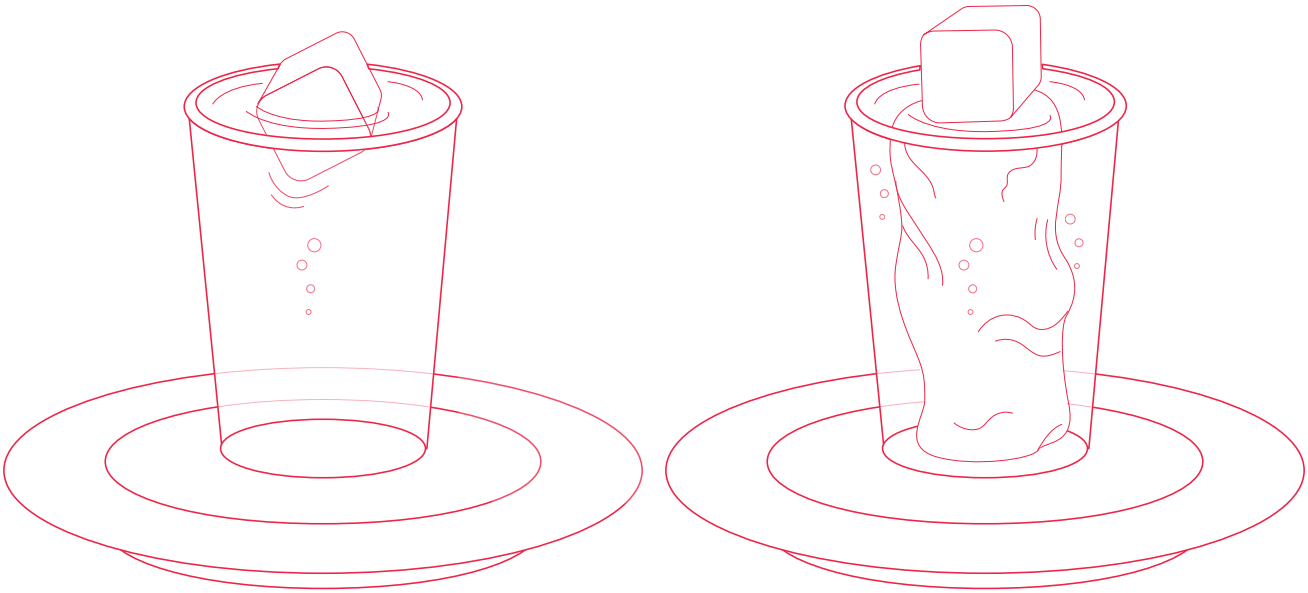
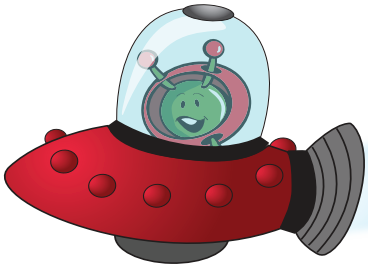
teach with space

→ THE ICE IS MELTING

How can we investigate the effects of melting ice?





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FAST FACTS

Age range: 8-12 years old

Type: pupil activity

Complexity: easy

Teacher preparation time: 20 minutes to read documents and organise materials

Lesson time required: 60-90 minutes

Cost: medium (10-15 euros)

Location: indoors

Includes the use of: modelling clay

Outline

In this set of four activities, pupils will explore the impacts of global warming and melting ice on the Earth. They will learn the difference between land ice and sea ice, and will investigate the respective effects of these melting. They will then design their own experiment to examine how melting ice changes the temperature of the atmosphere. Pupils will finish by learning about glaciers, and by looking at satellite images of a glacier to consider how much it has melted over a period of time.

Curriculum relevance

- Geography
- Science

Pupils will learn

- Where ice can be found on Earth
- That the amount of ice on Earth is decreasing
- The difference between land ice and sea ice
- That melting sea ice does not affect sea levels
- That melting land ice does affect sea levels
- That it is colder on areas of ice (white) than on land and water (dark)

Pupils will improve

- Their experimental skills
- Their ability to work in a group
- Their ability to plan an experiment
- Their ability to describe and explain physical effects that they see

Summary of activities

	Title	Subject	Outcome	Requirements	Time
1	Introducing ice	Ice and the difference between land ice and sea ice.	To understand the difference between land ice and sea ice. To realise that the ice caps are melting.	None	20 minutes
2	Will sea levels change?	A practical experiment to investigate the effects of sea ice and land ice melting.	To understand why melting land ice contributes to rising sea levels, whereas melting sea ice has no effect on sea levels.	Activity 1	20 minutes
3	Will temperature change?	A practical experiment to determine whether air is warmer over the light coloured ice or the dark coloured land and water.	To understand that the air is cooler over ice, because it is a lighter colour. Thus melting ice will also warm up the Earth further.	Activity 1	30 minutes
4	Watching a glacier	The melting of a glacier over a number of years.	To understand that glaciers are melting due to global warming, and that satellite images can help us monitor them.	None	20 minutes

→ ACTIVITY 1: INTRODUCING ICE

In this activity, pupils will be introduced to ice, including the difference between land ice and sea ice. They can either use information sources to answer the questions on their activity sheets, or use this activity as a way to record their base knowledge of the topic before carrying out practical investigations in later activities. Therefore Activity 1 forms a nice introduction to the lesson.

Equipment

- Information sources, such as the internet, an encyclopaedia, or an atlasInternet connection

Exercise

Pupils can use the information sources to research this topic and answer the questions on their activity sheets.

Discussion

Once pupils have completed their worksheets, discuss the answers as a class. You could ask for ideas about:

- The temperature at which water freezes to form ice (0°C).
- The different forms of frozen water (snow, hail, ice cubes, etc.).
- Where ice can be found on Earth (mostly at the North and South poles, Greenland, Siberia).
- We can find ice at the South pole (mainly land ice), at the North pole (both land ice and sea ice). The North Pole includes Greenland, which is land ice.
- Why the North pole has shrunk so much in recent years.
- The possible results of ice melting (e.g. sea levels rising).

→ ACTIVITY 2: WILL SEA LEVELS CHANGE?

In this activity, pupils will build on the knowledge they gained in Activity 1 by practically investigating the effect on sea levels when sea ice and land ice melts.

Equipment (per group)

- 2 small plastic cups
- 2 small plastic plates
- 2 ice cubes
- Enough water to fill the two cups
- Modelling clay

Health and safety

Ice cubes: Pupils should take care to wet their hands before picking up ice cubes, to stop the ice cube from sticking to their fingers.

Exercise

Pupils should first complete questions 1 and 2, where they predict what will happen as a result of ice melting. Then organise pupils into groups of four in order to carry out the practical experiment. Hand out the equipment and explain that the water represents the sea. Ask pupils to follow the instructions on their activity sheets.

Note that it may take quite a long time for the ice to melt. You can speed up the process by using lukewarm water, or putting the cups on a sunny windowsill.

Results

The water in cup 1 should stay at the same level, whereas the water in cup 2 should overflow.

Discussion

- Melting sea ice does not cause sea levels to rise, whereas melting land ice does.
- In ice form, the sea ice is already contributing its volume to the oceans. Thus when it melts it does not increase the volume of the oceans.
- In ice form, land ice is not contributing to the volume of the oceans. When it melts, it flows into the ocean, increasing the overall volume.
- It is misleading to say that melting ice overall leads to rising sea levels. It is melting land ice that mostly leads to rising sea levels.
- Note that indirectly, melting sea ice can lead to rising sea levels, through changing properties such as the salinity, density, and current. But these effects are less extreme, and less measurable than the changing volume as a result of melting land ice.
- Ice is special because it is one of the few materials where its solid form is less dense than its liquid form, so it floats. This means that in ice form, the sea ice takes up more space than it does in water form.

→ ACTIVITY 3: WILL THE TEMPERATURE CHANGE?

In this activity, pupils will design their own experiment to investigate whether the temperature of the Earth will rise if the ice melts.

Equipment (per group)

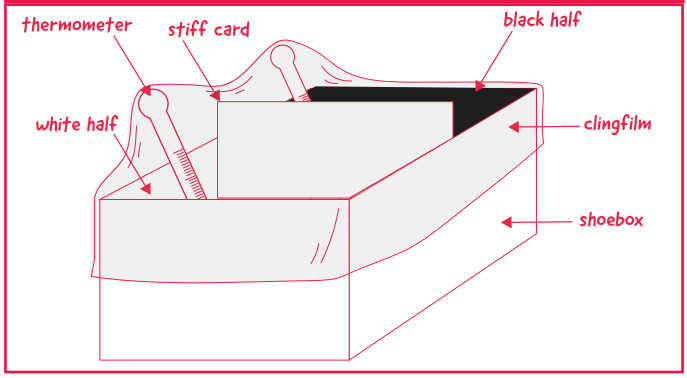
- Shoebox
- One A4 piece of stiff card
- Two A4 pieces of black paper
- Two A4 pieces of white paper
- Glue
- Clingfilm
- 2 thermometers
- Sunlight or bright lamp

Exercise

- Give out the materials to pupils and invite them to design their own experiment to investigate whether the air will be warmer over areas of light ice, or dark land and water.

- The idea is that pupils will set up the shoebox similar to the set-up shown in Figure 1. They should divide the shoebox in half using the piece of stiff card. They should cover one half with white paper and one half with black paper. One thermometer should be placed in each half, and the top covered with cling film. After about 10 minutes the students should check the temperature readings on the thermometers.

Figure 1



↑ Possible set-up for the experiment.

Results

The thermometer in the black half of the box should show a slightly higher temperature than the thermometer in the white half of the box. From this, pupils should conclude that melting ice will increase the temperature of the Earth further, because it will become water, which results in a smaller light area (ice) and a larger dark area (water). The light area (ice) will reflect sunlight, thus stay cold, whereas the dark area (land and water) will absorb the sunlight, making it warmer.

→ ACTIVITY 4: WATCHING A GLACIER

In this activity, pupils will look at images of a glacier to understand why satellite images are useful for monitoring the Earth.

Exercise

- Ask pupils to look at the three images of the Columbia glacier and describe how it has changed over time.

- Pupils can calculate what area the glacier shrank by. The answer should be about 150 km², but this is an estimate as the squares are quite large and pupils may include different areas.

- Finally pupils can attempt to explain why the glacier might have shrunk so much in the last 26 years. Explain that scientists think that global warming has caused glaciers to shrink. You might like to note that these images were taken in the summer. Every winter, the glacier increases in size, however overall the size is decreasing every year.

→ LINKS

ESA resources

ESA classroom resources:
www.esa.int/Education/Classroom_resources

ESA Kids homepage:
www.esa.int/esaKIDSen

Paxi Fun Book:
http://esamultimedia.esa.int/multimedia/publications/PaxiFunBook

ESA missions

Sentinel-1:
http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-1

Sentinel-2:
http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-2

Extra information

ESA Kids Climate Change website:
https://www.esa.int/esaKIDSen/Climatechange.html

ESA Climate Change Initiative:
http://www.esa.int/Our_Activities/Observing_the_Earth/Space_for_our_climate/ESA_s_Climate_Change_Initiative/(print)

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www.esa.int/education

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