INCREASING ACCESS TO SECONDARY SCHOOL LEVEL EDUCATION THROUGH THE PRODUCTION OF QUALITY LEARNING MATERIALS

JUNIOR SECONDARY LEVEL

CHEMISTRY

Module 3:

Heat, Energy, Air and Combustion

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JUNIOR SECONDARY LEVEL SCIENCE - CHEMISTRY

MODULE 3 – UNIT 1

HEAT, ENERGY, AIR AND COMBUSTION

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MODULE 3

UNIT 1

HEAT, ENERGY, AIR AND COMBUSTION

INTRODUCTION

At every moment of our life we make use of energy. In fact we eat to get the necessary energy to make a living for ourselves by working. But while eating, we are using energy to eat. Plants too need energy to manufacture their own food. Living organisms obtain their energy as a result of respiration.

There are many forms of energy. Heat and light are among the forms of energy which we use most commonly.

Energy is also dealt with in Module 3 of the Physics section. Different forms of energy are considered. The conservation of energy and interconversions are also noted.

In this Unit we are going to consider heat energy, air and combustion.

After completing this Unit, you should be able to:

- Name the different heat sources in the laboratory
- Produce luminous and non-luminous flames
- state use of different types of flames
- define rusting
- state the conditions necessary for iron to rust

- describe different methods of rust prevention
- describe combustion as the reaction of a substance with oxygen
- demonstrate the combustion of different substances in air
- describe examples of ordinary combustion
- classify types of fire
- relate fire-fighting equipment to types of fire
- identify types of fire extinguishers
- extinguish a small fire using the right extinguisher

1.0 HEAT – SOURCES & EFFECTS

In many experiments we perform in the chemistry laboratory, heat is applied to substances. Heat is necessary to start reactions or to make them proceed faster. It can also cause changes in state. You will recall us heating sugar in a spoon in Module 2. The sugar underwent a change of state. We shall be investigating this later on in this Unit.

Note: Please refer to Physics - Module 3 - 3.1.

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

ACTIVITY 1

(*a)* *What is the most common source of heat in a house?*

……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

(b) *What is the most common source of heat in the laboratory?*

……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

(c) *Which other alternative sources of heat are used in the laboratory?*

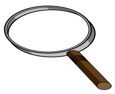
……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

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

As you may have noticed, there are air holes near the base of a Bunsen burner to regulate the air flow .The type of flame obtained depends on the amount of air passing through these holes.

Two flames are possible. In the case of an excess of air, the gas burns completely producing a non-luminous flame. If enough air is not supplied, a luminous flame will be seen. To confirm this, let's carry out the following.

We can now proceed with the following investigation.



INVESTIGATION 1: LUMINOUS AND NON-LUMINOUS FLAMES

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials needed:** • A Bunsen burner • A lighter **Method:** - *Open the gas supply connected to a Bunsen burner* - *Light the burner* *(a) Close the air holes of the burner. Record the appearance of the flame.* …………………………………………………………… …………………………………………………………… …………………………………………………………… *(b) Now open fully the air holes of the burner. Record the change in the appearance of the flame.* …………………………………………………………… …………………………………………………………… ……………………………………………………………..

I am sure that in (a) you noted the luminous flame, yellow in colour.

In (b) the flame should be non-luminous i.e. a blue flame.

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

ACTIVITY 2

Consider each statement below. Think over it. Then write 'yes' or 'no'

(a) A luminous flame is yellow [ ]

(b) The colours of a luminous-flame is due to fine particles of carbon in the flame. [ ]

(c) A luminous flame is hotter than a non-luminous flame (with the gas supply being at same rate) [ ]

(d) When the air holes of a burner are open, the gas burns in a plentiful supply of air. [ ]

(e) With the air holes closed partly, burning of the gas is incomplete. [ ]

(f) A non-luminous flame in the Bunsen burner has a bluish appearance. [ ]

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

Note: When your Bunsen burner is alight and not in use, always leave it with a luminous flame on the bench, away from everything.

When we apply heat energy to a substance, it can burn. Apart from burning, heat can have other effects e.g. heating can cause physical and chemical changes. Again, you will recall us explaining Physical and Chemical changes in Module 2. Cast a glance at it once again.

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

ACTIVITY 3

For each item in the list below, please tick the appropriate box.

		Yes	No
1.	*A common use of a flame is to heat substances*	☐	☐
2.	*When a dry leaf or dry paper is heated in a flame, it burns.*	☐	☐
3.	*The heat produced by a flame can cause a solid to change into a liquid (i.e melt).*	☐	☐
4.	*Under the effect of a flame, a liquid can turn into vapour.*	☐	☐
5.	*Heat from a flame can cause an increase in volume (i.e. expansion.)*	☐	☐
6.	*All substances can be decomposed by applying a flame.*	☐	☐
7.	*Heat slows down a chemical reaction.*	☐	☐

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

A non-luminous flame occurs in plentiful oxygen. As such it is also known as an oxidising flame.

We can now proceed with the following investigation.

INVESTIGATION 2: Using an oxidising flame

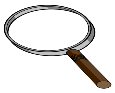
For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials needed:** • A strip of copper foil • A pair of tongs • A Bunsen burner • A lighter **Method:** *Light up the burner. Make sure that the air holes are open.* *With the help of a pair of tongs, hold the strip of copper in the flame for a minute or two. Put off the burner.* ***Record your observations.*** ………………………………………………………… ………………………………………………………… ………………………………………………………… …………………………………………………………

I am sure that you saw a clear (non-luminous) Bunsen flame. While heating, the flame above the strip of copper is green. When heating is stopped, the strip of copper (which was initially salmon-pink) turns black. The flame causes copper to combine with oxygen to form black copper oxide.

A luminous flame occurs in a reduced oxygen content. Such a flame is referred to as a reducing flame.

Note: The terms 'oxidising' and 'reducing' are beyond the scope of this course. However, in the context of flames, this is all you need to know at this stage.

We can now proceed with the following investigation.



INVESTIGATION 3: Using a reducing flame

For each investigation you will require the materials indicated.	**Materials needed:** • A piece of charcoal • Lead oxide (yellow) • A blower • A burner • A lighter • A knife
You should record your answers in the space provided.	**Method:** *Using the knife, make a small cavity in the charcoal. Fill the cavity with lead oxide. Light up the burner. Adjust the air hole to give a luminous flame. Hold the charcoal with lead oxide close to the flame. With the help of the blower, direct the flame towards the cavity (for this, you have to blow through the device).* Heat for 4 -6 minutes. Record all your observations. …………………………………………………………… …………………………………………………………… ………………………………………………………….. *Did you notice a reducing flame (yellow) and colour? The lead oxide finally changes into a silvery globule of lead.*

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.***

ACTIVITY 5

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?*

   ……………………………………………………………………………………..

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.

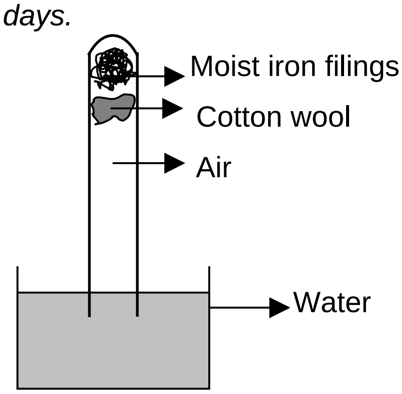
Materials needed:

- 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.



You should record your answers in the space provided.

Record your observations.

………………………………………………………………

………………………………………………………………

………………………………………………………………

………………………………………………………………

………………………………………………………………

………………………………………………………………

………………………………………………………………

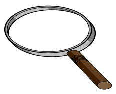
We can now proceed with the following investigation.

INVESTIGATION 5: Showing that *water* is necessary for rusting

For each investigation you will require the materials indicated.	**Materials needed:** • A greased plate of glass • A tall bell-jar • Fresh iron nails • A dry watch glass • A petri dish • A solid that absorbs moisture (e.g. *anhydrous calcium chloride)* **Method:** *On the greased plate place a watch glass having fresh iron nails. In the petri dish place solid anhydrous calcium chloride. Cover the above items by placing the bell-jar on the plate. Leave aside for 6 - 8 days.*
You should record your answers in the space provided.	*Record your observations* …………………………………………………………… …………………………………………………………… …………………………………………………………… ……………………………………………………………

Needless for me to tell you that the iron nails do not rust. Though oxygen was present in the gas jar, there was no water/moisture. In the absence of water, iron does not rust.

We can now proceed with the following investigation.



INVESTIGATION 6 Showing that *oxygen* is necessary for rusting

For each investigation you will require the materials indicated.	**Materials needed:** • Fresh iron nails • A greased glass plate • A tall bell jar • A solution to absorb oxygen (e.g. alkaline pyrogaloll) • A beaker of water (to ensure moist atmosphere) • A watch glass • A petri dish
You should record your answers in the space provided.	**Method:** *Place the iron nails in the dry watch glass* *Put sufficient alkaline pyrogallol in the petri dish* *Keep the beaker of water near the watch glass* *Now place the bell jar so as to cover the above items* *Leave aside for 6 - 8 days.* *Record your observations* …………………………………………………………… …………………………………………………………… ………………………………………………………

Here again the iron nails do not rust. Though the space below the bell-jar was moist, oxygen was absent. Rusting is not possible in the absence of oxygen.

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?

……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

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

……………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

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) *Fire from wood* ☐

(b) *Flame from magnesium* ☐

(c) *Flame from coal* ☐

(d) *A lighted candle* ☐

(e) *Burning sulphur* ☐

(f) *'Bottled' gas being burnt in gas cookers* ☐

(g) *Burning liquid fuel in suitable devices such as stoves.* ☐

(h) *Burning hydrogen in gas burners.* ☐

(i) *Flame from oxy-acetylene blowpipe used by welders.* ☐

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

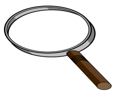
We can now proceed with the following investigation.

INVESTIGATION 7: COMBUSTION (SULPHUR)

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials needed:** • A combustion spoon • A burner • A lighter • A gas jar • Powdered sulphur **Method:** *Half fill the combustion spoon with sulphur* *Light up a burner* *Place the spoon in the flame till the sulphur catches fire* *Lower the spoon* in the gas jar (of air) **Record your observations** ………………………………………………………………… ………………………………………………………………… ………………………………………………………………… …………………………………………………………………

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.

We can now proceed with the following investigation.



INVESTIGATION 8: Combustion (Sugar)

For each investigation you will require the materials indicated.	**Materials needed:** • Cane sugar • A combustion spoon • A burner • A lighter • A gas jar
You should record your answers in the space provided.	**Method:** *Half fill the spoon with sugar, then light up a burner* *(a) Place the spoon in a flame* *Record your observations* *(b) When the sugar starts to burn lower it in the gas jar.* *Record your observations.* ……………………………………………………………… ……………………………………………………………… ……………………………………………………………… ……………………………………………………………… ……………………………………………………………… ………………………………………………………………

Did you note that the sugar melted giving off steamy fumes? The molten sugar usually gives out the smell of caramel. The sugar burns with a yellowish flame which eventually goes out. The gas jar becomes hot.

There is a black mass (carbon) left in the combustion spoon.

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

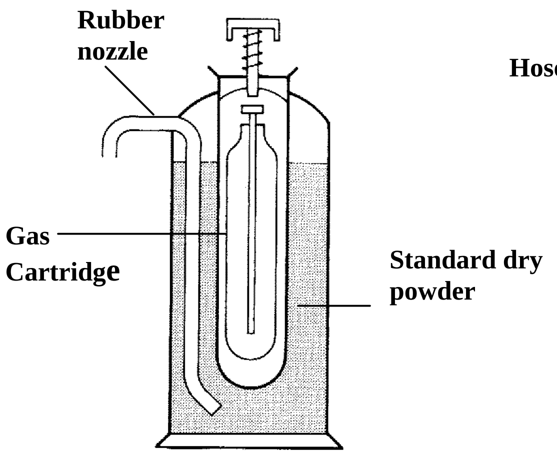
Fire extinguishers are in common use depending upon the class of fire being tackled.

There are different types e.g.

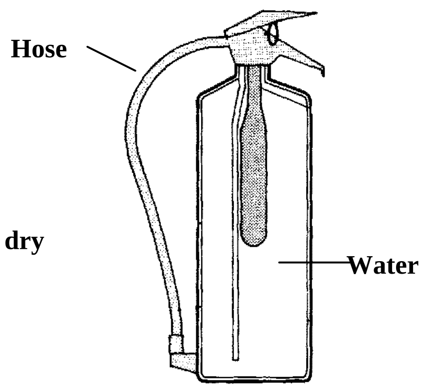
- water fire extinguisher,
- carbon dioxide extinguisher,
- dry powder extinguisher,
- foam extinguisher

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 (H_20)**
C	Water fire, carbon dioxide, dry powder, foam
D	Dry Powder, CO_2 **Do not use water (H_20)**

✍ ***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*

   …………………………………………………………………………….

2. *Carbon dioxide type fire extinguisher.*

   …………………………………………………………………………….

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.

MODULE 3 – UNIT 2

CONSERVATION OF ENERGY

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MODULE 3

UNIT 2

CONSERVATION OF ENERGY

INTRODUCTION

You'll recall that energy can exist in various forms in the previous Unit. We gave heat and light as examples. During chemical reactions, energy is usually liberated in the form of heat. **Energy can neither be created nor destroyed, but it can be converted from one form to another**. *This is the law of conservation of energy*. For example, a battery converts chemical energy into electrical energy, which can in turn be converted into light energy. This Unit takes the discussion on Energy further by citing specific examples of energy conversion and some energy sources. More Energy sources are looked at again in Module 8 of the Biology Section.

OBJECTIVES

After completing this Unit, you'll be able to:

- explain the law of conservation of energy
- name the sources of energy
- describe the destructive distillation of coal
- list acetylene and oxygen as examples of gaseous fuels used in industry
- state solar energy as an alternative source of energy.

2.0 KINDS OF ENERGY

If I were to ask you what is energy? I'm sure that got you thinking for a minute or two. Don't be surprised if I tell you that no one knows what it is exactly. What I can tell you is that we know what it does. It can make things happen and it allows you to do things, e.g. *you can walk, run and eat*. You use energy to do these things.

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

ACTIVITY 1

Draw up a list of ten forms of energy.

1. -- 5. --
2. -- 6. --
3. -- 7. --
4. -- 8. --

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

2.1 ENERGY CONVERSION

We said that energy can be converted from one type into another easily. In fact when this change happens some energy is wasted as heat. Let us explain this to avoid confusion.

Imagine you switch on electricity to light your bulb in the home. You're interested in the light energy. At the same time the bulb heats up but you don't need that heat. This is what we mean by some energy being wasted as heat. Think of other examples.

Note: **Please refer to Physics - Module 3, 3.1.1 for the Law of Conservation of Energy and Biology - Module 3, Unit 1: 1.2.**

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

ACTIVITY 2

Consider each statement below (concerning energy). Decide whether it is 'True' or 'False'.

1. *In a given system (e.g. a swinging pendulum) the total amount of energy remains the same.* ------------------------------
2. *One form of energy can be converted into other forms of energy.* -----------
3. *The unit of energy is the Joule.* --------------------------
4. *The law of conservation of energy states that energy cannot be created but can be destroyed*. --------------------------

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

As you might be aware, there are many energy conversions taking place around us. In our body, chemical energy from food is converted into heat energy which helps to maintain a constant body temperature. Green plants absorb light energy from the sun and transform it into chemical energy.

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

ACTIVITY 3

State the energy conversion in each case below

1. *A torch is lighted*

……………………………………………………………………………………………..

2. *A pendulum which is swinging.*

…………………………………………………………………………………………….

3. *An object is projected vertically upwards.*

…………………………………………………………………………………………….

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

2.2 ENERGY FROM FUELS

Most of the heat energy we use is obtained from fuels. The most common fuels used in the world are coal, petroleum and natural gas. These are called fossil fuels as they have been formed from the remains of dead plants and animals that lived millions of years ago. Another fuel commonly used is charcoal, which is obtained from wood.

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

ACTIVITY 4

(a) What is the source of coal?

………………………………………………………………………………………………

………………………………………………………………………………………………

(b) What is the source of the common fuels that we use?

………………………………………………………………………………………………

………………………………………………………………………………………………

(c) How is charcoal obtained?

………………………………………………………………………………………………

………………………………………………………………………………………………

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

Fuels can be in the solid, liquid or gas state. One example of a gaseous fuel used in industry is acetylene. In combination with oxygen it produces a very hot flame used for cutting and welding metals.

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

ACTIVITY 5

Complete the blanks (below) concerning the oxy-acetylene blowpipe.

(a) The blowpipe receives 2 different gases from 2 cylinders. The gases are ----------------- and ------------------------.

(b) When the mixture of the 2 gases is --------------------------- at the jet of the blowpipe it catches fire.

(c) The flame is very ----------------------------------.

(d) It is applied for ------------------------------- metal surfaces.

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

Fuels such as coal, charcoal and petroleum are non-renewable. They are not replaced by nature and will be eventually used up. These fuels release a lot of harmful gases in the air when they are burnt. Scientists are looking for other sources which are renewable and do not cause air pollution. One such alternative source is solar energy. You must surely have used a calculator operating on solar energy.

Note: Also refer to Biology - Module 8 - Unit 3.

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

ACTIVITY 6

(a) *In many tropical countries, solar energy is 'trapped' by certain devices to heat up water (e.g. for bathing). Outline how this is done.*

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………….

(b) *In certain countries solar energy is used to charge batteries during the day.*

(i) *What energy change takes place during this process?*

……………………………………………………………………………

(ii) *How are the charged batteries used at night?*

…………………………………………………………………

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

2.3 DESTRUCTIVE DISTILLATION OF COAL

We found out that Oxygen is necessary to support combustion. When we heat coal in air, it burns in the presence of oxygen. Obviously when heated in the absence of oxygen it doesn't burn. However if we subject coal to a temperature of 1000^{o}C or above, it produces a number of useful chemicals.

These include:

- Coal tar
- Coke
- Ammonia
- Coal gas

This is known as ***destructive distillation*** of Coal.

! POINTS TO REMEMBER

- Energy can exist in many different forms.
- Energy is conserved. It can neither be created nor destroyed.
- The common fuels are petroleum, coal, charcoal and natural gas.
- An alternative source of energy is solar energy.

ANSWERS TO ACTIVITIES

UNIT 1

Activity 1

(a) There are many possibilities and these should include fire, electric heater, brazier, stove, etc.

(b) **The Bunsen burner**

The gas supply connected to the burner is opened. The gas is ignited at the top of the burner. A flame occurs.

(c)
- An electric heater
- A portable burner equipped with a small gas cylinder
- A spirit lamp

Activity 2

(a) Yes (b) Yes (c) No (d) Yes (e) Yes (f) Yes

ACTIVITY 3

1. Yes 2. Yes 3. Yes 4. Yes 5. Yes 6. No 7. No

ACTIVITY 4

Oxygen, nitrogen, carbon dioxide, noble gases, water vapour.

ACTIVITY 5

Gas	PERCENTAGE IN AIR
Oxygen	19 – 20
Nitrogen	79 – 80
Carbon dioxide	0.03 – 0.04
Noble gases	0.9
Water vapour	variable

ACTIVITY 6

1. Air (oxygen) water
2. A new substance is formed

ACTIVITY 7

(a) It causes the wastage of iron.

(b) 1. Keeping the iron dry or out of contact with air.
2. coating with zinc (galvanising).
3. covering with oil paint.
4. putting a thin layer of grease on the iron.

Activity 8

1. False 2. True 3. True 4. True 5. True 6. True 7. False 8. True

Activity 9

(a) ✓ (b) × (c) ✓ (d) ✓ (e) × (f) ✓ (g) ✓ (h) × (i) ✓

Activity 10

(a) 1. Small heap of dry leaves being burnt
2. Dry pieces of cloth catching fire
3. Fire crackers giving small explosions

(b) 1. Forest fires
3. Petrol station on fire
4. Old wooden residences close together catching fire in series

ACTIVITY 11

1. Burning petrol
2. Fire in the kitchen
3. A flammable substance catching fire
4. A cook's clothes catching fire

ANSWERS TO ACTIVITIES

UNIT 2

Activity 1

1. light	2. heat	3. sound	4. chemical
5. electrical	6. kinetic	7. potential	8. vibrational

Activity 2

1. True 2. True 3. True 4. False

Activity 3

1. chemical energy $\longrightarrow$ heat + light

2. kinetic $\longrightarrow$ potential $\longrightarrow$ kinetic $\longrightarrow$ potential

3. kinetic $\longrightarrow$ potential

Activity 4

(a) It is mined from below the earth's crust

(b) Crude petroleum

(c) By the incomplete burning of wood

Activity 5

(a) acetylene and oxygen (b) ignited (c) hot

(d) welding together

Activity 6

(a) A solar water heater is used to 'trap' heat of the sun so as to heat up water

(b) (i) solar energy $\longrightarrow$ chemical energy

(ii) They are used to light up electric bulbs, tubes and to produce energy in various electrical devices.