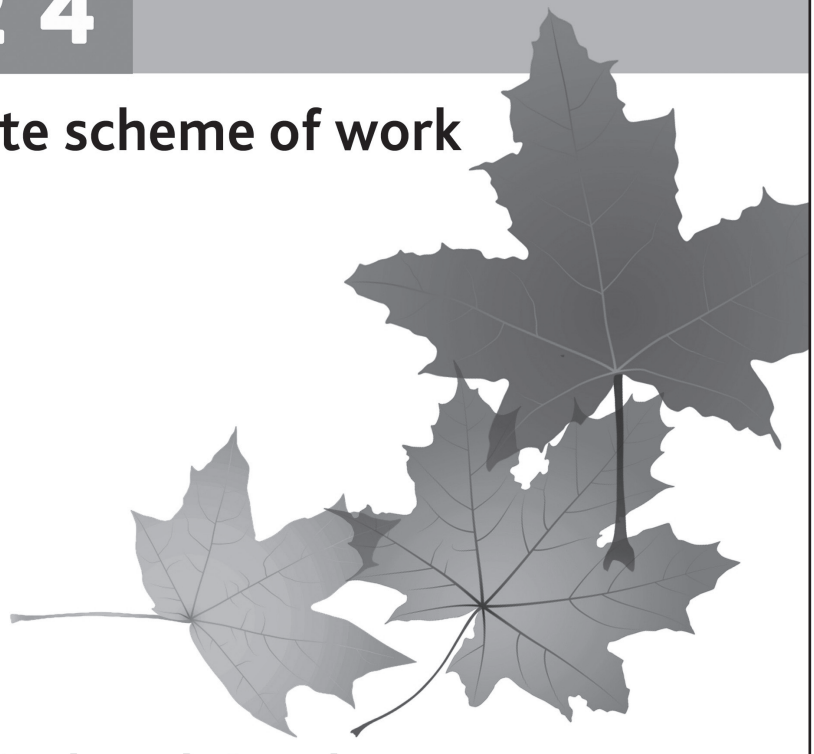
THE NATIONAL CURRICULUM OUTDOORS

YEAR 4

A complete scheme of work



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Dedication

We dedicate this book to all teachers who are willing to take their teaching outside the classroom and offer exciting learning opportunities, foster positive health and wellbeing outcomes and connect children with their natural environment. They are our hope for an education for excellence and sustainability.

We also dedicate it to Deborah's mum Jennifer Lilley for her support and guidance, her brother Jason Lilley for his shared passion for Art and her partner, Andy Rimmer for his patience and support throughout the writing process, to Michelle's partner Andy Mitchell for his continued support and excellent photographs and to her nephew and niece Robbie and Alice, who have inspired many of the KS2 ideas alongside Coads Green Primary School and to Sue's family, fellow committed nature and learning lovers.

Contents

Photos and further resources

Illustrative photos and further resources are available online at www.bloomsbury.com/NC-Outdoors.

KEY STAGE 2 | Year 4

Science

In this unit, children will be exploring states of matter through a range of outdoor learning activities. Each week the children will work scientifically by asking relevant questions, setting up simple experiments, making observations, taking accurate measurements, recording findings and drawing conclusions. They will be challenged to develop their outdoor learning skills, including fire-building, identifying and classifying natural objects, and creating pictures and landscapes using natural materials to show their understanding.

To support inclusive practice or to extend learning, the space, task, equipment and people (STEP) approach can be adopted throughout this unit. By changing the space, task, equipment or people, the activity can be made more challenging or easier to understand, enabling all pupils to take part in the activity. For more information see the chapter 'Assessment outdoors'.

The main activities offer opportunities for adult-directed whole-class and smaller-group work, as well as opportunities for individual exploration and experimentation where appropriate. The children will be expected to work independently or together in small groups, with support from an adult as described in each progression.

You may wish to record the activities using a camera.

Natural connections

- Observation of natural materials
- Fire-building
- Creative designs using nature.

Health and wellbeing

- Physical activity
- Teamwork, self-regulation and independence
- Risk-management and emotional resilience.

Word bank

States of matter

- solid
- liquid
- gas

Change state (heat, cool)

- freeze
- ice
- melt
- boil
- energy
- particles
- atoms

Water cycle

- evaporation
- water vapour
- invisible
- condensation
- precipitation

Classify

- natural
- man-made
- fair test

Summary overview

Progression	Curriculum content	Learning experiences/activities
Lesson 1	Compare and group materials together according to whether they are solids, liquids or gases.	Children explore school grounds and collect examples of solids, liquids and gases. Can they find examples of all three? Can you see all three? Discuss and look at what they have seen. Play 'Kim's game' with different matters. Develop simple descriptions of the different states and write on leaves/chalkboards. Explain how the atoms in solids, liquids and gases change. Game: 'Solids, liquids and gases'. Children use a storm kettle to see how water (liquid) can change to steam (gas). Use the hot water to make hot chocolate.
Lesson 2	Observe that some materials can change state when they are heated, and measure the temperature at which this happens in degrees Celsius.	Children play 'Solids, liquids and gases'. What material can be sometimes a solid, sometimes a liquid and sometimes a gas? Water. Build, light and manage a fire to find the difference in temperature of water in a pan using thermometers, in all three states, from ice to steam. Record the temperature of the water in the pan at which the changes in state happen. Crack an egg into a plastic bag and tie a knot in the bag. Put it in the boiling water and look to see what happens to its state.
Lesson 3	Observe that some materials can change state when they are heated and cooled, and measure the temperature at which this happens in degrees Celsius.	Children build, light and manage a group fire. What state is chocolate in when in a bar? Predict what will happen to chocolate when heated (melts) and at what temperature this will happen (measure). Is it the same as ice melting to water? What happens to chocolate when it is left to cool? Melt the chocolate and use it to make chocolate crispies that are left to cool.
Lesson 4	Identify the part played by evaporation and condensation in the water cycle.	Children pair and share what they know about the water cycle. Using natural materials in groups, make a 3D picture on the ground to show the water cycle. Children work in groups to light a storm kettle to boil water, to show how the hot water evaporates to steam. Look to see what happens to the steam when a large leaf is put over the escaping steam. Can you see the steam condensing back into water?
Lesson 5	Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	Recall the water cycle in pairs. Children work in groups to design and set up a fair test to look at how temperature affects the rate of evaporation, e.g. measuring the time it takes water to dry up in a tub, measuring the time it takes for a painting to dry, measuring the time it takes for a wet cloth to dry. Children begin the test and record observations over the week.
Lesson 6	Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	Children recall words related to the topic of 'states of matter'. Children make miniature gardens in groups in a container that will be sealed, to demonstrate and understand the water cycle. Watch and monitor over time.

PREPARATION

Ensure that there is a safe outdoor area with a selection of natural objects for the children to collect and plenty of dry, dead wood for fires.

Set out a tray with a selection of solids, liquids and gases – some natural and some man-made – for 'Kim's game', e.g. sticks, water, a leaf, body spray, juice, pond water, a stone.

Resources

- 'Kim's game' tray and objects, covered over
- Three hula hoops (or similar)
- Containers to collect solids and liquids in
- Balloons
- Storm kettle or pan and griddle
- Fire-starting kit (including strikers, cotton wool and petroleum jelly and water)
- Cups, spoons, hot chocolate and water
- Chalkboards/whiteboards and pens
- Permanent markers

Previous learning

This progression builds on previous learning about solids, liquids and gases.

CONSIDER

Health & Safety

Assess and evaluate hazards and risks in your setting. See the health and safety chapter.

LESSON OBJECTIVES

We are learning to group materials into solids, liquids and gases and understand and observe the difference between them.

National Curriculum Content

- Compare and group materials together according to whether they are solids, liquids or gases.

ADULT ROLES

- Ensure safe practice around the fire.
- Encourage children to use scientific vocabulary: solids, liquids and gases.

WARM UP IDEAS

Talk to the children about learning outdoors and how to stay safe, e.g. looking after themselves, the environment and each other. Establish the circle where they will return after group tasks.

Explain that they will be working on a science topic outside entitled 'States of matter' and ask them what they think this may mean. What is matter? (Any object can be described as 'matter', whether it is natural or man-made.) Can you name a few that you can see outside?

What about states? Give them an example of something that is solid, e.g. a stick. What about a liquid and a gas?

Introductory activity

Play 'Kim's game' with a variety of objects that are solids, liquids and gases. Include some natural and some man-made items.As an extension, if a child correctly guesses an object that has been removed, ask them whether it is a solid, liquid or gas.

MAIN ACTIVITIES

Grouping states of matter

Challenge 1 (in pairs and whole class)

Spot the solids, liquids and gases in the environment

Explore the area and collect examples of solids, liquids and gases in pairs. (Some blown-up balloons could be attached to low bushes outside to see whether children collect them as an example of a gas.) Bring items back to the circle and sort into three labelled hoops. Discuss together whether the items found are in the correct hoop. Which hoop has the most – why? Which hoop has the least? (Gas) Why? Has anyone thought of the oxygen given off by plants and the carbon dioxide that we breathe out? Can we see the gas?

In pairs, can you think of ways of describing the different states of matter? How do they relate to being in a container? How do they behave? For example, a solid holds its shape, a liquid forms a pool and a gas escapes from an unsealed container. (We can demonstrate this by holding our noses and mouths closed to show that the CO^2 cannot escape or by releasing the air from a balloon.) Why is this? Explain that all things are made up from atoms, and whether the matter is a solid, liquid or gas will depend on how the atoms behave.

- In a solid, the atoms are tightly packed and can hardly move, e.g. a stick.
- In a liquid, they are not so tightly packed and can move around more, e.g. water in a container will slop around.
- A gas not only doesn't hold its shape at room temperature but it does not even stay put, unless in a sealed container. It moves around all the time. The atoms in a gas move around very freely. Think of a balloon – air is blown into the balloon and when sealed it stays in there. If the balloon is popped or undone, the air escapes into the atmosphere and the balloon becomes deflated.

Discuss as a group. Write on whiteboards/chalkboards/leaves a simple description of each state.

Game: Call out the three states of matter and the children move like the atoms in whatever state is called. For example:

- Solid – tightly packed together, gently jostling.
- Liquid – moving around more freely, using up more space but still contained.
- Gas – wide apart and escaping to all areas!

Challenge 2 (whole class)

Changing liquid to gas by heating

Explain that a gas is invisible and so cannot be seen, but we are going to boil some water over a fire or in a storm kettle and see how the water changes from a liquid to a gas. Explain that matter can sometimes change between different states.

Collect sticks that are dry and sort into different size piles. Talk through with the children the step-by-step principles to making a fire.

Ensure that you have water to put the fire out prior to lighting – see fire-lighting safety principles in health and safety chapter. If using a pan, once the fire is lit, use a griddle to put the pan of water on. If using a storm kettle, make the fire in the base of the kettle and then put the kettle on the base, also as shown in the health and safety chapter.

Talk about what will happen as the water gets hotter. What will children be able to see? (Steam.) In between the spout of the storm kettle and the steam, there will be a space. This is the invisible gas (water vapour). The steam is the vapour as it is beginning to cool in the surrounding air (evaporating). Use the boiling water to make hot chocolate for the group.

PLENARY

Question the children on what they have learned.

- What are the three states of matter?
- Give me an example of each one.
- How can you describe each state?
- What happens to the atoms in each state of matter?

EVALUATION/FOLLOW ON

- What went well today?
- Which children understood the difference between the states of matter?
- Who needs further support?

PREPARATION

Ensure that there is a safe outdoor area with a selection of natural objects for the children to collect and plenty of dry, dead wood for fires.

Resources

- Fire-starting kit (including strikers, cotton wool and petroleum jelly and water)
- Ice cubes and water
- Eggs and plastic bags
- Pans and griddles
- Clipboards, paper and pencils
- Long thermometers
- Three cones
- Tongs
- Tape

Previous learning

Practise reading a thermometer quickly, so that when outside the children are adept at this task. What unit is temperature measured in? Children could watch the weather forecast to see units of temperature in degrees Celsius used.

CONSIDER

Health & Safety

Assess and evaluate hazards and risks in your setting. See the health and safety chapter.

LESSON OBJECTIVES

We are learning to observe changes in states of a matter when heated and find out at what temperature this occurs.

National Curriculum Content

- Observe that some materials can change state when they are heated, and measure the temperature at which this happens in degrees Celsius.

ADULT ROLES

- Ensure safe practice around the fire.
- Help children to use the thermometer and tongs correctly and safely.
- Support children in reading and recording the temperatures.

WARM UP IDEAS

Have three cones spaced apart and labelled solid, liquid or gas. Call out or show an object and children run to the correct cone and behave like atoms in that matter. Include an ice cube, water and steam in the objects.

Introductory activity (in pairs and whole class)

Pair and share how the atoms in a solid, liquid and gas differ.

Can the children remember/find the descriptions they wrote?

Pair and share. What material can sometimes be a solid, a liquid and a gas?

At what temperatures do they think these changes will take place?

Can the children think of anything else that might change state just from liquid to solid or solid to liquid when heated (e.g. egg, chocolate, butter, etc.)? You could use all these items in the warm up.

MAIN ACTIVITIES

States of matter when heated

These challenges can be done in sequence, or some groups could do Challenge 1 and some do Challenge 2 and report the findings back. If the fire safety areas are arranged as suggested in Challenge 1, both challenges could happen at the same time if there are enough adults to support the session.

Challenge 1 (whole class and groups of seven or eight)

How hot for state changes?

Explain that the children are going to determine the temperature at which ice changes from a solid to a liquid (water) and then into a gas (steam) when heated. Ask the children how they could set up a test to do this and what equipment they would need (pan, griddle, water, long thermometer, fire-making kit, sticks, clipboard, paper and pencil.) Ask them when they would record the temperature (when all ice melts and when steam starts to show) and what they think those temperatures might be.

Children form groups of seven or eight with a pan and griddle each. Tape circles could be used to designate each fire safety area, and these could be arranged in a big circle, with the teacher and TA in the middle. Ensure that each group has safety water. Children collect sticks for the fire. Remind the children of the basis of building and managing fire. Make a fire and melt the ice cubes in a pan on the griddle until they become water, and then continue heating until steam is seen. Children should:

1. Take and record the temperature of the ice cubes at the start.
2. Record the temperature when they have all melted into water.
3. Record the temperature when steam begins to be seen.

For safety, long thermometers are necessary, and the children must keep the thermometer on the ice/in the water for 30 seconds to get a good reading, and then read it quickly before the outside temperature affects the result.

As a whole class, discuss the group results. Were they what they expected? Was there a big difference between groups? Why might this have occurred? What happened to the ice when it was heated? (Melted into water.) What happened to the water? (Turned into steam.) What happened to the atoms in the matter as the temperature got hotter?

Challenge 2 (groups of seven or eight and whole class)

Changing an egg from liquid to solid state

Explain that the children are going to determine the temperature at which an egg changes from a liquid to a solid. Can they think of a way of measuring this?

Children should set up as per Challenge 1 but put water in a pan rather than ice.

An egg is cracked into a plastic bag and a knot tied at the top. What state of matter is the egg now? (Liquid.)

1. Put the bag in the water and take the temperature.
2. Heat the pan with the fire and, at intervals, take the bag out of the water using a pair of tongs and see whether any change has taken place.
3. Each time, take the temperature of the water and record the temperature at which the egg starts to change state (soft-poached) to when it finishes (hard-poached).

Once all the readings have been obtained, the fires can be put out safely, as explained in the health and safety chapter.

Discuss the results. Did the water need to be boiling (100 degrees Celsius) for the change to happen?

PLENARY

Ask children to find a space. Talk through Challenge 1, asking children to move in the different states that happened to the ice, water and water vapour. Repeat for Challenge 2.

EVALUATION/FOLLOW ON

- What went well today?
- Which children understood what happened when the ice/egg was heated?
- Can they pair and share to explain the results?
- Who needs further support?

PREPARATION

Ensure that there is a safe outdoor area with a selection of natural objects for the children to collect and plenty of dry, dead wood for fires.

Resources

- Five or six small tarpaulins
- Fire-starting kit (strikers, cotton wool and petroleum jelly)
- Fire glove, water, pan and griddle
- Chocolate, cake cases and crisped rice cereal
- Heat-proof bowl, wooden spoon, dessert spoons and trays
- Beanbags
- Pen and paper
- Thermometer
- Whiteboard/chalkboard

Previous learning

This lessons follows on from Progression 2, in which children investigate the changes in state of water and eggs, and at what temperatures these happen.

CONSIDER

Health & Safety

Assess and evaluate hazards and risks in your setting. See the health and safety chapter.

LESSON OBJECTIVES

We are learning to observe changes in states of chocolate when heated and cooled and find out at what temperature this occurs.

National Curriculum Content

- Observe that some materials can change state when they are heated and cooled, and measure the temperature at which this happens in degrees Celsius.

ADULT ROLES

- Ensure safe practice around the fire.
- To encourage good questioning and safe behaviour.

WARM UP IDEAS

Icebergs

Groups of six to eight stand on the tarpaulins (icebergs).

Global warming (the long-term rise in Earth's average surface temperature) has caused the ice to melt and now it is only half the size.

Can everyone stay on a tarpaulin while it is folded to half its size?

Repeat so that the tarpaulin is a quarter of its original size.

Discuss the effects of global warming on animals and on other parts of the world.

Introductory activity

Ask the children whether they can explain the game 'Icebergs' in terms of changes in states of matter.

- What are the atoms in an iceberg like?
- How do they change when it starts to melt?

Discuss how heat can cause changes in states of matter. Children may remember this from Progression 2.

- Can you think of something that can change its state when heated but change its state back again when cooled? Discuss.

MAIN ACTIVITIES

States of matter – heating and cooling

Challenge 1 (whole class and groups of four)

Changes in chocolate with heating and cooling

Explain that the children are going to heat chocolate and then cool it. The melted chocolate will be used to make chocolate crispies. What changes in state should they see?

- What do we call the process when chocolate changes from a solid to a liquid? (Melting.)
- What term could we use for when the chocolate cools again? (Solidifying.)
- Thinking about the temperatures children may have investigated in Progression 2, when water changes to steam and egg solidifies, estimate the temperature at which the chocolate needs to be for melting (melting point).
- Ask the children how we might do this, as we don't want the chocolate to burn. Discuss.

Set up a fire with a pan and griddle. Heat a small amount of water in the pan and place in the pan a heatproof bowl of broken chocolate. Stir the chocolate carefully with a wooden spoon using a fire glove, and ensure that no water from the pan goes into the bowl of chocolate. When melted, remove the pan from the fire and the bowl from the pan. Extinguish the fire. Measure the temperature of the melted chocolate using a thermometer and record it.

Pour crisped rice into the bowl and stir until it is all coated. Spoon the mixture into individual cake cases and leave to cool. Can the children predict where the best and quickest place will be to cool the crispies – the fridge, outside or inside the classroom – giving reasons? They can leave a few in each place and test their predictions by seeing which chocolate crispies harden first (chocolate changing from a liquid to a solid).

Note: Although a whole class is doing this, the children can be split into groups and given jobs as follows:

- Stick collectors
- Fire-builders
- Fire managers and extinguishers
- Temperature recorders
- Chocolate melters
- Chocolate crispie makers
- Washer uppers!

When they are not involved in a job, they should sit around the fire circle with a whiteboard/chalkboard/leaf and write all the scientific words they can think of to do with this lesson. Who will think of the most?

While the chocolate crispies are cooling, discuss the results. Was the melting point near their estimate? Did they predict which place would cool the crispies most quickly? Who wrote the most scientific words?

Beanbag name game (while the chocolate is cooling and when the fire is out)

In a circle of about ten children, call out the name of someone and then throw a beanbag to them. They in turn call out the name of someone else and then throw them the beanbag. Continue until all have received the beanbag just once and it is returned to you. Repeat the sequence again, making sure that they throw to exactly the same person in the same order again. Keep on repeating this but add in two more beanbags. This game is great for building concentration in children.

PLENARY

Enjoy the chocolate crispies while pairing and sharing the processes of today:

- Solid to liquid through melting.
- Liquid to solid through cooling.

Explain that we call this a reversible process. Think about cooking an egg (as in Progression 2). Could this process be reversed?

EVALUATION/FOLLOW ON

- Did the children work collaboratively to get all the jobs done?