

## Contents

There are **five games** that show how oil was originally formed, how we search for it, the places in Great Britain where oil is stored and used for manufacturing, how it is changed and common products of oil. These topics are tackled in reverse order, taking the student from the everyday back to the prehistoric.

- 1 **Things made from oil** introduces everyday items made from oil. Students are asked to put the oil-derived objects in an oil bin, and all others in another bin.
- 2 **Tankers, lorries and pipes** presents a map of Great Britain. Physical features like cities, mountains, seas and rivers can be placed on the map using a grid reference system.
- 3 **Changing and creating** shows how a distillation tower can be used to separate the different components of oil, from light gases to heavy tars, by heating and drawing off the products at different temperatures.
- 4 **The great search** shows an area of the sea. An oil exploration boat trawls it, and by adding and subtracting to produce data to complete a 'magic square', the boat can be helped to find oil.
- 5 **Back to the beginning** presents pictures of the development of oil reserves together with continuous prose describing the process from plankton to drilling.

## Curriculum links (using the COL keyword scheme)

### Materials and their properties

Work on solids, liquids and gases should be related to pupils' observations of changes that take place when materials are heated and cooled, and to ways in which mixtures can be separated.

#### Pupils should be taught:

##### 1 Grouping and classifying materials

**a** to compare everyday materials, e.g. wood, rock, iron, aluminium, paper, polythene, on the basis of their properties, including hardness, strength, flexibility and magnetic behaviour, and to relate these properties to everyday uses of the materials;

**d** to describe and group rocks and soils on the basis of characteristics, including appearance, texture and permeability;

**e** to recognise differences between solids, liquids and gases, in terms of ease of flow and maintenance of shape and volume.

##### 2 Changing materials

**b** to describe changes that occur when materials, e.g. water, clay, dough, are heated;

**c** that temperature is a measure of how hot or cold things are;

**d** about reversible changes, including dissolving, melting, boiling, condensing, freezing and evaporating.

## Web links

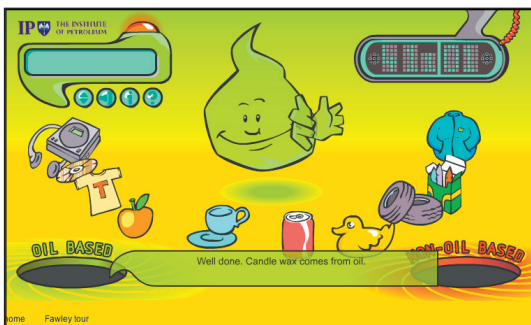
### Animation of the Fawley distillation

[www.schoolscience.co.uk/content/4/chemistry/petroleum/knowl/4/flash/distillation.html](http://www.schoolscience.co.uk/content/4/chemistry/petroleum/knowl/4/flash/distillation.html)

## Using the resource

### 1 - To compare everyday materials on the basis of their properties

Relevant prior knowledge: The world is made of materials; some of these can be found naturally, and all can be named. Materials can be sorted on the basis of their properties and materials are chosen for different uses on the basis of these properties.



Use game 1 to illustrate how many things around us are made from oil. Show it on a demonstration screen, or on an interactive whiteboard, and invite contributions and choices. Where appropriate, use the fact files to inform, correct and enhance the children's understanding.

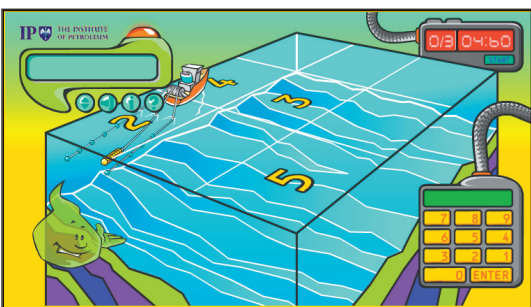
You could make deliberate mistakes, challenging the children to put you right.

You might challenge the children's understanding, too. 'Surely that's not made from oil? How do you know?'

Extend the game by asking for materials that have been replaced by oil products. What preceded this product? What would your grandparents have used?

Now ask the children to work on the game in groups – and perhaps to name some objects or materials not used here that could be put in the oil and non-oil bins.

Ask the children to find the most unlikely use for an oil product, in time for the next lesson, and to bring their safe example in.



Make a collection of oil-based products and exhibit them.

Finally, link form and function; ask groups to examine oil-based products and explain what qualities the material has that match it to its task – for example a plastic toothbrush is strong, waterproof and easy to keep clean. You can secure bristles in it. It also comes in a range of colours – one each for all the family.

## Using the resource

### 2 - As an example of what happens when materials are heated or cooled

The distillation tower is the place where the dark, sticky oil is separated into different parts, called fractions. Refining makes use of a handy fact - different oils boil at different temperatures. So the crude oil enters the tower as a hot gas (around 400°C). The gas goes into a tower where the temperature is different from bottom to top. Heavier oils condense - become liquid again - near the bottom. Lighter oils condense further up - the lightest at the top.

By taking the oil from different heights in the tower, the different oils are separated out. Then some of the oil is 'cracked' - its molecules are broken up into smaller molecules. Other molecules are joined together into long chains. This is called polymerisation. Plastics are made by polymerisation.

Relevant prior knowledge: Children will need to know that temperatures are measured in degrees, and that the temperature of something is how hot it is – not how much heat there is in it. There is a lot of heat in a bucket of boiling water, but a red-hot poker is at a higher temperature.

Temperatures are commonly measured in degrees Celsius (once Centigrade) named after their deviser and signalled with a superscript degree sign and a large letter C: 0°C is the freezing point of pure water; 100°C is its boiling point.

Children may be used to the idea that heat rises, and find the reverse situation in the distillation tower – higher temperatures near the bottom – confusing. Introduce – or revise – the words related to changes in state – solids, liquids and gases; evaporate and condense, solidify and liquefy.

Use the game to introduce the idea that different materials react differently to different temperatures. Heavy oils and tars need high temperatures to liquefy, and even higher to evaporate; gases need low temperatures to condense. Present it on the interactive whiteboard; use the fact file to confirm the characteristics of different materials.

Discuss the differences in solids, liquids and gases in terms of ease of flow and how they maintain their volume. The atoms or molecules in a solid cannot move; they stay in their position, vibrating. They won't pour or float away. Crystals reflect the packing of their molecules. If they are packed in cubes, the crystal will be a cube. Gases, liquids and some powdered solids can flow, but gases expand to fill the available space. A liquid will pour, taking the shape of its container. Some solids pour too, like salt or dry sand, but liquids have a flat top. The atoms and molecules in a liquid are freer to move around than the ones in a solid; but they are not completely free like those in a gas. If a liquid is heated, molecules fly from its surface as it becomes a gas.

Ask the children to research the uses of the different 'fractions' of oil. Note that kerosene and paraffin are the same; also gasoline and petroleum or petrol.

## Using the resource

### 3 - Make a class display of different plastics.

Use these facts to help present each one:

'**Plastic**' is a word meaning bendy or supple. Plastikos is a Greek word meaning mould or form. Many materials are 'plastic' - like clay or wax. But we use the word to mean a group of materials that are manufactured from oil. About a tenth of thick black crude oil has the complicated chemicals in it that can be changed to plastic. After treatment, the gases and liquids from the crude oil become hard, shiny granules. This is plastic. Plastic can be coloured, melted, shaped, squashed, stretched, rolled into sheets or pulled into fibres. There are many different plastics, including:

**Acrylic.** Hard, often clear. You can make spectacle lenses and telephones from acrylic.

**Polystyrene.** Hard and rigid. Polystyrene can be made into food containers and model kits. It can be cut, glued and painted - but it breaks easily. 'Expanded' polystyrene is a light, soft material that reflects back the heat of your hand - it feels warm. It packs delicate things and lines cool-boxes.

**Polythene.** Light, tough and bendy. Made into buckets, bowls, bags and sacks. It takes forty years to decay - making it a long-term insulation for electrical wires.

**PVC.** Polyvinylchloride is waterproof and a good insulator. It makes bags, luggage, coats, wellingtons and bouncy castles!

**Nylon.** Strong, light and great for fibres. Nylon fibres can make delicate stockings or tough bullet-proof vests. 'Crimped' or folded, it makes a bulky fabric that can trap air and keep you warm.

**PET.** Polyethylene terephthalate is used to make plastic bottles; but Daimler-Chrysler believes it could make car bodies as crash resistant as steel - at half the price.

**PTFE.** PTFE is short for polytetrafluoroethene. It is used to make non-stick coatings on pans. PTFE is so slippery that it takes sandblasting and baking to make it stick to the pan! Its commercial name is Teflon.

After a risk assessment, and only as a safe demonstration, boil a kettle in front of a cold wall mirror. (You may need to hold the switch on). Observe how the water vapour from the kettle condenses on the mirror as water droplets and ask the children where the evaporation and condensation are taking place. This is taking place at 100°C. Explain that this is what happens in a distillation tower – but that different oil products evaporate and condense at different temperatures.

88 out of every hundred barrels of crude oil are used to produce energy. 30 are used for cars and lorries, 23 to keep us warm, 15 in factories, 11 to make electricity and nine to fuel ships, planes and trains. Seven go to make chemicals, and the rest are used in other ways - for road surfaces, for lubrication, for wax candles and even in grease proof paper. Ask children to represent these figures as a pie chart, first drawing a circle and then marking each quarter as 25, then marking the statistics on it. They could use a graphing program to produce an accurate electronic version.