# 1. Oil

Children's knowledge about oil is established and they are introduced to an 'oil rig'.

## OBJECTIVES

- To establish children's knowledge about oil and introduce them to the oil platform and its use for recovering oil from the sea bed.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.
- Identify and compare the suitability of a variety of everyday materials, for particular uses.

## RESOURCES

- Motor oil
- Bicycle oil
- Mini pop bottles
- Activity sheet 1
- Cooking oils (optional)
- Essential oils (optional)
- Massage oil (optional)
- Cotton wool buds

## DISCUSSION & CLASS TASK

Depending on the age of the children, this discussion may best be carried out in two stages on consecutive days, to maintain children's interest and attention.

Before showing children the range of oils, ask them what they know about oil. When children have offered all they can to this open-ended question, further discussion can be stimulated, using questions such as:

- What do we use oil for?
- What different types of oil are there?
- What different jobs do these oils do?
- How would you describe these oils?
- What do the different oils look/smell/feel like?
- What is the same about all the oils?
- What is different about the oils?
- Imagine that we had no oil, what would you not be able to do?

Children's ideas can be recorded before showing them the oils (see the section on recording, page 4). Only discuss types of oil that children have mentioned. Introducing 'new' oils may confuse them.

**Note:** Pour the motor oil and bicycle oil into transparent containers, such as mini pop bottles, and screw the lids on tightly. The children will then be able to see them clearly. The original containers can be shown alongside the samples.

Ask children where the different types of oil come from (the names and pictures on the labels of cooking oils provide suitable clues). Children should realise that the cooking oils come from nuts, seeds, berries and flowers (more able children may realise these are all parts of plants).

Children can smell the oils, to appreciate the differences between cooking oils, essential oils and motor/bicycle oils. To do this, dip a cotton wool bud into each type of oil, and pass the bud round for each child to smell, telling children not to touch their clothes with the buds.

*Essential oils contain concentrated extracts of plants mixed with a base oil, thus providing a range of perfumed oils. This can be demonstrated with children, by mixing a bland or sweet smelling cooking oil (such as almond oil) with a few drops of perfume. Children can thus create their own range of essential oils.*

## LINK TO ACTIVITY 2

The essential oils and the cooking oils are plant-based. Ask the children where they think the motor/bicycle oils come from. Some children may already have mentioned oil rigs (strictly called 'platforms' - see Background Information page), as they may have seen them on television programmes, or have relatives working on oil rigs. At this stage, simply discuss the location of oil, i.e. deep in the ground and often beneath the sea bed. Make it as clear as possible that because this oil comes from the sea bed, it is very different to cooking oils and essential oils. Activities 2-5 look more closely at platforms and drilling for oil.

## RECORDING IDEAS

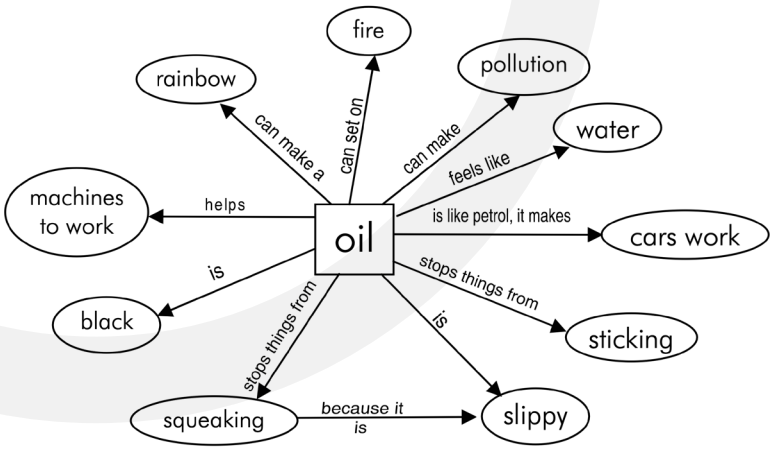
Class responses at various stages of the discussion can be written on a large piece of paper, and kept as a record of their collective ideas at the start of the topic. This can also be done as a concept-mapping exercise, with the teacher recording responses on the blackboard or on sugar paper. Activity sheet 1 'About oil' suggests words to include on the concept map. The teacher can use these words on the class record, the number of words being selected according to the ability of the children. Any key words that children use can also be added. Ask children to link any two words to make sentences about oil.

"The discussion was very lively. I introduced it as a game where they had to find two words which they could link in a sentence."

"The children enjoyed this task. I was amazed at their knowledge and understanding."

An example of this exercise, carried out with a class of 5-7 year olds, is given on the next page (words not linked have been omitted).

Children may associate oil with incidents of pollution, as these receive much media attention. It is important, in creating a balanced picture, to acknowledge this aspect Children may associate oil with incidents of pollution, as these receive much media attention. It is important, in creating a balanced picture, to acknowledge this aspect




along with the many ways in which oil enhances our lives, such as:

- For cars, buses, etc. to travel to school, work and holiday destinations.
- To heat our homes, schools, and other buildings.
- For industry to use for making other products.
- To help generate electricity for e.g. heating, lighting, and cooking.

# Background Information

**Note:** *This information is provided as a reference for the teacher. Most of the information is too difficult for 5-7 year olds to understand. Some aspects can be discussed, though these must be carefully selected to provide simple and appropriate discussion points with the children.*

## THE FORMATION OF OIL

Oil is formed from the remains of small sea animals and plants from 50 million years ago. Immense pressure and heat over time changes these tissues physically and chemically into crude oil and natural gas.

## SEARCHING AND DRILLING FOR OIL

Nobody knows precisely where oil can be found.

Geologists gather information about rock formations to make intelligent deductions about possible locations, often under the sea. Exploratory drilling then takes place, using a drilling rig. This is a tall structure with suspended steel pipes and a strong steel drill bit. Once oil is reached (sometimes as deep as 6000 metres below the sea bed) the drilling rig is replaced with a production platform - a more permanent structure in which the crew will live and work.

The platform must be strong enough to support its community and buildings, and withstand the severest storm conditions at sea. The platform is therefore made from a combination of steel and cement.

The North Sea has many oil rigs and platforms which have been built on the North East coast of Britain, and then towed out to the place where oil production will begin.

Rigs used for exploration are quite different from those erected for long term oil extraction. There are also a variety of platform designs for extracting the oil, which depend on the sea and weather conditions. For example, floating platforms are anchored in very deep seas. Others can sit on the sea bed with the legs of the structure deeply embedded. 'Feet' for a platform can be used on dry land, but the force of the sea water would still move the platform about in the water. For the children's activities, distinctions between different types of platforms are not made.

The rate of drilling depends largely on the hardness of the rock. In ideal conditions up to 60 metres an hour can be achieved; whereas extremely hard rock can reduce this rate to 60 metres in 24 hours. A typical drill bit varies in diameter from 30 to 60 cm, depending on the drill hole and depth. In very deep holes, the diameter of the drill bit can be as small as 12.5 cm. The bit has many individual teeth which are made from steel that has been toughened by adding chips of tungsten carbide. For exceptionally hard rock, the teeth are toughened using diamond.

To weigh down the drill bit, 'collars' are used. These are each 9 metres long and weigh 1.5 tonnes. Up to 20 in a 'string' can be added. Replacement of a worn drill bit can take 24 hours - 12 hours to bring it up, and 12 to take it down again.

## WORKING ON A PLATFORM

100-200 people can work on one platform, though small or 'satellite' platforms have less. Due to the difficult travelling to and from work, most staff work 1-2 weeks on the platform, followed by 1-2 weeks on shore. People usually travel by helicopter, whilst supplies can travel by boat or helicopter. One helicopter typically transports 20 people.

The platform functions as a small community, so jobs vary widely, as in a village or town. As well as the production, maintenance and drilling team, there are cooking staff (head chef, baker, cooks, and stewards), cleaning staff, medical staff, radio operators, etc.

A typical weekly 'shopping list' for the platform crew includes:

| | |
|---|---|
| 100 kg butter | 500 kg vegetables |
| 350 kg flour | 1,000 kg meat |
| 500 kg fruit | 2,000 litres milk |

In addition to this food, a fresh supply of water must always be available. For this reason, a platform has its own desalination plant which converts sea water into fresh water. A typical demand for fresh water can be 30,000 litres per day!

## TRANSPORTING THE OIL

Tankers are used to transport oil around the world. They are categorised according to the quantity of crude oil they carry. Very large crude oil carriers (VLCCs) can carry 300,000 tonnes, whilst the cargo of ultra large crude oil carriers (ULCCs) can be 500,000 tonnes. The largest tankers are 400 metres long - approximately 5 football pitches placed end-to-end. Often the crew use bicycles to travel around the ship.

These ships are too large to travel through the Suez Canal, and so their route from the Middle East to Europe takes them around the Cape of Good Hope. This journey takes 60 days, rather than the 40 days needed to travel through the Suez.

The oil is carried in several compartments in the ship. As a cargo is unloaded (in order to maintain the ship's stability) the compartments are filled with water for the return journey.

Smaller coastal tankers sail between refineries, and usually carry loads of 20,000 tonnes or less.

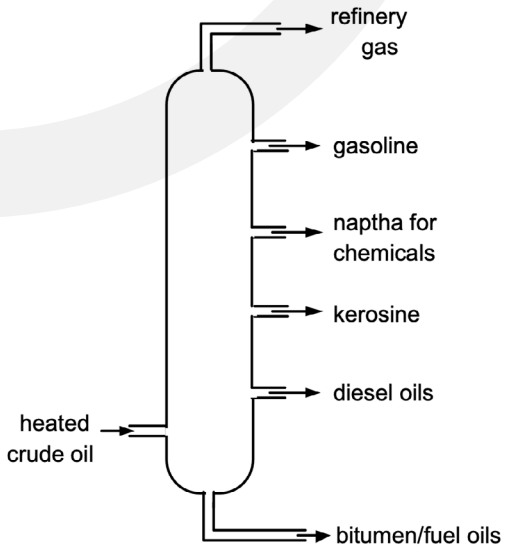
In addition to tankers, pipelines are used to carry crude oil from platforms in the North Sea to shore. Oil can be transported from several platforms to the shore by one pipeline. Pipelines are also used within the UK to transport oil products, such as petrol, to large consumers and distribution centres. For example, nearly 90% of Esso oil and gas products are transported by pipeline. A network of 1100 km of pipelines runs from the Esso refinery near Southampton to centres such as Manchester, London, Birmingham and Gatwick Airport. It is the safest means of transportation, as spillages are rare. It is also environmentally friendly, as pressures on road transport are reduced, and the only visible signs of the pipeline are small markers along its length - similar to those seen on street corners for gas pipelines.

The pipeline consists of sections of steel pipe welded together. When being laid, the newly-welded joints are cleaned, X-rayed, wrapped and waterproofed before the pipeline is covered over. To ensure no leakage occurs, the entire pipeline is regularly tested by running high pressure water through its length.

Road tank vehicles are used to carry oil products to smaller distribution centres, such as petrol stations, and to some customers. These tankers can weigh 38 tonnes and carry 35,000 litres of petrol, though smaller vehicles are used for less accessible places.

## SEPARATING CRUDE OIL

Crude oil is a mixture of components which can be separated by heating. This process is called 'distillation'. The process relies on the fact that each component in the mixture changes from a liquid to a gas at a different temperature. The crude oil mixture is heated up to 400°C before being passed into a tall tower (about 80m high). Some of this mixture is now a liquid, but most of it has turned into gases. As the mixture enters the tower, the liquid falls to the bottom, and the gases rise up the tower. As the gases rise they cool down, and one by one they become liquids. As each gas becomes a liquid, it is drawn away from the tower by pipeline. The diagram overleaf shows the main components of the mixture. These components are often further distilled, or refined, to provide a wider range of products.




## USES OF OIL

In the 1860s the main use of oil was as a fuel for domestic lighting (paraffin lamps). However, the demands for lubrication grew as industry developed, for lubricating wheels, pulleys and engines. In the 1960s the main use was for producing heat. Today, the main demands on oil are fuels for transportation, a wide range of lubricants, and for the production of chemicals.

A variety of oil products provide fuels, such as aviation fuels, diesel oil and petrol. Each product is tailor-made for its use, be it a heavy grade of fuel oil for use in ships, or kerosene used to heat large buildings such as hospitals, or liquefied petroleum gas (LPG) for camping gas stoves. In many countries these fuels are also used for cooking.

Similarly, products for lubrication vary - from a fine clear liquid to thick grease for the rollers in a steel mill. Paraffin wax is extracted from oil during lubricant manufacture. It is used to make candles and waxed containers for packaging.

Fine oils and greases are used in cosmetics and medicines.

Bitumen is used for road surfacing and for waterproofing roofs, dams and tunnels. This list is not exhaustive, and oil products are found in many applications - such as plastics, ointments, polishes and a wide range of chemicals. In the children's activities the distinction between crude oil and its many products is not made. It is sufficient to say that crude oil is changed in 'factories' (oil refineries) to make many types of oil and products.