vocabulary that they don't understand. This could be a group work activity, to peer teach or research these words. If students have access to ICT, give students words to

research or otherwise use the geography dictionary. Geographical vocabulary are the building blocks of written questions and provide the structure for students to be able to write SRPS'S at leaving certificate level.

- For differentiation in homework written assignment, teachers may give the key words. Encourage students to use and explain each word in their answer. A sample answer is also provided with the intention of being used as an example of work in line with expectations of what is Higher Level Leaving Certificate. In no way is it expected to be a final and definitive solution as from the marking scheme it is clear that any discussion points are valid. It is merely intended as a teaching aid.
- To use nine of the resources together in a student led activity : use the tic-tac-toe board as formative assessment tasks. The tic-tac-toe board in a classroom is a grid that teachers present to students with filled-in spaces of different ways to reach an objective. Students have the freedom to choose which task they wish to complete. The tasks are geared toward different student interests and abilities. The central purpose to remember about this teaching method is that it allows students to choose a task that they can be confident with. Some students may not be writers, but they may be creative artists. This is why the teacher should celebrate differences in the classroom, and this activity is an adequate way to do so.

Approaches to teaching and learning

Resources

- PowerPoint.
- Photocopies of resources; either to share to use in group work or one copy per student if using as a homework activity.
- White boards may be used to complete some of the tasks, i.e. comparing geothermal to solar or wind, or think, pair and share the advantages and disadvantages of Geothermal Energy production.
- Various types of rocks.
- Note: this lesson is planned without the use of student ICT technology.

Online Resources

- Videos embedded in the PowerPoint.

Accompanying Resources

- PowerPoint and accompanying questions
- Word search
- Crossword
- Geothermal: Iceland vs Ireland
- Reading comprehensions, related questions and discussion x2
- Key words on Geothermal Energy in Ireland
- Key word definition match
- Exam question, closed test
- Tic-tac-toe board
- Fact Sheet: Geothermal Energy in Ireland
- Geography Higher Level sample question answer

Assess student learning

Assess student understanding through their participation in class discussion, group presentations, and their ability to answer questions related to the article and group topics. See more in Teacher Notes.

Teacher Notes

Human Interaction with the Rock Cycle: Geothermal Energy Production in Ireland

Learning Activities and Detailed Instructions

Introduction (5 minutes):
1. Begin the lesson by asking students what they know about renewable energy sources and whether they have heard of geothermal energy.
2. Explain the objective of the lesson: to explore geothermal energy sources in detail and to look at geothermal energy uses in Ireland in particular.

Class structure:
The PowerPoint is designed to be used in three possible ways:

1. ***Geothermal Energy use in Ireland*:** After the initial introduction to geothermal, you may choose to focus on Ireland by simply selecting Ireland on portal. This would take 40 x2 minutes to cover.

2. ***Geothermal Energy in Iceland**:* After the initial introduction to geothermal, you may choose to focus on Iceland and elsewhere by simply selecting Iceland on the portal slide. This would take 40 minutes. This is already well covered by the text books but is interesting for comparison.

3. ***In its entirety**:* it explores geothermal energy, the geological processes, examples of geothermal energy use for electricity production and more shallow geothermal heat being used for space heating and cooling, using Ireland as a case study. The lessons also aims to help students compare geologic settings in order to identify appropriate technologies. These topics would take 2x 40 minutes lessons or a 1 hour lesson.

Use of accompanying resources: The resources attached are designed to be used in various ways:

- As homework
- As retrieval exercises between lesson 1 and lesson 2.
- As group work i.e. think, pair, share.
- To provide differentiation, EFL students in particular may find the terminology challenging. Reading exercises and word searches may be used as appropriate.
- Tic- Tac-Toe board for differentiation – suggestion to print in booklet form.
- To form part of notes for higher level leaving certs in preparation for answering an exam question.
- If time permits, explore additional renewable energy sources like wind, solar, or biomass in future lessons to provide a comprehensive overview of sustainable energy options.

Suggestion for group work:
If teacher has access to a selection of rocks the 6 most common rocks of Ireland. Place a rock on each desk. Suggestion to use 3 x basalt, granite, sandstone, limestone, marble, schist or shale. Arrange students into mixed-ability groups for the group activity, ensuring that each group has a range of skills

and knowledge levels. This promotes peer learning and allows students to help and learn from each other. Ask them to form groups with the same rock type – 3 minutes.
Extension to ask the questions:

- "What is meant by the term permeable rock?"
- "Is your rock permeable?"

Written Assignments for Assessment: Differentiated (Summative Assessment)

Higher Leaving Cert Homework Task:

"Examine human interaction with the rock cycle with reference to geothermal energy production in Ireland" - 30 marks.

Sample Marking scheme

Examination 15 x SRP's

- Credit 1 x SRP for example from examination.
- Credit 1 x SRP for interaction identified from examination. All further interactions require examination.
- Credit relevant labelled diagram for 1 x SRP. Diagram without labelling 0 marks.
- Credit additional relevant information on a labelled diagram for 2 x SRP's. This must be information not already awarded in the written account.
- Question is not tied to Ireland.
- Discussion may be positive or negative.

Ordinary Leaving Cert Homework Task:

" Examine human interaction with the rock cycle with reference to geothermal energy production in Ireland" – 30 marks.
Sample Marking Scheme (2023)

Description / explanation 10 SRP's @ 3m each.

Allow one SRP for a named example.
At least one SRP for explanation.
Allow one SRP for relevant annotated diagram.
Relevant information, additional to the text, given on the diagrams can be awarded SRP's.
Positive and negative interpretation can be accepted.

Total 30m

Useful Links:

- For dealing with eco-anxiety : Climate change teaching resources | British Red Cross
- Simplified bedrock maps: https://tinyurl.com/3p628jst
- Geographical Dictionary: https://tinyurl.com/3c54yjm3
- Tic-Tac-Toe in Differentiated Instruction | Methods & Strategy - Video & Lesson Transcript | Study.com