

Changing state – transforming water

Practical activities to change the state of water; solid, liquid, gas

A: 'Disappearing' ice

Check that ice cubes are not so cold that they stick to your hand, then give one to each pupil

As they hold the ice cube clasped in their hands, discuss these questions:

- How does the ice cube feel? Why?
- Where is the water coming from? How?
- Where will the ice cube go?
- How could you make another ice cube from the water?

This gives pupils opportunities to explore ideas about the change of state from ice to water (and back again), whilst developing their language and discussion ideas.



B: 'Disappearing' water

Show the pupils two plastic beakers, one empty, and the other containing half a centimetre of water. Explain that the empty one had just as much water in it as the other one, when it was left on the shelf by the window over the weekend. On Monday morning, it was empty.



Ask the pupils to:

- think of as many things as they can, that might have happened to the water over the weekend;
- note down their ideas;
- then write numbers beside their ideas from the most likely (No. 1) to the least likely;
- think about how to describe how the most likely ideas might have worked.

Pupils can let their imagination run riot in thinking of different things that might have happened to the water, but then need to concentrate on reality, in deciding which is the most likely. This will probably be that the water evaporated into the air, and can no longer be seen.

C: 'Reappearing' water

Take a cold dry bottle of liquid from the fridge (milk or a soft drink). Leave it in the air until drops of water appear on the outside and discuss these questions:

- Where does the water come from?
- Does this happen outdoors naturally?



Peter Kennett.

This leads into a discussion about the invisible water in the air becoming visible liquid water on the outside of the bottle when the air cools down. This happens when dew (or frost – as ice) forms on the grass on cool mornings or when rain drops grow in the atmosphere as they become cooler.

The back up

Title: Changing state – transforming water

Subtitle: Practical activities to change the state of water: solid, liquid, gas

Topic: Investigating and discussing the change in state of water from solid to liquid to gas and *vice versa*.

Age range of pupils: 5 – 8 years

Time needed to complete activity: 10 mins

Pupil learning outcomes: Pupils can:

- describe what happens to ice as it melts to form liquid water;
- describe what happens to liquid water as it evaporates to form water vapour;
- describe how liquid water collects on cold surfaces as the water vapour in the atmosphere condenses;
- explain some of these processes.

Context:

A series of three activities for pupils to encounter and discuss the changing states of water, from ice to water to water vapour and back again – giving opportunities to develop a range of observation and description skills.

Note that water vapour is an invisible gas; when we breathe out on a cold morning, we can see our breath because the gas condenses to tiny water droplets that can be seen. These droplets can also be seen coming out of the spout of a boiling kettle, and in clouds, mist and fog.

Following up the activity:

- Ask, 'What state am I in, myself?' to reinforce learning about the states of matter and their transformations. Pupils should realise that whilst they are mostly solid, they contain several litres of liquid (blood and other fluids) and also gas in the lungs (and in the bowel!). They may also realise that transformations happen in their bodies, for example that the gas in the lungs becomes dissolved in blood, thus becoming part of the liquid, whilst the blood takes materials to form new solid cells. Meanwhile the gut breaks down food into liquids and gases. A variety of other solid/ liquid/ gas changes occur in the body too.
- Discuss how wet washing hung on a line outside, dries – and the factors that might affect how quickly it dries.
- Devise classroom tests for testing the variables affecting drying washing, eg. one 'control' cloth lying on the bench and others, a) on the radiator, b) hanging near the window, c) hanging near the door, d) hanging near a fan, etc.

Underlying principles:

- Solid water (ice) becomes liquid through melting.
- Liquid water becomes the invisible gas, water vapour through evaporation.
- Water vapour becomes liquid through condensation.
- Liquid water becomes solid through freezing.

Thinking skill development:

Thinking about how the processes discussed, link to the real world and the 'What state am I in myself?' follow up, both involve bridging learning to new situations. Meanwhile, discussions involving disagreements involve cognitive conflict.

Resource list:

The ice cube containers full of water should be put in the freezer part of a fridge (or into a freezer) beforehand in time to freeze. Meanwhile, a bottle of liquid should be put into the fridge to cool.

A: 'Disappearing' ice

- a container of ice cubes
- a cloth to mop up with

B: 'Disappearing' water

- two transparent plastic beakers, or similar, one containing about 0.5 cm depth of water

C: 'Reappearing' water

- a bottle of liquid from the fridge (milk or a soft drink), that has been dried off before using

Useful links: see the other Earthlearningidea 'watery' activities at:

http://www.earthlearningidea.com/home/Teaching_strategies.html

Put "water cycle song" into a search engine like Google™ to find several songs at different learning levels. By just inserting "water cycle", you will find a range of other water-related activities.

Source: Devised during an Earth Science Education Unit workshop in Scotland, based on ideas by Roger Mitchell.

The progression of thinking skills shown by the Earthlearningidea Water Cycle activities

Earthlearningidea	Strategies and skills developed
Changing state – transforming water: practical activities to change the state of water; solid, liquid, gas	Demonstrations of the change of state of water in a tactile way, enabling language skill development
Mini-world water cycle: a water cycle demonstration model in a box	Demonstration of key water cycle processes in a simple model, allowing bridging to the more abstract water cycle and the development of higher level thinking skills through discussion
Water cycle world: a discussion activity on the natural water transformations on Earth	Extended discussion about the different elements of the water cycle and the many different products of the cycle
'Tagging' water molecules – to explore the water cycle: a thought experiment to investigate the water cycle	A 'thought experiment' to encourage creativity and imagination in pupils in the context of the water cycle
Cycling water and heat in the lab – and the globe: demonstrating the water cycle, latent heat and global energy transfer	A lab demonstration of the water cycle, extended to promote higher level thinking skills and an understanding of the abstract process of latent heat transfer

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