Learning Objective:

To investigate different conditions which affect the melting process.

Environmental scientists study icebergs to track how they move and change. With global warming and climate change affecting different parts of the world, they are studying how the ice caps on the Earth's north and south pole, and the icebergs which are made from them, are melting.

After the Titanic disaster, it became a priority to track iceberg movements and how they melt so that the disaster never happened again.

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It is important for these scientists to experiment and find out the different conditions which may speed up or slow down the melting process.

Think, pair, share...

What do you think
are some different conditions
that would speed up or slow down
the process of an ice cube melting
compared to leaving it at room
temperature?

Things which would speed up the melting process	Things which would slow down the melting process

Think, pair, share...

If putting an ice cube in hot water would melt the ice cube quicky, what would putting an ice cube in cold water do?

Putting an ice cube in cold water would still melt the ice cube, just not as quickly as hot water would.

Cold water is still warmer than an ice cube as it hasn't hit the freezing point of 0°C yet. When liquid water reaches this temperature it will start to freeze. When water is at a temperature **above its freezing point**, it will begin to melt.

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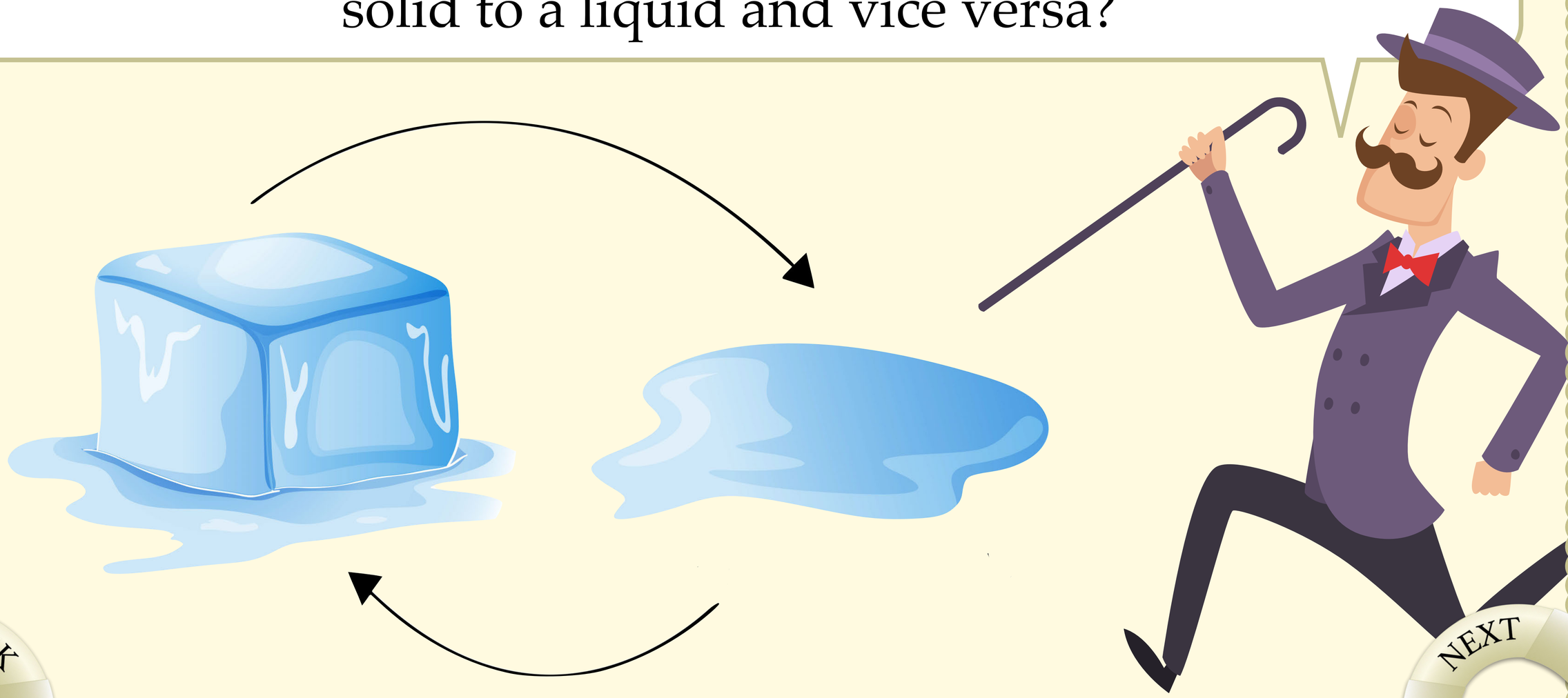
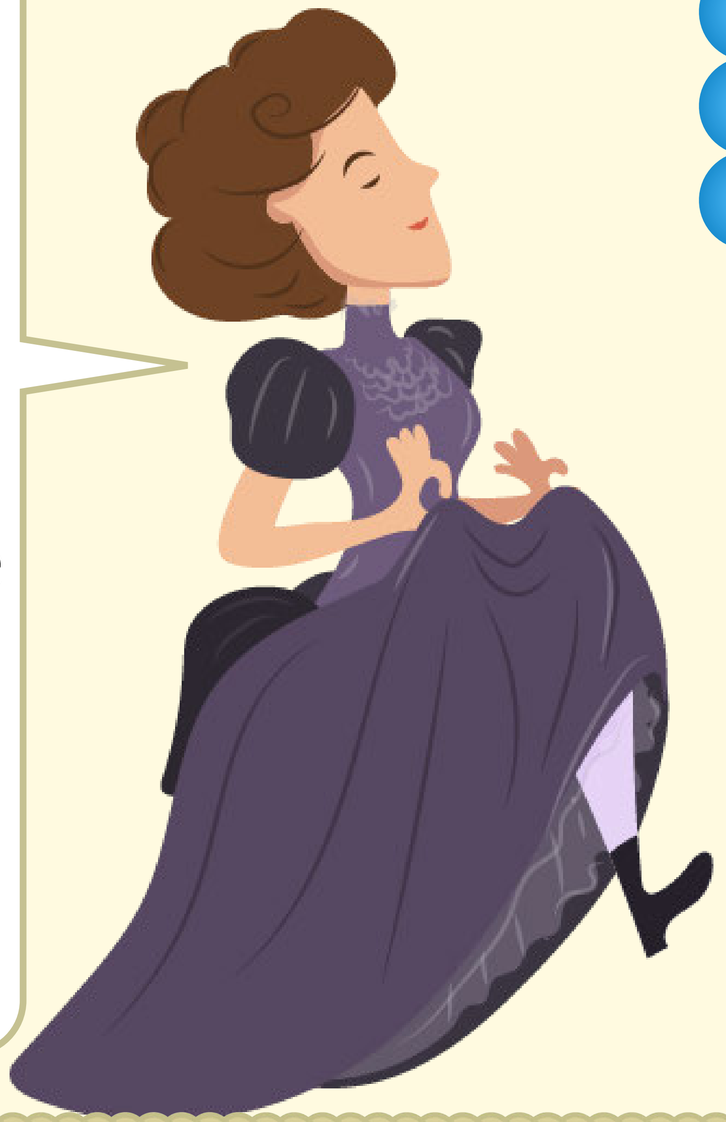
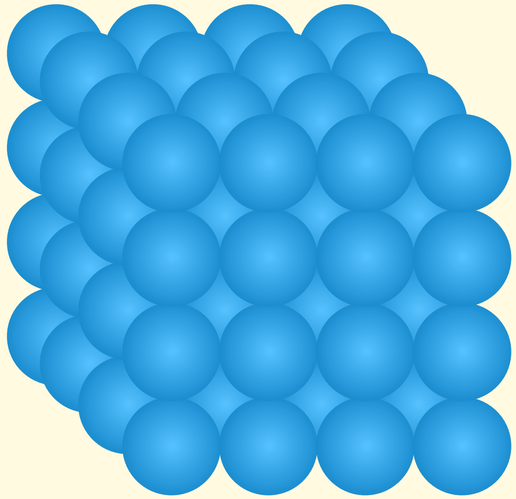
What happens to the molecules in water as it changes from a solid to a liquid and vice versa?



In its solid state, water molecules form tight bonds with each other and usually have a regular arrangement. They have a little bit of energy and slowly vibrate next to each other but don’t generally move about. Solids have a fixed shape and volume.





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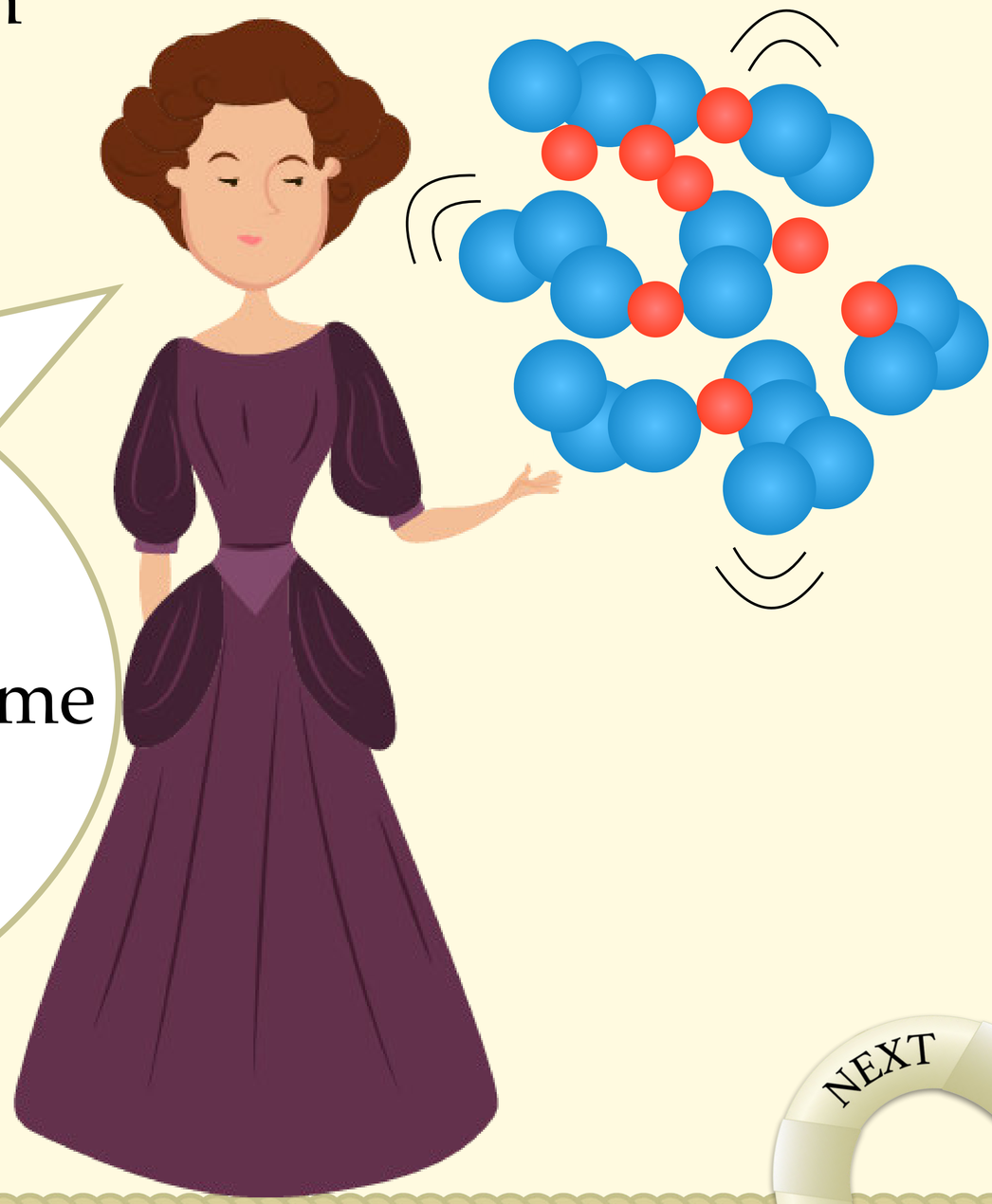
In its liquid state, water molecules form bonds with a few other molecules. They are close together with no regular arrangement. They have a bit more energy and can move about, sliding past one another. Liquids don't have a fixed shape but do have a fixed volume.

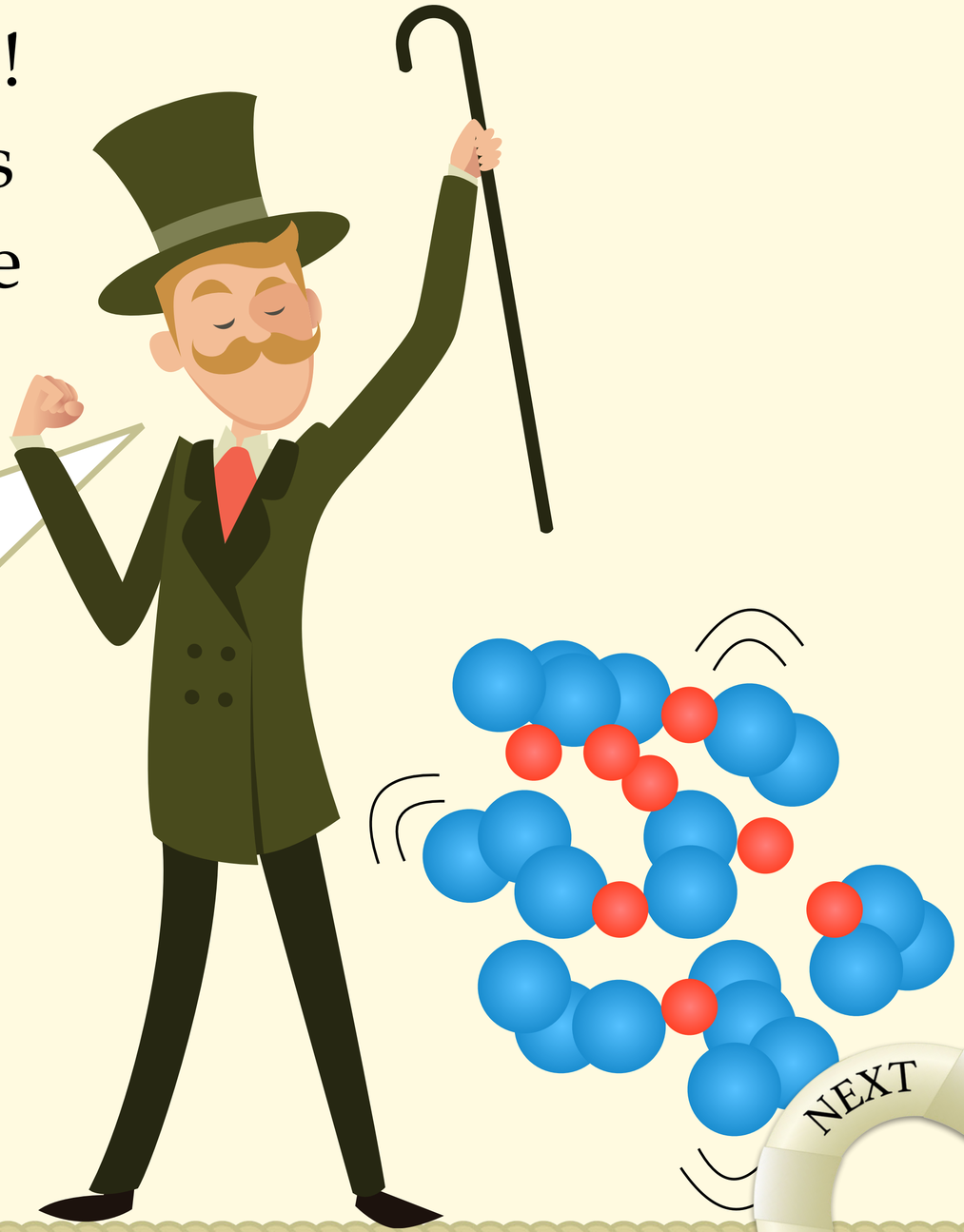
When salt is added to water, it has an interesting effect on the water's freezing point.

The salt molecules dissolved in the water make it harder for the water molecules to form the tight bonds needed to become a solid at 0°C.
What do you think happens as a result of this?



The water's freezing point is lowered! Depending on how much salt there is in the solution, the water won't freeze at 0°C.

This also means that the temperature when the ice will start to melt is lowered too! Using salt, it is possible to melt ice at temperatures below 0°C!



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Salt water (like the water in the seas and oceans) will freeze at a lower temperature than fresh water (like the water in rain, snow, lakes and tap water).

Seawater will freeze at around -2°C, but it does depend on how salty the water is. All water will be frozen at around -21°C, no matter how much salt there is dissolved in the water.

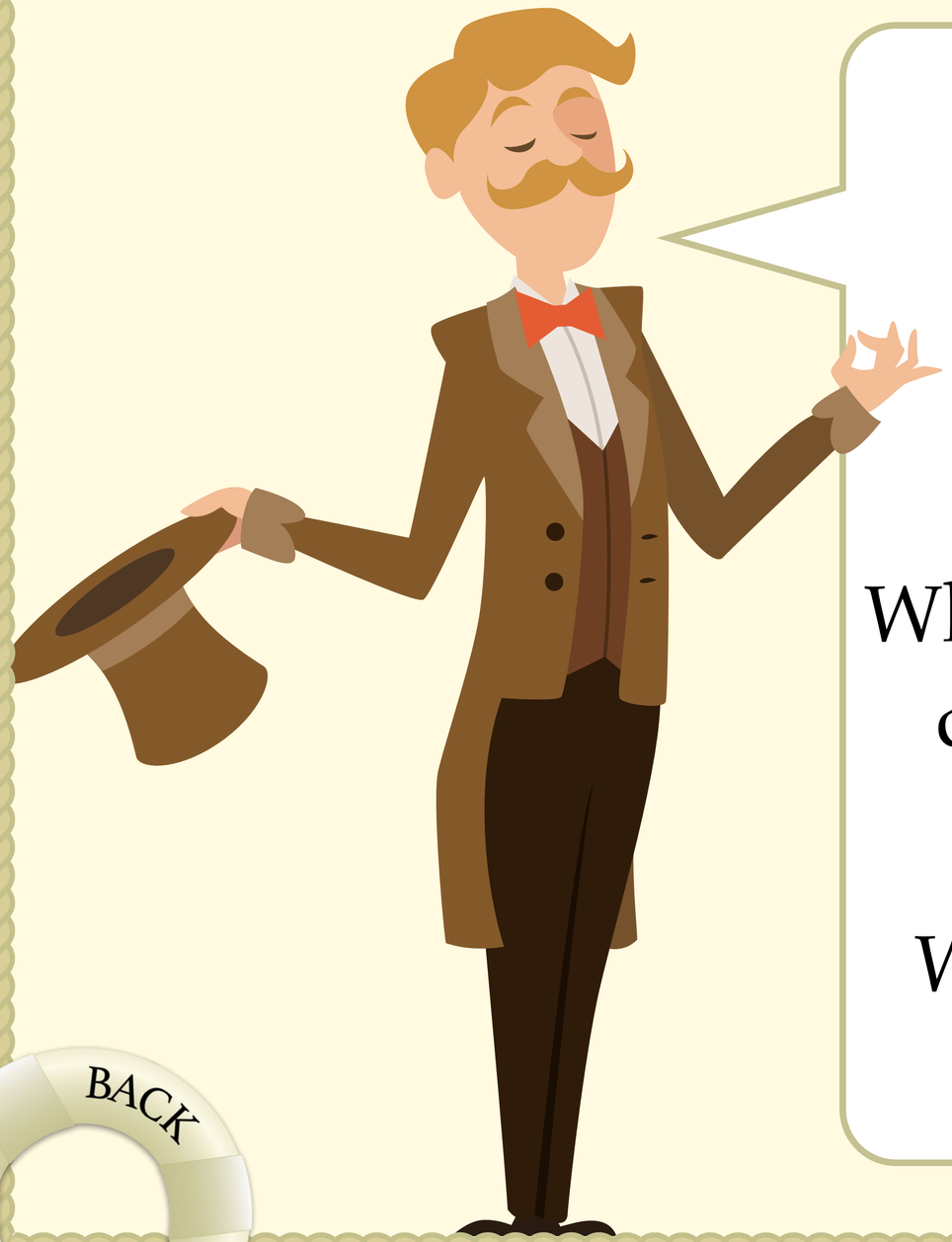
Do you have any questions about salt and the melting process?
Have a look at what equipment you have available to you.
Do you think you could conduct an investigation to answer your enquiry question?

Does adding more salt affect how quickly ice melts?

Does salt water melt more quickly than fresh water?

Is it just salt which affects how ice melts?

Would an ice cube melt more quickly in salt water than in fresh water?



Write down your enquiry question.

Think carefully about how you will conduct a fair test in order to find an answer to your enquiry question.

What are your independent (the thing you change) and dependent (the thing you measure) variables going to be?

What control variables are you going to have?

In this kind of investigation it is useful to have a **control** experiment to compare your results to. This is an example where you have not changed anything about the test (no independent variable). In this case, an ice cube left to melt on its own at room temperature.

Having a control experiment is useful to see if your independent variable has had an effect by comparing the other test results to your control.

In this case, you could compare the time it takes for an ice cube to melt on its own, to an ice cube which has had a measured amount of salt added to it.

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Plenary

Why do you think we spread salt on the roads and paths during a cold winter?

Plenary

The salt being spread on the roads and paths helps to melt the ice which could cause people and cars to slip and cause accidents. The salt helps to lower the ice's freezing point (which is the same as its melting point) meaning the ice will melt at temperatures below 0°C.