

1.1 USES OF DIFFERENT TYPES OF FLAMES

Non-luminous flames are hotter than luminous ones. When we need a hot flame e.g. to cook rapidly, it is the non-luminous type which applies. For gentle heating we prefer a luminous flame to non-luminous one.

1.2 IMPORTANCE OF AIR

We've already said in Module 2, Unit 2 that the air we breathe is a mixture of several gases. The most abundant and common gas found in air is nitrogen. Oxygen which is important for breathing is also found in air. For the other gases present in air, please go back to module 2 - 2.1.

The amount of water vapour in air is not fixed. It varies from place to place and depends on the climate.

 *Before proceeding further, complete the following activity.*

ACTIVITY 4

Below is a list of gases. From the list underline those gases that are present in clean air.

Hydrogen, Oxygen, Chlorine, Nitrogen, Carbon dioxide, Air pollutants, Noble gases, Carbon monoxide, Ammonia, Water vapour.

You will find the answer at the end of the Module.

Note: A pie chart showing the composition of gases in air is in Module 1, Unit 2: 2.3 of the Biology component. Please refer to it.

By now we know that air is a mixture of several gases. From the list of gases that are present in unpolluted air, complete the table to show the gases in air and their approximate percentage (by volume)

 *Before proceeding further, complete the following activity.*

<u>ACTIVITY 5</u>	
Name of Gas	Percentage composition in air

You will find the answer at the end of the Module.

Having considered air, we shall now look at its importance in 2 instances of major concern to us i.e.

- rusting and
- combustion.

1.2.1 RUSTING

It is a matter of common observation that ordinary iron which is exposed to moist air is covered with a brown layer of rust. You must surely have noticed this in old vehicles such as cars, lorries and agricultural machinery left lying around for a while. Leave an iron nail outside for a few days. What do you see?

Rusting of iron is a chemical change. Rust is formed when iron combines with water and oxygen from the air. It is good to point out here that rusting like combustion uses up oxygen. But the rusting is a slower process. Rusting is also a wasteful process as money must be spent to protect iron. There are several ways for rust prevention, including barrier methods. Later on we shall look at some of them.

 ***Before proceeding further, complete the following activity.***

ACTIVITY 6

1. *What conditions are necessary for the rusting of iron?*

.....

2. *Why is rusting a chemical change?*

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You will find the answer at the end of the Module.

We can now proceed with the following investigation.



INVESTIGATION 4 : Rusting

For each investigation you will require the materials indicated.

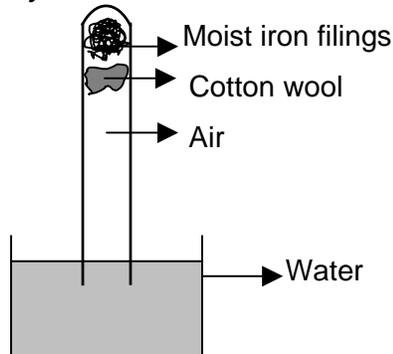
You should record your answers in the space provided.

Materials needed:

- Fresh iron filings or steel wool
- A beaker almost full of water
- A test-tube (fairly tall)
- Stand with clamp

Method:

*Put some moist iron filings in the test-tube
 Insert a piece of cotton wool to support the iron filings at the closed end of the test tube. Invert the test tube carefully over the beaker of water. Measure the height of the air column trapped inside the test tube. Leave aside for a few days.*



Record your observations.

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Rust Prevention

We must prevent things rusting because otherwise it can turn out to be very expensive for us.

Some of the commonest methods are coating the metal to be protected with something. This then excludes air and water. From the previous investigations, you were able to see how.

We therefore:

- use paint. You must have observed road signs being painted regularly or house owners painting their gates or window frames etc.
- wrap the metal with plastic. The dish rack or clothes rack is very often covered in plastic.
- use grease or oil. When you take your car for servicing, the car mechanic normally greases the chassis.
- galvanise the metal. Gates are very often plunged in a zinc bath for protection against rust.

 *Before proceeding further, complete the following activity.*

ACTIVITY 7

(a) Why is rusting considered wasteful?

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.....
.....

(b) Make a list of different methods to prevent rusting.

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.....

YOU WILL FIND THE ANSWER AT THE END OF THE MODULE.

1.2.2 COMBUSTION

Many substances react with oxygen from the air when they are heated. The combination of a substance with oxygen is known as combustion or simply burning. Heat and oxygen are necessary for combustion to take place. Combustion is a chemical change as new substances are always formed.

 *Before proceeding further, complete the following activity.*

ACTIVITY 8

Think over each statement below. Write 'TRUE' or 'FALSE' after it.

- 1. All substances can be burnt. -----*
- 2. To burn gas in a burner, the gas has to be ignited. -----*
- 3. Burning is also called combustion. -----*
- 4. Combustion usually gives out energy in the form of light and heat.-----*
- 5. In everyday life, fuels are burnt as a source of energy. -----*
- 6. Striking a matchstick on the moon will NOT produce a flame because of the absence of air (oxygen) on the moon. -----*
- 7. Combustion is a physical process. -----*
- 8. Burning of a substance in air can be considered as its reaction with oxygen. -----*

You will find the answer at the end of the Module.

Combustion has also found numerous applications in our day-to-day living. A simple example is the burning of firewood or gas for cooking and heating.

Think of a car. The petrol we put in has to burn in oxygen for the necessary energy to move the car.

 *Before proceeding further, complete the following activity.*

ACTIVITY 9

Which of the following serve as examples of ordinary burning used in everyday life? Tick the correct answers in the box and put a cross for the incorrect ones.

- | | | |
|-----|--|--------------------------|
| (a) | <i>Fire from wood</i> | <input type="checkbox"/> |
| (b) | <i>Flame from magnesium</i> | <input type="checkbox"/> |
| (c) | <i>Flame from coal</i> | <input type="checkbox"/> |
| (d) | <i>A lighted candle</i> | <input type="checkbox"/> |
| (e) | <i>Burning sulphur</i> | <input type="checkbox"/> |
| (f) | <i>'Bottled' gas being burnt in gas cookers</i> | <input type="checkbox"/> |
| (g) | <i>Burning liquid fuel in suitable devices such as stoves.</i> | <input type="checkbox"/> |
| (h) | <i>Burning hydrogen in gas burners.</i> | <input type="checkbox"/> |
| (i) | <i>Flame from oxy-acetylene blowpipe used by welders.</i> | <input type="checkbox"/> |

You will find the answer at the end of the Module.

We can now proceed with the following investigation.



INVESTIGATION 7: COMBUSTION (SULPHUR)

<p>For each investigation you will require the materials indicated.</p> <p>You should record your answers in the space provided.</p>	<p>Materials needed:</p> <ul style="list-style-type: none">• A combustion spoon• A burner• A lighter• A gas jar• Powdered sulphur <p>Method:</p> <p><i>Half fill the combustion spoon with sulphur</i></p> <p><i>Light up a burner</i></p> <p><i>Place the spoon in the flame till the sulphur catches fire</i></p> <p><i>Lower the spoon in the gas jar (of air)</i></p> <p>Record your observations</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
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You must have observed sulphur melting and catching fire. It burns with a blue flame. It continues to burn for a while. Then the flame goes off. A strong smell occurs in the gas jar. The smell reminds us of burning firecrackers.

1.3 CLASSIFICATION OF FIRES

I am sure that you have performed many experiments where you have used a flame for heating. The use of flames and flammable substances in the laboratory represents a serious fire risk. Necessary precautions should be taken to avoid fires. We can classify fires according to the type of substance burning. Here are a few examples:

- Class A - solids like wood or paper, cloth
- Class B - liquids like petrol, diesel, oil
- Class C - gases
- Class D - metals like magnesium, potassium, sodium

 *Before proceeding further, complete the following activity.*

ACTIVITY 10

(a) Give a few instances of small fires

1.
.....
2.
.....
3.
.....

(b) Now, give examples of large fires

1.
.....
2.
.....
3.
.....

You will find the answer at the end of the Module.

1.3.1 FIRE-FIGHTING

It is almost an automatic reaction to put out a fire with water. But not all fires will respond to water e.g. a chip pan fire. On the contrary, water will enhance the fire. In this case a fire blanket is used to exclude oxygen from the air.

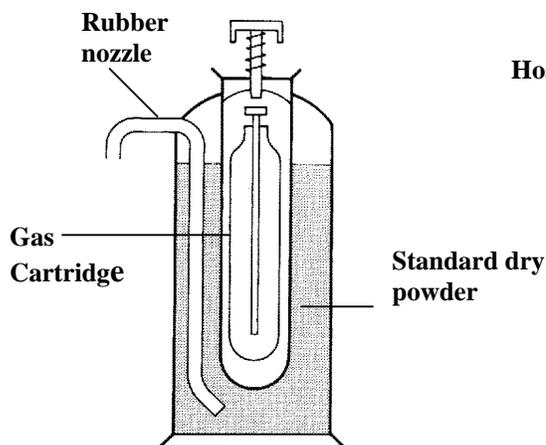
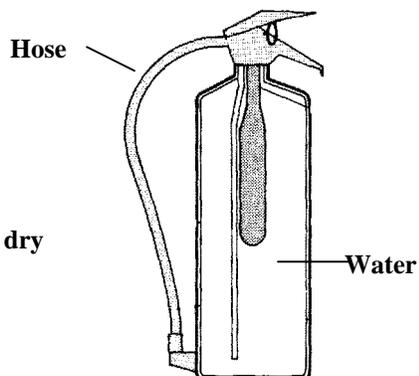
1.3.2 FIRE EXTINGUISHERS

Fire extinguishers are in common use depending upon the class of fire being tackled.

There are different types e.g.

- water fire extinguisher,
- carbon dioxide extinguisher,
- dry powder extinguisher,
- foam extinguisher

Here are two types:

Powder fire extinguisher**Water fire extinguisher**

During your travels, try to identify the other types. Note the contents.

For convenience here is a table to enable you to deal with the different classes of fires in an emergency. However remember to call the fire-fighters in the meantime. They are the experts and they know best. Only deal with the fire if you feel safe and confident to do so. Do not take risks.

Class	Extinguisher recommended
A	Water fire, carbon dioxide, dry powder, foam
B	Foam, Dry Powder, CO ₂ , Do not use water (H₂O)
C	Water fire, carbon dioxide, dry powder, foam
D	Dry Powder, CO ₂ Do not use water (H₂O)

 *Before proceeding further, complete the following activity.*

ACTIVITY 11

Give one instance where each of the following can be used in fire fighting.

1. *Buckets of sand*

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2. *Carbon dioxide type fire extinguisher.*

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3. *Foam type fire extinguisher*

.....

4. *A wet blanket or towel*

.....

You will find the answer at the end of the Module.



POINTS TO REMEMBER

- Different heat sources can be used in the laboratory.
- A gas burner can produce a luminous flame or a non-luminous flame.
- The air around us is a mixture of several gases.
- Burning is referred to as combustion.
- Iron rusts in the presence of air and water and moisture.
- Rusting is a wasteful process. It can be prevented by several methods.