

**ABOUT THE UNIT**

Through this unit children learn that gases are material and can be distinguished from solids and liquids by their properties.

They also learn about the uses of some important gases and where gases are found.

Experimental and investigative work focuses on:

- making and repeating observations
- relating observations and conclusions to scientific knowledge and understanding.

Work in this unit also offers opportunities for children to use scientific knowledge and understanding to explain everyday phenomena related to air and other gases.

This unit takes approximately 10 hours.

**WHERE THE UNIT FITS IN**

Builds on Unit 3D 'Rocks and soils', Unit 4D 'Solids, liquids and how they can be separated' and Unit 4E 'Friction'

**Children need:**

- to know that volume is the amount of space that something takes up
- to recognise differences between solids and liquids.

Links with Units 3B, 4B, 5E and 6A.

**VOCABULARY**

In this unit children have opportunities to use:

- names of gases *eg air, carbon dioxide, helium, natural gas, oxygen*
- names of processes related to changes of state, and verbs related to them *eg evaporation/evaporate*
- descriptions and explanations involving a sequence of ideas.

**RESOURCES**

- digital balance or coat hanger
- balloons (reasonably large)
- sheets of card
- sponge
- jar of marbles/ball bearings
- soils
- measuring jugs/cylinders
- helium balloon
- can of fizzy drink
- picture of gas cooker
- strong perfume, air freshener
- syringes filled with air, water and sand
- sealed balloons/polythene bags containing air and water

**EXPECTATIONS****at the end of this unit**

*most children will:*

recognise that air is a material and that it is one of a range of gases which have important uses, that liquids evaporate to form gases and that gases change shape and flow from place to place; measure volumes of liquids accurately, recognise when observations and measurements need to be repeated and provide explanations for what they observe in terms of knowledge and understanding about gases

*some children will not have made so much progress and will:*

state that air is a gas; recognise that gases flow from place to place and measure volumes of liquid

*some children will have progressed further and will also:*

explain the relationship between liquids and solids in terms of evaporation, make clear distinctions between the properties of solids, liquids and gases and explain why observations and measurements need to be repeated

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
<ul style="list-style-type: none"> <li>to recognise differences between solids and liquids</li> </ul>	<ul style="list-style-type: none"> <li>Present children with a collection of solids and liquids, or of pictures of solids and liquids, and ask them to group them and list the similarities in, and differences between, each group. <i>The collection will include powders and soft solids as well as hard ones.</i></li> </ul>	<ul style="list-style-type: none"> <li>identify characteristic properties of solids and liquids, <i>eg solids retain their own shape, liquids flow and take the shape of the container they are in</i></li> <li>recognise that powders are solids</li> </ul>	<p>Teachers will need to take account of what this introductory work shows about children's understanding of solids and liquids in their short-term planning for this unit.</p>
<ul style="list-style-type: none"> <li>that air has weight and is all around us</li> <li>to explain phenomena related to air in terms of scientific knowledge and understanding</li> </ul>	<ul style="list-style-type: none"> <li>Ask children to say what they know and understand about air.</li> <li>Remind them of earlier work on air resistance, ask them to suggest how they could show you that air is a real material. Possibly repeat some activities <i>eg running across the playground holding a sheet of card.</i></li> <li>Talk with children about the effect of air/wind on kites, sails, umbrellas and ask children if they can feel the effect of air.</li> <li>Weigh a collapsed balloon on a digital balance, or balance two uninflated balloons on a coat hanger/<i>large beam balance</i>, blow one balloon up and demonstrate that a highly inflated balloon weighs more. Talk with the children about their different ideas.</li> </ul>	<ul style="list-style-type: none"> <li>use phenomena related to moving air <i>eg on kites, parachutes, drying washing</i> and the effects of pumping up inflatable objects to support the idea that air is real</li> </ul>	<p>Children often think that air is 'nothing'.</p> <p>Children often confuse 'air pressure' with 'air resistance'. It is helpful to avoid the term 'pressure' when discussing air resistance.</p> <p>Teachers should be aware that the inflated balloon weighs more because the compressed air inside it is more dense than the air outside.</p>

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<ul style="list-style-type: none"> <li>• that powders and sponges are solid materials with air in the 'gaps' in between particles</li> <li>• to make careful observations of materials and to explain these using scientific knowledge and understanding</li> </ul>	<ul style="list-style-type: none"> <li>◆ Present children with several short activities <i>eg squeezing a sponge under water, pouring water onto ball bearings, beads or marbles in a jar, pouring water gently onto loosely packed sand or soil.</i></li> <li>◆ Ask children to speculate about what the bubbles are and where they came from. Encourage children to look closely at dry sponge or soil using a hand lens and discuss their ideas about what is in the 'spaces'.</li> </ul>	<ul style="list-style-type: none"> <li>• describe how bubbles appear <i>eg when I squeezed the sponge lots of bubbles came up, when I poured the water on the soil bubbles started to come up. They went on coming after I stopped pouring</i></li> <li>• identify the bubbles as coming from the spaces between the particles and with help suggest they are air</li> </ul>	<p>At this stage children should be encouraged to think of particles simply as very small pieces of material.</p> <p><b>SAFETY</b> – Collect soil from areas free from broken glass and unlikely to be contaminated with dog faeces. Children should wash hands after handling soil.</p>

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<ul style="list-style-type: none"> <li>• that observations and measurements may need to be repeated</li> </ul>	<ul style="list-style-type: none"> <li>◆ Ask children whether they are sure about the observations made in the previous activity. Talk with them about what they could do to check.</li> <li>◆ Repeat the previous activities and compare the observations with those obtained previously.</li> </ul>	<ul style="list-style-type: none"> <li>• explain why it is helpful to repeat observations <i>eg the first time I saw lots of bubbles which I didn't expect, when I did it again I saw lots of bubbles again. I think my observations were right or you might make a mistake, if you get the same results another time, they are probably right</i></li> </ul>	

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<ul style="list-style-type: none"> <li>• that soils have air trapped within them</li> <li>• to measure volumes of water carefully</li> <li>• to recognise whether measurements need to be repeated</li> <li>• to use their results to compare the air trapped in different soils</li> <li>• that soils have air trapped in them</li> </ul>	<ul style="list-style-type: none"> <li>◆ Ask children to suggest why it is helpful for soil to have air in it. If necessary, remind them of what they know about animals living in the soil.</li> <li>◆ Ask the children why air might be needed within soil and what animals might use it. Introduce the idea that all soils may not necessarily have the same amount of air trapped within it. Ask the class how they could test to find out which soils contain the most air.</li> <li>◆ Ask them to suggest how they could compare the amount of air in different soils <i>eg pouring water on the soils and measuring the volume.</i></li> <li>◆ Explore with children how they might do this and with them decide on a method <i>eg by pouring water on to equal quantities of different soils and measuring the volume which sinks into the soil by subtracting the volume left in the measuring jug or cylinder from that at the start.</i></li> <li>◆ Talk to the children regarding how accurate their results will be. Can anyone in the class think of a way of getting more accurate results? (repeat tests)</li> <li>◆ Talk with children about their results and help them to interpret them.</li> <li>◆ compare results and discuss which soil had the most/least air trapped in it. Children can then write their findings</li> </ul>	<ul style="list-style-type: none"> <li>• use measuring jugs or cylinders to make measurements of volume</li> <li>• repeat measurements to check results using the same quantity of dry soil</li> <li>• explain that bubbles appear because the water pushes the air (gas) out of the spaces between the particles of soil</li> </ul>	<p>This activity offers children the opportunity of carrying out a whole investigation. It may be helpful to concentrate on the aspects of investigation highlighted in the learning objectives.</p> <p><b>RESOURCES</b> Different dry soils e.g. clay, chalk etc., measuring jugs/cylinders, water, write up sheet for less able</p> <p><b>EXTENSION ACTIVITIES</b> Children can carry out research into the different types of clay tested and the creatures that are usually found in those clay types.</p> <p><b>ASSESSMENT OPPORTUNITIES</b> Can children carry out a fair test, work co-operatively in a group and make careful observations? Can the children take accurate measurements? Are the children able to draw conclusions from their investigation?</p>

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<ul style="list-style-type: none"> <li>that there are many gases and many of these are important to us</li> </ul>	<ul style="list-style-type: none"> <li>Review what children have learnt about air and remind them that it is not a solid or liquid.</li> <li>Introduce (or re-introduce) the word gas.</li> <li>Ask children what other gases they have heard of.</li> <li>Stimulate ideas by showing children examples <i>eg a helium balloon, shaking a bottle of fizzy drink containing carbon dioxide, a picture of a gas cooker using natural gas.</i></li> <li>Ask children to use secondary sources <i>eg video, CD-ROM, reference books</i> to find out about a range of gases and how they are used <i>eg natural gas as a fuel to heat, helium in balloons, oxygen in hospitals, 'gas' as anaesthetics, carbon dioxide in fizzy drinks.</i></li> <li>Ask children to present findings as an information leaflet or poster.</li> </ul>	<ul style="list-style-type: none"> <li>name several gases and identify one way in which each is useful to us</li> </ul>	<p>Children may be confused by the use of the word 'gas' (short for gasoline) for petrol, which is a liquid.</p> <p>If possible it is helpful to show children what liquid air is like <i>eg using a video or CD-ROM clip.</i></p>
<ul style="list-style-type: none"> <li>that gases are formed when liquids evaporate</li> <li>to explain 'disappearance' of water in a range of situations as evaporation</li> </ul>	<ul style="list-style-type: none"> <li>Ask children what happens to puddles in the playground when it stops raining and to wet washing when it is put out to dry. Discuss their ideas with them.</li> <li>Illustrate evaporation <i>eg chalking round the edges of puddles at intervals as they evaporate or by showing children a container of water left in the classroom for several days on which the original water level was marked.</i></li> <li>Talk with the children about where the water has gone and introduce the term 'evaporate'. Help children to make annotated drawings to describe and explain what happened.</li> </ul>	<ul style="list-style-type: none"> <li>identify the process which takes place when water changes to a gas as evaporation</li> <li>identify a range of contexts <i>eg water left in an open dish, washing, drying, puddles drying up</i>, in which water evaporates</li> </ul>	<p><a href="#">make connections with Geography unit on Water and Rivers</a></p> <p>Children may encounter the terms 'gas' and 'vapour'. At this stage it is not necessary to make a distinction between them.</p> <p>Children often use the term 'disappear' to describe evaporation. It is important that they understand that although <i>eg a puddle</i> has disappeared, the water remains in the air.</p>

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<ul style="list-style-type: none"> <li>• that other liquids evaporate and form gases which flow easily from place to place</li> <li>• to make observations and to explain phenomena in terms of scientific knowledge and understanding</li> </ul>	<ul style="list-style-type: none"> <li>◆ Put a small quantity of a strong perfume or air freshener on a saucer at the front of the class.</li> <li>◆ Ask children to respond when they smell it and to try to explain what they observed using annotated drawings.</li> <li>◆ Ask children to find out why natural gas has a 'smell' added to it before it is supplied to consumers.</li> </ul>	<ul style="list-style-type: none"> <li>• explain that we smell things when gases enter our noses <i>eg the perfume evaporated and made a gas which travelled to us and we smelt it</i></li> <li>• explain that we smell many liquids <i>eg paint</i> because gases from the liquid travel through the air to our noses when some of it evaporates</li> <li>• explain that natural gas can cause explosions, and if we can smell it we can detect leaks</li> </ul>	<p><b>SAFETY</b> – Petrol must never be used in the classroom.</p>
<ul style="list-style-type: none"> <li>• that gases are different from solids and liquids in terms of how they do not maintain their shape and volume</li> <li>• that gases flow more easily than liquids and in all directions</li> </ul>	<ul style="list-style-type: none"> <li>◆ Present children with some short activities <i>eg pouring a liquid from one container to another, transferring a solid from one container to another, attempting to squash syringes filled with air, water and sand, squashing tightly sealed balloons filled with water and air, removing the stopper from a bottle of perfume and from a bottle of water.</i></li> <li>◆ Ask children to write down as many differences as they can think of between solids, liquids and gases.</li> </ul>	<ul style="list-style-type: none"> <li>• describe a number of differences <i>eg gases are more easily squashed than solids or liquids, gases escape from containers and flow everywhere, when liquids spill they just run along the floor</i></li> </ul>	<p><b>SAFETY</b> – Coloured gases should <b>not</b> be shown to children as they are really too dangerous to be used in primary schools. Secondary sources might be used to illustrate that gases are not always colourless.</p> <p><b>SAFETY</b> – LEA/school guidelines on the use of any syringe must be observed. Use of syringes must be carefully supervised, count them out and count them back.</p>
<ul style="list-style-type: none"> <li>• to identify and describe differences in properties of solids, liquids and gases</li> </ul>	<ul style="list-style-type: none"> <li>◆ Ask children to make summary cards to explain to new Year 5s, ways in which solids, liquids and gases differ.</li> </ul>	<ul style="list-style-type: none"> <li>• summarise differences identifying aspects such as ease of flow, and whether solids, liquids and gases retain their own shape and volume when moved to different containers</li> </ul>	