

► **Key Question: How are mixtures separated in industry?**

Many industries separate mixtures to make pure products. In this section, you will learn about three industries that separate mixtures.

## 1. THE FLOUR INDUSTRY

Bread, cake, cookies, and other goods are made with flour. Flour is made from wheat grains.

### Hint

*Purifying* means "making pure," or "cleaning."

The two main stages in making flour from wheat grains are

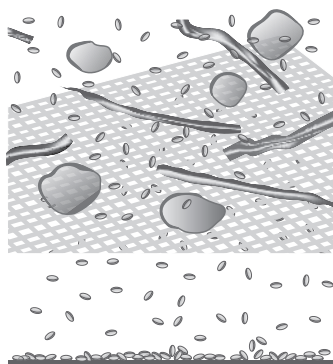
- purifying
- grinding

### Purifying the Wheat Grains

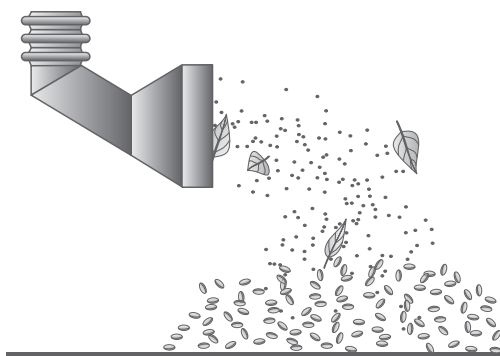
When wheat grains arrive at a factory, they can come mixed with dust, plant parts, metal splinters, or sand. Figure 1 shows how the wheat is separated from the rest of the mixture.

A metal grid separates the grains from twigs and stones. The larger particles are removed.

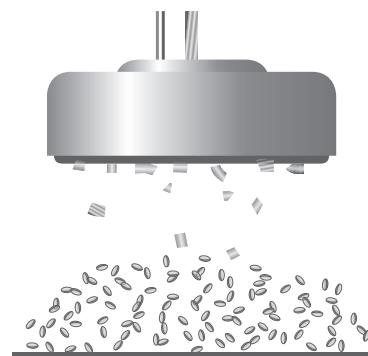
A vacuum sucks away particles that are lighter than grain. A magnet removes metal splinters away.



Wheat grains pass through metal filters. Twigs and stones are too large to pass.



A vacuum sucks up dust and leaves. The wheat grains remain.

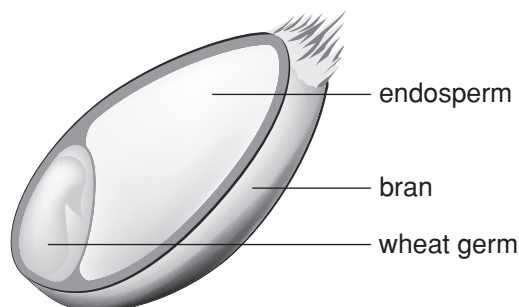


A magnet pulls metal splinters away.

**Figure 1** Methods used to purify wheat grains

## Grinding the Wheat Grains

Wheat grains are a mechanical mixture. A grain of wheat has three parts: the bran, the endosperm, and the germ (Figure 2).



**Figure 2** Parts of a grain of wheat

Metal rollers break open, or mill, the wheat grains. The broken grain mixture then passes through filters. The bran, endosperm, and germ are separated from one another.

The endosperm is then sent off to become white flour. The bran and germ are usually packaged and sold separately.

Whole-wheat flour is flour that is made from all three parts of the wheat grain.

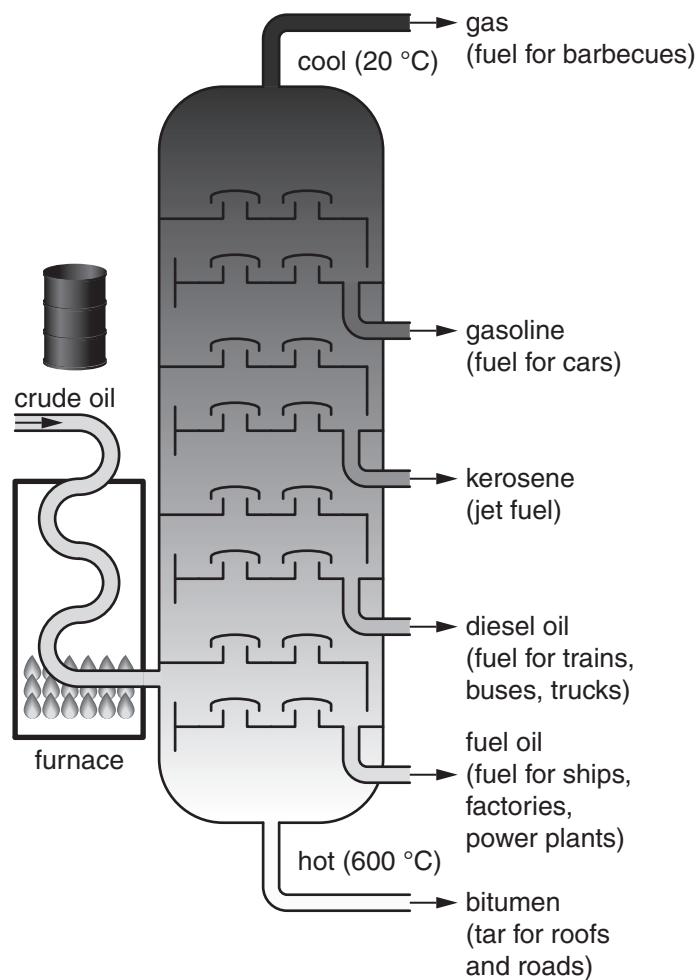
## 2. THE PETROLEUM INDUSTRY

Petroleum, or crude oil, is a mixture of different pure substances. It comes out of the ground as a thick liquid. Many products that we use in everyday life are made from petroleum. These include fuels, plastics, asphalt, many medicines, and fertilizers. We have to separate petroleum into its parts to make it useful.

Remember that we can separate liquids through the process of distillation. Different parts of the petroleum mixture boil at different temperatures. It is possible to separate petroleum into its parts by heating it.

First, a furnace heats the petroleum until some of its parts start to evaporate. The hot gases rise through a tall column, where they cool.

Different parts of the gas mixture become liquids at different temperatures. They become liquids at different levels inside the column (Figure 3). The liquid that cools at each level of the column is called a “fraction.”



**Figure 3** A “fractional distillation column” is used to separate liquids in crude oil.

Each fraction has very useful properties. The heaviest fraction is at the bottom. It is used to make “bitumen.” This is a thick, black, tar substance used to cover roads.

The lighter fractions are at the top. These are used to make thinner liquids like gasoline, natural gas, and kerosene. These fractions can also be used to make paints, plastics, and medicines.

#### Hint

*Refinement* means  
“making better or  
purer.”

## Problems with Petroleum Refinement

Refining petroleum can be very risky.

- The lighter fractions can catch fire easily or cause explosions.
- Leaks during the refining process can pollute the air.
- Petroleum products can be spilled in transit. They can then pollute the air, soil, or water.

## 3. THE NUCLEAR POWER INDUSTRY

Ontario gets some of its energy from petroleum, but not all. Ontario also receives energy from sources such as water power and nuclear power. In each case, a machine called an **electric generator** converts this energy into electricity.

Uranium is a pure substance that can be used for obtaining nuclear energy. Its particles break apart more easily than those of other pure substances. This is why it is known as a **radioactive** substance.

As uranium particles split, they produce a large burst of **nuclear energy**. Nuclear power plants use this energy to make electricity.

There are three main processes involved in using uranium for nuclear energy:

1. separating uranium from uranium ore
2. using uranium for power
3. containing used uranium

### Separating Uranium from Uranium Ore

We use uranium ore to get uranium particles. Uranium ore is a mixture of uranium particles and many other materials. Uranium is separated from the ore by:

1. crushing the uranium ore into small pieces.
2. adding a solution that dissolves the uranium.
3. removing the waste rock through sieving and collecting the dissolved uranium.
4. evaporating the water in the solution.

#### **electric generator**

a machine with moving parts that produce electricity when they spin

#### **radioactive**

a term used to describe pure substances whose particles naturally split into smaller particles, releasing energy as they break apart

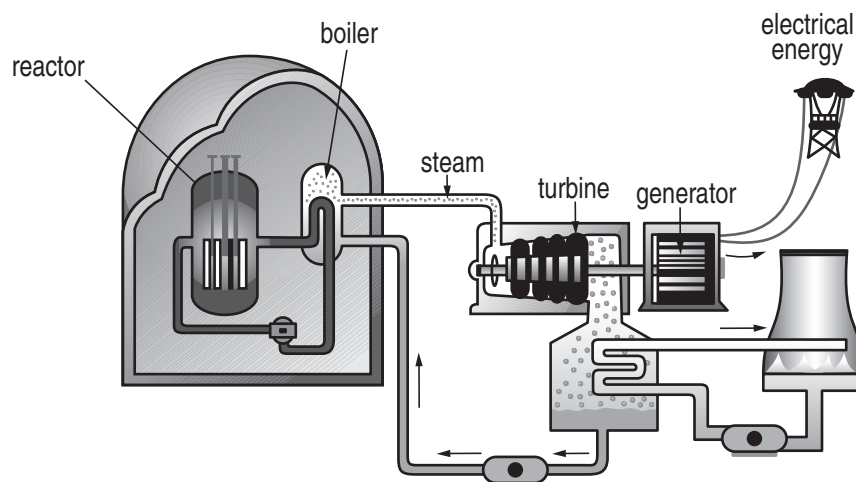
#### **nuclear energy**

the energy released when the particles of pure substances like uranium split apart

## Using Uranium for Power

Inside a nuclear power plant, the uranium pellets are placed at the center of a nuclear reactor. There, the uranium particles split and release energy.

This energy is in the form of heat and radiation. The energy heats water around the core. The water evaporates. The water vapour pushes on the blades of a turbine. The spinning turbines then turn generators that produce electricity (Figure 5).



**Figure 4** A small amount of uranium can produce a great deal of electricity.

After some of the uranium particles have split, the amount of energy produced slows down. The used uranium must be replaced. Most of the used uranium can be used again in a nuclear reactor.

## Disposing of Used Uranium

Some of the used uranium cannot be re-used. It must be handled carefully. It is still very dangerous to people and animals.

To solve the problem, nuclear power plants actually create a mixture.

- The used uranium is mixed with a form of melted glass.
- The glass and uranium cool into a solid.
- Then, the mixture is buried deep in Earth.

## Advantages of Nuclear Power

- Very little uranium produces a lot of power.
- Nuclear power does not produce pollution that can lead to acid rain.
- Nuclear power does not release carbon dioxide, which causes climate change.

## Problems with Nuclear Power

Many people do not like nuclear power for the following reasons:

- Accidents can happen. High levels of radioactive particles can cause diseases, and often death.
- Used uranium is still radioactive for a long time. There is no good way to get rid of it. Even if it is buried, people or animals can find it.



### CHECK YOUR UNDERSTANDING

1. What kind of mixture is

- (a) flour? \_\_\_\_\_
- (b) petroleum? \_\_\_\_\_
- (c) uranium ore? \_\_\_\_\_

2. Describe one way to separate each of the following mixtures.

- (a) wheat grains with large sticks \_\_\_\_\_

- (b) wheat grains with metal pieces \_\_\_\_\_

3. Name two products that come from the lighter parts of petroleum.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

4. Describe how uranium is separated from uranium ore.

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5. Think about another product that is made by separating mixtures.

(a) What is the product? How is it separated?

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(b) Which process from the section is this most like?

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6. Think back to the Key Question. What are the two ways wheat grain mixtures are separated in the flour industry?

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