Science Foundation Ireland sfi For what's next

Engineers Week Lighthouses

Classroom Resource Booklet

EngineersWeek
2 March – 8 March 2019

Discover Primary Science and Maths
www.primaryscience.ie

Ireland esero

DPSM/ESERO
Framework for Inquiry

THEME	Overall theme	
CURRICULUM	Strand:	
	Maths:	
	Strand Unit:	
	Curriculum Objectives:	
	Skills Development:	

ENGAGE

THE TRIGGER	WONDERING	EXPLORING

INVESTIGATE

STARTER QUESTION	PREDICTING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS

TAKE THE NEXT STEP

APPLYING LEARNING	MAKING CONNECTIONS	THOUGHTFUL ACTIONS

Considerations for inclusion

REFLECTION	

DPSM/ESERO
Framework for Inquiry

THEME	LIGHTHOUSES
CURRICULUM	**Strand: SESE:** Energy and Forces, Materials, Environmental Awareness and Care. **Strand Unit:** Forces, Magnetism and Electricity, Properties and Characteristics of Materials, Science and the Environment. **Curriculum Objectives:** Investigate how forces act on objects. Investigate how some objects may be made to float by hollowing them out. Investigate materials for different properties, e.g materials that absorb water and those that are waterproof. Investigate current electricity by constructing simple circuits. Begin to explore and appreciate the application of science and technology in familiar contexts in designing and making activities. **Skills Development:** Design and Make: Explore, Plan, Make, Evaluate. Working Scientifically: Investigating and Experimenting, Analysing, Recording and Communicating.

ENGAGE

THE TRIGGER	WONDERING	EXPLORING
Photos of lighthouses from https://www.greatlighthouses.com/ Video Clip https://www.greatlighthouses.com/stories/great-lighthouses-of-ireland-rte/ Full series available on DVD Books: Hello Lighthouse by Sophie Blackall, The Lighthouse Keeper's Series by Ronda and David Armitage Other Videos: https://thekidshouldseethis.com/post/420274982800 https://www.youtube.com/watch?v=rUoqhWbebHQ	Why were lighthouses built? How were lighthouses built? How were materials and people transported to the lighthouse before they had helicopters? Why were lighthouses round? What was the significance of the colours on lighthouses? Have lighthouses changed much over time?	Explore floating and sinking with different objects. Explore lighthouse shapes. Take 2 A4 sheets of card. Fold one into a cuboid shape and the other into a cylinder and tape them to a heavy cardboard base. What do you think will happen if we blow air from a fan or hairdryer at the tower? (Cuboid tower may cave in or topple over quickly while the wind goes around the cylinder).

INVESTIGATION 1 – BUILD A BOAT

STARTER QUESTION	PLANNING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS
We want to build a lighthouse out on a rock in the middle of the ocean. Can we build a boat that will carry lots of building materials without sinking?	Each team / pair is given identical amounts of plasticine. What shape boat do you think would hold the greatest load?	Designs can be tested in the water and modified until teams come up with the final design. Teams can then test against each other to see which boat carries the most cargo.	Teams evaluate their own designs. What features make a good boat?

INVESTIGATION 2 – MATERIAL FOR A LIFEJACKET

STARTER QUESTION	PLANNING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS
We are travelling out to build our lighthouse but we need to be safe in the boat. What would help us to stay afloat if we fell overboard?	We have already looked at how changing the shape of the plasticine can help it to float. What else could help someone to float – armbands, polystyrene float, inflatable life jacket.	What materials could we use to design a lifejacket for a lego figure / other toy? How will we make the lifejacket? How will we attach it to our figure? What will our person need to stay alive (head needs to be above water when floating).	Float the figures in water and children evaluate their own lifejackets. If the figure is floating face down is your lifejacket working well? Could we change the design in any way to make it work better?

Considerations for inclusion

Consider potential area of difficulty for students with Special Educational Needs.

DPSM/ESERO
Framework for Inquiry

INVESTIGATION 3 – DESIGN AND MAKE A LIGHTHOUSE

STARTER QUESTION	PLANNING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS
We have made a boat to carry the workers and cargo. Can we design and build a strong lighthouse with a working light?	What materials do we need for our lighthouse? What shape will be strong? How will we make the light work? Draw a plan of your lighthouse to include all of these design features.	Start with the circuit. How do we connect the battery to the bulb / LED? Make the lighthouse and include the circuit inside. Can we design a switch to turn our light on and off from outside?	Children evaluate their lighthouse design. Is the lighthouse strong? – can we test it with the hairdryer? Are the colours easy to spot from a distance? Does the light work?

Considerations for inclusion

Consider potential area of difficulty for students with Special Educational Needs.

TAKE THE NEXT STEP

APPLYING LEARNING | MAKING CONNECTIONS | THOUGHTFUL ACTIONS

- More information on Irish lighthouses from https://www.greatlighthouses.com/
- Lighthouses around Ireland have different colours and patterns so they can be easily identified. They also each have a different pattern of flashes. Teams could use their lighthouse switches to turn on and off the light and come up with individual pattern of flashes for their lighthouses.
- History of lighthouses in Ireland.
- We use our oceans for so many things – food, transport, recreation. In what ways are human activities damaging the oceans?
- Materials designed to float on water or to be used in our oceans such as buoys and fishing nets are often made from plastics. What happens to these materials when they start to break apart?
- Most plastic is made from oil which is a non-renewable resource but plastic can also be made from plants or other natural materials. Do you think this would be better or worse? - Investigating Plastic https://www.sfi.ie/site-files/primaryscience/media/pdfs/col/investigating_plastic_activity.pdf
- Other ideas around lighthouses http://www.teachingideas.co.uk/video/Lighthouse
- Book: Lighthouses of Ireland by Roger O'Reilly https://www.easons.com/lighthouses-of-ireland-roger-oreilly-9781848893535?gclid=EAIaIQobChMIqvSBraak4AIVQ7HtCh1F8AnnEAAYAiAAEgIWk_D_BwE

REFLECTION

- Did I meet my learning objectives?
- Are the children moving on with their science skills?
- Are there cross curriculum opportunities here?
- What went well, what would I change?
- Did I take into account the individual learning needs of my students with SEN? What differentiation strategies worked well?

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INVESTIGATION

Design a boat

Class level

All

Skills

Designing and making.
Investigating and experimenting - fair testing.

Background information

Water pushes upwards with a force called 'upthrust'. (You can feel this if you try to push a light object such as a balloon or aeroboard under water). The shape of a 'boat' affects the weight (passengers/cargo) it can hold. The more water that the boat displaces the more it will float and therefore the more weight it can take.

Equipment

Plasticine, Dried peas, Container (e.g. butter carton) of water, Orange, Jam jar.

Preparation

Collecting materials.

Safety

Care with water.

Activity

Design and make a boat to take the maximum number of passengers with the given materials.

For fair testing give each group the same amount of Plasticine.

Suggest they first roll the Plasticine into a ball and put it into the water.

What happens? (It sinks).

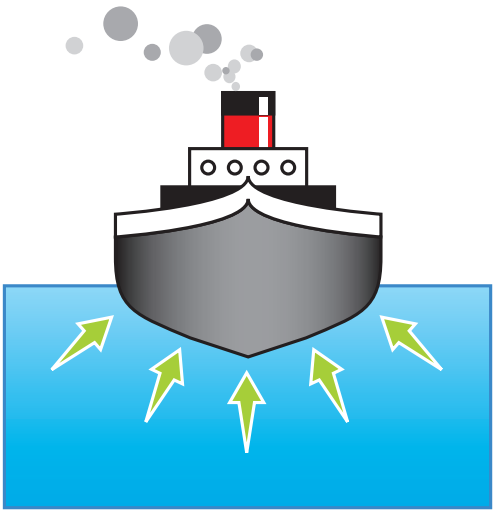
Now see if they can get it to float.

Once they have it floating can they get it to take some 'passengers' (dried peas)?Can they alter the shape so that the boat will take more 'passengers' before it sinks? Whose boat takes the most 'passengers?

Follow-up Activities

(i) Put an orange in water. What happens? (It floats). Now peel the orange and put it back into the water. What happens? (It sinks. Orange peel is full of trapped air bubbles, which make the orange light for its size, so the unpeeled orange floats. Without the peel the orange is heavy for its size, so it sinks).

(ii) Make a diver (see next page).



SHIPS ARE HEAVY

but they are shaped so that they push aside lots of water.

The water pushes back hard enough to keep them floating.

INVESTIGATION

Making a diver

Equipment

Plasticine pen top with clip, Plasticine, Paper clip, Large plastic bottle with screw top.

Aim

To make the plastiine figure of such a size that when it is attached to the paper clip and pen top if just floats (i.e. the top is just above the water-level).

What happens when you squeeze the bottle?

What happens when you relax your grip?

Explanation

When you put the diver (pen top, paper clip and plasticine) into the water so that it floats the trapped air bubble inside the pen top makes the diver lighter than water so it floats.

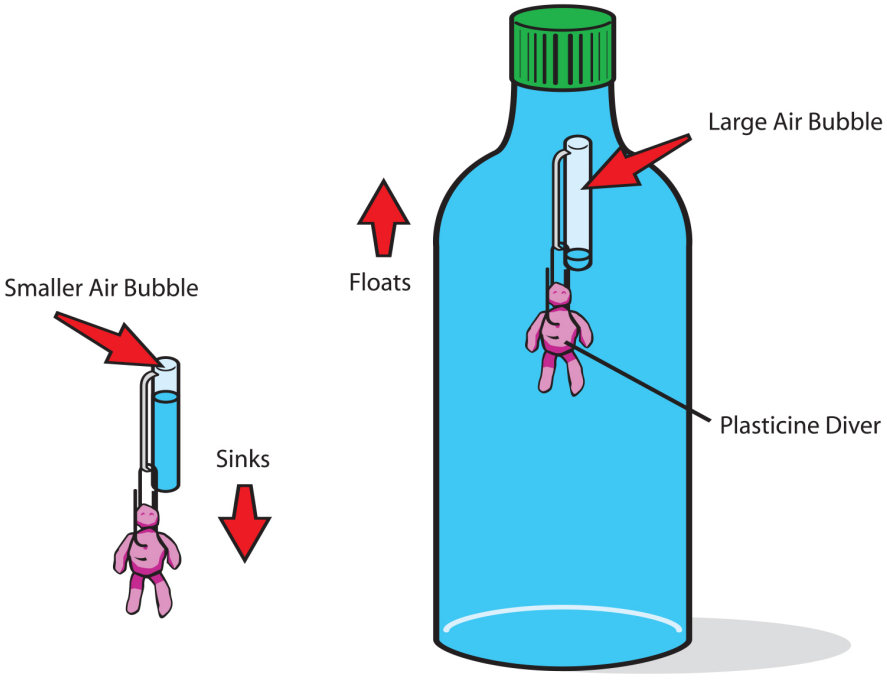
When you squeeze, the bottle water is pushed up into the pen top, squashing the air into a smaller bubble.

The pen top now has more water in it, making the diver heavier, so it sinks.

When you relax your grip on the bottle, the air in the pen expandss again, the diver becomes lighter and floats again.

Further discussion

Submarines, squashing air - air pressure.



INVESTIGATION

Material for a Lifejacket

Class level

Younger classes

Background information

Things that are lighter than water (i.e. lower density) float, and things that are heavier than water (i.e. denser) sink. (Avoid using the term 'density' with primary children).

Heavier things can be made to float in different ways, e.g.

1) By changing their shape, if this is possible (e.g. by hollowing out plasticine).
2) By attaching some very light stuff to them so that they are now 'light for their size' (e.g. swimming armbands and lifejackets increase the size – person + bands/jacket – but with very little increase in weight).

Equipment

Plasticine, various materials for making a lifejacket , e.g. cork, sponge, cotton wool, polystyrene, newspaper, bottle caps, balloons, swimming armbands or aeroboards.

Content

SCIENCE: Forces: Sinking and floating
Materials – Properties and Characteristics

MATHS: Measures: Weight, capacity

Preparation

A previous class on 'Sinking and Floating' would be useful: the children feeling the up thrust of the water as they try to push, say, a balloon under the water; and balancing this up thrust force with the force of gravity pulling downwards.

They should also investigate various objects in water, I.e. predict and test whether they sink or float.

Trigger questions

What do you think will happen to a ball of plasticine if you put it in water – will it sink or float?How do you think you could make it float? (The children may suggest hollowing it out (see 'Design a Boat' in DPS Activity sheets).

The children should then be asked to shape the plasticine into a person and then asked the same questions.

What happens when you jump into deep water – sink or float?

How can you stay on the surface? (Swim, float, or use air-filled armbands, aero board or lifejacket).

What should you wear when you go out in a boat? (A lifejacket).

What sort of material do you think lifejackets should be made of?

(The children may suggest light materials that do not absorb water which would make them heavier).

(Have various things on hand to show the children at this stage, e.g. balloons, armbands, cotton wool, newspaper, cork, etc.).

INVESTIGATION

Material for a Lifejacket

Skills

Exploring, planning, making, evaluating.

Cross - curricular links

SPHE – Safety in the water. Most clothes and shoes absorb water and make you heavier and sink. So it is important to remove your shoes and most clothes if you fall into the water accidentally.

Activity:

1. The children should be asked "Can you make their piece of plasticine into the shape of a person?".
2. They should then be shown the various materials and asked "Can you say which of these do you think would make the best life jacket?" "Why do you think that?"
3. They are then asked to find a way of attaching the material to the 'person'.
4. They then test the different materials to see which of them helps the 'person' to float the best.
5. Can they put the materials in any order? If so, what factors are they using to do this (i.e. why are they putting them in this order?).

   "Which material would make the best lifejacket?"
   "Which material would make the worst lifejacket?"
6. Can they make it as fair a test as possible?Evaluation: Ask the children: "How did your design work?".

   "If you were doing it again would you do it differently?"

N.B.

1. This activity can also be done using a small plastic figure such as a Lego man instead of plasticine. It would save time making the figure.
2. It may be difficult to get the figure to float with the face up. Just getting the model to float, even if face downward, may have to be accepted!

MATHS: To introduce Maths into this activity, the children could:

(i) During the preparation work: put the various items (cork, sponge, cotton wool, newspaper, etc. on a balancing scales and compare them to see which is the lightest and which is the heaviest; (Weight).

(ii) Measure the water which they put into the container, e.g. "we need to put ten cups of water into the plastic container before we start." (Capacity).

Follow-up Activity

If children have been learning to swim can they find out what helped them to float during their first lessons, i.e. what were their armbands, boards or whatever they used, made of?

INVESTIGATION

Make a lighthouse

Class level

Third – sixth classes

Safety

Care with batteries and wire.

Objectives

Content strand and strand unit

Energy & forces, Magnetism and electricity

Through investigation the child should be enabled to investigate current electricity by constructing simple circuits SESE: Science Curriculum pages 64 and 86. In this activity children apply the knowledge gained and skills learned in making electrical circuits to construct a model of a lighthouse that shines a light.

Skill development

Experimenting; designing and making.

Preparation

Collect materials, check batteries and prepare connecting wire.

Curriculum links

SESE: History

Local studies/explore some feature of local environment/ purpose of construction.

Continuity and change over time/ technological and scientific developments over long periods.

SESE: Geography

Human environment/ features of the built and natural environment.

Maps, globes and graphical skills/ construction of sketch maps (e.g. location of lighthouses).

Visual arts

Construction / making constructions / make drawings from observations to analyse the structures of buildings.

Construction / looking and responding / look at collections or photographs of built structures.

Language: English/Gaeilge

Folklore, sea-tales involving lighthouses.

Background

Some classes on electricity and circuit-making should have taken place prior to this activity; so that the children understand the basics of electric circuits (i.e. need a source of electricity, conducting wires and a complete circuit).

Materials/equipment

For lighthouse: Cardboard tube (e.g. empty kitchen roll or a long crisps tin), Bulb-holder, 3.5V bulb (flashing or ordinary), Battery (3 V or 4.5 V), Connecting wires, Small plastic jar, Black and white paper, Sellotape, Glue.
For switch: Cardboard, 2 paper fasteners, 1 paper clip.

Background information

The bulb will light only when there is a complete path for the electricity to flow (i.e. a complete circuit).

INVESTIGATION

Make a lighthouse

Setting the scene

Begin with a brainstorm on finding one's way around – e.g. street names, maps, compasses, etc. Talk about land, sea (and perhaps air if they wish).

Introduce lighthouses. Look at pictures of lighthouses. Visit a lighthouse if possible. Why do we need lighthouses?

Lighthouses send out warning lights. The interval between the flashes identifies the lighthouse; e.g. Dun Laoghaire will have a different interval to the Old Head of Kinsale.

Trigger questions

How do you find your way safely when travelling?

What about travelling at sea?

How do sailors know if there are dangerous rocks sticking up?

Do you know any lighthouses? Where are they?

Do all lighthouses look the same?

Does the light from a lighthouse shine continuously?

How does a lighthouse tell you where you are

(as well as warning you of land/danger)?

How did lighthouses work long ago?

Do you know any stories about lighthouses?

Draw a diagram.

Development of activity

How could you make a lighthouse? What would you need? Draw a diagram.

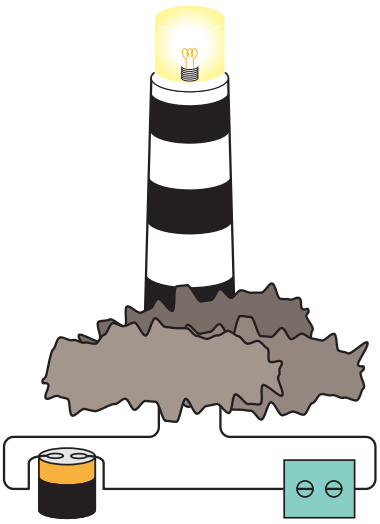
How would you design your lighthouse?

Activity

The children could be given the opportunity to build their own designs.

Here are some instructions if they find this difficult:

Glue the black and white paper onto the cardboard. Make an electric circuit using the battery, wires, bulb and bulb-holder. Arrange the circuit so that the bulb is at the top of the tube and the battery at the bottom. Put the jar over the bulb.



INVESTIGATION

Make a lighthouse

Review

If your lighthouse does not light what do you need to check?

(INCOMPLETE CIRCUIT, SHORT CIRCUIT, DEAD BATTERY, BROKEN BULB)

How could you make a better lighthouse?

What did you like/dislike about this activity?

Assessment

Children could draw their lighthouse and circuit showing how they made the light work.

Another approach would be to use the models the children have made. They could display their models with annotated notes. They could be asked to show their models to their peers and explain how they work. They could invite other classes to view their displays and they could answer questions that the other children might have.

Follow-up activities

(1) You can operate the lighthouse by inserting a switch in the circuit as follows: Insert two paper fasteners into cardboard and join them with a paper-clip on top, so that the latter can swivel. Join the wires from the circuit to each paper fastener at the back of the cardboard.

(2) Rocks made from papier-mâché add a nice touch to this activity, and a link with art.

(3) Research a local lighthouse.

(4) Make a lighthouse quiz e.g. in what counties are various lighthouses.

(5) Design a lighthouse model that includes a sensor switch. When boats sail over a certain point in the 'water' the lighthouse light comes on.

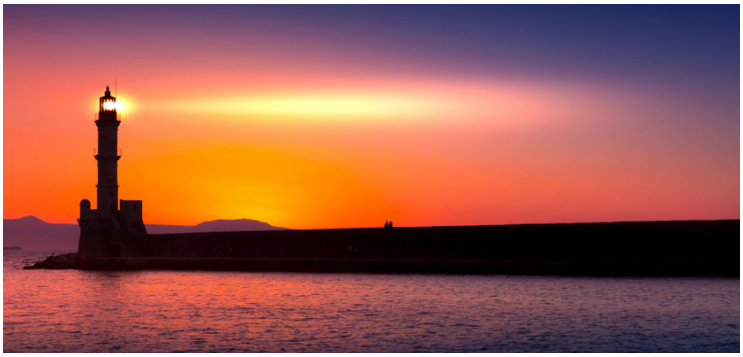
Further information on lighthouses can be obtained from the Commissioners of Irish Lights Information webpage at http://www.cil.ie/sh675y.html.

The children could be asked:

What else would you like to find out?

How would you find it out?

This would encourage them to design their own investigation.



Curriculum Links
LIGHTHOUSES

English / Irish

- Write some entries for a diary of a lighthouse keeper
- Write a story about a lighthouse.

Geography

- How many lighthouses do we have in Ireland? Can we locate them on a map?
- Weather, climate and atmosphere: How did the weather affect those working in lighthouses?

History

- What is the oldest lighthouse in Ireland? What historical events has the lighthouse witnessed during its lifetime? Can we draw up a timeline?
- Research and write about the history of one of Ireland's lighthouses.

The Arts

- Paintings, drawings, collage based on lighthouses.
- Drama: Drama based on a trip out to the lighthouse, living in a lighthouse.

PE

- Lighthouse and Rocky Shore Game from the Marine Institute https://oar.marine.ie/handle/10793/1027.

Other

- Further curriculum ideas based on a marine theme from Explorers Education Programme https://oar.marine.ie/handle/10793/753.
- Further curriculum ideas based on lighthouses from http://www.teachingideas.co.uk/video/Lighthouse.

Science Foundation Ireland
Wilton Park House
Wilton Place
Dublin 2
Ireland

t: +353 1 6073184
Primaryscience@sfi.ie