

## Teacher Notes

### 1. Lesson Outline

During their voyages in around Antarctica both Dame Ellen MacArthur and the crew of *HMS Endurance* frequently encounter albatrosses. These magnificent birds weigh up to about 11 kg and are masters of gliding on the air currents above the oceans and can remain aloft for months on end without having to land.

Of the 22 known albatross species, 19 are now threatened with extinction.

Not only can albatrosses fly but they float as well.

In this lesson pupils are asked to explore how an 11 kilogram albatross is able to float.

### 2. Learning Objectives

By the end of the lesson, pupils should be able to:

- Work effectively within a small group/team.
- Discuss within a group/team.
- Communicate effectively with others.
- Understand that a force is a push or a pull.
- Appreciate that heavy objects are able to float.
- Start to appreciate the concept of density.
- Develop an understanding of how the albatross is adapted to its environment.

### 3. Age Group

Years 4, 5 and 6. However, the concept of density is probably best avoided with year 4 and 5 pupils

### 4. Timing

This lesson should take approximately two hours to complete.

## 5. Curriculum Links

### England (National Curriculum)

Key Stage 2 Science

- Sc2: 2e; 5c
- Sc4: 2b,d,e

England (QCA Schemes of Work)

- Unit 4B: Habitats
- Unit 6E: Forces in action
- Unit 6A: Interdependence and adaptation

### Scotland (5-14 National Guidelines)

Environmental Studies: Science

- Materials from Earth: Level A,B
- Forces and their effects: Level A,B
- Variety and characteristic features: Level A,B,C

### Wales

Key Stage 2 Science

- Life Processes and Living Things: 4.1, 4.2
- Materials and their Properties: 1.1, 1.5
- Physical Processes: 2.1, 2.2, 2.5, 2.8

### Northern Ireland

Key Stage 2 Science and Technology

- Living Things: Animals and Plants a, b, e
- Materials: Properties c
- Physical Processes: Forces and Energy c

## 6. Keywords

The following is a list of keywords that will be used in this lesson:

- *force* - a push or a pull.
- *gravity* - the force that pulls things towards the ground and gives matter weight.
- *upthrust* - the force produced by the water that pushes upwards against a floating object.

## 7. Equipment & Materials

### Teacher Resources

- A large globe and/or world map.
- Pictures of Dame Ellen MacArthur *HMS Endurance* from the Resource Gallery either printed out or displaying on the class whiteboard.
- Albatross pictures from the Resource Gallery either printed out or for displaying on the class whiteboard.

### Practical Activity Resources

This lesson is supported with resource sheets which provide a template for building a flying model albatross and instructions for how to test the effect of adding more weight and changing the size and form of the wings.

Each pupil will need the following materials and resources:

- A copy of *Resource Sheet 11.1 - Why don't albatrosses sink?*
- 50 g of modelling clay.
- About 10 cm of string.
- A variety of materials which can be wrapped around the modelling clay. These could include cloth, tinfoil, paper etc. Bubble wrap must be included.
- A force meter/spring balance.
- A plastic mixing bowl filled with water.
- A selection of feathers - **please note that feathers may produce an adverse reaction in asthma sufferers.**
- A magnifying glass alternatively, a video microscope linked to the class whiteboard can be used if available.
- Something with a mass of approximately 11 kg - 11 bags of sugar in a basket for example.

## 8. Lesson Structure

### Introduction

- I. Explain the role of *HMS Endurance*. You may want to use some of the images included in the Resource Gallery on this website to help illustrate this. You may also want to use a globe or map to show pupils where Antarctica is in relation to the UK. Explain also who Dame Ellen MacArthur is and that she has spent a lot of time sailing the oceans around Antarctica during her racing. Explain that her racing yachts are very different in design and purpose to *HMS Endurance*. You could do a quick comparison on the board.
  - Ask pupils to spend one minute in pairs writing down as many different animals as possible that they think that Dame Ellen MacArthur and the crew of *HMS Endurance* might see during a trip to the Antarctic..
- II. Show pupils an image of an albatross from the Resource Gallery and ask them if they know what it is.
  - Explain that albatrosses are among the world's largest flying birds. An adult wandering albatross can have a wingspan of over 3 metres and live for more than 60 years. You could ask pupils to measure out a length of 3 metres on the floor so that pupils can then compare this to their own height.
  - Explain that an adult albatross can weigh up to 11 kg. Allow pupils to get a feel for this weight by either passing round the 11 kg mass you have chosen or ask a few volunteers to come to the front of the class to try to lift it.
  - Explain that albatrosses sleep while floating on the surface of the ocean.
- III. Ask pupils how it is possible for an 11kg bird to float. Write some of the best explanations on the class white board.
  - Explain that pupils are now going to do an experiment to try to find out why heavy things, like an albatross (or *HMS Endurance* or Dame Ellen MacArthur's boat) are able to float.

**Main Activities**

- I. Before pupils start their experiments it will be necessary to demonstrate what they have to do. For the purposes of the demonstration it will be useful to have a large stone and spring balance/force meter available. When doing the demonstration be careful to emphasise the following points:
  - The weight of the stone in air
  - The weight of the stone in water
  - The difference between the measured weights is due to an upward force produced by the water this is called *upthrust*.
  - Pupils should work on this experiment in pairs.
- II. Once pupils have carried out the experiment they can plot a bar chart as shown on *Resource Sheet 11.1 - Why don't albatrosses sink?*
  - Pupils can then try to reach a conclusion about why an albatross floats. This is likely to be difficult and may be best done as a teacher guided class activity.
- III. Ask pupils what material(s) allowed their modelling clay albatross to float. Ask pupils what the weight of modelling clay wrapped in this material was in and out of the water. If the albatross was floating they should have measured zero weight in the water. Ask the pupils what was different about this material to the other materials. The key points here are that (if the material was bubble wrap) it contained trapped air and it was waterproof.
- IV. Now show the pupils the feather samples (see note in section 7 regarding asthma sufferers). Point out that the albatross will have downy feathers close to the skin to trap air and it will have smoother, oily feathers on the outside to keep the water out.

**Conclusion**

Summarise key points ie;

- A force is a push or a pull.
- Gravity is the force which pulls things towards the Earth.
- When an object is placed in water it experiences a force pushing upwards called *upthrust*.
- The ability of an albatross to float is directly related to the fact that its feathers are water proof and able to trap air against the bird's body.
- Albatrosses are well adapted to their environments their feathers help to give them the ability to float on the water when they are not flying.

**9. Differentiation**

- Adapt discussion sessions to suit ability and age group.
- Provide extra support during group activities for those pupils who require it.
- More able pupils could also notice that the layer of bubble wrap around their modelling clay is greatly increasing its overall volume, but not increasing its mass by much. This could be used to introduce the concept of density.
- The concept of *upthrust* could be explained in more depth by telling pupils that the *upthrust* experienced is equal to the weight of the water displaced by the object.

**10. Extension Work**

- Pupils could be asked to consider what happens to sea birds when they get covered in oil from spillages and how this affects the condition of their feathers.

**11. Risk assessment**

Some safety advice is included in this lesson plan, however, it is the responsibility of the supervising teacher to carry out all risk assessments with regard to this activity and to make sure that any such risk assessment complies with the requirements of the particular institution in which it is being conducted.

## 12. Find Out More

### Teachers

[www.visitandlearn.co.uk](http://www.visitandlearn.co.uk) and [www.royalnavy.mod.uk](http://www.royalnavy.mod.uk)

Lots of information about HMS Endurance and its work in Antarctica.

[www.earthlife.net/birds/feathers.html](http://www.earthlife.net/birds/feathers.html)

Lots of information about the technicalities of feathers.

[www.antarctica.ac.uk/about\\_antarctica/wildlife/birds/albatross.php](http://www.antarctica.ac.uk/about_antarctica/wildlife/birds/albatross.php)

An outline of the problems facing the albatross.

[www.savethealbatross.net/](http://www.savethealbatross.net/)

Lots of information about albatrosses and the problems that human activities are causing them.

<http://en.wikipedia.org/wiki/Albatross>

Detailed information about the albatross lifecycle and taxonomy.

[www.rspb.org.uk/supporting/campaigns/albatross/support.asp](http://www.rspb.org.uk/supporting/campaigns/albatross/support.asp)

Details of how to support the RSPB *Save the Albatross* campaign

### Pupils

[www.antarctica.ac.uk/about\\_antarctica/wildlife/birds/albatross.php](http://www.antarctica.ac.uk/about_antarctica/wildlife/birds/albatross.php)

An outline of the problems facing the albatross.

[www.savethealbatross.net/](http://www.savethealbatross.net/)

Lots of information about albatrosses and the problems that human activities are causing them.

[www.kcc.org.nz/birds/albatross.asp](http://www.kcc.org.nz/birds/albatross.asp)

Interesting albatross factsheet on a childrens' conservation website.

An adult albatross can weigh up to 11 kg. That's pretty heavy. Your teacher might show you something of the same weight to give you an idea of exactly how heavy it is.

So how come albatrosses can float?

This experiment will help us to investigate why albatrosses (and other sea birds) don't sink.

Your teacher will give you:

- 50 grammes of modelling clay
- About 10 cm of string
- Some different materials which can be wrapped around the modelling clay.
- A force meter/spring balance
- A plastic mixing bowl filled with water

Having a classroom full of albatrosses could get cramped (and messy!) so we are going to use a ball of modelling clay to take the place of our albatross.

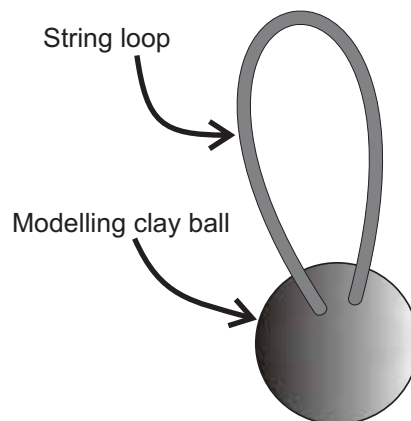
Now follow these steps:

## Step 1

Tie your string into a loop and roll your modelling clay into a ball.

Push the blunt end of a pencil into the top of your modelling clay ball and then poke about half of your string loop into the hole.

Squash the hole shut so that half of the loop now sticks out of your ball.



## Step 2

If you want to you can shape your modelling clay into an albatross. If you do this, (and you don't have to) make sure that it has its wings folded up.

## Weighing your albatross

When you hang your albatross from the force meter and put it into the water it is important that it doesn't touch the sides or bottom of the bowl.

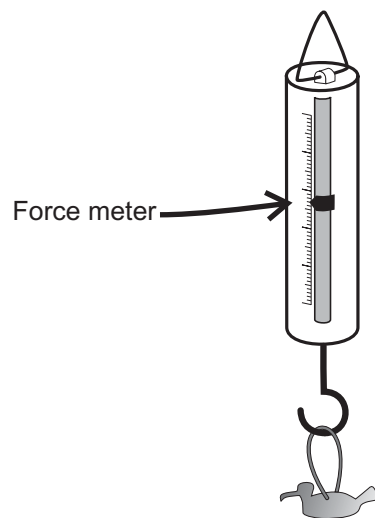
If your albatross floats don't push it down further than it wants to go.

If your albatross doesn't float let it sink under the water so it is completely covered, but still don't let it touch the bottom.

## Step 3

Hang your albatross on the force meter and weigh it.

Write the weight down in the table on the next page.



## Step 4

With your albatross still hanging from the force meter dip it in the water until it is completely covered and weigh it.

Write the weight down in the table on the next page.

## Ellen's quick facts about keeping warm



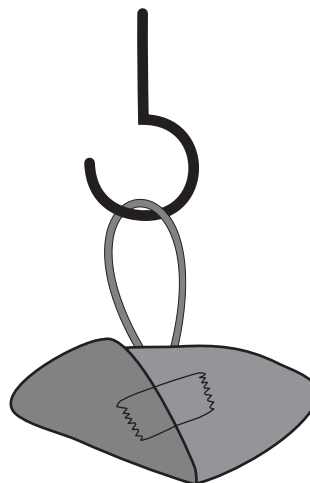
Did you know that although albatrosses are one of the biggest flying birds they don't have the most feathers. The whistling swan has something like 25 000 feathers during the winter!

## Step 5

Now choose one of the materials that your teacher has given you and wrap your albatross up in it.

You may need to fasten it with a small piece of sticky tape.

Weigh your albatross out of the water and in the water then write the weights down in the table below.



## Step 6

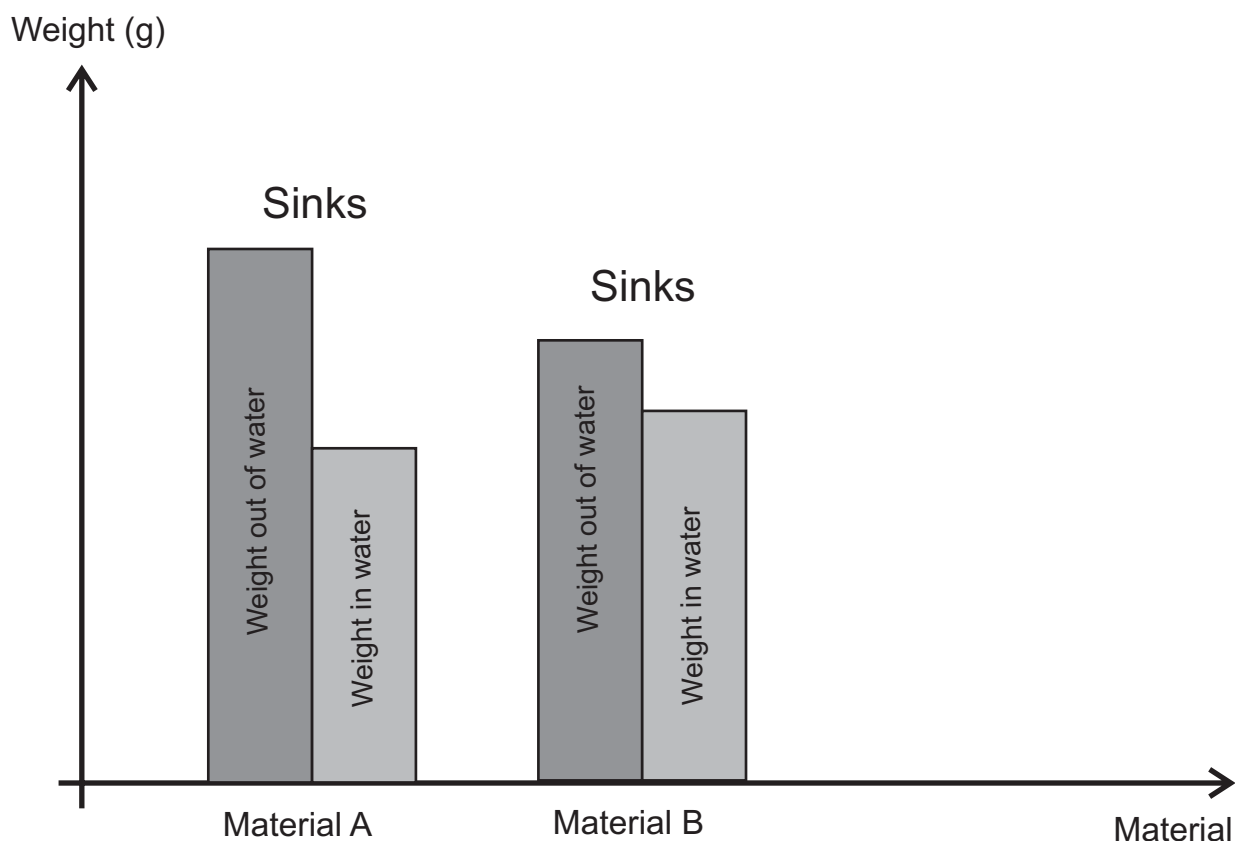
Repeat step 5 with each different material.

Write down your results in this table.

| Which material did you use? | Albatross weight out of the water in grams | Albatross weight in the water in grams | Did the albatross float or sink? |
|-----------------------------|--|--|----------------------------------|
| No material                 |  |  |                                  |
|                             |  |  |                                  |
|                             |  |  |                                  |
|                             |  |  |                                  |
|                             |  |  |                                  |
|                             |  |  |                                  |

## Step 7

Now plot your results in a bar chart like this:



You can use different colours for the columns showing the weight in and out of water for each material.