

LESSON 2: THE ARCTIC OCEAN AND WATER CYCLE

All lesson resources can be found at: <https://encounteredu.com/teacher-resources/frozen-oceans-at-home-x-curric-7-11-lesson-2-arctic-ocean-and-the-water-cycle>

Lesson overview

Students will visit the Arctic Ocean and learn about the water cycle. They will first consider whether it rains / snows more in Belfast or the Arctic, and then will conduct a practical to link the ideas of temperature and evaporation (and precipitation). Students will then put the concepts of evaporation and precipitation into the context of the entire water cycle, through identifying the main features of the water cycle and then use a card sort to combine the processes involved (evaporation, condensation and precipitation) with the main features (seas, lakes, clouds, rivers and streams).

Details

Time

90 minutes

Curriculum links - Sci and Geog

- Name the main geographical features of the water cycle
- Observe how evaporation rates differ with temperature
- Describe the water cycle using precise vocabulary

Age






7-11 (Key Stage 2)

Lesson steps

Learning outcomes

Resources

1 5 mins ↓	Mission statement from Dr Mark Brandon Students are introduced to their lesson's mission by polar oceanographer, Dr Mark Brandon. Opportunities for literacy practice using Dr Mark Brandon's opening statement.	Understand the learning context and outcomes
2 10 mins ↓	Where? Why? How? Present students with two different locations, one in the Arctic and one in the UK. Students develop predictions on the amount of snow / rain in each location and consider how these could be tested.	Formulate hypothesis
3 10 mins ↓	Evaporation rates practical (part 1) Students will use practical observation to investigate the link between temperature and evaporation. This first stage of the practical involves the set up. The analysis and observation are addressed in Step 6.	Observe how evaporation rates differ with temperature
4 15 mins ↓	Features of the water cycle Students put their learning about evaporation rates and precipitation into context through identifying the main features of the water cycle through a 'flash diagram' activity.	Name the main geographical features of the water cycle
5 15 mins ↓	The water cycle process Students combine their knowledge of the main features of the water cycle with the processes involved (evaporation, condensation and precipitation) using a card sort activity.	Describe the water cycle using precise vocabulary

-  **Slideshow**
Slideshow 2
Arctic Ocean and the water cycle
-  **Activity Overview**
Activity Overview 2
Evaporation rates practical
-  **Student Sheets**
Student Sheet 2a
Water cycle card sort
Student Sheet 2b
Water cycle data
Student Sheet 2c
Water cycle exam style questions
-  **Answer Sheet**
Water cycle exam style questions mark scheme
-  **Subject Update**
Subject Update
Developing literacy in science

Continued on next page

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Lesson steps

Learning outcomes

- 6**
15
mins
- Evaporation rates practical (part 2)**
Students observe the samples from earlier in the lesson and describe the changes that have taken place. They put these observations into the context of the water cycle and how temperature can affect different precipitation rates in different places.

Observe how evaporation rates differ with temperature

- 7**
20
mins
- Summative assessment**
Students answer exam style questions to assess their learning.

Demonstrate learning

Differentiation

By task

To support lower ability students, focus on labeling the features in the water cycle and observing evaporation at different temperatures. Use the flash game and practical (Activity Overview 2) to facilitate this. Students can demonstrate their learning by answering Question 1(b) on Student Sheet 2c (7-9).

To challenge higher ability students, focus on using ideas about temperature to explain differences in the water cycle, using evidence to support conclusions. Use the practical (Activity Overview 2) and Student Sheet 2b to facilitate this. Students can demonstrate their learning by answering Question 2(b) on Student Sheet 2c (9-11).

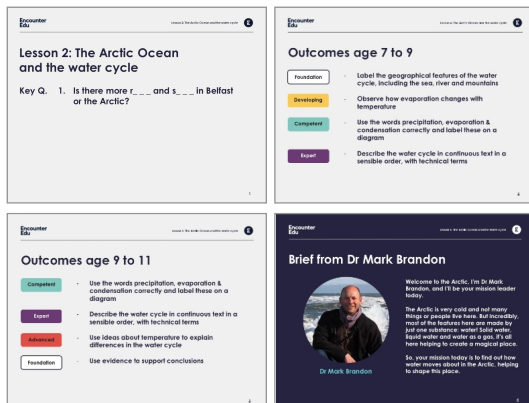
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Step

1

5 mins



Lesson 2: The Arctic Ocean and the water cycle

Key Q. 1. Is there more r... and s... in Belfast or the Arctic?

Outcomes age 7 to 9

- Foundation** - Label the geographical features of the water cycle, including the sea, river and mountains
- Developing** - Observe how evaporation changes with temperature
- Competent** - Use the words precipitation, evaporation & condensation correctly and label these on a diagram
- Expert** - Describe the water cycle in continuous text in a sensible order, with technical terms

Outcomes age 9 to 11

- Competent** - Use the words precipitation, evaporation & condensation correctly and label these on a diagram
- Expert** - Describe the water cycle in continuous text in a sensible order, with technical terms
- Advanced** - Use ideas about temperature to explain differences in the water cycle
- Foundation** - Use evidence to support conclusions

Brief from Dr Mark Brandon

Welcome to the Arctic, I'm Dr Mark Brandon, and I'll be your mission leader today.

The Arctic is very cold and not many things in Belfast are here. But incredibly, most of the features here are made by just one substance: water! Solid water could enter and water can go. It's all here helping to create a magical place.

So, your mission today is to find out how water moves around in the Arctic, helping to shape this place.

Dr Mark Brandon



The purpose of step 1 is to share the intended learning outcomes, set the context and engage students with the learning.



Ask students to write the mission title from the top left of **Slide 1**, as well as the date in their books. They can then try to guess the missing words from the Key Question, which in this case are "rain" and "snow".



Read the outcomes with the students and ask them to put their hands up to show what they can already do.



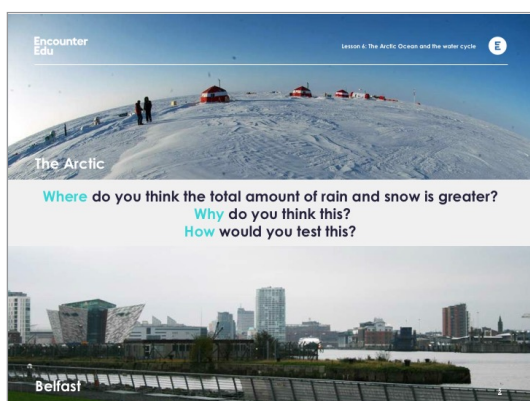
Read the mission statement on **Slide 4** from Dr Mark Brandon to put the lesson into context.



This is a good opportunity for students to take the lead and practise reading aloud.

2

10 mins



The Arctic

Where do you think the total amount of rain and snow is greater?
Why do you think this?
How would you test this?

Belfast



The purpose of Step 2 is to encourage students to think scientifically by proposing an idea with reasons and then consider what should be done to collect evidence for this.



Using **Slide 5**, ask students to discuss in groups:

1. Where they think the total amount of rain and snow is greater: Belfast or the Arctic?
2. Why do they think this?
3. How would they test their ideas?

Review answers as a whole class discussion.



Students' hypotheses [ie ideas about why they think it rains / snows more in Belfast or the Arctic] don't have to be correct.

It's important that it's about the total amount of rain and snow together.

To stimulate ideas about 'why', ask students what they have seen or about different seasons in the UK.

To stimulate 'how' ideas, ask students what happens if you leave a glass outside in the rain. Then ask how this could be useful with a ruler, ie you can measure the height of the water in the glass.

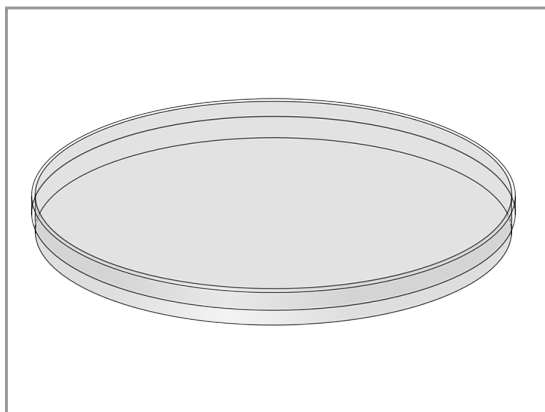
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Step

3

10 mins



Step 3 is broken up into three sections:

1. Set up the experiment (10 minutes)
2. Wait for changes to occur, and continue with other activities (30+ minutes)
3. Observe and analyse any changes that have occurred (15 minutes)



Use **Activity Overview 2 Evaporation rates practical** to guide you through the preparation, set up and running of this activity.



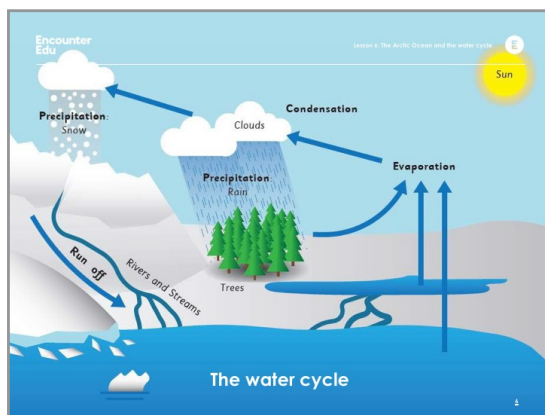
Students will need petri dishes (or similar), water and spoons to set the experiment up. Make sure you have a suitably warm and cool place in advance.



This experiment presents a low risk slipping hazard and medium risk slipping and tripping hazards. See **Activity Overview 2** for detailed Health and Safety instructions.

4

15 mins



The purpose of Step 4 is to teach or remind students about the water cycle. Younger students should recognise geographical features associated with water, older students link these together with processes like evaporation.



Print off a copy of **Slide 6**. Remember not to show this slide on the board as this will reveal the water cycle diagram that students need to draw in this 'flash diagram' activity. This is where students work in groups to reconstruct a picture from memory. All students in a group are allowed to see the picture, but with some catches explained below.



Put the students into groups and give each group a few blank sheets of A4 paper.

Explain the activity to students. As a group, students will be re-drawing a diagram on their sheet of paper. All the students in a group will get to see the diagram, but there are some catches:

1. only one group member is allowed to see the diagram at a time,
2. students cannot write or draw anything while they look at the diagram,
3. and each group member is only allowed to see the diagram for a short period of time, and this time will get shorter after each viewing.



Station yourself so that class cannot see the diagram, but there is room behind you where students can stand and "view" the diagram.

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Step



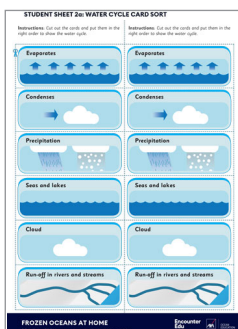
1. Each group sends up one student to view the diagram for 45 seconds.
2. Students return to their groups and start drawing.
3. Leave 45 seconds before calling the second group member. Warn the students in advance so that they focus on what is being drawn.
4. The second group member only gets a 40 second viewing before being sent back.
5. Repeat so that there are 4 or 5 viewings, each 5 seconds shorter than the last.
6. Allow students 2 minutes to finish their shared diagram.



Ask groups to share their diagrams with the class. Compare them with the full one on **Slide 6** and allow students to make additions in a different colour.

5

15 mins



Learning Check Point (Assessment for Learning)
Remind students of the learning outcome on **Slide 7**. Put the students into pairs and hand each pair one half of **Student Sheet 2a Water cycle card sort**. Ask students to put them into a circle to show the water cycle. Students can peer mark the answers using an example on **Slide 8**.



Younger students could be asked to split the cards into two groups: things that have water in and things that change water.

6

15 mins

Considering your observations

Question 1
Josh says: "Water evaporates faster in warmer conditions." How does your experiment support his conclusion?

Question 2
Jamie says: "Water boils at 100°C." Does the experiment support this conclusion? Why?

Considering your observations

Question 3
What could be done to improve the experiment?



This lesson step, completes the evaporation rates practical started at the beginning of the lesson. Use **Activity Overview 2** to complete the investigation. The outline has additional guidance.



Return the dishes to the students and ask them what they can observe. They should notice that the dishes in the warmer conditions have lost more water. Ask students to consider the following questions shown on **Slides 9 and 10**:

Q1. Josh says: "Water evaporates faster in warmer conditions". How does your experiment support this conclusion?

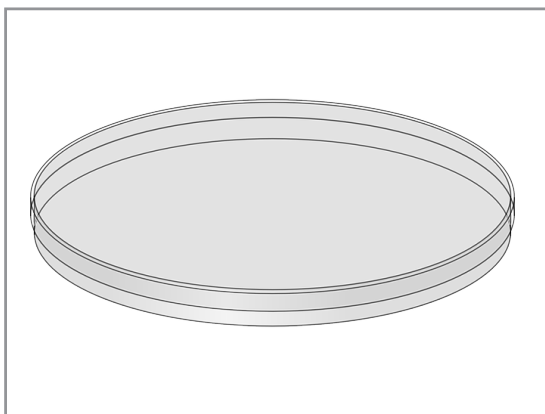
Answer: The dish in the warm place lost more water.

Q2. "Water boils at 100°C". Does the experiment support this conclusion? Why?

Answer: We can't tell because we didn't use 100°C and we didn't look for boiling.

Q3. What could be done to improve the experiment?

Answers: Measure the water out precisely with a measuring cylinder, measure the change in mass of the water, use a thermometer to measure the surrounding temperature, use more places, repeat the experiment.



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Step

STUDENT SHEET 2b: WATER CYCLE DATA

Instructions
You will be discussing the questions below. Use the diagram above and your own understanding to help you.

Questions

- How much does it rain in each of the three climates?
- Which climate has the most evaporation?
- How does the temperature affect the amount of evaporation?
- What is the effect of the amount of evaporation on the amount of precipitation?
- What is the effect of the amount of precipitation on the amount of evaporation?
- What is the effect of the amount of evaporation on the amount of precipitation in the desert and rainforest?
- What is the effect of the amount of precipitation on the amount of evaporation in the desert and rainforest?
- What is the effect of the amount of evaporation on the amount of precipitation in the desert and rainforest?

Step 4: Use the data to explain the differences in the water cycle.

What is the effect of the amount of precipitation on the amount of evaporation in the desert and rainforest?

Climate	Desert	Rainforest
Annual precipitation (mm)	100	2000

Use the data in the table to explain the differences in the water cycle.

FROZEN OCEANS AT HOME



Handout **Student Sheet 2b Water cycle data**. Ask students to discuss the questions in pairs.



As a class, discuss what the data shows. Use it to reinforce the idea that warmer places have more evaporation so there is more precipitation. Assess students through Q&A.

7

20 mins

STUDENT SHEET 2c: WATER CYCLE EXAM STYLE QUESTIONS 7-9

1 (a) The diagram shows part of the water cycle in the UK.

The letters X, Y and Z are some of the processes in the water cycle.

(i) Which letter is showing precipitation? (2 marks)

(ii) Why does the water in air condense? (1 mark)

(b) The table below shows the normal temperature in July for London, Edinburgh and the North Pole.

Place	London	Edinburgh	North pole
Normal temperature	18 °C	12 °C	1 °C

(i) What piece of equipment do we use to measure temperature? (1 mark)

(ii) Use the data in the table to help answer the next two questions: (1 mark)

(iii) Where would water evaporate fastest? (1 mark)

(iv) Explain why. (1 mark)

FROZEN OCEANS AT HOME

Final thoughts from Dr Mark Brandon

The world and our oceans are truly amazing places, but even if there are some things that we can't see, we can still see them by looking at the world around us. We can see the world around us by looking at the world around us.



The purpose of Step 7 is for students to demonstrate their learning from this lesson.



Students complete the Exam Style questions on **Student Sheet 2c** in timed conditions. Collect the questions in and mark them using the **Answer Sheet**. Give students feedback in another lesson.



Question 1 is for younger students and has a 7 minute limit. Question 2 is for older students and has a 10 minute limit (due to extended writing). See **Subject Update Developing literacy in science** for more detail on how literacy is being assessed in science in high school and beyond.



Read **Slide 11** as a class, to round off the "mission".