

CHANGING STATES (teacher's notes)

About the activities:

Throughout this unit the idea of the importance of the increase or decrease in temperature to change a state is reinforced.

About changing states:

- These changes are physical changes because they don't produce a new substance.
- When we heat a solid the molecules vibrate faster and when they reach melting point the solid melts into liquid.
- Substances have their own melting and boiling points. Pressure and the addition of other substances change the melting and boiling points, for example on a mountain water boils at less than 100° C or salt water boils at a higher temperature than 100° C.
- Not all solids have a melting point, an example could be wood.
- We can say frozen carbon dioxide or dry ice.
- We exhale carbon dioxide (CO₂) when we breathe.
- When water becomes cold it contracts up to 4° C, but if it becomes colder the water begins to expand because the ice molecules increase the distance from each other because they arrange themselves in a hexagonal pattern. So ice is less dense than water and for this reason ice floats. Due to this fact life in lakes... doesn't die when low temperatures freeze the water (the ice is just at the top).

Activity 1: You've seen an ice cube out of the freezer a lot of times.

B) The ice cube melted after some minutes.

C) The increase in temperature melts the solid into liquid.

Activity 2: Let's investigate solid and liquid water.

- Ice cube molecules are packed together very tightly in fixed positions, they can't move around, they can't go through the hole.
- Cold water molecules are not so tightly packed together, but they are close together (they stick to one another), they move around and change places. The molecules in a liquid can move about more than in a solid and less than in a gas.
- Hot water molecules move faster than cold water molecules. So the faster the molecules move around, the easier it is for them to slide past one another.

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- As you increase the temperature, the molecules move quicker.

Activity 3: You've seen evaporation a lot of times.

The water has evaporated because of the increase in temperature; although it is far below its boiling point, some particles have enough energy to break free from the rest.

The water has transformed into invisible drops of water vapour.

The air absorbs the invisible drops.

Activity 4: You've seen boiling water a lot of times.

The more we increase the temperature, the faster the evaporation is. You can use the results in activity 3 to exemplify the increase in temperature.

Activity 5: You've seen condensation a lot of times.

The water vapour or steam, a gas, returns to a liquid state when it cools because the vapour comes into contact with the cold lid. So, the decrease in temperature is important in this process.

Activity 6: Let's investigate liquid water again.

Molecules make the colours spread. The slower the molecules move (cold water) the slower the food colouring spreads in the water. So, the decrease in temperature is important in this process.

Activity 7: Imagine...

The temperature is reduced because of the low temperature in the freezer. So, the decrease in temperature is important in this process.

The name given to this process is solidification, solidifying or freezing.

Activity 01: Final activity.

You can ask your pupils to make a poster about changing states and the scheme can be useful as an example.