Encounter Edu

Our Ocean Planet

Science / Geography | Ages 7 - 11

Teacher Book

evaluated

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

AXA | OCEAN EDUCATION

Contents

Foreword	2
Overview	3-5
Scheme of work	6-13
Resource guidance	14
Subject update	15
Our Ocean Experts	16-18

Lessons

The UK seas with Paul Rose	19
UK marine habitats with Susana Lincoln	36
UK marine life with Dr Ceri Lewis and Dr Helen Findlay	43
Using our seas with Jennifer Gomez Molina	52
Our ocean voyage with Prof Alex Rogers	62
The Arctic Ocean and water cycle with Prof Mark Brandon	70
The Atlantic Ocean and climate with Prof Penny Holiday	81
The Indian Ocean and classification with Sheena Talma	90
The Pacific Ocean and plastic pollution with Jo Royle	101
The Southern Ocean and penguin adaptation with Dr Norman Ratcliffe	109
The Southern Ocean and penguin evolution with Dr Michael Dunn	114
Captain's log	126

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Welcome to Our Ocean Planet

AXA XL has a legacy of supporting ocean science research for more than 25 yearsas part of our broader commitment to sustainability, climate, and biodiversity. Our mission is simple: as a global (re)insurer, building resilience to climate and ocean-related risks is part of our mission. We're proud to lead the development of insurance solutions to the risks our planet will face in the years ahead.

Increasing and broadening ocean literacy is foundational to AXA XL's commitment to a more sustainable future.

Working with our partners, we deliver high-quality, curriculum-led and accessible educational resources through AXA Ocean Education that grow knowledge and curiosity about our ocean.

As part of AXA Ocean Education, Our Ocean Planet is our latest educational resource to help raise ocean literacy and inspire a new generation.

We hope you enjoy the materials in these pages.

Chip Cunliffe
Biodiversity Director
AXA XL

A resource by

AXA OCEAN EDUCATION

Encounter Edu

with

National Oceanography Centre

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British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Cefas

Common Seas

UNIVERSITY OF EXETER

INSTITUTE OF MARINE Engineering, Science & Technology

NEKTON

The Open University

UNIVERSITY OF OXFORD

PML Plymouth Marine Laboratory

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Overview

About Our Ocean Planet

Our Ocean Planet provides primary school teachers and students with a comprehensive topic-based approach to meet the new National Curriculum focus on the ocean. The resource has been developed in conjunction with some of the United Kingdom's leading research institutes including British Anarctic Survey, CEFAS, Common Seas, The University of Exeter, the Institute of Marine Engineering, Science and Technology, Nekton, the Open University, the University of Oxford and Plymouth Marine Laboratory. Our Ocean Planet focuses on the Geography and Science Programmes of Study for Key Stage 2, with opportunities for numeracy, literacy or creativity highlighted throughout.

On the following pages, you will find a description of the learning journey your students will follow as they develop their understanding of the ocean, its life and the impact it has on us, as well as the impact we have on the ocean.

AXA Ocean Education Programme

This resource is just one of the ways that the AXA Ocean Education programme is supporting teachers and students to learn about the marine environment. Although comprehensive, this resource is not exhaustive and further resources are detailed here to support learning about additional ocean-related topics.

Live Lessons

Each year, Encounter Edu runs Live Lessons. These feature an expedition educator embedded with a scientific research expedition, anywhere from the Arctic to the coral reef. Schools are invited to book interactive video lessons live from the expedition.

More oceans education resources

Our Ocean Planet is complemented by three existing primary school schemes of work, all of which can be downloaded for free from the Encounter Edu website.

Coral Oceans

Based on the science and findings of the XL Catlin Seaview Survey, the Coral Oceans programme looks to bring the wonder and complexity of fragile reef habitats to the classroom. A series of virtual dives give students an insight into life on the reef, its interdependence and variety, as well as the uncertain future for coral ecosystems around the world.

Frozen Oceans

The Frozen Oceans resources relate to the science of the Catlin Arctic Survey 2009-2011. The melting of the sea ice is one of the most easily identifiable signs of climate change. But this is not the only change occurring in the region, with the chemistry of the Arctic Ocean changing faster than at any other point in the past 300 million years.

Submarine STEM

The Submarine STEM units are based on the exploratory submersible journeys undertaken as part of the XL Catlin Deep Ocean Survey off Bermuda, the Sargasso Sea (between Bermuda and Canada) and off Canada's east coast. Using our exclusive galleries, videos and online 360 VR technology students are fully immersed in the deep ocean.

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Learning journey

Learning journey

This is a journey of wonder and excitement for your class, taking in the diversity and importance of Britain's surrounding seas, before heading on a round the world voyage studying everything from penguin evolution in the Southern Ocean, to the water cycle in the Arctic and a lot more in between.

As your class travel the world's oceans, they will be joined by a diverse crew of experienced ocean scientists and explorers. Each lesson is introduced by a different expert who will set the students their mission. Each lesson is based around a key question, with activities and resources to support group-based investigation and learning.

Assessment and Feedback

The lessons provide regular opportunities for Assessment for Learning (AfL) at "learning check points". In keeping with the voyage theme, each lesson can end with students writing a postcard showing what they have learnt. Alternatively, there are range of assessment worksheets, posters and exam style questions.

Working Scientifically and Geographical Skills

Every mission aims to develop a skill. These include enquiry through research, observation and classification, handling data skills and map skills. Subject specific skills development are outlined in the Scheme of Work on pages 6-8.

Numeracy and Literacy in Science and Geography

Students have the opportunity to practise extended writing: ranging from story boards and creative writing, to concise scientific explanations. There are also activities to help develop their numeracy skills including drawing graphs and analysing data. The final mission also allows students to practise public speaking.

Careers

Each lesson is framed as a mission that is set by a big name in the marine world. They will introduce the mission and pass on their final thoughts at the end.

1. UK seas with Paul Rose

Content Locational knowledge
Human and physical geography

Skills Map skills

2. UK marine habitats with Dr Susana Lincoln

Content Living things and their habitats

Skills Enquiry through research

3. UK marine life with Dr Ceri Lewis and Dr Helen Findlay

Content Living things and their habitats

Skills Enquiry through research

4. Using our seas with Jennifer Gomez Molina

Content Place knowledge
Human and physical geography

Skills Handling data

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5. Our ocean voyage with Prof Alex Rogers

Content Locational Knowledge

Skills Map skills

6. Arctic ocean and the water cycle with Dr Mark Brandon

Content States of matter

Skills Enquiry through comparative testing, observation and pattern seeking

7. Atlantic Ocean and climate with Prof Penny Holliday

Content Place knowledge
Human and physical geography

Skills Enquiry through classification

8. Indian Ocean and classification with Sheena Talma

Content Living things and their habitats

Skills Enquiry through classification

9. Pacific Ocean and plastic with Jo Royle

Content Reusing plastic

Skills Making
Evaluating

10. Penguin adaptation with Dr Norman Ratcliffe

Content Living things and their habitats

Skills Enquiry through research

11. Penguin evolution with Dr Michael Dunn

Content Evolution and inheritance

Skills Enquiry through observation and pattern seeking

12. Captain's log

Content Spoken English and presentation

Skills Public speaking

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Applicable standards

National Curriculum for England Key Stage 2

KS2 Science

Living things and their habitats	Lessons 1	2	3	4	5	6	7	8	9	10	11	12
• Recognise that environments can change.		✓	✓							✓	✓	
• Explore and use classification keys to help group, identify and name a variety of living things in the local and wider environment.								✓				
• Recognise that living things can be grouped in a variety of ways.								✓				
• Identify how animals and plants are adapted to suit their environment in different ways.		✓	✓					✓		✓		
• Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals.		✓	✓					✓		✓		
• Give reasons for classifying plants and animals based on specific characteristics.		✓	✓					✓		✓		
Evolution and inheritance												
• Recognise that living things have changed over time.											✓	
• Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.											✓	
• Understand that adaptation may lead to evolution.											✓	
States of matter												
• Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.						✓						
Working scientifically												
• Observing over time						✓					✓	
• Pattern seeking						✓					✓	
• Identifying, classifying and grouping								✓				
• Researching using secondary sources		✓	✓							✓		
• Presenting data				✓								

KS2 Geography

Locational knowledge	Lessons 1	2	3	4	5	6	7	8	9	10	11	12
• Name and locate the UK's surrounding seas.	✓											
• Develop contextual knowledge of the location of globally significant marine places including their defining physical and human characteristics.					✓							

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Applicable standards

National Curriculum for England Key Stage 2

KS2 Geography (continued)

Locational knowledge	Lessons 1	2	3	4	5	6	7	8	9	10	11	12
• Identify the position and significance of latitude including the Equator, the Tropics of Cancer and Capricorn, and the Arctic and Antarctic Circles.							✓					
• Understand geographical similarities and differences through studying the human geography of a small area of the UK.				✓								
• Understand geographical similarities and differences through the study of physical geography of a region of the United Kingdom, a region in a European country, and a region within North America.							✓					
Human and physical geography												
• Describe and understand key aspects of human geography, including: types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water.				✓								
• Use basic geographical vocabulary to refer to key physical and human features, e.g. beach, cliff, coast, sea, ocean, river, port, harbour.	✓											
• Describe and understand key aspects of the water cycle.						✓						
• Describe and understand key aspects of climate zones.							✓					
Geographical skills												
• Students work geographically by using maps and atlases to locate and describe features studied.	✓				✓							
• Students work geographically by handling and processing data.							✓					

KS2 Design & Technology

Making	Lessons 1	2	3	4	5	6	7	8	9	10	11	12
• Select from and use a wider range of tools and equipment to perform practical tasks accurately.									✓			
• Select a wider range of materials based on their properties.									✓			
Evaluating												
• Evaluate ideas and products against students' own design criteria.									✓			

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Applicable standards

National Curriculum for England Key Stage 2

KS2 English

Spoken English	Lessons 1	2	3	4	5	6	7	8	9	10	11	12
• Students give well-structured descriptions, explanations and narratives.												✓
• Students speak audibly and fluently with an increasing command of Standard English.												✓
• Students participate in presentations.												✓
• Students gain, maintain and monitor the interest of the listeners.												✓
• Students practise public speaking and self-reflection.												✓

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SCHEME OF WORK

Lesson 1: The UK seas with Paul Rose

Overview

This introductory lesson to the Our Ocean Planet topic sees students explore the seas and coasts of the United Kingdom with explorer and TV presenter Paul Rose. Students will be able to name and locate the UK's surrounding seas and major marine features and landmarks, with opportunities to develop map skills.

Learning outcomes

- Name and locate the UK's surrounding seas
- Name and locate the UK's major marine features and landmarks
- Develop appropriate marine-focused geographical vocabulary
- Develop map skills

Resources

Slideshow 1:
The UK seas

Student Sheet 1a:
UK places and seas

Student Sheet 1b:
UK marine landmarks

Student Sheet 1c:
Postcard template

Student Sheet 1d:
Travel brochure template

Lesson 2: UK marine habitats with Susana Lincoln

Overview

The ocean is not a giant bathtub nor swimming pool, but is composed of different habitats like on land. In this lesson, students learn about the five major marine habitats around the UK and the different conditions in each one. In the following lesson, students will investigate the different types of marine life that live in each habitat.

Learning outcomes

- Identify marine habitats and microhabitats
- Describe the features of major marine habitats
- Describe how some habitats change using science words

Resources

Slideshow 2:
UK marine habitats

Activity Overview 2a:
Dictogloss of marine habitats

Student Sheet 2a:
Marine habitats diagram

Student Sheet 2b:
Marine habitats and conditions cards

Student Sheet 2c:
Marine habitats and life poster

Subject Update:
Marine habits

Lesson 3: UK marine life with Dr Ceri Lewis and Dr Helen Findlay

Overview

99% of the living space of the planet is in the ocean. It is not just far off and tropical seas that have amazing marine life. The seas around the UK are host to a huge variety of life. This lesson uses a virtual ocean for students to explore the diversity, features and adaptations of marine life around the UK.

Learning outcomes

- Identify marine organisms
- Match organisms to their habitats
- Describe the adaptations of some marine organisms

Resources

Slideshow 3:
UK marine life

Student Sheet 3a:
What lives where?

Student Sheet 3b:
Marine life profiles

Student Sheet 3c:
Marine habitats and life poster (from the last lesson)

Thinglink:
Marine life

Subject Update:
How to teach evolution

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Lesson 4: Using our seas with Jennifer Gomez Molina

Overview

The sea is worth over £69 billion to the UK economy. In this lesson, students will investigate the main uses of the sea, before analysing data demonstrating the worth of the major marine industries to the UK economy. Students will develop both a knowledge of the marine economy and develop their data analysis and numeracy skills.

Learning outcomes

- Name and describe uses of the sea
- Get information from a bar chart
- Draw a chart
- Make a conclusion based on data
- Calculate a percentages

Resources

Slideshow 4:
Using our seas

Student Sheet 4a:
Using our seas

Student Sheet 4b:
How much is the sea worth?

Student Sheet 4c:
Using our seas poster

Thinglink:
How do we use the seas

Multimedia Slideshow:
Pixels marine economy

Lesson 5: Our ocean voyage with Prof Alex Rogers

Overview

This lesson introduces students to the breadth and wonder of the world's ocean. Students will learn about the names and locations of the world's oceans before looking at some of the major marine features. The lesson also sets up the students' ocean voyage over the next six lessons, where they will explore the different parts of the ocean discovering the diversity and importance of the ocean as well as some of the issues it faces.

Learning outcomes

- Name and locate the world's oceans
- Name and locate major marine features
- Write geographical descriptions for major marine landmarks

Resources

Slideshow 5:
Our ocean voyage

Student Sheet 5a:
World oceans map

Student Sheet 5b:
Marine wonders card sort

Student Sheet 5c:
Voyage map template

Subject Update:
How many oceans are there?

Lesson 6: The Arctic Ocean and water cycle with Prof Mark Brandon

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. 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 with the main features.

Learning outcomes

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

Resources

Slideshow 6:
Arctic ocean and the water cycle

Activity Overview 6a:
Evaporation rates practical

Mark Scheme 6a:
Water cycle exam style questions

Student Sheet 6a:
Water cycle card sort

Student Sheet 6b:
Water cycle data

Student Sheet 6c:
Water cycle exam style questions

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Lesson 7: The Atlantic Ocean and climate with Prof Penny Holliday

Overview

Students will investigate the relationship between latitude and climate, describing the major climate zones before investigating the impact of the ocean on climate with a specific reference to the Gulf Stream and its warming influence on the United Kingdom and northwest Europe. The lesson ends with students evaluating model answers and coming up with their own explanations.

Learning outcomes

- Describe weather and climate
- Show major climate zones on a map
- Describe the impact of latitude on climate
- Describe what is meant by the Gulf Stream and its influence on climate
- Explain the differences in climate between specific places in Europe and North America

Resources

Slideshow 7:
Atlantic Ocean and climate

Student Sheet 7a:
World city cards

Student Sheet 7b:
World climate zones

Student Sheet 7c:
Explaining the UK climate

Student Sheet 7d:
The ocean and climate

Subject Update:
Ocean circulation and climate

Lesson 8: The Indian Ocean and classification with Sheena Talma

Overview

A science focused lesson where students classify some organisms that are frequently thought to be other things: dolphins are mammals not fish; sponges are actually animals; and coral are colonies of animals that can look like trees.

Learning outcomes

- Identify living, dead and non-living things
- Group objects in different ways
- Classify living things using standard scientific groups with reasons
- Create and use a key to classify organisms
- Classify difficult organisms using standard scientific groups with reasons

Resources

Slideshow 8:
Indian Ocean and classification

Activity Overview 8a:
Sorting objects practical

Student Sheet 8a:
Classifying coral life

Student Sheet 8b:
Making a key

Student Sheet 8c:
Classification card sort

Student Sheet 8d:
Coral life fact sheet

Video:
Wonders of coral

Gallery:
Coral Life

Subject Update:
How to teach classification

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Lesson 9: The Pacific Ocean and plastic pollution with Jo Royle

Overview

Nearing the end of their ocean voyage, students will investigate one of the issues facing the world's ocean, plastic pollution. Students will begin by learning about the impact of litter on marine life. They will then explore the 3 Rs (reduce, reuse, recycle) and how they can be applied to the issue of marine plastic pollution. Students will then be guided to reuse common plastic waste to make a new useful object such as a bird-feeder or snack box.

Learning outcomes

- Understand the impact of human activity on the environment
- Understand the importance of the 3 Rs (reduce, reuse, recycle)
- Reuse plastic waste to create a high quality product
- Review product design and making against criteria

Resources

Slideshow 9:
The Pacific Ocean and plastic pollution

Activity Overview 9a:
Reusing plastic bottles

Student Sheet 9a:
Reusing plastic bottles (preparation)

Student Sheet 9b:
Reusing plastic bottles (guidance)

Student Sheet 9c:
Plastic product review

Lesson 10: The Southern Ocean and penguin adaptation with Dr Norman Ratcliffe

Overview

Students travel to the Southern Ocean and the waters around Antarctica to study how penguins have adapted to this habitat. Students will learn about the different adaptations that allow penguins to live in this frozen world and get their food from the ocean. This lesson can be used as a standalone lesson for lower Key Stage 2 students, or as an introductory lesson to the topic of evolution for upper Key Stage 2 students, which is the focus of Mission 11.

Learning outcomes

- Describe similarities between features of penguins and other birds
- Describe how penguins have adapted to their habitat

Resources

Slideshow 10:
The Southern Ocean and penguin adaptation

Student Sheet 8a:
Penguin adaptations

Thinglink:
Penguin adaptations

Subject Update:
How to teach classification

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Lesson 11: The Southern Ocean and penguin evolution with Dr Michael Dunn

Overview

Following on from their study of penguin adaptation in Mission 10, students explore how penguins might have evolved to suit past environmental changes. The core of this lesson is the Penguin Evolution Game, which simulates the six stages of adaptation that lead to evolution. This mission is best suited to older students in Key Stage 2.

Learning outcomes

- Define the terms evolution and extinction
- Explain how penguins became adapted to their habitat
- Explain how adaptation led to the evolution of penguins

Resources

Slideshow 11:
The Southern Ocean and penguin evolution

Activity Overview 11a:
Penguin evolution script

Activity Overview 11b:
Penguin evolution game

Student Sheet 11a:
Penguin adaptations

Student Sheet 11b:
Penguin adaptations

Student Sheet 11c:
Penguin adaptations

Student Sheet 11d:
Penguin adaptations

Subject Update:
How to teach evolution

Lesson 12: Captain's log

Overview

In this final lesson, students will create and deliver a presentation about their ocean voyage. Students will learn about presentation skills including delivery and slide design. Students will deliver their presentation to the class, receiving feedback from their peers. Celebrate the end of the ocean voyage with certificates or prize giving.

Learning outcomes

- Give well-structured descriptions, explanations and narratives for different purposes, including for expressing feelings
- Speak audibly and fluently with an increasing command of Standard English
- Participate in presentations
- Gain, maintain and monitor the interest of the listeners

Resources

Slideshow 12:
Captain's log

Student Sheet 12a:
Presentation storyboard

Student Sheet 12b:
Presentation peer assessment

Certificate:
Our Ocean Planet

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Teacher guidance

The Teacher Guidance for each lesson uses a set of icons as seen below to provide visual clues to support teachers:

Lesson activities

Explain
teacher exposition using slides or script to support

Demonstration / watch
students watch a demonstration or video

Student activity
activity for students to complete individually such as questions on a Student Sheet

Pair activity
activity for students to complete in pairs

Group work
activity for students to complete in groups

Whole class discussion
teacher conducts a whole class discussion on a topic or as a plenary review

Home learning
home learning exercise for after school or alternatively, a lesson extension

Teacher ideas and guidance

Assessment and feedback
guidance to get the most from AfL (Assessment for Learning)

Guidance
further information on how to run an activity or learning step

Idea
optional idea to extend or differentiate an activity or learning step

Information
background or further information to guide an activity or explanation

Technical
specific ICT or practical hints and tips

Health and safety
health and safety information on a specific activity

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Marine habitats

The sea is where we think life first evolved and it still has numerous and diverse species living in a range of habitats. This article outlines some of the important factors that combine to make each unique marine habitat.

Types of habitats

From the surface, the sea can look like one homogenous single habitat. In fact, the ocean has a huge diversity of habitats. There are many different types of marine habitats that serve as homes for different types of organisms.

Grouping habitats

Sometimes scientists talk about habitats in terms of the layer of water that they lie in:

- Pelagic or open ocean habitats lie in the water near the surface.
- Demersal and deep sea habitats lie near the bottom, towards the benthic layer or sea floor.

They also talk about how far habitats are from the shore:

- Coastal, shoreline or shallow sea habitats are near the shore, where the water is often more shallow.
- Deep ocean habitats are further out, where the water is often very deep.

Factors affecting marine habitats

Many factors affect what a marine habitat is like. The major abiotic, or non-living factors that affect marine habitats are:

- Amount of light
- Temperature
- Amount of oxygen and carbon dioxide
- Amount of nutrients in the water
- Pressure

These factors are affected by three things:

1. Depth of the water
2. Distance from the shore
3. Ocean currents and tides

Impact of depth

Generally, as you get deeper:

- It gets darker
- It gets colder
- There is less oxygen
- There is more carbon dioxide
- There are more nutrients
- The pressure gets much higher

Impact of distance from shore

Generally, if you stay at the same depth, as you get further from shore:

- The amount of nutrients can vary
- The other factors don't really change

But, as you get further from shore, because the distance to the sea floor increases and it makes things darker, it's harder for plants that live on the sea floor to grow.

Impact of currents

Currents are interesting because they can mix up the water. Currents and tides mean that marine habitats are always changing and they often don't have clear boundaries.

Perhaps the most important type of currents to marine diversity are the 'upwelling currents'. These bring cooler, nutrient-rich waters to the surface near the coast. This means that not only can the plants get lots of light and carbon dioxide in a fairly warm environment, but they can also get lots of nutrients. Most marine life lives in coastal habitats, because the conditions tend to be more favourable than the open ocean.

There are also many organisms that rely on currents to move them through the water. For instance, plankton are the many different types of very small organisms (animals, algae, bacteria, etc.) that drift along with the current.

Examples of marine habitats

Intertidal zones	Kelp forests
Sandy and rocky shores	Seagrass meadows
Salt marshes	Sea mounts
Estuaries	Deep sea vents
Mangroves	Abyssal plains

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OUR OCEAN EXPERTS

PAUL ROSE

Mission 1: The UK seas

Expedition Leader, National Geographic Pristine Seas Expeditions

Paul Rose is, amongst other things, an expedition leader, explorer, TV and radio presenter, former Vice-President of the Royal Geographical Society (with IBG) and namesake to an Antarctic mountain. For his work with NASA he received the UK Polar Medal.

SUSANA LINCOLN

Mission 2: UK marine habitats

Marine Scientist, Cefas

Susana Lincoln studied Biology in her native Spain and completed a PhD in Marine Ecology before moving to the UK, where she worked in the Plymouth Marine Laboratory for a few years before joining Cefas in 2005. Susana's career and interests have taken her to work in unique marine habitats: from the deep oceanic canyons of the Canary Islands to the seagrass meadows in the Pacific Ocean, from the man-made gas rigs of the North Sea to tropical coral reefs in the Indian Ocean, from the hot and salty Arabian or Persian Gulf to the Caribbean.

DR CERI LEWIS

Mission 3: UK marine life

Associate Professor in Marine Biology, University of Exeter

Ceri Lewis is an experienced marine biologist with expertise in how environmental change and pollution affects reproductive processes in marine animals. Ceri currently holds an associate professor position at Exeter University and is conducting research into how marine animals adapt and respond to environmental change, such as ocean acidification, climate change and increasing pollution.

DR HELEN FINDLAY

Mission 3: UK marine life

Biological Oceanographer, Plymouth Marine Laboratory

Helen Findlay completed an MSc in oceanography at the National Oceanography Centre, Southampton before moving to Plymouth to do a PhD in biological oceanography at Plymouth Marine Laboratory (PML). During her PhD Helen carried out laboratory and field research in the UK and in the Arctic. In 2010 she was awarded the Lord Kingsland Fellowship at PML to continue investigating the impacts of climate change and ocean acidification on marine ecosystems.

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OUR OCEAN EXPERTS

JENNIFER GOMEZ MOLINA

Mission 4: Using our seas

Committee Member of Offshore Renewables Special Interest Group, The Institute of Marine Engineering, Science and Technology

Jennifer coordinates teams who develop offshore wind power technologies. By arranging workshops to talk about how to work with bigger turbine blades or planning how generating hydrogen instead of electricity changes the way we need to work, she is working with others to make sure we are designing our wind farms to be safe and sustainable so that the benefits of marine renewable energy can be brought to everyone.

PROF ALEX ROGERS

Mission 5: Our ocean voyage

Professor of Conservation Biology, University of Oxford

Alex is Professor of Conservation Biology at the University of Oxford. His research focuses on biodiversity hotspots in the oceans. This work has focused on the deep sea and also on tropical coral reef ecosystems. He also works on marine policy specifically related to the sustainable management of marine resources, particularly deep-sea fisheries. Alex is an advisor to the Global Ocean Commission and on the Programme Committee of WWF. In the past, Alex has been a key scientist involved in the Core Programme on Biodiversity at the British Antarctic Survey and has worked with the Zoological Society of London.

PROF MARK BRANDON MBE

Mission 6: The Arctic Ocean and the water cycle

Associate Dean, STEM Faculty, The Open University

Mark Brandon is a Fellow of the Royal Geographical Society, and an Associate Dean at the Open University. He is also a member of the Antarctic Place Names Committee that makes recommendations for place names within the British Antarctic Territory. His research is mostly based around the way the oceans interact with the frozen parts of our planet in Antarctica and the High Arctic.

PROF PENNY HOLLIDAY

Mission 7: The Atlantic Ocean and climate

Associate Head of Marine Physics and Ocean Climate, National Oceanography Centre

Penny Holliday carries out world class research into the inner workings of our oceans. She is based at the National Oceanographic Centre but spends several weeks a year collecting data at sea. Penny values education outreach and helping young people develop science skills and ocean literacy.

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OUR OCEAN EXPERTS

SHEENA TALMA

Mission 8: The Indian Ocean and classification

Marine Scientist and Science Program Manager, Nekton

Sheena Talma is a Marine Scientist with Nekton from The Seychelles Islands. The Seychelles are made up of 115 islands located off the East Coast of Africa.

Her research focusses on how animals in our oceans have special adaptations to survive at different depths and locations.

JO ROYLE

Mission 9: The Pacific Ocean and plastic pollution

CEO, Common Seas

Jo Royle is on a mission to raise ocean ecosystem awareness at a global scale. As an experienced skipper, Jo has visited some of the most beautiful and remote places on Earth.

Jo took part in the Plastiki expedition, sailing for five months across the Pacific on a boat floating on 12,000 reused plastic water bottles! On board the team pioneered sustainable technologies aimed at reducing the impact of single use plastics.

DR NORMAN RATCLIFFE

Missions 10: The Southern Ocean and penguin adaption

Seabird Ecologist, British Antarctic Survey

Norm is a seabird ecologist who is interested in the foraging and population biology of penguins: how their find their prey, how their numbers are changing and how climate change is affecting these processes.

Prior to joining BAS, Norm studied skuas in Shetland for his PhD and then worked for RSPB as a conservation scientist, finding out how to protect threatened seabird species.

DR MICHAEL DUNN

Mission 11: The Southern Ocean and penguin evolution

Seabird Ecologist, British Antarctic Survey

Michael is a Seabird Ecologist studying seabirds, including penguins, for the British Antarctic Survey.

He's made 13 trips to the Antarctic, studying three species of penguin on a very remote island called Signy. Michael surveys the numbers of penguins, what they eat and how many chicks they produce each year. This helps him identify any changes to penguin populations and the causes of those changes. It also helps predict the size of future penguin populations.

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The UK seas with Paul Rose

Age 7-11

60-120 minutes

Curriculum links

- Name and locate the UK's surrounding seas
- Name and locate the UK's major marine features and landmarks
- Develop appropriate marine-focused geographical vocabulary
- Develop map skills

Resources

Slideshow 1
The UK Seas

Student Sheet 1a
UK places and seas

Student Sheet 1b
UK marine landmarks

Student Sheet 1c
Postcard template

Student Sheet 1d
Travel brochure template

Lesson overview

This introductory lesson to the Our Ocean Planet topic sees students explore the seas and coasts of the United Kingdom with explorer and TV presenter Paul Rose. Students will be able to name and locate the UK's surrounding seas and major marine features and landmarks, with opportunities to develop map skills.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to the Our Ocean Planet topic by Paul Rose and meet the crew of ocean experts who will guide them on their voyage.	• Understand the learning context and outcomes • Give an example of a marine job
2. **UK's surrounding seas (15 mins)** Students name and locate the UK's home nations, with their capitals and the surrounding seas on a map.	• Name and locate the UK's surrounding seas
3. **UK's major marine features and landmarks (25 mins)** Students develop their knowledge of the UK's major marine features and landmarks. They locate these on a map and can use atlases, maps and grid references as appropriate.	• Name and locate the UK's major marine features and landmarks • Develop map skills • Develop appropriate marine-focused geographical vocabulary
4. **Sharing the UK's seas (<60 mins)** Using either the Postcard or Travel brochure template, students share their learning about the UK's seas, marine features and landmarks. The time range reflects the time needed for these two different options.	• Demonstrate learning
5. **Reflection (5 mins)** Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 1 (page 1 of 3)
MISSION 1: THE UK SEAS WITH PAUL ROSE

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the slide, 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 is "land". · Read the outcomes with the students and ask them to put their hands up to show what they can already do. · Introduce the Our Ocean Planet topic. Students will learn about the UK's surrounding seas, marine life and habitats as well as how people use the sea. They will then set out on a global voyage to learn about the wonders of the global ocean, its place in all our lives and some of issues affecting it. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 1** Slides 1-5
2 15 mins	The purpose of Step 2 is for students to name and locate the UK's surrounding seas. · Hand out the age appropriate version of Student Sheet 1a UK places and seas. Ask students to solve the clues on the sheet to complete tasks one, two and three. Students should write these in pencil on their worksheet. · Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 6. Students answer the questions on Slide 7. Students can peer mark the answers using Slide 8. To support lower ability students, provide them with a list of the seas' names to help them solve the clues. Add in a few that they won't need, e.g. the Pacific Ocean and the Black Sea. Lower ability students can also work in groups. Encourage students to make corrections rather than just ticks and crosses. The answers for the five seas questions on the student sheet are: 1. North Sea, 2. Irish Sea, 3. Celtic Sea, 4. Atlantic Ocean, 5. English Channel	**Slideshow 1** Slides 6-8 **Student Sheet 1a** UK places and seas
3 25 mins	The purpose of Step 3 is for students to learn about the names, descriptions and locations of some famous marine features around the UK. Older students will practise using an atlas. · Hand out the age appropriate version of Student Sheet 1b UK marine landmarks. · Older students will also need an atlas. · Working in pairs, students complete the boxes on their Student Sheet 1a from earlier.	**Slideshow 1** Slides 9-12 **Student Sheet 1a** UK places and seas **Student Sheet 1b** UK marine landmarks

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Step	Guidance	Resources
	· They show the names, descriptions and locations of famous marine landmarks. Younger students can draw lines to the locations, whilst the oldest should try and give the six figure grid reference from the map on their worksheet. · Go through the answers as a class. · Learning Check Point (Assessment for Learning) Remind students of the learning outcomes on Slide 9. Students answer the questions on Slide 10. · Students can peer mark the answers using Slides 11-12.	
4 <60 mins	The purpose of Step 4 is for students to demonstrate their learning from this lesson. · Students can show what they have learnt by writing a postcard (Student Sheet 1c) or a travel brochure (Student Sheet 1d). · Use peer assessment to mark these and allow students time to make improvements. · Use Slide 13 to explain to students how to complete the postcard. Prepare Student Sheet 1c by cutting it in half along the dotted line. Students should draw a picture of their favourite marine landmark from the lesson on the left hand side and write a description on the right hand side, and of course write the name and address of the recipient. Students may wish to complete more than one postcard. · Using Slide 14, explain to students how to complete the two sides of the travel brochure. · Slide 14 shows the outside of the brochure: from right to left, students should draw or paste a photo; write their name and other details; and a description of the UK's coast, including places to visit. · Slide 14 also shows the inside of the brochure, where students can select aspects of what they have learnt during the lesson; writing the name and description and drawing lines to locate these on the map. The postcards are a running theme throughout and can be used to make a display. Both the brochure and the postcards are designed so that the students' decoration and learning can both be seen on a display. The postcards are a short activity, the travel brochure is much longer and in depth. The time range for this step reflects the time needed for these two different options.	**Slideshow 1** Slides 13-14 **Student Sheet 1c** Postcard template **Student Sheet 1d** Travel brochure template

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Step	Guidance	Resources
5 5 mins	The purpose of Step 5 is to help students see what they have learnt and to pass on a final message from Paul Rose. · Using Slide 15, students write in their books: · three new things they have learnt, · two things that connect this to what they already know, · and one thing they still want to know about this topic. · Select a few students to read out their answers. · Read Slide 16 as a class, to round off the mission. This is a great place to use questioning to really probe the depth of students' knowledge.	**Slideshow 1** Slides 15-16

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STUDENT SHEET 1a

UK places and seas Ages 7-8

Outcome 1
On a map label the United Kingdom's four home nations with their capitals and surrounding seas

Outcome 2
Name and give the location of some major marine landmarks around the UK

Outcome 3
Describe the features using the terms: port, cliff, river, harbour, beach, coast, sea and ocean

Task 1: Use a pencil to label the four home nations of the UK.

Task 2: Use a pencil to label their capital cities. These are marked with a ■

Task 3: The maps shows five seas surrounding the UK, marked with a number like (4)

a. Use the clues below to work out the name of each sea.

This sea is named after the compass point that points up.

This sea is named after the country to the west of the UK mainland.

This sea is an anagram of "cceilt".

This ocean is where some people think the lost city of Atlantis is found.

The missing word in this sentence is the name of this stretch of water "BBC1, BBC2, ITV1, Sky1 and E4 are all examples of TV _____."

b. Use a pencil to label the seas.

Task 4: Use the UK marine landmarks sheets to help you:

a. Draw a line from the boxes to the feature's location on the map.

b. Describe the features.

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STUDENT SHEET 1a

Name: **Atlantic Ocean**
Feature:
Description:

Name: **Fair Isle**
Feature:
Description:

Name: **Hangman Cliff**
Feature:
Description:

Name: **Poole Harbour**
Feature:
Description:

Name: **Blackpool**
Feature:
Description:

Name: **River Severn**
Feature:
Description:

Name: **Felixstowe**
Feature:
Description:

Name: **English Channel**
Feature:
Description: A sea is a smaller part of the Ocean near land.

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STUDENT SHEET 1a

UK places and seas Ages 8-10

Outcome 1
On a map label the United Kingdom's four home nations with their capitals and surrounding seas

Outcome 2
Name and give the location of some major marine landmarks around the UK

Outcome 3
Describe the features using the terms: port, cliff, river, harbour, beach, coast, sea and ocean

Outcome 4
Use an atlas to find locations

Task 1: Use a pencil to label the four home nations of the UK.

Task 2: Use a pencil to label their capital cities. These are marked with a ■

Task 3: The maps shows five seas surrounding the UK, marked with a number like (4)

a. Use the clues below to work out the name of each sea.

This sea is named after the compass point that points up.

This sea is named after the country to the west of the UK mainland.

This sea is an anagram of "cceilt".

This ocean is where some people think the lost city of Atlantis is found.

The missing word in this sentence is the name of this stretch of water "BBC1, BBC2, ITV1, Sky1 and E4 are all examples of TV _____."

b. Use a pencil to label the seas.

Task 4: Use an atlas and the UK marine landmarks sheets to help you:

a. Find the location of the landmarks, and name these on your map.

b. Name and describe the features.

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STUDENT SHEET 1a

Name:
Feature:
Description:

Name:
Feature:
Description:

Name: **Hangman Cliff**
Feature: A cliff
Description: A steep rock face on the coast.

Name:
Feature:
Description:

Name:
Feature:
Description:

Name:
Feature:
Description:

Name:
Feature:
Description:

Name:
Feature:
Description:

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STUDENT SHEET 1a

UK places and seas Ages 10-11

Outcome 1
On a map label the United Kingdom's four home nations with their capitals and surrounding seas

Outcome 2
Name and give the location of some major marine landmarks around the UK

Outcome 3
Describe the features using the terms: port, cliff, river, harbour, beach, coast, sea and ocean

Outcome 4
Use an atlas to find locations

Outcome 5
Give a six figure grid reference for locations on a map

Task 1: Use a pencil to label the four home nations of the UK.

Task 2: Use a pencil to label their capital cities. These are marked with a ■

Task 3: The maps shows five seas surrounding the UK, marked with a number like (4)

a. Use the clues below to work out the name of each sea.

This sea is named after the compass point that points up.

This sea is named after the country to the west of the UK mainland.

This sea is an anagram of "cceilt".

This ocean is where some people think the lost city of Atlantis is found.

The missing word in this sentence is the name of this stretch of water "BBC1, BBC2, ITV1, Sky1 and E4 are all examples of TV _____."

b. Use a pencil to label the seas.

Task 4: Use an atlas and the UK marine landmarks sheets to help you:

a. Find the location of the landmarks, and name these on your map.

b. Name and describe the features.

Task 5: Add the six figure grid reference for each feature on your map.

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Name:

Description:

Grid reference:

Name:

Description:

Grid reference:

Name: **Hangman Cliff**

Description: This is the highest cliff in the UK. A cliff is a steep rock face on the coast.

Grid reference: 055168

Name:

Description:

Grid reference:

Name:

Description:

Grid reference:

Name:

Description:

Grid reference:

Name:

Description:

Grid reference:

Name:

Description:

Grid reference:

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Felixstowe

Felixstowe is a town on the coast of Suffolk facing the North Sea. People have lived in Felixstowe for over 1,000 years, but it didn't become important until the port opened in 1875.

More ships load and unload goods at the Port of Felixstowe than anywhere else in the UK.

Poole Harbour

On the south coast of Dorset is an area sheltered from the sea called Poole Harbour.

The harbour was formed at the end of the last ice age when sea levels rose. It is the largest harbour in the UK, and one of the biggest in the world.

River Severn

The River Severn runs 220 miles from Plynlimon in the Welsh mountains to the sea.

On its journey, the fresh water in the UK's longest river travels through Shropshire, Worcestershire and Gloucestershire.

Hangman Cliff

On the north coast of Exmoor is Hangman Cliff. The cliff is a very steep rock face and is made from limestone.

The cliff rises to 1,043ft or 318m from the sea which makes it the highest in the UK.

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Blackpool

About 250 years ago, people started to spend their free time in a new way: by going to the beach!

Beaches are areas covered by sand or pebbles where the land meets the sea. Since 1840, when the rail station opened there have been millions of visitors making Blackpool the most popular beach in the UK.

Atlantic Ocean

An ocean is a very large body of salt water and the Atlantic Ocean is the second largest ocean in the world.

In total it covers more than one fifth of the Earth's surface. In the middle of the Atlantic there are lots of mountains deep underneath the water.

English Channel

During the last ice age, the English Channel was dry land with a massive river running down the middle.

When all the ice melted, the English Channel was flooded to make the UK's newest sea. A sea is a smaller part of an ocean near land.

Fair Isle

Fair Isle is an island with less than 100 people and only one school!

The nearest inhabited places are the Shetland Islands and the Orkney Islands which are both over 20 miles away by sea, so the island's famous coast is the most remote in the UK. The coast is where the sea meets the land.

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POSTCARD TEMPLATE

Wish you were here...

fold here

Greetings from...

fold here

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fold here

Name:

Teacher:

Class:

Date:

fold here

UK Seas & Coast

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FAIR ISLE

The UK's most remote coastline is on the Fair Isle. This is a beautiful place where the land meets the sea.

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UK marine habitats with Susana Lincoln

Age 7-11

60 minutes

Curriculum links

- Identify marine habitats and microhabitats
- Describe the features of major marine habitats
- Describe how some habitats change using science words

Resources

Slideshow 2
UK marine habitats

Student Sheet 2a
Marine habitats diagram

Student Sheet 2b
Marine habitats and conditions cards

Student Sheet 2c
Marine habitats and life poster

Activity Overview 2a
Dictogloss of marine habitats

Subject Update
Marine habitats

Lesson overview

The ocean is not a giant bathtub nor swimming pool, but is composed of different habitats like on land. In this lesson, students learn about the five major marine habitats around the UK and the different conditions in each one. In the following lesson, students will investigate the different types of marine life that live in each habitat.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to the variety of UK marine habitats by Susana Lincoln.	• Understand the learning context and outcomes • Say what a marine scientist does
2. **Habitats and conditions (15 mins)** Students use a card sort activity to identify the different habitats and conditions in the seas around the UK.	• Identify marine habitats and microhabitats • Describe the features of major marine habitats
3. **Marine habitat dictogloss (25 mins)** Using a dictogloss activity, students refine their ideas about the different marine habitats and their conditions, including introducing the process of tides. Key words can be written on the board.	• Describe how some habitats change using science words
4. **The variety of the UK seas (10 mins)** Students demonstrate learning through completing a marine habitats and conditions poster.	• Demonstrate learning
5. **Reflection (5 mins)** Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 2 (page 1 of 2)
MISSION 2: UK MARINE HABITATS WITH SUSANA LINCOLN

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the slide, as well as the date in their books. They can then try to guess the missing word from the Key Question, which in this case is "environment". Point out the silent 'n' to students. · 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 from Susana Lincoln to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 2** Slides 1-4
2 15 mins	The purpose of Step 2 is for students to learn the names of marine habitats and the conditions there, as well as develop skills in visual literacy. · Put students into groups of 3 or 4. · Hand out Student Sheet 2a Marine habitats diagram and Student Sheet 2b Habitats and conditions cards. Ask students to cut the names of the habitats out and decide where they think they go on the diagram. Ask them to do the same with the conditions.	**Student Sheet 2a** Marine habitats diagram **Student Sheet 2b** Habitats and conditions cards
3 25 mins	Use Activity Overview 2a to do the dictogloss with students. · Inform students you will be reading a short text about marine habitats aloud. Their task is to listen and use what they hear to complete the diagram on their sheet. You will be reading the text to students four times. Before each read through, tell students what they need to focus on. Read fairly slowly. · On the first read through, students just listen · On the second read through, students focus on the names of the habitats, they should add these to their diagram. · On the third read through, students should focus on the conditions of the habitats, and add these to their diagram. · On the fourth read through, students can write or add whatever they wish. · Students can then share their diagrams in pairs and make any changes.	**Slideshow 2** Slides 5-13 **Activity Overview 2a** Dictogloss of marine habitats

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Step	Guidance	Resources
	· Use Slides 5 to 8 to show students the correct answers and to introduce the idea of microhabitats on the shore with Slides 9 and 10 and discuss any differences or points of interest. · Learning Check Point (Assessment for Learning) Remind students of the learning outcomes on Slide 11. Students answer the questions on Slide 12. · Students can peer mark the answers using Slide 13. Help for students who may struggle: Instead of working individually, students could work in pairs to support each other to complete their sheet. They could then share as a four to: Add the first letter of the habitat name to each box. List the key words on the board.	
4 10 mins	· Hand out a copy of Student Sheet 2c Marine habitats and life poster to each student. · Explain to students that they will complete the names of the habitats and their descriptions this lesson and then the example organism section next lesson, when they find out about the marine life around the UK. · Students complete the habitat names and descriptions on Student Sheet 2c. · Ensure that the Student Sheets are held onto for the next lesson.	**Slideshow 2** Slide 14 **Student Sheet 2c** Marine habitats and life poster

5
5 mins
	The purpose of Step 5 is to help students see what they have learnt and to pass on a final message from Susana Lincoln.
	· Using Slide 15, students write in their books:
	  · three new things they have learnt,
	  · two things that connect this to what they already knew
	  · and one thing they still want to know about this topic.
	· Read Slide 16 as a class, to round off the mission.
		Slideshow 2
		Slides 15-16

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Dictogloss of marine habitats

Ages 7+

15 minutes

There are five main marine habitats: the shore, shallow sea, the sea floor, the deep ocean and the open ocean. The shore is where the land meets the sea; next is the shallow sea above the shelf where the water is still not very deep. Away from the land, the top 200 metres of the sea is the open ocean and the bottom is called the deep ocean. The sea floor is the ground at the bottom of the sea.

The conditions in the habitats are all different. In the open ocean there is lots of light, but there is no sea floor, so the living things there always have to float and swim. In the deep ocean lots of strange creatures live in permanently dark and cold conditions where the pressure is very high. Shallows seas are lighter and warmer than the deep ocean (although it wouldn't feel warm to us!). Lots of plants and animals live here as there is more food.

On the shore there is lots of light, but the shore is different to the rest of the habitats because it is not always wet.

The sea moves on and off the shore, which is called the tide. This means the plants and animals that live there are sometimes in the wet sea, and sometimes on dry land. Finally as you travel along the sea floor from the shore to the open ocean, the deeper you go, the darker it gets, and the higher the pressure is.

Names
- Coast
- Deep ocean
- Open ocean
- Sea floor
- Shallow sea
- Shelf
- Shore
- Slope

Processes
- Tide

Concepts
- Cold(er)
- Dark(er)
- Dry
- Environments
- High pressure
- Light(er)
- Wet

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MARINE HABITATS DIAGRAM

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STUDENT SHEET 2b

Marine habitats and conditions

Cut out the cards and put the habitats and conditions where you think they go on the diagram (Student Sheet 2a)

HABITAT

SHORE

CONDITIONS

LIGHT

MORE FOOD

HABITAT

SHALLOW SEAS

CONDITIONS

LIGHT

VERY COLD

Habitat:

DEEP OCEAN

CONDITIONS

LIGHT

SOMETIMES WET, SOMETIMES DRY

HABITAT

OPEN OCEAN

CONDITIONS

GETS DARKER AND COLDER AS YOU GO DEEPER

HABITAT

SEA FLOOR

CONDITIONS

LIGHT

LESS FOOD

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STUDENT SHEET 2c

Marine habitats and life poster

Habitat:	Habitat:	Habitat:
Description:	Description:	Description:
Example organism:	Example organism:	Example organism:
Habitat:	Habitat:	Habitat:
Description:	Description:	Description:
Example organism:	Example organism:	Example organism:

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LESSON 3

UK marine life with Dr Ceri Lewis and Dr Helen Findlay

Age 7-11

60 minutes

Curriculum links

- Identify marine organisms
- Match organisms to their habitats
- Describe the adaptations of some marine organisms

Resources

Slideshow 3
UK marine life

Student Sheet 3a
What lives where?

Student Sheet 3b
Marine life profiles

Student Sheet 2c
Marine habitats and life poster (from the last lesson)

Thinglink
Marine life

Subject Update
How to teach evolution

Lesson overview

99% of the living space of the planet is in the ocean. It is not just far off and tropical seas that have amazing marine life. The seas around the UK are host to a huge variety of life. This lesson uses a virtual ocean for students to explore the diversity, features and adaptations of marine life around the UK.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to the variety of UK marine life by Dr Ceri Lewis.	• Understand the learning context and outcomes • Say what a marine biologist does
2. **What lives in the sea? (10 mins)** Students use their own knowledge to share the animals and plants they think live in the sea.	• Identify marine organisms
3. **Marine life Thinglink (30 mins)** Using a virtual sea made with Thinglink, students explore the variety of life in the UK's seas. Students note the names, habitats and descriptions of UK marine life. Older students can list adaptations and consider how these make each organism suited to its habitat and conditions.	• Identify marine organisms • Match organisms to their habitats • Describe the adaptations of some marine organisms
4. **Marine life and habitats (10 mins)** Students use their learning from this lesson to complete their Marine habitats and life poster from the previous lesson. Older students may also wish to describe the adaptations of select marine organisms.	• Demonstrate learning
5. **Reflection (5 mins)** Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 3 (page 1 of 3)
MISSION 3: UK MARINE LIFE WITH DR CERI LEWIS AND DR HELEN FINDLAY

Step	Guidance	Resources

1
5 mins
	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning.
	· Ask students to write the mission title from the top left of the slide, 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 "animals", "plants" and "adapted".
	· Read the outcomes with the students and ask them to put their hands up to show what they can already do.
	· As a guide, the lesson steps and associated outcome are targeted at the following age groups:
	  · Step 1-2 = Age 7-9
	  · Step 1-3 = Age 9-11
	· Read the mission statement from Dr Ceri Lewis and Dr Helen Findlay to put the lesson into context.
	
	This is a good opportunity for students to take the lead and practise reading aloud.
		Slideshow 3
		Slides 1-4

2 10 mins	In small groups of 3 to 4, ask students if they can think of any types of life (plants and animals) that live in the seas around the UK. Set the class the competition of coming up with as many as possible in 5 minutes. · Student groups then share these with the rest of the class. Write the names of all the different types of marine life on the board. This offers opportunities for additional challenge: · Probe students on whether they really think that each living thing lives in the seas around the UK. · If students share a generic term such as 'fish' or 'shell', see if they can think of a specific type or species.	**Slideshow 3** Slide 5
3 30 mins	The purpose of Step 3 is for students to explore a virtual sea to become familiar with a range of common marine organisms and to describe some simple features about them. Older students can also learn how organisms in marine habitats have features which make them suited to living there. · Students conduct scientific enquiry by researching the features and adaptations of specific organisms. They then share these with other members of their group. The research is conducted using the interactive online Thinglink tool. This can be accessed using the button on slide 6, or at https://encounteredu.com/multimedia/images/what-organisms-live-in-the-seas-around-the-uk	**Slideshow 3** Slides 6-9 **Student Sheet 3a** What lives where? **Subject Update** How to teach evolution **Thinglink** Marine life

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Step	Guidance	Resources

	· Each group of 3 to 4 students will need access to a connected tablet or computer. Ensure that the electronic devices are charged and that the internet access is working.
	· Hand out copies of Student Sheet 3a. There are four sheets. Students should divide the sheets between each member of the group.
	· Outline the aim of the activity to students. Emphasise the importance of sharing information as students will be asked questions about organisms from all of the worksheets.
	· Show the class the Thinglink on the board. Demonstrate picking out the key information from the pop-outs.
	· As you roll over the icons, boxes pop out with more information:
	  · Key features and adaptations are highlighted in bold.
	  · Other science words are in italics.
	· Students use the Thinglink to complete their worksheet. Students share what they have found with their group.
	· Encourage students to ask each other spot questions to check the others have understood what has been shared.
	· Learning Check Point (Assessment for Learning). Remind students of the learning outcome on Slide 7. Students answer the questions on Slide 8.
	· Students can peer mark the answers using Slide 9.	

	Support students who may struggle: · Place students into pairs for peer support. · Provide students with a set of targeted questions, eg "How big is it?", "Is it a plant or an animal?", "What is its habitat?"	
	Challenge more able students: · Encourage these students to explain how the organism survives well because of its adaptations. So rather than: "The sea urchin's spines protect it from predators." · A student might say: "If the sea urchin finds a place on the sea floor with lots of food, it can stay there because its long, sharp spines help to protect it from predators." · This is a difficult skill and even GCSE students struggle with it.	
	For further guidance and teaching tips, use our Subject Update: How to teach evolution. Available at: https://encounteredu.com/cpd/subject-updates/how-to-teach-evolution	

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Step	Guidance	Resources
4 10 mins	The purpose of Step 4 is for students to demonstrate their learning from this lesson. · Students complete their copies of Student Sheet 2c Marine habitats and life poster from the previous lesson. · Older students can be challenged by complete profiles of different organisms to show their adaptations using Student Sheet 3b Marine life profiles. This activity is suited to home learning. To promote progress extend the activity by using peer assessment and allowing students extra time to make improvements.	**Student Sheet 2c** Marine habitats and life poster (previous lesson) **Student Sheet 3b** Marine life profiles

5
5 mins
	The purpose of Step 5 is to help students see what they have learnt and to pass on a final message from Ceri and Helen.
	· Using Slide 10, students write in their books:
	  · three new things they have learnt,
	  · two things that connect to what they already knew
	  · and one thing they still want to know about this topic.
	· Select a few students to read out their answers.
	· Read Slide 11 as a class, to round off the mission.
	
	This is a great place to use questioning to really probe the depth of students' knowledge.
		Slideshow 3
		Slides 10-11

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STUDENT SHEET 3a

What lives where?

Name: Lugworm	Name: Eelgrass
Sketch	Sketch
Habitats and conditions	Habitats and conditions
Features and adaptations	Features and adaptations

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Name: Sea urchin

Sketch

Habitats and conditions

Features and adaptations

Name: Bottlenose dolphin

Sketch

Habitats and conditions

Features and adaptations

Name: Cockles

Sketch

Habitats and conditions

Features and adaptations

Name: Egg wrack

Sketch

Habitats and conditions

Features and adaptations

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Name: Basking shark

Sketch

Habitats and conditions

Features and adaptations

Name: Anglerfish

Sketch

Habitats and conditions

Features and adaptations

Name: Hermit crab

Sketch

Habitats and conditions

Features and adaptations

Name: Cuttlefish

Sketch

Habitats and conditions

Features and adaptations

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Name: Copepod

Sketch

Habitats and conditions

Features and adaptations

Name: Barnacle

Sketch

Habitats and conditions

Features and adaptations

Name: Herring

Sketch

Habitats and conditions

Features and adaptations

Name: Scallop

Sketch

Habitats and conditions

Features and adaptations

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Name:

Habitats and conditions

Features and adaptations

Name:

Habitats and conditions

Features and adaptations

Name:

Habitats and conditions

Features and adaptations

Name:

Habitats and conditions

Features and adaptations

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Using our seas with Jennifer Gomez Molina

Age 7-11

70 minutes

Curriculum links

- Name and describe uses of the sea
- Get information from a bar chart
- Draw a chart
- Make a conclusion based on data
- Calculate a percentages

Resources

Slideshow 4
Using our seas

Student Sheet 4a
Using our seas

Student Sheet 4b
How much is the sea worth?

Student Sheet 4c
Using our seas poster

Thinglink
How do we use the seas

Multimedia Slideshow
Pixels marine economy

Extension or home learning

Students demonstrate their learning by creating a poster about the uses of the UK's seas.

Lesson overview

The sea is worth over £69 billion to the UK economy. In this lesson, students will investigate the main uses of the sea, before analysing data demonstrating the worth of the major marine industries to the UK economy. Students will develop both a knowledge of the marine economy and develop their data analysis and numeracy skills.

Lesson steps	Learning outcomes
1. Mission statement (5 mins) Students are introduced to the uses of the seas and the ideas of marine careers by Jennifer Gomez Molina.	• Understand the learning context and outcomes • Say what a Marine Engineer does • Name and describe uses of the sea
2. Marine economy & places (10 mins) Students connect learning about the uses of the sea to their learning about marine landmarks. Students consider how marine landmarks may have an economic use.	
3. Using the sea (25 mins) Using a virtual seaside, students explore how the UK's seas are used. Students note how different people use the sea in different ways.	• Name and describe uses of the sea
4. Marine economy data (25 mins) Students work through data on the UK's marine economy, developing and applying data analysis and numeracy skills. There are differentiated Student Sheets depending on the ability of your students.	• Get information from a bar chart • Draw a chart • Make a conclusion based on data • Calculate a percentage
5. Reflection (5 mins) Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 4 (page 1 of 3)
MISSION 4: USING OUR SEAS WITH JENNIFER GOMEZ MOLINA

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the slide, 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 "use", "much" and "worth". · 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 from Jennifer Gomez Molina to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 4** Slides 1-4
2 10 mins	The purpose of this activity is to refresh students' memory of coastal features. · Display the Multimedia Slideshow: Pixels marine economy on the board. Students work in groups to try and guess what the picture shows. The screen starts black, but with each click, more and more random pixels are revealed. The first team to guess correctly gets a point. Clearly explain that students need to put their hands up before answering, otherwise you may face a barrage of shouting out. Answers: 1. port, 2. beach (accept pier), 3. harbour, 4. river, 5. cliff.	**Multimedia Slideshow** Pixels marine economy
3 25 mins	The purpose of Step 3 is for students to explore a virtual seaside to research how the sea is used in a variety of ways by different people. · Show students Slide 5 and ask them to discuss in pairs what each of the words means to them. · Take feedback from the class and make a list of notes on the board. · In this activity conduct geographical enquiry by researching how the sea is used. The research is conducted using the interactive online Thinglink tool to provide context. · Each group of 3 to 4 students will need access to a connected tablet or computer. Ensure that the electronic devices are charged and that the internet access is working. · This can be accessed using the button on slide 6, or at https://encounteredu.com/multimedia/images/how-do-we-use-the-seas	**Slideshow 4** Slides 5-9 **Student Sheet 4a** Using our seas **Thinglink** How do we use the seas

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Step	Guidance	Resources

	· Show the class the Thinglink on the board. Demonstrate picking out the key information from the tool. As you roll over the image, boxes pop out with more information:
	  · Key geographical words are in highlighted in bold.
	  · Other important terms are in italics.
	· Students then access the Thinglink in groups and make notes in their book about different uses of our seas.
	· Encourage students to ask each other spot questions to check what they have understood. Share what has been found out as a class.
	· Hand out Student Sheet 4a Using our seas. Ask students to fill this from memory or their notes and then to use the Thinglink if they need help. Take feedback from the class and correct any misconceptions.
	· Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 7. Students answer the questions on Slide 8.
	· Students peer mark the answers using Slide 9.
	
	Support students who may struggle:
	· Place students into pairs for peer support
	· Provide students with a set of targeted questions, eg:
	  · "What do each of the words in bold mean?"
	  · "What two ways can we use the sea for energy?"
	  · "How can we use the sea for tourism and leisure?"
	
	Challenge more able students:
	· Ask students to think of reasons why, unlike the picture, in real life, all these activities cannot happen so close together.	

4 25 mins	The purpose of Step 4 is to help students appreciate how valuable the sea is and then to practise processing data. · Using Slide 10, ask students to predict how much they think the sea is worth. Use Slides 11-14 to tell students how much the sea is worth and to put this into context. · Using Slide 15 ask students to write a prediction about which type of use makes the most money a year. Students should explain their answers with a reason. · Students analyse data about how much each industry is worth and how many people they employ using the age appropriate student sheet (Student Sheet 4b How much is the sea worth? has versions for ages 7-9 and 9-11). Older students are expected to process numbers in terms of thousands.	**Slideshow 4** Slides 10-15 **Student Sheet 4b** How much is the sea worth?

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TEACHER GUIDANCE 4 (page 3 of 3)
MISSION 4: USING OUR SEAS WITH JENNIFER GOMEZ MOLINA

Step	Guidance	Resources
5 5 mins	The purpose of Step 5 is to help students see what they have learnt and to pass on a final message from Jennifer Gomez Molina. · Using Slide 16, students write in their books: · three new things they have learnt, · two things that connect to what they already knew · and one thing they still want to know about this topic. · Select a few students to read out their answers. · Read Slide 17 as a class, to round off the mission. This is a great place to use questioning to really probe the depth of students' knowledge.	**Slideshow 4** Slides 16-17
+ 20 mins	The purpose of this home learning assignment or lesson extension is for students to demonstrate their learning from this lesson. · Students complete a poster of the seaside to show how it is used (Student Sheet 4c Using our seas poster). To promote progress, extend the activity by using peer assessment and allowing students extra time to make improvements.	**Student Sheet 4c** How much is the sea worth?

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STUDENT SHEET 4a

Using our seas

Outcome 1.
Name some uses of the sea.

Outcome 2.
Describe how the sea is useful using geography words.

Who uses it in this way?	**Leisure and tourism**	How is it useful to them?

Who uses it in this way?	**Food and fishing**	How is it useful to them?

Who uses it in this way?	**Energy**	How is it useful to them?

Who uses it in this way?	**Shipping**	How is it useful to them?

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STUDENT SHEET 4b

How much is the sea worth? Ages 7-9

Outcome 3.
Use the bar chart for information.

Graph to show the number of people that work in the different industries.

1. How many people work in the shipping industry?

..... **thousand people.**

2. Which industry has the most people working in it?

.....

3. How many more people work in energy than in fishing?

..... **thousand people.**

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Table to show the amount of money each industry made in one year.
In total, £69,100 million was made by major marine industries.

Industry	Money made (£ millions)
Energy	31,100
Shipping	18,900
Tourism and leisure	17,100
Fishing	2,000

Outcome 4.
Draw a chart on your own.

4. Use the information in the table to label the pie chart correctly.

Outcome 5.
Make a conclusion.

"In total, £69,100 million was made by marine industries.
The fishing industry made £2,000 million of this."

5. Does the information support your prediction?

.....

6. Explain your answer to question 5.

.....

.....

.....

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STUDENT SHEET 4b

How much is the sea worth? Ages 9-11

Outcome 3.
Use the bar chart for information.

1. How many people work in the shipping industry?

.....

2. Which industry has the most people working in it?

.....

3. How many more people work in energy than in fishing?

.....

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Table to show the amount of money each industry made in one year.
In total, £18,500 million was made by major marine industries.

Industry	Money made (£ billions)
Energy	31.1
Shipping	18.9
Tourism and leisure	17.1
Fishing	2

Outcome 4.
Draw a bar chart on your own.

4. Draw a bar chart to show this. Use the graph paper below.

Outcome 5.
Make a conclusion.

"In total, £69.1 billion was made by marine industries.
The fishing industry made £2 billion of this."

5. Does the information support your prediction?

.....

6. Explain your answer to question 5.

.....

.....

Outcome 6.
Work out percentages.

7. What percentage of the money made by marine industries comes from energy?

.....

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Using our seas poster

Type of use:	Type of use:
Description:	Description:
Worth:	Worth:
Type of use:	Type of use:
Description:	Description:
Worth:	Worth:

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Our ocean voyage with Prof Alex Rogers

Age 7-11

105 minutes

Curriculum links

- Name and locate the world's oceans
- Name and locate major marine features
- Write geographical descriptions for major marine landmarks

Resources

Slideshow 5
Our ocean voyage

Student Sheet 5a
World oceans map

Student Sheet 5b
Marine wonders card sort

Student Sheet 5c
Voyage map template

Subject Update
How many oceans are there?

Lesson overview

This lesson introduces students to the breadth and wonder of the world's ocean. Students will learn about the names and locations of the world's oceans before looking at some of the major marine features. The lesson also sets up the students' ocean voyage over the next six lessons, where they will explore the different parts of the ocean discovering the diversity and importance of the ocean as well as some of the issues it faces.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to the ocean voyage they will go on for the next six lessons.	• Understand the learning context and outcomes • Say what a conservation biologist does
2. **Our ocean in numbers (5 mins)** Students guess the answers to ocean questions choosing from a list of numbers on the board.	• Engage students
3. **Naming and locating the oceans (20 mins)** Students follow clues to name and locate the world's oceans. Students also try to solve the problem of counting the number of oceans.	• Name and locate the oceans • Explain the problem of trying to count the number of ocean(s)
4. **Marine wonders (20 mins)** Students explore some of the world's major marine features. This is also an opportunity to practise atlas skills or the use of online maps.	• Name and locate major marine features
5. **Voyage map (45 mins)** Using the idea of a marine chart, students use the map template to make their own voyage map, where they can record their learning over the next weeks as they explore the world's oceans.	• Write geographical descriptions for major marine features • Apply map skills • Demonstrate learning
6. **Reflection (10 mins)** Use the reflection pyramid to guide students to review their learning for this lesson.	• Reflect on learning

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TEACHER GUIDANCE 5 (page 1 of 4)
MISSION 5: OUR OCEAN VOYAGE WITH PROF ALEX ROGERS

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the slide, 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 "wonders" and "sea". · 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 from Prof Alex Rogers to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 5** Slides 1-4
2 5 mins	The purpose of Step 2 is to bring some "wow factor" about the ocean with some numbers. · Show students the numbers on Slide 5. Tell them that the answers to your questions are on the slides. Read the questions and ask students to decide on their answers. Go through the answers as a class, emphasising the importance and scale of the ocean. · Ask students to look at the numbers on the slide. The answer to your questions will be one of those numbers and they have to guess. 1. What percentage of the Earth's surface is covered by water? (71%) 2. What percentage of the ocean has been explored? (5%) 3. What percentage of living space is in the ocean? (99%) 4. What's the average depth of the ocean in kilometres? (3.7km) 5. What percentage of the Earth's water is in the ocean? (97%) 6. How deep can light go in the ocean in metres? (200m) 7. How many teaspoons of salt in every litre of sea water? (6 tsps)	**Slideshow 5** Slide 5

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Step	Guidance	Resources
3 20 mins	The purpose of Step 3 is for students to learn the names and locations of the world's oceans, and for older students to appreciate that the five oceans (or more correctly the five ocean basins) are all connected. · Hand out Student Sheet 5a, and show students the Learning Outcome on Slide 6. · Next show students the clues on Slide 7. The aim is to use the clues to work out the names of each of the numbered oceans and to label these on the map on Student Sheet 5a. · Review with your students, using Slide 8. · Show older students the different ocean diagrams on Slides 9 to 12. Use the following questions to promote whole class discussion: · What do the students notice? · Which one of the four diagrams is 'correct'? Why? · Highlight that the water and currents are shared between the different oceans, so they could all be counted as one. · Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 13. · Students answer the questions on Slide 14. · Students can peer mark the answers using Slide 15. See Subject Update: How many oceans are there? for more background information on this topic. This can be accessed at: https://encounteredu.com/cpd/subject-updates/learn-more-how-many-oceans-are-there	**Slideshow 5** Slides 6-15 **Student Sheet 5a** World oceans maps **Subject Update** How many oceans are there?
4 20 mins	The purpose of Step 4 is for students to explore, name and locate famous marine features. · Hand out Student Sheet 5b. Students will need to cut out the cards and then match the names to the descriptions. Encourage them to use the pictures to help. · Review the answers with students: · Great Barrier Reef, Largest coral habitat, Australia · Mauna Kea, Tallest mountain (not highest), Hawaii, Central Pacific · Southern Ocean, Roughest ocean, all around Antarctica · Challenger Deep, Deepest place on Earth, Pacific · Red Sea, Saltiest sea, Africa / Middle East · Mid Atlantic Ridge, Underwater mountain range, Middle of the Atlantic · Bay of Fundy, Biggest different between high and low tide, Canada	**Slideshow 5** Slides 16-18 **Student Sheet 5b** Marine wonders card sort

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Step	Guidance	Resources
	· Hand out the atlases. Students use these to find the locations of the features on a world map. · Students add the name and description of each marine feature to the map on Student Sheet 5a World oceans map. · Learning Check Point (Assessment for Learning. Remind students of the learning outcome on Slide 16. · Students answer the questions on Slide 17. · Students can peer mark the answers using Slides 18.	

5
45 mins
	The purpose of Step 5 is for students to demonstrate their learning from this lesson.
	· Show students the map on Slide 19. Explain that over the next six lessons, they will be going on a voyage around the world's oceans. An indicative line indicates the learning journey on the map.
	· Students will make their own map and add a post card home each week demonstrating their learning.
	· Students should be provided with craft materials to make their own voyage map:
	  · Large sheet of paper, eg sugar paper at least A2 size
	  · Scissors and glue
	  · Coloured pencils or pens
	  · Copy of Student Sheet 5c Voyage map template
	· Students should follow the steps on Slide 20 to create their voyage map:
	  · Copy the outline of the world map onto their sheet of paper
	  · Add the names of the world's oceans
	  · Add their name at the top
	· Optional:
	  · Add any of the marine features they have learnt about this lesson (they can stick the card sort cards onto the map)
	  · Copy or cut out and stick examples of ocean exploration pictures (eg research vessel, compass rose, submersible and the elusive giant squid)
		Slideshow 5
		Slides 19-20
		Student Sheet 5c
		Voyage map template

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TEACHER GUIDANCE 5 (page 4 of 4)
MISSION 5: OUR OCEAN VOYAGE WITH PROF ALEX ROGERS

Step	Guidance	Resources

6
10 mins
	· The purpose of Step 6 is to help students see what they have learnt and to pass on a final message from Prof Alex Rogers.
	· Using Slide 21, students write in their books:
	  · three new things they have learnt,
	  · two things that connect this to what they know already
	  · and one thing they still want to know about this topic.
	· Select a few students to read out their answers.
	· Read Slide 22 as a class, to round off the "mission".
	
	This is a great place to use questioning to really probe the depth of students' knowledge.
		Slideshow 5
		Slides 21-22

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WORLD OCEANS MAP

Name:

Description:

Name:

Description:

Name:

Description:

Name:

Description:

Name:

Description:

Name:

Description:

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Marine wonders card sort

GREAT BARRIER REEF		This has the biggest difference between the high and the low tide: 16.3m which is taller than a 3 storey building! Location: east coast of Canada
MAUNA KEA		This is the largest coral habitat in the world. Location: off the east coast of Australia
SOUTHERN OCEAN		This is the deepest place on Earth. It is 10,925m below sea level. Location: in the Pacific Ocean
CHALLENGER DEEP		This is the roughest ocean in the world, making tall, steep waves. This happens because of the wind and current. Location: all around Antarctica
RED SEA		An enormous, mostly underwater mountain range that runs for over 10,000 miles. Location: middle of the Atlantic Ocean
MID ATLANTIC RIDGE		This is the saltiest sea on Earth. Location: between Africa and the Middle East
BAY OF FUNDY		The tallest mountain in the world at over 10,000m, but most of it is below the sea. Location: Hawai'i, centre of the Pacific

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VOYAGE MAP TEMPLATE

Title:

Name:

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The Arctic Ocean and water cycle with Prof Mark Brandon

Age 7-11

90 minutes

Curriculum links

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

Resources

Slideshow 6
Arctic Ocean and the water cycle

Student Sheet 6a
Water cycle card sort

Student Sheet 6b
Water cycle data

Student Sheet 6c
Water cycle exam style questions

Activity Overview 6a
Evaporation rates practical

Mark Scheme 6a
Water cycle exam style questions

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. 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 with the main features.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to their lesson's mission by polar oceanographer, Prof Mark Brandon.	• Understand the learning context and outcomes
2. **Where? Why? How? (10 mins)** Students develop predictions on the amount of precipitation in different locations and consider how these could be tested.	• Formulate hypotheses
3. **Evaporation rates pt.1 (10 mins)** Students will use practical observation to investigate the link between temperature and evaporation.	• Observe how evaporation rates differ with temperature
4. **Features of the cycle (15 mins)** Students put their learning about evaporation rates and precipitation into context through identifying the main features of the water cycle.	• Name the main geographical features of the water cycle
5. **The water cycle process (15 mins)** Students combine their knowledge of the main features of the water cycle with the processes involved.	• Describe the water cycle using precise vocabulary
6. **Evaporation rates pt.2 (15 mins)** Students observe the samples from earlier in the lesson and describe the changes that have taken place.	• Observe how evaporation rates differ with temperature
7. **Summative assessment (20 mins)** Students answer exam style questions to assess their learning.	• Demonstrate learning

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TEACHER GUIDANCE 6 (page 1 of 3)
MISSION 6: THE ARCTIC OCEAN AND THE WATER CYCLE

Step	Guidance	Resources
1 5 mins	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 2, 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 5 from Prof Mark Brandon to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 6** Slides 1-5
2 10 mins	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 6, 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.	**Slideshow 6** Slide 6
3 10 mins	In step 3, students set up an evaporation rates practical. They will observe and analyse any changes later on in the lesson. · Use Activity Overview 6 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.	**Activity Overview 6a** Evaporation rates practical

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Step	Guidance	Resources
	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 6 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 7. 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. · Each group sends up one student to view the diagram for 45 seconds. Students return to their groups and start drawing. · Leave 45 seconds before calling the second group member. Warn the students in advance so that they focus on what is being drawn. · The second group member only gets a 40 second viewing before being sent back. · Repeat so that there are 4 or 5 viewings, each 5 seconds shorter than the last. 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 7 and allow students to make additions in a different colour. Station yourself so that class cannot see the diagram, but there is room behind you where students can stand and "view" the diagram.	**Slideshow 6** Slide 7 (printed)

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MISSION 6: THE ARCTIC OCEAN AND THE WATER CYCLE

Step	Guidance	Resources
5 15 mins	Learning Check Point (Assessment for Learning Remind students of the learning outcome on Slide 8. · Put the students into pairs and hand each pair one half of Student Sheet 6a 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 9. Younger students could be asked to split them into two groups: things that have water in and things that change water.	**Slideshow 6** Slides 8-9 **Student Sheet 6a** Water cycle card sort
6 15 mins	This lesson step, completes the evaporation rates practical started at the beginning of the lesson. Use Activity Overview 6 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 Slide 10. · Answer 1: The dish in the warm place lost more water. · Answer 2: We can't tell because we didn't use 100°C and we didn't look for boiling. · Answers 3: 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. · Hand out Student Sheet 6b 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.	**Slideshow 6** Slide 10 **Student Sheet 6b** Water cycle data **Activity Overview 6a** Evaporation rates practical
7 20 mins	The purpose of Step 7 is for students to demonstrate their learning from this lesson. · Students complete the Exam Style questions on Student Sheet 6c in timed conditions. · Collect the questions in and mark them using the Mark Scheme. · Give students feedback in another lesson. · Read Slide 11 as a class, to round off the "mission". Question 1 is for younger students (7 minutes) Question 2 is for older students (10 minutes) Use Subject Update: How to develop literacy in science for more detail on how literacy is being assessed in science in high school and beyond.	**Slideshow 6** Slide 11 **Student Sheet 6c** Water cycle exam style questions **Mark Scheme 6a** Water cycle exam style questions

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Evaporation rates practical

Age 7+
(adult supervision)

30 minutes

Details

Each group will need

- 2 sticky notes
- 2 petri dishes / watch glasses / jam jar lids
- A spoon or pipette
- 10ml of water in a small container (eg a yoghurt pot)
- 2 class trays (optional)
- Prearranged warm and cold locations

Safety and Guidance

Cutting injuries - broken glass

- Students should carry watch glasses with two hands, carefully observing the environment around them
- You may want to ask students to place the dishes in the environments before adding the water, depending on how likely they are to drop things
- Spills should be reported to an adult immediately

Slipping on water

- Students should carry watch glasses with two hands, carefully observing the environment around them
- Breaks should be reported to an adult immediately, and students should not attempt to clear these themselves

Tripping over trays

- Ensure that trays are placed out of the way and clearly signed

Overview

In this activity students investigate how the amount of evaporation is affected by the surrounding temperature. They do this by observing water loss in two different places: one warm and one cold. They will then go on to use their observations to help them interpret data about evaporation rates from the sea.

Preparation

Identify a suitably warm and cool place (eg on top of a radiator and on a window sill). If you cannot find a place in your classroom, arrange another place, eg outside, the staff room fridge, or another classroom with a better radiator.

Running the activity

1. Outline aim of the activity and safety instructions to students.
2. Indicate the warm and cool places. If you are using trays to take the dishes somewhere else, point them out and clearly label them.
3. Give each pair of students their equipment.
4. Ask them to write “warm” on one sticky note and “cold” on the other.
5. Ask them to write both their names on the sticky notes.
6. Ask them to add a teaspoon (about 5ml) of water to each of their dishes.
7. One partner takes one of the dishes and the sticky notes labelled “warm” and takes it to the warm place / tray.
8. The other partner takes the other dish, the sticky note saying “cold” and takes it to the cold place / tray.
9. If you have used trays, send a pair of students with an adult to the prearranged place, with clear safety instructions.
10. Set the timer for about 30 minutes.
11. Ask students to predict what they think will happen and why.
12. Leave the dishes for 30 minutes.
13. Continue with the next portion of the lesson.

Observation and analysis

- After 30 minutes, or when you have finished with the other lesson activities, 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.

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Water cycle exam style questions

Question			Marks	Answer
1	a	i	1	Condensation - Z
			1	Precipitation - X
		ii	1	It cools
	b	i	1	Thermometer
		ii	1	London
		iii	1	It is the warmest place: - Accept "it's warmer", "it's hotter" or "it's the hottest". - Accept "the other places are colder". - Do not accept "it's warm" or "it's hot" unqualified as the marks are for a comparison. - Do not accept "the other places are cold" unqualified as the marks are for a comparison.

Question		Marks	Marks	Literacy	Content
2	a	4	1-2	Some spelling errors. Capitals and full stops often not used correctly. The answer has little organisation. Few scientific words used.	The idea that there is water in the sea, rivers and lakes and in the sky. The idea that water moves in a cycle between these areas.
			3-4	Few spelling errors Capital and full stops used correctly The answer is well organised Many scientific words are used	The idea that water moves between the sea and sky by evaporation when it is warm The idea that water forms clouds as it rises and cools down The idea that water returns to the ground in precipitation and the sea as run off and underground
			Award ZERO marks for only ONE correct row Award ONE mark for TWO or THREE correct rows Any row with more than one tick is marked incorrect		
	b	2	It is normally hotter in London than in Svalbard - CANNOT TELL The temperature of an ocean and the amount of precipitation in towns close to it, are not related - DOES NOT SUPPORT The hotter a place is, the more evaporation there is - CANNOT TELL It rains more in Edinburgh than London - CANNOT TELL		

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Water cycle card sort

Instructions: Cut out the cards and put them in the right order to show the water cycle.

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Water cycle data

The annual precipitation for the other UK nation capitals

Capital	Cardiff, Wales	Edinburgh, Scotland	London, England
Annual precipitation (cm)	115	70	60

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

Questions
(Step 2)
Observe how evaporation is different at different temperatures.

1. How much does it rain in Alert over the year?

.....

2. Which place:
   a. has a lower temperature?
   b. has more rain and snow?
   c. has more evaporation?

A -
.....

B -
.....

C -
.....

3. When it's hotter in an ocean, what happens to the amount of evaporation?

.....

(Step 5) Use ideas about temperature to explain differences in the water cycle.

4. When it's hotter in an ocean, what happens to the amount of precipitation in the towns and cities near to it?

.....

5. Use your answer to question 4 to explain your answer to part 5.

.....

.....

(Step 6) Use evidence to support conclusions.
The annual precipitation for the other UK nation capitals is shown in a table.
6. Does this support your answer to question 5? Explain your answer.

.....

.....

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

The arrows X, Y and Z are some of the processes in the water cycle. (2 marks)

(i) Which arrow is showing:

the water condensing? ☐ precipitation? ☐

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

.....

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

Place	London	Edinburgh	North Pole
Normal Temperature	19°C	13°C	1°C

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

.....

(ii) Using the table - in which place would water evaporate fastest? (1 mark)

.....

(iii) Explain why (1 mark)

.....

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2 (a) Using the first diagram, describe what happens in the water cycle. (4 marks)

.....

.....

.....

.....

.....

.....

The table below shows the average daily temperature and the total yearly precipitation in London, Edinburgh and Svalbard, in the Arctic.

Place	London	Edinburgh	Svalbard
Closest ocean's temperature	8 to 12	8 to 12	-2 to 4
Precipitation (cm)	60	70	27

2 (b) For each of the conclusions below, tick ONE box in each row of boxes to say if the evidence, supports or doesn't support it, or if you cannot tell. (2 marks)

	Supports	Doesn't support	Can't tell
It is normally hotter in London than Svalbard.	☐	☐	☐
The temperature and the amount of rain are not related.	☐	☐	☐
The hotter the place is, the more evaporation there is.	☐	☐	☐
It rains more in Edinburgh than in London.	☐	☐	☐

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The Atlantic Ocean and climate with Prof Penny Holiday

Age 7-11

80 minutes

Curriculum links

- Describe weather and climate
- Show major climate zones on a map
- Describe the impact of latitude on climate
- Describe what is meant by the Gulf Stream and its influence on climate
- Explain the differences in climate between specific places in Europe and North America

Resources

Slideshow 7
Atlantic Ocean and climate

Student Sheet 7a
World city cards

Student Sheet 7b
World climate zones

Student Sheet 7c
Explaining the UK climate

Student Sheet 7d
The ocean and climate

Subject Update
Ocean circulation and climate

Lesson overview

Students will investigate the relationship between latitude and climate, describing the major climate zones before investigating the impact of the ocean on climate with a specific reference to the Gulf Stream and its warming influence on the United Kingdom and northwest Europe. The lesson ends with students evaluating model answers and coming up with their own explanations.

Lesson steps	Learning outcomes
1. Mission statement (5 mins) Students are introduced to their lesson's mission by Prof Penny Holliday.	• Say what a senior ocean scientist does
2. Weather words (5 mins) Present students with two different locations, one in the United Kingdom and one in sunnier climes. Students demonstrate and develop their weather vocabulary.	• Describe weather and climate
3. Climate and latitude (20 mins) Students will examine the relationship between climate and latitude, learning about the major climate zones.	• Describe the impact of latitude on climate
4. Climate and the ocean (10 mins) Students are asked to predict how cities on different and similar latitudes rank in terms of average temperature. Students are then introduced to the influence of ocean currents on climate.	• Describe what is meant by the Gulf Stream and its influence on climate
5. Explaining influences on climate (20 mins) Students evaluate descriptions of the impact of latitude and the ocean climate and develop their own explanations.	• Explain the differences in climate between specific places in Europe and North America
6. Summative assessment (20 mins) Students demonstrate their learning by completing a map and through extended writing.	• Demonstrate learning

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TEACHER GUIDANCE 7 (page 1 of 3)
MISSION 7: THE ATLANTIC OCEAN AND CLIMATE

Step	Guidance	Resources
1 5 mins	This lesson is in an alternative order. The objective and outcomes are actually shared in the middle of the session. This is to facilitate the enquiry based approach. Students get some foundation knowledge before being asked the key question. · Ask students to write the mission title from the top left of the slide, as well as the date in their books. · Read the mission statement from Prof Penny Holliday to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 7** Slides 1-3
2 5 mins	The purpose of Step 2 is for students to share weather words. Weather words that you might expect, include: hot, cold, warm, cool, windy, sunny, damp, raining, clear, snowy, wet, dry. · Ask students to give you weather words that come to mind from Slides 4 and 5.	**Slideshow 7** Slides 4-5
3 20 mins	The purpose of Step 3 is for students to use their knowledge about places to understand climate zones. This may be prior knowledge for some students, but it is useful to recap to put the influence of the ocean on climate in context. · Hand out Student Sheet 7a World city cards. · Looking at Slide 6, ask students to rank the cities on the light cards from the warmest to the coolest. · Show students the graph and map on Slides 7 and 8. Discuss any differences between their ranking and the actual data. · Show the climate zones on Slide 9, and explain the major climate zones, emphasising that the areas near to the equator are warm and then the climate cools towards the polar regions. · Hand out Student Sheet 7b World climate zones and ask students to complete it using Slide 9 to help. · On student sheet 7b, students demonstrate their learning of Outcome 2 by answering Question 1. · They can demonstrate their learning of Outcome 3 by answering Questions 2 and 3. · You can differentiate this task by asking younger students to complete just Questions 1 and 3. · Use the Red vs Green Slides (Slides 9 to 24) to pose questions to consolidate knowledge of the major climate zones. Students use the traffic light cards or point with their arms to indicate their answers.	**Slideshow 7** Slides 6-25 **Student Sheet 7a** World city cards **Student Sheet 7b** World climate zones

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Step	Guidance	Resources
4 10 mins	The purpose of Step 4 is to introduce students to the idea that the ocean influences climate as well as distance from the equator. More able students will be able to develop explanations for why the climate in the United Kingdom is warmer than Canada at a similar latitude. · Tell students they now need the two darker cards saying "Venice" and "Ottawa" from Student Sheet 7a World city cards. · Show students the map on Slide 26. Ask them to add these two cards to their previous ranking. · Ask students to share their ranking. Can students give reasons for their answers? Slide 27 offers a frame for making this prediction. · Show students Slides 28 and 29 to highlight that Ottawa is colder. Why do students think that this may be the case? More able students should also include Bordeaux and their own town in the ranking exercise. You can use this step as an opportunity to increase place knowledge of Canada, Italy and France.	**Slideshow 7** Slides 26-29 **Student Sheet 7a** World city cards
5 20 mins	Use the whole class discussion to lead into today's key question on Slide 30. They can try to guess the missing words from the Key Question, which in this case are "warmer" and "Canada". Share the learning outcomes on Slide 31 with students. · Show students Slide 32. Ask them what they think it shows. · Emphasise that rather than Ottawa being colder, the UK is warmer than expected because of the Gulf Stream which brings warm water from the Caribbean. · Show students Slide 33 and use it to explain that because of the ocean conveyor belt, the major climate zones do not go in parallel bands around the Earth. · Hand out Student Sheet 7c Explaining the UK climate. Ask students to cut the explanations out and rank them from best to worst. · Samha's is the weakest because she doesn't mention the Gulf Stream. · Wiktoria's and Justin's are the strongest, but both are still lacking. Wiktoria's doesn't explicitly say that the sea warms the UK. Whereas, Justin's does actually say the UK is warmer than Canada. · Mariano's answer sits somewhere in between Samha's and Wiktoria's / Justin's. He clearly says the UK is warmer than Canada and that this is because of the Gulf Stream, but he doesn't explain that the Gulf Stream is a current that brings warm water up from the tropics.	**Slideshow 7** Slides 30-36 **Student Sheet 7c** Explaining the UK climate

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Step	Guidance	Resources
	· Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 34. Students complete the cloze task on Slide 35. Students can peer mark the answers using Slide 36.	
	For less able students, you may want to get them to only look at two of the explanations, in which case use Samha's and Wiktoria's. You may also want to write the words / phrases for the cloze task on the board: ocean, warmer, close to, warmer, Gulf Stream, further away from, warmer, warmer.	

6
20 mins
	The purpose of Step 6 is for students to demonstrate their learning from this lesson and to pass on a final message from Prof Penny Holliday.
	· Students demonstrate what they have learnt by completing a map and through extended writing using Student Sheet 7d The ocean and climate.
	· Using Slide 37 students write in their books:
	  · three new things they have learnt,
	  · two things that connect this to what they already know
	  · and one thing they still want to know about this topic.
	· Read Slide 38 as a class, to round off the "mission".
		Slideshow 7
		Slides 37-38
		
		Student Sheet 7d
		The ocean and climate

	Less able students can be tasked with completing only the map activity, leaving out the extended writing. To promote progress extend the activity by using peer assessment and allowing students extra time to make improvements. Maps (and explanations) can be stuck to the students' voyage map. Students may also want to add the Gulf Stream to their maps.	

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World city cards

Instructions: Cut out the cards and put them in the order of coolest to warmest.

ACCRA	LISBON
DAKAR	LONDON
OTTAWA	VENICE
BORDEAUX	Your local city
ACCRA	LISBON
DAKAR	LONDON
OTTAWA	VENICE
BORDEAUX	Your local city

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World climate zones

Outcome 2 Show climate zones on a world map

1. Shade and label the map to show the climate zones. Use the words below to help.

TEMPERATE x 2 **TROPICAL** **POLAR x 2**

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Outcome 3 Describe the relationship between distance from the equator and climate.

There are four cities labelled on the map.
2 a. Rank the cities on the map from coolest to warmest.

Coolest .....

.....

.....

Warmest .....

2 b. Why did you put them in this order?

.....

.....

.....

.....

.....

3. Complete the sentence.

The further you get from the equator, the ..... the climate gets.

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Explaining the UK climate

Outcome 2 Say what has a large impact on the UK's climate

Outcome 4 Describe what is meant by the Gulf Stream and describe how it affects the climate of Europe.

A group of students were asked to answer the question:

"Why is the UK warmer than Canada?"

Their explanations are below.
Cut the explanations out.
Read the explanations.
With your group, discuss which you think is best at answering the question.
Put them in order of how good you all think they are at answering the question.

Samha

The UK and Canada are both quite far from the equator so they have cold climates.
But the UK is warmer than Canada because the sea around the UK is warmer.

Mariano

The UK and Canada are both quite far from the equator so they have cold climates.
But the sea around the UK is warm and this keeps the temperature here warmer than Canada. The sea is warm because of the Gulf Stream.

Wiktoria

The UK and Canada are both quite far from the equator so they have cold climates.
But the UK is warmer than Canada because of the Gulf Stream. The Gulf Stream is a large ocean current that brings warm water from the tropics up to Europe.

Justin

The UK and Canada are both quite far from the equator so they have cold climates.
The Gulf Stream is a current that brings warm water from the equator to Europe. The warm water in the sea keeps the UK warm.

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The ocean and climate

"The UK is warmer than Canada" Using the map and space below, explain why.

On my map I can...

☐ **Outcome 2** Label the climate zones

☐ **Outcome 4** Shade the map to show the impact of the Gulf Stream.

In my explanation I can...

☐ **Outcome 1** Describe the local climate conditions in my area.

☐ **Outcome 3** Describe the relationship between the distance from the equator and the climate.

☐ **Outcome 4** Describe what the Gulf Stream is and how it affects the climate of the UK.

☐ **Outcome 5** Compare the climate of Ottawa and London and explain the seasons for similarities and differences.

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LESSON 8

The Indian Ocean and classification with Sheena Talma

Age 7-11

110 minutes

Curriculum links

- Identify living, dead and non-living things
- Group objects in different ways
- Classify living things using standard scientific groups with reasons
- Create and use a key to classify organisms
- Classify difficult organisms using standard scientific groups with reasons

Resources

Slideshow 8
Indian Ocean and classification

Activity Overview 8a
Sorting objects practical

Student Sheet 8a
Classifying coral life

Student Sheet 8b
Making a key

Student Sheet 8c
Classification card sort

Student Sheet 8d
Coral life fact sheet

Video
Wonders of coral

Gallery
Coral Life

Subject Update
How to teach classification

Lesson overview

A science focused lesson where students classify some organisms that are frequently thought to be other things: dolphins are mammals not fish; sponges are actually animals; and coral are colonies of animals that can look like trees.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to their lesson's mission by Sheena Talma.	• Understand the learning context and outcomes
2. **Discovering coral life (10 mins)** Present students with different examples of marine life and ask them to think about what, why and how they are.	• Group objects in different ways
3. **Grouping characteristics (15 mins)** Students are presented with a range of different objects and asked to put these into groups.	• Group objects in different ways
4. **Grouping things (15 mins)** Students sort objects into living, dead and non-living things using a practical activity.	• Identify living, dead and non-living things
5. **Using a key to classify (20 mins)** Students use a key to classify different living things found on coral reefs.	• Classify living things using standard scientific groups with reasons • Create and use a key to classify organisms
6. **Grouping scientifically (15 mins)** Students learn about the features of different scientific groups and match the organisms with these features and examples.	• Classify living things using standard scientific groups with reasons
7. **Explaining classification (20 mins)** Students demonstrate their learning by explaining how to classify difficult examples of coral life.	• Demonstrate learning
8. **Reflection (10 mins)** Students consider what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 8 (page 1 of 3)
MISSION 8: THE INDIAN OCEAN AND CLASSIFICATION

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the slide, 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 "sponges" "corals" and "dolphins". · 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 from Sheena to put the lesson into context. Students may wish to watch the Wonders of coral video to see the team in action talking about the coral habitat. https://encounteredu.com/multimedia/videos/wonders-of-coral	**Slideshow 8** Slides 1-4
2 10 mins	The purpose of Step 2 is to engage students by encouraging them to hypothesise by looking at a set of amazing images. · Show students Slide 4. Ask them to discuss in groups: · what a dolphin is; · why they think this; · and how they could find out. · Repeat this with coral (Slides 5-6) and sponges (Slide 7)	**Slideshow 8** Slides 5-8
3 15 mins	The purpose of Step 3 is for students to start to think about how objects can be put into groups. By the end of this section, they should understand that we look for shared features and that things can be grouped in many ways. · Show students Slide 9 and ask them which they think is the odd one out. There is no correct answer. Students may think that the mangrove is the odd one out as it is the only living thing or that the pebbles are the odd one out as they have never been alive. · Show younger students Slide 10 and older students Slide 11. Describe each of the images on the relevant slide: · Images on Slide 10 (l-r) · Top row: sand, salt, anchor, driftwood, sea grass · Middle row: paper, fossil, shell, feather, seaweed Bottom row: clown fish, penguin, killer whale · Images on Slide 11 (l-r) · Top row: sea grass, Cauliper sea weed, camel, mushroom, lug worm	**Slideshow 8** Slides 9-11

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Step	Guidance	Resources
	· Middle row: killer whale, squid, crocodile, mould, clown fish · Bottom row: mangrove tree, gull, penguin, clam · Ask students to put the images into 4 groups. Tell them there are no correct groups and the winner is the students who come up with the most interesting groups. Take feedback from each group. Use questioning to make students justify why they have put the images into these groups. Highlight the fact that the basis for their classification is shared features.	
4 15 mins	The purpose of Step 4 is for the younger students to appreciate the differences between living and non-living things, and to question if things like shells which are made my living things are alive as well. · Use Activity Overview 8 to run the practical. The outline has additional guidance and ways to support and challenge students. · Use the True or False slides 13-25 and traffic light cards to assess students understanding of living and non-living objects. If you don't have traffic light cards, students can point. Use questions to check students can justify their choices. This will encourage deeper learning. The last slide shows a shell, which is a difficult object to classify. Hopefully students will show yellow or both red and green.	**Slideshow 8** Slides 13-26 **Activity Overview 8a** Sorting objects practical
5 20 mins	The purpose of Step 5 is to help students practise using and making keys to systematically classify organisms. · Using Student Sheet 8a Classifying coral life, students use a key to classify organisms found on coral reefs. A coral life photo gallery is available for students to view on connected computers. Students can use this to review their work on using a key. View the coral life photo gallery at: https://encounteredu.com/multimedia/images/what-creatures-live-on-a-coral-reef If you wish to develop students' ability to create their own keys, first, model how to construct a key. To do this, call four students to the front. Ask what is different about them. Use this to create a key on the board. During this process, explain the thinking, so students can see how you have worked. Students can then use Student Sheet 8b to attempt to create their own key. Students can then swap their keys with each other to see if they work.	**Student Sheet 8a** Classifying coral life **Student Sheet 8b** Making a key

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Step	Guidance	Resources
6 15 mins	The purpose of Step 6 is for older students to appreciate that all organisms fall into major groups with some common features. This includes unusual organisms that they may not have even realised were living things. · Students use Student Sheet 8c Classification card sort. They need to match the group of organisms to their features, examples and a picture. · Use the True or False Slides 27-41 and traffic light cards to assess students understanding of why organisms are grouped. To provide more challenge for higher ability students, when they finish, ask them, "ooh, are you sure?", and ask students to argue against statements such as "humans are plants", "trees are animals" etc.	**Slideshow 8** Slides 27-41 **Student Sheet 8c** Classification card sort
7 20 mins	The purpose of Step 7 is for students to demonstrate their learning from this lesson. · Students can show what they have learnt by writing a postcard (from lesson 1, Student Sheet 1c), describing and classifying their favourite example of life on the coral reef. Alternatively, hand students Student Sheet 8d Coral life fact sheet. Ask them to write a short paragraph for two of the organisms, explaining what they are and how they know. A short example sentence is shown on Slide 42. The postcards are a short activity, the paragraphs take longer. The dolphin and seaweed are less challenging, the sponge is more challenging and the coral is very challenging. See Subject Update: How to teach classification for more detail on what sponges and coral are. The subject update is available at: https://encounteredu.com/cpd/subject-updates/how-to-teach-classification	**Slideshow 8** Slides 42 **Student Sheet 1c** Postcard template (from lesson 1) **Student Sheet 8d** Coral life fact sheet **Subject Update** How to teach classification

8
10 mins
	The purpose of Step 8 is to help students see what they have learnt and to pass on a final message from Sheena.
	· Using Slide 43 students write in their books:
	  · three new things they have learnt,
	  · two things that connect this to what they already know
	  · and one thing they still want to know about this topic.
	· Read Slide 44 as a class, to round off the "mission".
	
	This is a great place to use questioning to really probe the depth of students' knowledge.
		Slideshow 8
		Slides 43-44

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Sorting objects practical

Age 7+
(adult supervision)

10-15 minutes

Details

Each group will need

- About 3 to 4 living objects associated with the sea, eg a shell, wood, dried seaweed, a natural sponge.
- About 3 to 4 non-living objects associated with the sea, eg pebbles, sand, salt, feathers, paper, plastic.
- About 3 to 4 objects (living or non) not associated with the sea, eg form sponge, a book, glue, an eraser, leaves, flowers, pine cones.

Safety and Guidance

Choking
- Students should not put objects into their mouths
- Avoid unnecessarily small items

Poisoning
- Avoid poisonous plants
- Do not use live animals, substitute for pictures if necessary
- Students should not put objects into their mouths
- Students should wash their hands at the end of the practical and before they handle any food

Overview

In this activity students investigate the features that all living things share and how this makes them different to non-living things. They will sort a variety of objects and then try and come up with a criteria that can be used by someone else to determine if something can be considered a living thing.

Preparation

Place the students into groups of 2-4. Prepare trays of living and non living objects.

Running the activity

1. Outline the aim of the activity to students.
2. Outline the safety instructions.
3. Highlight that ethical consideration that living creatures deserve to be treated with respect.
4. Give students their tray of objects and ask them to split them into 2 groups: living and non-living. This will be hard as some of the objects are dead or made from living things.
5. Next ask students to make three groups: living, dead / made by a living thing, non-living.
6. Ask groups to make a criteria that another group could use to tell if an object is living or non-living.
7. Ask groups to swap their criteria and use them to classify everyday classroom objects or things that can be seen out of your window.

Observation and analysis

- After 30 minutes, or when you have finished with the other lesson activities, 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.

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STUDENT SHEET 8a

Classifying coral life

Classify the organisms on the Coral Reef photo sheet, using the coral reef key to help you.

Plant	Coral

Phytoplankton	Mammal

Fish	Bird

Reptile	Echinoderm

Mollusc	Crustacean

Complete the sentences, using the information from the key

A tiger shark is a fish, because .....

A crown-of-thorns starfish is an echinoderm, because .....

A dolphin is a mammal, because .....

A green turtle is a reptile, because .....

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STUDENT SHEET 8a

Mantis shrimp

Sea slug

Seagrass

Crown-of-thorns starfish

Staghorn coral

Clownfish

Phytoplankton

Parrotfish

Tiger shark

Dolphin

Triton's Trumpet

Manta ray

Boulder coral

Common Noddy

Green turtle

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STUDENT SHEET 8a

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Making a key

Your challenge now is to make your own key. In your groups decide on the key questions that will help anyone identify the coral reef invertebrates below.
Remember that your key questions need to be about observable characteristics and have 'yes' or 'no' answers. Hint: you may need to practise on some spare paper first.

Copepod

Christmas tree worm

Crown-of-thorns starfish

Sea slug

Sea cucumber

Sea anemone

Triton's trumpet

Mantis shrimp

Your challenge now is to make your own key. In your groups decide on the key questions that will help anyone identify the coral reef invertebrates below.
Remember that your key questions need to be about observable characteristics and have 'yes' or 'no' answers. Hint: you may need to practise on some spare paper first.

Copepod

Christmas tree worm

Crown-of-thorns starfish

Sea slug

Sea cucumber

Sea anemone

Triton's trumpet

Mantis shrimp

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CLASSIFICATION CARD SORT

Vertebrate Animals	**Features** • Consumers that digest food inside their body • Do not have a backbone • Only some have eyes • Can move	**Examples** Bacteria Viruses	
Invertebrate Animals	**Features** • Can be small to very large • Producers • Use photosynthesis • Can't move	**Examples** Sea slug Scallop Hermit crab Starfish	
Plants	**Features** • Can be small to large • Consumers than digest food outside their bodies • Can't move	**Examples** Green turtle Dolphin Tiger shark Noddy	
Fungi	**Features** • Very, very small • Can move	**Examples** Mangrove trees Seagrass	
Microbes	**Features** • Consumers that digest food inside their bodies • Have a back bone • Have a brain • Can move	**Examples** Mushrooms Mould Yeast	

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Coral life fact sheet

Bottlenose dolphin

Bottlenose dolphins live all over the world. They are excellent swimmers, which is because of their arrow-like shape. They have a pointed nose, a strong back bone and a tail. Bottlenose dolphins are some of the cleverest organisms on Earth because of their large brain.
Bottlenose dolphins cannot breathe underwater and have to rise to the surface to breathe oxygen from the air.

Caulerpa (seaweed)

Caulerpa seaweed (sounds like cauliflower) live in shallow seas. They have green fronds which are like leaves and use photosynthesis to make thier own food.

In the Indian Ocean, caulerpa is not a problem, but in other oceans, where it is not natural, it damages the habitat.

Sponge

Sponges live on the sea floor. They don't have brains or a back bone but they do have lots of holes running through them called pores. When plankton (small plants and animals) get washed through the pores, the sponges trap them to digest them inside their bodies. Their pores also take oxygen out of the water. Most adult sponges are fixed in place, but the very young ones can move in the water.

Coral

Corals are beautiful. They live in shallow seas and make reefs. The biggest example is the Great Barrier Reef. Corals get their food in two ways. They use their tentacles to eat plankton (tiny animals). They also have plantlike organisms living inside them that provide food from photosynthesis.

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LESSON 9

The Pacific Ocean and plastic pollution with Jo Royle

Age 7-11

90 minutes

Curriculum links

- Understand the impact of human activity on the environment
- Understand the importance of the 3 Rs (reduce, reuse, recycle)
- Reuse plastic waste to create a high quality product
- Review product design and making against criteria

Resources

Slideshow 9
The Pacific Ocean and plastic pollution

Activity Overview 9a
Reusing plastic bottles

Student Sheet 9a
Reusing plastic bottles (preparation)

Student Sheet 9b
Reusing plastic bottles (guidance)

Student Sheet 9c
Plastic product review

Lesson overview

Nearing the end of their ocean voyage, students will investigate one of the issues facing the world's ocean, plastic pollution. Students will begin by learning about the impact of litter on marine life. They will then explore the 3 Rs (reduce, recycle, reuse) and how they can be applied to the issue of marine plastic pollution. Students will then be guided to reuse common plastic waste to make a new useful object such as a bird-feeder or snack box.

Lesson steps	Learning outcomes
1. **Mission statement (10 mins)** Students are shown images of the impact of plastic litter on marine life. Students are then introduced to their lesson's mission by Jo Royle. Opportunities for literacy practice using Jo Royle's opening statement.	• Understand the learning context and outcomes
2. **The impact of plastic pollution (15 mins)** Show students basic infographics on the issue of marine plastic litter and use photographs as discussion points. Introduce students to the 3 Rs (reduce, reuse, recycle) and their relevance to the issue of marine plastics.	• Understand the impact of human activity on the environment • Understand the importance of the 3 Rs
3. **Reusing plastic bottles (45 mins)** Students use their prepared plastic bottles to make new, high quality items.	• Reuse plastic waste to create a high quality product
4. **Making review (10 mins)** Students judge their new plastic bottle creations against a set of criteria.	• Review product design and making against criteria
5. **Reflection (10 mins)** Students make a pledge based on their learning from the lesson. This pledge should be based around the 3Rs and the issue of marine plastic.	• Reflect on learning

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TEACHER GUIDANCE 9 (page 1 of 2)
MISSION 9: THE PACIFIC OCEAN AND PLASTIC POLLUTION

Step	Guidance	Resources
1 10 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. A particularly powerful image is used at the start to evoke an emotional response from students. · Show students the image on Slide 2. Ask them how it makes them feel and what questions they want to ask from this. · Tell them that some of these questions will be answered in this lesson. · Ask students to write the mission title from the top left of the slide, 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 "plastic" and "ocean". · 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 from Jo Royle to put the lesson into context. A range of imagery has been made available as some of the options may be too distressing for your students. Choose which the most appropriate images to show are.	**Slideshow 9** Slides 1-7
2 15 mins	The purpose of Step 2 is for student to recognise the harm caused by single-use plastics and how they can help to prevent this. · Show students Slide 8. Ask them what rubbish they can see in the picture. · Show students Slide 9. Ask them what the Slide shows and if anything surprises them. Remind them of the images they saw earlier (Slides 2 to 5) and ask them why plastic in the sea is a problem. Show students Slide 10. Discuss the meanings of the terms reduce, reuse and recycle. Ask students what they could do to reduce their waste and how you can encourage recycling at home. · Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 11. Students answer the questions on Slide 12 in their books. Students can peer mark the answers using Slide 13 and 14. · Review the answers to the questions as a whole class discussion. The data on Slide 9 is from: http://www.oceanconservancy.org/ who had nearly a million volunteers all around the world cleaning up beaches in 2020. Use the photos to draw out ideas that animals can eat plastic or get trapped in it.	**Slideshow 9** Slides 8-14

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TEACHER GUIDANCE 9 (page 2 of 2)
MISSION 9: THE PACIFIC OCEAN AND PLASTIC POLLUTION

Step	Guidance	Resources
3 45 mins	The purpose of Step 3 is for students to learn about the ways plastic bottles can be reused and to put this into practice. Use Activity Overview 9 Reusing plastic bottles to guide this activity. · Student Sheet 9b Reusing plastic bottles (guidance) contains two different options for the students. Hand out the appropriate guidance for each student. Go through the guidance, highlighting health and safety issues. Remind students of the outcomes on Slide 15 and then display the products on Slide 16. · Students complete their making activity using the instructions on the appropriate page of Student Sheet 9b Reusing plastic bottles (guidance).	**Slideshow 9** Slides 15-16 **Activity Overview 9a** Reusing plastic bottles **Student Sheet 9b** Reusing plastic bottles (guidance)
4 10 mins	The purpose of Step 4 is for students to review their learning from this lesson. · Hand out a copy of Student Sheet 9c Plastic product review to each student and use the questions on Slide 17 to explain how students can complete their evaluation. Should students wish, they can add a photo or drawing of their product in the space provided. · Students complete an evaluation of their product and explain why it's important using Student Sheet 9c Plastic product review.	**Slideshow 9** Slide 17 **Student Sheet 9c** Plastic product review
5 10 mins	The purpose of section 5 is to help students see what they have learnt and to pass on a final message from Jo. · Using Slide 18, students write in their books a pledge based on the 3Rs and their understanding of the impact of plastic pollution on marine life. · Select a few students to read out their pledges. · Read Slide 18 as a class, to round off the mission. This is a great place to use questioning to really probe the depth of students' knowledge. You can find an entire unit of lessons about ocean plastics, created in collaboration with Jo's organisation at https://encounteredu.com/teacher-resources/ocean-plastics-x-curric-ages-7-11	**Slideshow 9** Slides 18-19

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Reusing plastic bottles

Age 7+
(adult supervision)

30-60 minutes

Details

Each student will need:

- Ruler
- Dry wipe marker pen
- Scissors

For the snack boxes:

- 2 or 4 pint plastic milk bottle
- Self-sticking Velcro© pads
- Stickers (for decorating)

For the bird-feeder:

- 2 or 4 pint plastic milk bottle
- Self-sticking Velcro© pads
- Stickers (for decorating)

Safety and Guidance

Cutting
- Students should squeeze the bottles firmly to make a flat section
- Students should carefully make a slit where they have squeezed
- If in any doubt, ask an adult to put slit holes in the bottles before the lesson
- Students should use safety scissors

Choking
- Ask students to fill their bird-feeders at home

Allergies
- Students should not put objects into their mouths

Overview

In this activity students develop design and technology skills by: using equipment, considering the advantages and disadvantages of plastic as a material and evaluating their product. The bird-feeders are the more challenging of the two options.

Preparation

Have all the materials students will need ready, and for younger children, have them in bundles they can just collect in one go.

Running the activity

1. Outline the activity and safety precautions to students.
2. Clearly display the finished products on the board and leave them on throughout the rest of this activity so that students may refer to them.
3. Put students into groups that are all making the same product.
4. Make sure students' desks are clear.
5. Hand out the students' bottles.
6. Hand out Student Sheet 9b Reusing plastic bottles guidance.
7. Ask students to read the instructions through as a group and to make a list of questions for things they are unsure about.
8. Answer the questions.
9. Once students are comfortable, allow them 20 to 30 minutes to follow the instructions so they can make and decorate their product.
10. One they have finished, they could take pictures of it for a display.
11. To avoid allergy issues, students should fill their bird feeders when they get home. This would also stop them spilling seeds all the way home!

Extra support or challenge

- For students who may struggle, allow them to work in pairs, or place students that need support next to a stronger student. Demonstrate how to make each product, clearly modelling how you have referred to the instructions at each point.
- For more able students, really challenge them to produce a high quality product, paying attention to using the equipment with precision for neat lines.

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Reusing plastic bottles (Preparation)

Soon, we will be reusing plastic to make a useful product.

Choose one of the following options, and bring your materials in by .....

Option 1: Snack box

Materials to bring to school:
A 1 or 2 litre (2 or 4 pint) plastic milk bottle

Option 2: Bird Feeder

Materials to bring to school:
A 500ml plastic drinks bottle
2 wooden spoons

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Reusing plastic bottles (Bird feeder)

-Medium 500ml plastic drink bottle
-2 wooden spoons
-String (30cm)
-Ruler
-Marker pen
-Scissors
-Tray
-Bird seed

1. Prepare your area by clearing your desk and laying newspaper down.

Get all of your materials out.

Wash the bottle out with water.

2. Measure about 10 cm up the bottle and draw a small circle. It needs to be about the same size as the handle of your wooden spoon.

3. On the opposite side draw a larger circle, about the size of a 2p.

The bottoms of the circles need to be at the same height.

4. Squeeze the bottle together and carefully cut the circle out.

DO NOT TRY AND POKE A HOLE IN THE BOTTLE!

5. Do this again at 5 cm from the bottom.

Do it round from the first hole so that they don't overlap.

6. Put the wooden spoons into the bottles.

The big end of the spoon needs to go snugly in the big hole.

7. Put the lid on the bottle.

Use string to make a loop so you can hang the bird-feeder.

8. In a tray at home, fill the bottle with seeds.

The tray will stop the seed making a mess.

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Reusing plastic bottles (Snack box)

-2 or 4 pint milk bottle
-Self-sticking Velcro© pads
-Ruler
-Marker pen
-Scissors
-Stickers (to decorate)

1. Prepare your area by clearing your desk and laying newspaper down.

Get all of your materials out.

Wash the bottle out with water.

2. Use the marker pen to draw out a semi-circle on each side and the front of the milk cartoon. These will be the flaps on your box.

3. Draw a larger semi-circle on the back.

This will be your lid. Make sure the bottoms of the semi circles all match up.

4. Squeeze the milk carton together at the top, and cut into it.

Cut into the top of the bottle.

Cut along the lines neatly.

5. Fold the flaps and the lid along the ridge in the milk bottle.

6. Stick the Velcro© pad to the main part of the box.

Stick the tabs together.

7. Remove the back from the second pad and close the lid.

This will stick the second pad in the right place.

Make sure your pads are on properly.

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STUDENT SHEET 9c

Plastic product review

What did you make?

.....

Who would want to use it?

.....

Why is plastic good for this?

.....

.....

What is good about your product?

.....

.....

What could you do to make your product better?

.....

.....

Why is it important to reuse plastic?

.....

.....

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LESSON 10

The Southern Ocean and penguin adaptation with Dr Norman Ratcliffe

Age 7-11

60 minutes

Curriculum links

- Describe similarities between features of penguins and other birds
- Describe how penguins have adapted to their habitat

Resources

Slideshow 10
The Southern Ocean and penguin adaptation

Student Sheet 10a
Penguin adaptations

Thinglink
Penguin adaptations

Subject Update
How to teach evolution

Lesson overview

Students travel to the Southern Ocean and the waters around Antarctica to study how penguins have adapted to this habitat. Students will learn about the different adaptations that allow penguins to live in this frozen world and get their food from the ocean. This lesson can be used as a standalone lesson for lower Key Stage 2 students, or as an introductory lesson to the topic of evolution for upper Key Stage 2 students, which is the focus of Mission 11.

Lesson steps	Learning outcomes
1. **Mission statement (5 mins)** Students are introduced to their lesson's mission by Dr Norman Ratcliffe.	• Understand the learning context and outcomes • Say what a scientist does
2. **Penguin adaptations (25 mins)** Students research the adaptations of penguins using the interactive Thinglink tool.	• Describe similarities between features of penguins and other birds
3. **Penguin gallery (15 mins)** Students apply their knowledge to identify adaptations in a variety of penguins.	• Describe how penguins have adapted to their habitat
4. **Penguin postcard (10 mins)** Students can complete a postcard about penguins, describing the adaptations that make them suited to living in and around the Southern Ocean.	• Demonstrate learning
5. **Reflection (5 mins)** Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 10 (page 1 of 3)
MISSION 10: THE SOUTHERN OCEAN AND PENGUIN ADAPTATION

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the 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 "adapted" and "habitat". · Read the outcomes with the students and ask them to put their hands up to show what they can already do. · As mentioned in the Lesson Overview, this lesson can be used as a standalone lesson on adaptation for lower Key Stage 2, and an introductory lesson on evolution for upper Key Stage 2, completed by Mission 11. · Read the mission statement from Dr Norman Ratcliffe to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 10** Slides 1-4
2 25 mins	The purpose of Step 2 is for students to research how a penguin is adapted to its habitat. In this activity, students conduct scientific enquiry by researching the adaptations of a penguin. The research is conducted using the interactive online Thinglink tool to provide context. · Launch the Thinglink on your board by clicking on the image on Slide 5. Demonstrate picking out the key information from the pop-outs. · Working in groups of 3 to 4, students view the information in the Thinglink and make notes in their book about how penguins are adapted to their environment. Encourage students to ask each other spot questions to check what they have understood. · Share what has been found out as a class. · Hand out Student Sheet 10a Penguin adaptations. Ask students to answer both questions from memory or their notes: Question 1 in their books and Question 2 on the sheet. Students can then use the Thinglink if they need help. · Take feedback from the class and correct any misconceptions Ensure that the electronic devices are charged. Check that the Thinglink can be accessed on computers, tablets or smartphones (https://encounteredu.com/multimedia/images/how-have-penguins-survived-in-the-antarctic). If not, speak to your IT support to allow access.	**Slideshow 10** Slide 5 **Student Sheet 10a** Penguin adaptations **Thinglink** Penguin adaptations

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Step	Guidance	Resources
	Support for students who may struggle: Place students into pairs for peer support Provide students with a set of targeted questions, eg: "How do penguins make sure they stay warm?" "What makes penguins good swimmers?" "What are some differences between penguins and other birds?"	
	Challenge for more able students: Tell these students that there are actually 27 different types (species) of penguins. Some live nearer the equator, some live on snow, some live on rocks. Ask students to make additional notes on how the general adaptations might be slightly different depending on the specific habitat. There is no additional information for them to do this, it will require them to apply their knowledge of adaptations.	
3 15 mins	The purpose of Step 3 is for students to apply their knowledge of penguin adaptations to a range of photos from the British Antarctic Survey. · Show students the penguin photos on Slides 6-10. For each photo, ask students what adaptations they can spot and how these features make them better adapted to life in and around the Southern Ocean. · Slide 5 shows Emperor penguin chicks with the extra down feathers they hatch with for warmth. · Slide 6 shows a Gentoo penguin leaping out of the water. Note its shape, its sleek waterproof feathers and its flippers. · Slide 7 shows an Emperor penguin chick resting on an adult's feet to keep warm. Note the adult is using its claws to keep most of its feet off the ground. · Slide 8 shows King penguins. Note their shape, sleek outer feathers and bills. · Slide 9 shows Emperor penguins huddling to stay warm. · Learning Check Point (Assessment for Learning) Remind students of the learning outcome on Slide 11. Students answer the questions on Slide 12. · Students can peer mark the answers using Slides 13-14.	**Slideshow 10** Slides 6-14
	To challenge more able students before you review the slides, ask them to make a list of features they would expect an organism that lives in a polar marine habitat to have and explain the benefit of these features. They can see if these match the adaptations on the slides.	

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MISSION 10: THE SOUTHERN OCEAN AND PENGUIN ADAPTATION

Step	Guidance	Resources
4 10 mins	The purpose of Step 4 is for students to demonstrate their learning from this lesson. · Students can show what they have learnt by writing a postcard (Student Sheet 1c). Students should draw a picture of a penguin on one side and describe the features that make penguins suited to the cold of the Southern Ocean on the other side.	**Student Sheet 1c** Postcard template (from lesson 1)
5 5 mins	The purpose of Step 5 is to help students see what they have learnt and to pass on a final message from Dr Norman Ratcliffe. · Using Slide 15, students write in their books: · three new things they have learnt, · two things that connect this to what they already know, · and one thing they still want to know about this topic. · Select a few students to read out their answers. · Read Slide 16 as a class, to round off the mission.	**Slideshow 10** Slides 15-16

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Penguin adaptations

Outcome 1 - Describe the similarities and differences of penguins and other land birds.
Outcome 2 - Describe how penguins are adapted to their habitat.

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LESSON 11

The Southern Ocean and penguin evolution with Dr Michael Dunn

Age 7-11

60 minutes

Curriculum links

- Define the terms evolution and extinction
- Explain how penguins became adapted to their habitat
- Explain how adaptation led to the evolution of penguins

Resources

Slideshow 11
The Southern Ocean and penguin evolution

Activity Overview 11a
Penguin evolution script

Activity Overview 11b
Penguin evolution game

Student Sheet 11a
Penguin evolution game cards

Student Sheet 11b
Penguin evolution card sort

Student Sheet 11c
Storyboard cloze task

Student Sheet 11d
Penguin template

Subject Update
How to teach evolution

Lesson overview

Following on from their study of penguin adaptation in Mission 10, students explore how penguins might have evolved to suit past environmental changes. The core of this lesson is the Penguin Evolution Game, which simulates the six stages of adaptation that lead to evolution. This mission is best suited to older students in Key Stage 2.

Lesson steps	Learning outcomes
1. **Mission engagement (5 mins)** Students are introduced to their lesson's mission by Dr Michael Dunn.	• Understand the learning context and outcomes • Say what a scientist does
2. **Penguin evolution presentation (10 mins)** Explain the process of the evolution of penguins using a series of Slides and accompanying script.	• Define the terms evolution and extinction • Explain how penguins become adapted to their habitat
3. **Penguin evolution game (20 mins)** Students play a penguin evolution simulation game to see how the six stages in the process of adaptation could have led to them evolving over time.	• Explain how adaptations led to the evolution of penguins
4. **Evolution card sort (10 mins)** Students consolidate their understanding of the evolutionary process using a card sort activity.	
5. **Evolution storyboard (10 mins)** Students demonstrate their learning by creating a storyboard of the evolutionary process. A simplified cloze activity has also been provided.	• Demonstrate learning
6. **Reflection (5 mins)** Students reflect on their learning, considering what they have learnt, what connects to their prior knowledge and what they still want to know.	• Reflect on learning

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TEACHER GUIDANCE 11 (page 1 of 2)
MISSION 11: THE SOUTHERN OCEAN AND PENGUIN EVOLUTION

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of Slide 2, as well as the date in their books. They can then try to guess the missing word from the Key Question, which in this case is "evolve". · 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 from Dr Michael Dunn to put the lesson into context. This is a good opportunity for students to take the lead and practise reading aloud.	**Slideshow 11** Slides 1-4
2 10 mins	The purpose of Step 2 is to introduce students to the process of evolution and how changes in the environment can lead to extinction or evolution. Older students should appreciate that evolution is a step-by- step occurrence that happens over vast periods of time. · Use Slides 4-16 and the accompanying script (Activity Overview 11a Penguin evolution script) to explain the process of evolution in penguins.	**Slideshow 11** Slides 5-17 **Activity Overview 11a** Penguin evolution script
3 20 mins	The purpose of Step 3 is for students to work through the process of evolution themselves using a simulation game. · Using Slide 18, explain the differences in the different varieties of penguin. · Start the game. Ask students what would happen to penguins if the temperature dropped suddenly, or if their prey could swim much faster. Introduce the word "extinction". · You may need to model the first two or three rounds and then students can play the game in groups. · Review the game, asking different groups what happened to the numbers of the different varieties of penguins over time (rounds). Why do they think this happened? Explain that this represents the process of evolution and that this process can take place over thousands and millions of years, rather than a few roll of the dice. Explain the rules of the game using Activity Overview 11b Penguin evolution game. Hand out cards and record sheets to each group of six students from Student Sheet 11a Penguin evolution game cards.	**Slideshow 11** Slides 18-28 **Activity Overview 11b** Penguin evolution game **Student Sheet 11a** Penguin evolution game cards

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Step	Guidance	Resources
4 10 mins	The purpose of Step 4 is for students to consolidate their learning about evolution. · Hand out the card sort (Student Sheet 11b Penguin evolution card sort). · Ask students to use their experiences from the game to put the cards in the correct order.	**Student Sheet 11b** Penguin evolution card sort
5 10 mins	The purpose of Step 5 is for students to demonstrate their learning about evolution. · Students could use the storyboard (Student Sheet 11d Storyboard template) to show what they have learnt. · Some students may struggle, and there is an alternate storyboard with a cloze task (Student Sheet 11c Storyboard cloze task). The words for the cloze task in order are: Different Variation Thick Thin Changed Colder Suited Environment Survive Reproduce Inherit Long Time Evolved	**Student Sheet 11c** Penguin storyboard cloze task **Student Sheet 11d** Storyboard template

6
5 mins
	The purpose of Step 6 is to help students see what they have learnt and to pass on a final message from Dr Michael Dunn.
	· Using Slide 28, students write in their books:
	  · three new things they have learnt,
	  · two things that connect this to what they already know,
	  · and one thing they still want to know about this topic.
	· Select a few students to read out their answers.
	· Read Slide 29 as a class, to round off the mission.
	
	This is a great place to use questioning to really probe the depth of students' knowledge.
		Slideshow 11
		Slides 29-30

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Penguin evolution script

Age 7+
(adult supervision)

10 minutes

Penguins are a type of flightless bird that live in the southern hemisphere.

The adaptations they have to live in their habitats make them so different from land birds, that some scientists don't even think we should call them birds.

How are they like land birds? They have: beaks, feathers, four limbs and they lay eggs.

They are also warm blooded.

So how are penguins different from land birds? They have:

1. a very thick layer of downy feathers to keep them warm
2. wings shaped like flippers
3. webbed feet

But once upon a time, the birds that became penguins, looked like other birds. So what happened? Well, the environment that the birds lived in changed, and this caused them to evolve into penguins so that they stayed suited to their new habitat. Let's look at how one specific feature could have evolved: the very thick downy layer of feathers.

To do this we need to go back millions of years.
Here we can see that the birds that evolved into penguins were all slightly different. We say they showed variation.

Some had thin downy layers and some had thick downy layers.

About 15 million years ago, we think the environment where the birds lived changed.

The climate got much colder.

This meant that the birds with the thicker downy layer had an adaptation which made them better suited to the environment.

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So they were much more likely to survive.

And reproduce. We call babies 'offspring'.

The offspring also have thick downy feathers because they inherit features from their parents.

Over a really long time, the environment got colder and colder.

Each time, the birds with the thicker downy layer survive and reproduce.

Eventually, they are very different from other birds.

We say they have evolved. We call these new birds penguins!

How do we know this happened?

Evidence for evolution comes from fossils and by looking at DNA. The evidence isn't perfect, and there is a lot missing.

But that's exciting because it means there is still lots for scientists to discover as they explore.

The main points:

1. Ancient birds showed variation.
2. Some had thicker downy layers than others.
3. When the environment changed and got colder, the ones with a thick downy layer were better suited.
4. So they survived, and they reproduced.
5. Their offspring inherited the thick downy layer too.
6. Over a long time, the birds with thicker coats survived and reproduced, until they were penguins.
7. If the environment changed again, penguins could evolve into something else.

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Penguin evolution game

Age 7+
(adult supervision)

20-30 minutes

Details

Each group of 6 students needs:

- A dice
- Student Sheet 11a Penguin evolution game cards

Overview

This activity reinforces the idea that a drastic change in the environment can cause organisms to die. It also develops an understanding of adaptation as a process that happens to a group of organisms over a long period of time and that adaptation leads to evolution.

Preparation

The Penguin evolution game works through the six steps of adaptation that lead to evolution.

Running the activity

1. Hand a selection of one of each Penguin evolution game cards to each group. Place the remaining cards in the middle of the group (there should be an additional 12 cards).
2. Explain the rules to students.
3. Show the first environmental change slide (Slide 18).
4. Ask students which variety is less suited to this change. Let them discuss this and give reasons.
5. Once a variety which is less suited has been agreed on, roll the dice to choose which penguins from that variety will die.
6. Allow for some dramatic death acting!
7. Students place these cards in a discard pile.
8. Students take a card that is the same as the Penguin variety held by the student to their left.
9. Move onto the next Slide and repeat.
10. Repeat until there is only one variety of penguin left: this will take between 6 and 10 goes.

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VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

ODD

VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

ODD

VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 1

Inner feathers:
Soft and fluffy

Shape:
Long thin body

Survival factor:

ODD

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VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

ODD

VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

ODD

VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

EVEN

VARIETY 2

Inner feathers:
Long and sleek

Shape:
Long thin body

Survival factor:

ODD

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VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

EVEN

VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

ODD

VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

EVEN

VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

ODD

VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

EVEN

VARIETY 3

Inner feathers:
Soft and fluffy

Shape:
Short round body

Survival factor:

ODD

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Penguin adaptations

Variation

Change in the environment

Survive

Reproduce

Long time

Better suited

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[TIME] [VARIATION] [CHANGED] [COLDER] [INHERIT] [LONG] [EVOLVED] [REPRODUCE] [DIFFERENT] [THICK] [SURVIVE] [ENVIRONMENT] [THIN] [SUITED]

All penguins were slightly d _ _ _ _ _ _ _ _. We say they show v _ _ _ _ _ _ _ _. Some had a t _ _ _ _ layer of downy feathers, some had a t _ _ _ layer.

The environment c _ _ _ _ _ _ slightly by getting a bit c _ _ _ _ _.

Now, some of the penguins are better s _ _ _ _ _ to the e _ _ _ _ _ _ _ _ _ _ than others.

These penguins s_ _ _ _ _ _ and r_ _ _ _ _ _ _ _.

Their offspring i_ _ _ _ _ _ the thick feather coat.

Over a l_ _ _ t_ _ _, the small changes build-up to a big change and we say the penguins have e_ _ _ _ _ _.

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STORYBOARD TEMPLATE

1

2

3

4

5

6

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Captain's log

Age 7-11

120 minutes

Curriculum links

- Give well-structured descriptions, explanations and narratives for different purposes, including for expressing feelings
- Speak audibly and fluently with an increasing command of Standard English
- Participate in presentations
- Gain, maintain and monitor the interest of the listeners

Resources

Slideshow 12
Captain's log

Student Sheet 12a
Presentation storyboard

Student Sheet 12b
Presentation peer assessment

Certificate
Our Ocean Planet

Lesson overview

In this final lesson, students will create and deliver a presentation about their ocean voyage. Students will learn about presentation skills including delivery and slide design. Students will deliver their presentation to the class, receiving feedback from their peers. Celebrate the end of the ocean voyage with certificates or prize giving.

Lesson steps	Learning outcomes
1. Mission statement (5 mins) Explain to students that they will be making a captain's log in the form of a presentation. Discuss ideas of what they might want to include and write these on the board.	• Understand the learning context and outcomes
2. Modelling presentation skills (20 mins) Model a presentation for your class, using a range of poor presentation techniques. Students will record these and then be asked to model how these could be improved. **3. Voyage presentation preparation (60 mins)** Explain the structure of the voyage presentation. Students will then create a presentation to share what they have learnt during their ocean voyage.	• Give well-structured descriptions, explanations and narratives for different purposes, including for expressing feelings • Speak audibly and fluently with an increasing command of Standard English • Participate in presentations • Gain, maintain and monitor the interest of the listeners
4. Voyage presentations and feedback (30 mins) Students deliver their presentations and receive feedback from their peers.	• Demonstrate learning
5. Celebration! (5 mins) Take the opportunity to ask students to describe how they feel about the ocean in a single word and hand out certificates to the class celebrating their ocean voyage and learning.	• Reflect on learning

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TEACHER GUIDANCE 12 (page 1 of 2)
MISSION 12: CAPTAIN'S LOG

Step	Guidance	Resources
1 5 mins	The purpose of Step 1 is to share the learning outcomes, set the context and engage students with the learning. · Ask students to write the mission title from the top left of the Slide, 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 "learnt", "ocean" and "work". · Read the outcomes with the students and ask them to put their hands up to show what they can already do. · Tell students they will be making a presentation of a captain's log of their voyage. Ask students what they think a captain's log is and what information should be in it. Write these points on the board.	**Slideshow 12** Slides 1-3
2 20 mins	The purpose of Step 2 is for students to see a bad presentation as the teacher takes on the persona of "Bad Presentation Belinda or Barry". They identify bad points and use these to think of success criteria for a good presentation. · Ask students to share their ideas in a group and then feedback to the whole class. You can write these on the board. · Next ask students to choose three of the bad points, and to decide what should be done instead. · Take feedback from the class. Ask students not just to tell you what should be done, but to demonstrate it for the class. This will model good practice. · You can use the points on Slides 13-14 to cover any points that might have been missed. · Create a list of success criteria on the board. Consider using any of the following to model poor presentation delivery: · Not facing the audience · Speaking too quickly or quietly · Mumbling · Monotonous tone · Crossing your arms · Sitting down · Standing rigid · Fidgeting or fiddling · Forgetting what you want to say · Saying a Slide is rubbish or not useful · Just reading a Slide · Giving irrelevant information	**Slideshow 12** Slides 4-14

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Step	Guidance	Resources
3 60 mins	The purpose of Step 3 is for students to work together in groups to produce a presentation about what they have learnt. · Hand out Student Sheet 12a Presentation storyboard, one per group of five to six students. · Go through this with students to explain the structure of the presentation, using Slides 15-20 to model this. · Students create their presentations using a programme such as PowerPoint, Google slides or Keynote. Put students into small groups of 5-6 students. This depends on your class size, as you may wish to limit the number of student presentations to five, so they can be presented in a half hour lesson. If students to do not have access to computers to create their presentation, they can use drama, or their voyage map as the centrepiece for their presentation. The storyboard template can still be used to structure this work.	**Slideshow 12** Slides 15-20 **Student Sheet 12a** Presentation storyboard
4 30 mins	The purpose of Step 4 is for students to demonstrate their learning from this lesson by presenting to the whole class. · Hand out the Student Sheet 12b Presentation peer assessment. · Explain to students that they should shade in the boxes on the assessment sheet that represents good presentation skills. · Let each group present in turn. · While they present, the other students consider their peer assessment grid. · After each presentation, select two groups to share two things that the presenters have done well (ie shaded boxes) and one thing that they could do to improve their presentation (ie an unshaded box). Each presentation should take no longer than 5 minutes. Students may wish to use images from the Encounter Edu Our Ocean Planet collection available at: https://encounteredu.com/multimedia/collections/our-ocean-planet	**Student Sheet 12b** Presentation peer assessment
5 60 mins	The purpose of Step 5 is to look back at what students have learnt and look forward to the future. · Ask students to describe the ocean in one word and then in one freeze frame, using the inspirational photo on Slide 21. · You can print out certificates for students to celebrate the end of their learning journey.	**Slideshow 12** Slide 21 **Certificate** Our Ocean Planet

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Use this storyboard to write your own ocean presentation.

Make sure you stick to the rules:
- Every slide must have an image
- Only 5 words or less on a slide
- Font must be size 36
- You have a 5 minute time limit for your talk

Section	Images and words	Speech
Title	Slide 1	Write the title of your presentation Introduce your group
Introduction to your voyage	Slide 2	Where did you go on your voyage?
What made you see that the ocean is important?	Slide 3	Why is the ocean important to you? Why should it be important to other people?
	Slide 4	What made you realise the ocean was important?
The most interesting thing you did	Slide 5	What were the three best things you did?

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Section	Images and words	Speech
The most interesting thing you did	Slide 6	Give some more detail about one of these
The most inspiring person	Slide 7	Who inspired you the most? What is their job?
	Slide 8	How did they inspire you?
Conclusion	Slide 9	In the future what do you hope you will do or learn?
Credits	Slide 10	List the names of your group. (You can go over five words on this slide!)

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Group	Shade all that apply						
	Spoke loudly and clearly	Looked at the audience	Gave more information than was on the slides	Used prompt cards to help them	Spoke in different tones	Used gestures	Had their arms unfolded and weren't fidgeting.
	Spoke loudly and clearly	Looked at the audience	Gave more information than was on the slides	Used prompt cards to help them	Spoke in different tones	Used gestures	Had their arms unfolded and weren't fidgeting.
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Encounter Edu

Certificate of participation

Our Ocean Planet

Awarded to

Thank you for participating in Our Ocean Planet

Chip Cunliffe,
Biodiversity Director, AXA XL

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Our Ocean Planet is a series of 12 lessons designed for primary-level students who will discover the diversity and importance of Britain's surrounding seas before heading on a round the world voyage. As they travel the oceans, they will be studying everything from the water cycle in the Arctic to penguin evolution in the Southern Ocean and a lot more in between.

Each lesson is introduced by a different expert from a diverse crew of experienced ocean scientists and explorers. They will set the students their mission which is based around a key question, with activities and resources to support group-based investigation and learning.

Where Learning Meets The World

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