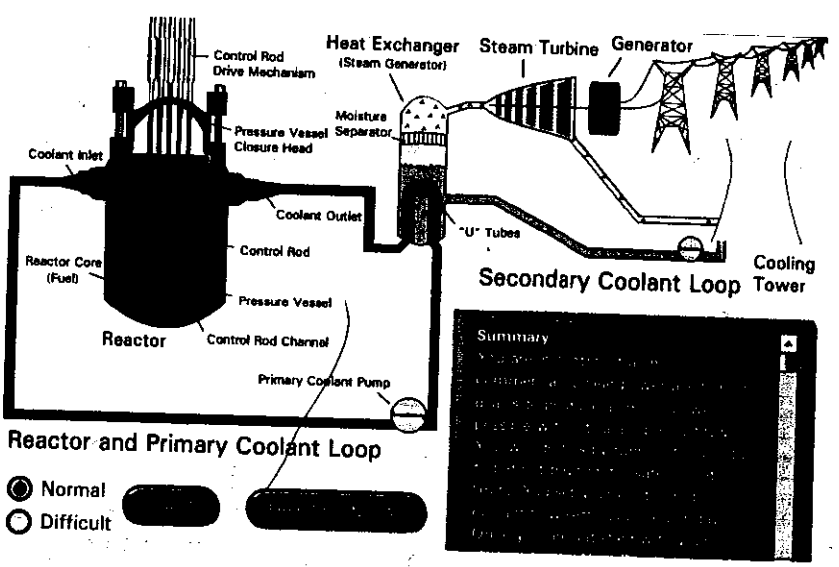
BỘ GIÁO DỤC VÀ ĐÀO TẠO
TRƯỜNG ĐẠI HỌC KT-KT BÌNH DƯƠNG
KHOA: KỸ THUẬT- CÔNG NGHỆ

BÀI GIẢNG MÔN HỌC

TIẾNG ANH CHUYÊN NGÀNH ĐIỆN- ĐIỆN TỬ



LƯU HÀNH NỘI BỘ

NGƯỜI BIÊN SOẠN: TS. NGUYỄN TƯỜNG DŨNG

BÌNH DƯƠNG 07/2012

PART I. VOCABULARY

1. Vocabulary 1: file attached.
2. Vocabulary 2: file attached.

PART II. UNITS

UNIT 1. THE ELECTRIC MOTOR

Tuning - in

Task 1

Working in your group, list as many items as you can in the home which use electric motors. Which room has the most items?

Reading *Skimming*

In Unit 1 you studied scanning – locating specific information quickly. Another useful strategy is reading a text quickly to get a general idea of the kind of information it contains. You can then decide later, depending on your reading purpose. This strategy is called skimming.

Task 2

Skim this text and identify the paragraphs which contain information on each of these topics. The first one has been done for you.

a. What electric motors are used for
b. The commutator
c. Why the armature turns
d. Electromagnets
e. Effect of putting magnets together
f. The armature

Paragraph 1

In an electric motor an electric current and magnetic field produce a turning movement. This can drive all sorts of machines, from wrist-watches to trains. The motor shown in Fig.1 is for a washing machine. It is a universal motor, which can run on direct current or alternating current.

(Paragraph 1)

An electric current running through a wire produces a magnetic field around the wire. If an electric current flows around a loop of wire with a bar of iron through it, the iron becomes magnetized. It is called an electromagnet; one end becomes a north pole and

the other a south pole, depending on which way the current is flowing around the loop. *(Paragraph 2)*

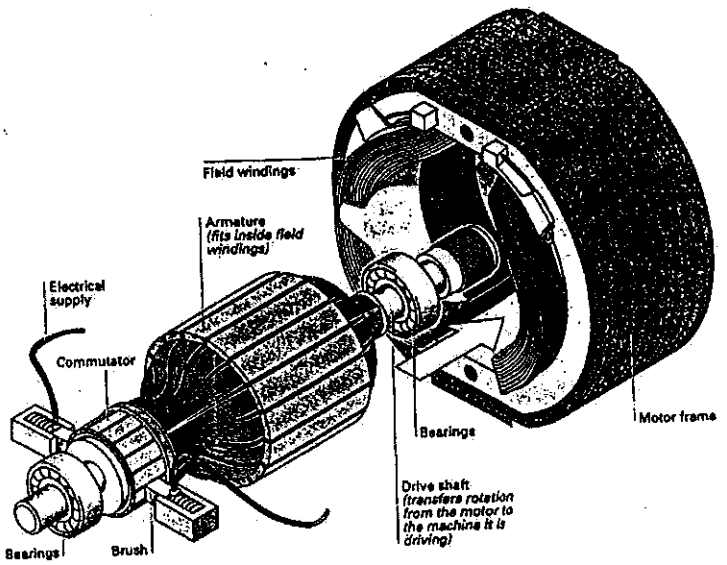


Fig. 1

If you put two magnets close together, like poles – for example, two north poles – repel each other, and unlike poles attract each other.
(Paragraph 3)

In a simple electric motor, like the one shown in Fig.2 a piece of iron with loops of wire round it, called an armature, is placed between the north and south poles of a stationary magnet, known as the field magnet. When electricity flows around the armature wire, the iron becomes an electromagnet.
(Paragraph 4)

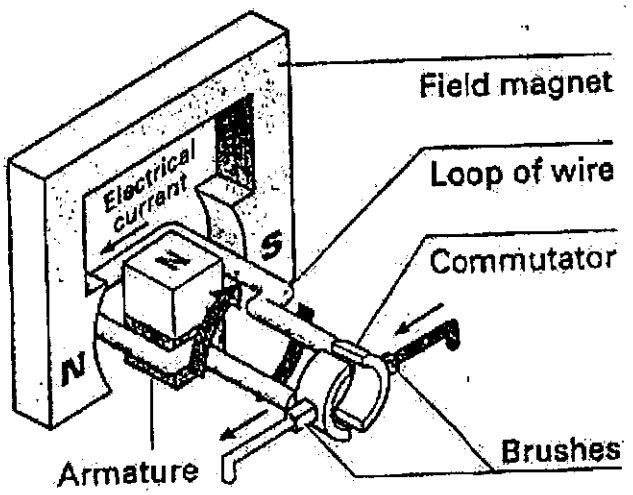


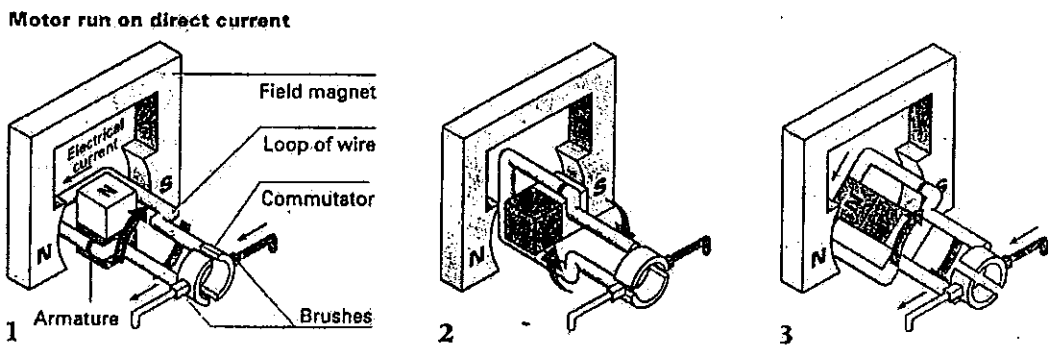
Fig. 2

The attraction and repulsion between the poles of this armature magnet and the poles of the field magnet make the armature turn. As a result, its north pole is close to the north pole of the armature. Then the current is reversed so the north pole of the armature magnet becomes the south pole. Once again, the attraction and repulsion between it and the field magnet make it turn. The armature continues turning as long as the direction of the current, and therefore its magnetic poles, keeps being reversed.
(Paragraph 5)

To reverse the direction of the current, the ends of the armature wire are connected to different halves of a split ring called a commutator. Current flows to and from the commutator through small carbon blocks called brushes. As the armature turns, first one half of the commutator comes into contact with the brush delivering the current, and then the other, so the direction of the current keeps being reversed. *(Paragraph 6)*

Task 3

Match each of these diagrams with the correct description, A, B, C or D. One of the descriptions does not match any of the diagrams.(The diagrams are in the correct sequence, but the description are not.)



A

The armature turns a quarter of a turn. Then electric contact is broken because of the gap in the commutator, but the armature keeps turning because there is nothing to stop it.

B

When current flows, the armature becomes an electromagnet. Its north pole is attracted by the south pole and repelled by the north pole of the field magnet.

C

When a universal motor is run on direct current, the magnetic poles in the armature change while those of the field magnet remain constant.

D

When the commutator comes back into contact with the brushes, current flows through the armature in the opposite direction. Its poles are reversed and the turn continues.

Language study *Describing function*

Try to answer this question:

- What does an electric motor do?

When we answer a question like this, we describe the function of something. We can describe the function of an electric motor in this way:

- An electric motor converts electrical energy to mechanical energy.

We can emphasize the function like this:

- The function of an electric motor is to convert electrical energy to mechanical energy.

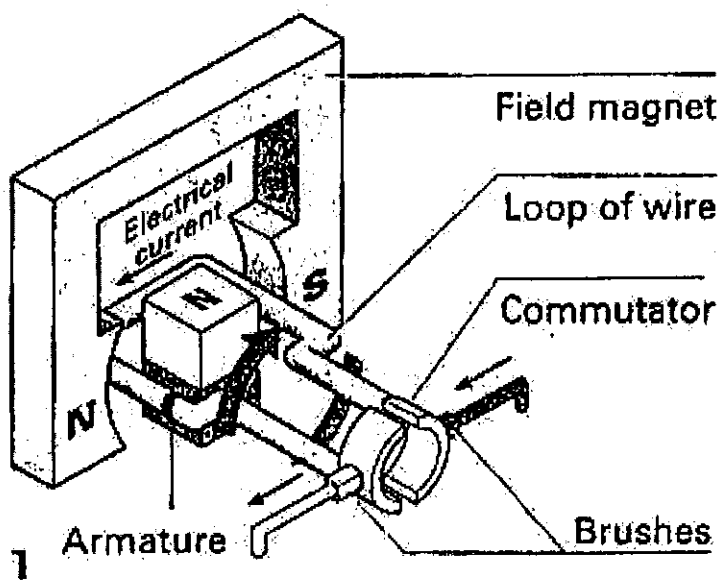
Task 4

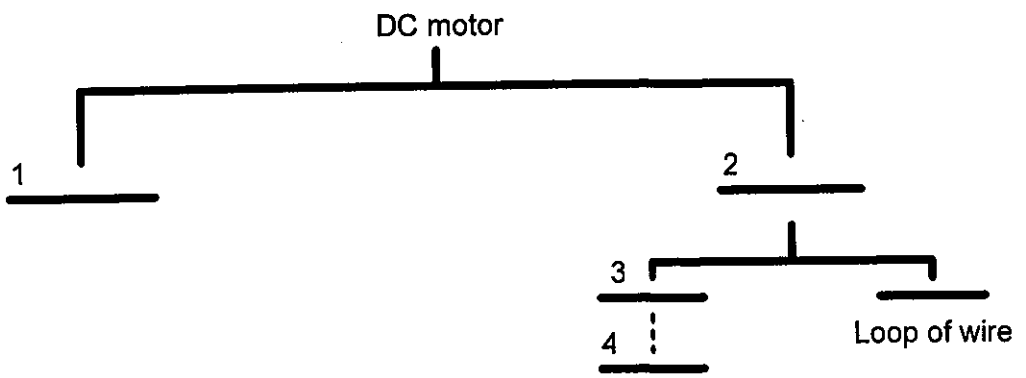
Match each of these motor components to its function, and then describe its function in a sentence.

Component		Function	
1	armature	a	transfers rotation from the motor
2	bearings	b	create an electromagnetic field
3	brushes	c	converts electromagnetic energy to rotation
4	commutator	d	reverses the current to the armature
5	drive shaft	e	support the drive shaft
6	field windings	f	supply current to the armature

Writing *Describing components*

Task 5. Dismantle this simple dc motor into its components by completing the labelling of the chart below.





Now study this description of the motor.

A simple dc motor consists of a field magnet and an armature. The armature is placed between the poles of the magnet. The armature is made up of a loop of wire and a split ring known as a commutator. The loop is connected to the commutator. Current is supplied to the motor through carbon blocks called brushes.

To write a description, you need to use language to:

1 dismantle a piece of equipment into its main parts. These expressions will help:

	consists of	X
A A	is made up of	X and Y
	is composed of	Y

2 name components:

	known as	
Carbon blocks		brushes
	called	

3 locate components:

The armature is placed between the poles.

4 connect components:

The loop is connected to the commutator.

Task 6

Complete the text with the help of the diagram on the next page. Use the following words:

are made up

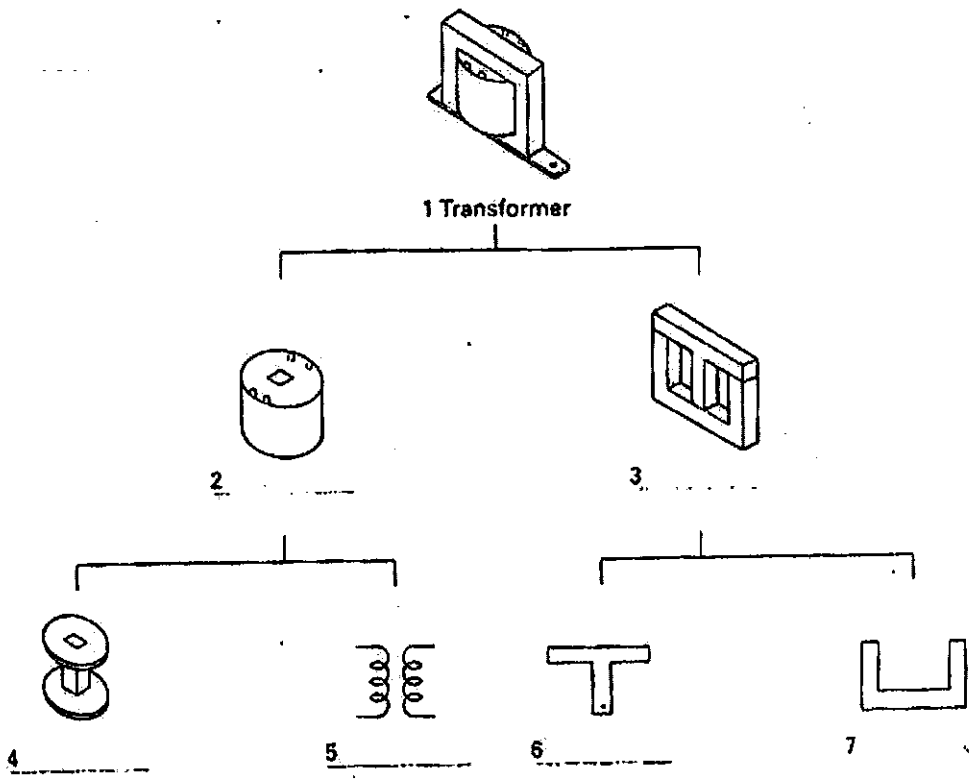
is placed

is composed

consists

A transformer .....of two coils, a primary and a secondary. The coils are wound on a former which is mounted on a core. The coil.....of a number of loops of wire. The core.....of thin pieces of soft iron. U – and T- shaped pieces are used. The former .....on the leg of the T.

Now label the diagram opposite using the completed text.



Word study

Study these expression for describing how components are connected to each other.

A is bolted to B. = A is connected to B with bolts.

A is welded to B. = A is connected to B by welding.

A is fixed to B. = no specific method given.

Task 7 Explain each of these methods of connection.

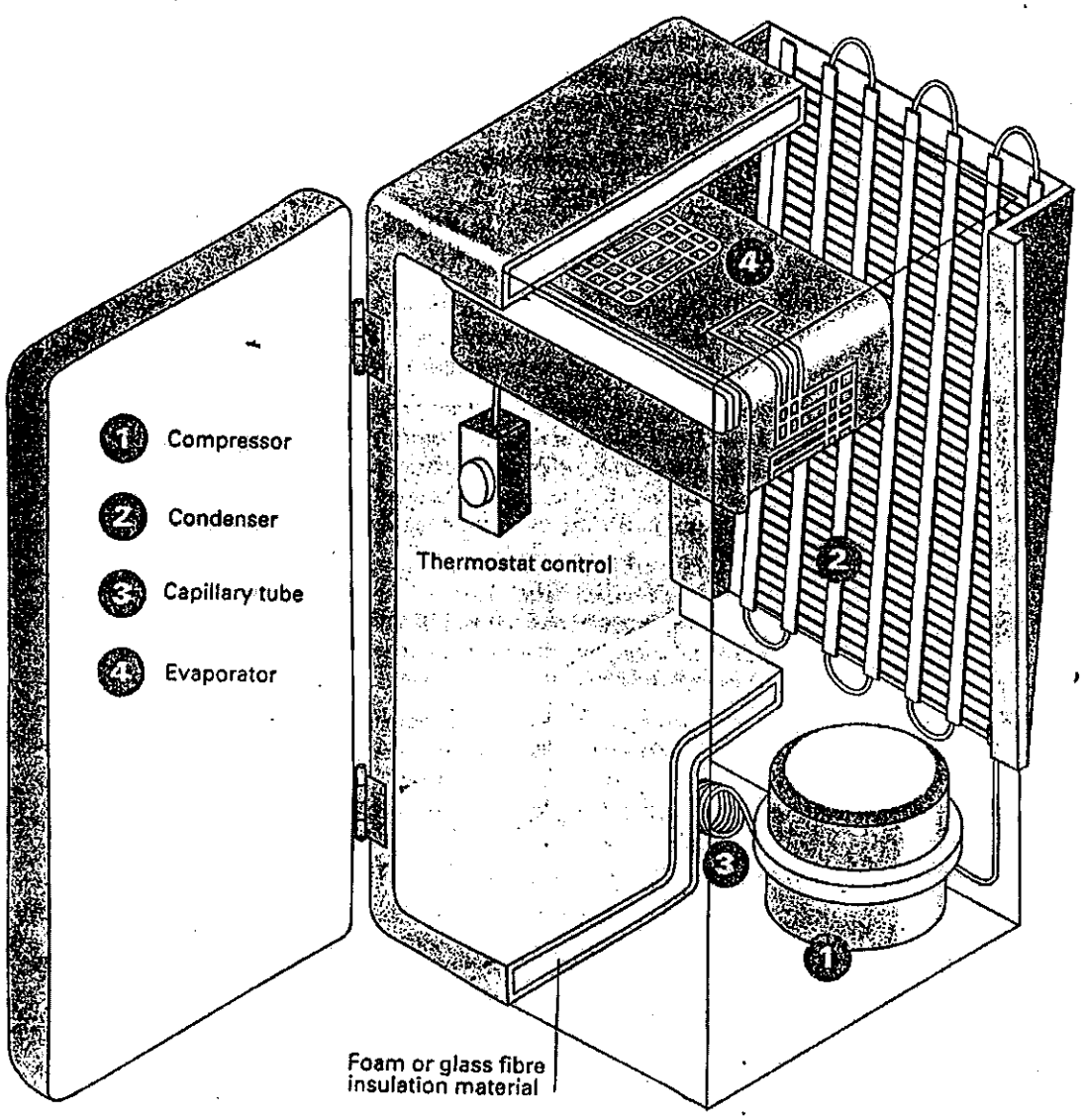
1 screwed
2 soldered
3 attached
4 wired
5 bonded
6 glued
7 riveted
8 welded
9 brazed
10 nailed

UNIT 2. REFRIGERATOR

Tuning- in

Task 1

Study this diagram. It explains how a refrigerator works. In your group try to work out the function of the numbered components using the information in the diagram.



Reading *Dealing with unfamiliar words, 1*

You are going to read a text about refrigerator. Your purpose is to find out how they operate. Read the first paragraph of the text below. Underline any words which are unfamiliar to you.

- Refrigeration preserves food by lowering its temperature. It slows down the growth and reproduction of micro-organisms such as bacteria and the action of enzymes which cause food to rot.

You may have underlined words like *micro-organisms*, *bacteria*, or *enzymes*. These are words which are uncommon in engineering. Before you look them up in a dictionary or try to find translations in your own language, think! Do you need to know the meaning of these words to understand how refrigerators operate?

You can ignore unfamiliar words which do not help you to achieve your reading purpose.

Task 2

Now read the text to check your explanation of how a refrigerator works.

Ignore any unfamiliar words which will not help you to achieve this purpose.

Fridge

Refrigeration preserves food by lowering its temperature. It slows down the growth and reproduction of micro-organisms such as bacteria and the action of enzymes which cause food to rot.

Paragraph 1

Refrigeration is based on three principles. Firstly, if a liquid is heated, it changes to a gas or vapour. When this gas is cooled, it changes back into a liquid. Secondly, if a gas is allowed to expand, it cools down. If a gas is compressed, it heats up. Thirdly, lowering the pressure around a liquid helps it to boil.

Paragraph 2

To keep the refrigerator at a constant low temperature, heat must be transferred from the inside of the cabinet to the outside. A refrigerant is used to do this. It is circulated around the fridge, where it undergoes changes in pressure and temperature and changes from a liquid to a gas and back again. *Paragraph 3*

One common refrigerant is a compound of carbon, chlorine, and fluorine known as R12. This has a very low boiling point: - 29^0C. At normal room temperature (about 20^0C) the liquid quickly turns into gas. However, newer refrigerants which are less harmful to the environment, such as KLEA 134a, are gradually replacing R12. *Paragraph 4*

The refrigeration process begins in the compressor. This compresses the gas so that it heats up. It then pumps the gas into a condenser, a long tube in the shape of a zigzag. As the warm gas passes through the condenser, it heats the surroundings and cools down. By the time it leaves the condenser, it has condensed back into a liquid. *Paragraph 5*

Liquid leaving the condenser has to flow down a very narrow tube (a capillary tube). This prevents liquid from leaving the condenser too quickly, and keeps it at a high pressure.

Paragraph 6

As the liquid passes from the narrow capillary tube to the larger tubes of the evaporator, the pressure quickly drops. The liquid turns to vapour, which expands and cools. The cold vapour absorbs heat from the fridge. It is then sucked back into the compressor and the process begins again. *Paragraph 7*

The compressor is switched on and off by a thermostat, a device that regulates temperature, so that the food is not over- frozen.

Paragraph 8

Language study *Principles and laws*

Study these extracts from the text above. What kind of statements are they?

1 If a liquid is heated, it changes to a gas or vapour.

2 If a gas is allowed to expand, it cools down.

3 If a gas is compressed, it heats up.

Each consists of an action followed by a result. For example:

Action	Result
A liquid is heated	it changes to a gas or vapour

These statements are principles. They describe things in science and engineering which are always true. The action always followed by the same result.

Principles have this form:

If/When (action – present tense), (result- present tense).

Task 3

Link each action in column A with a result from column B to describe an important engineering principle.

A - Action	B - Result
1. a liquid is heated	a. it heats up
2. a gas is cooled	b. there is an equal and opposite reaction
3. a gas expands	c. it changes to a gas
4. a gas is compressed	d. it extends in proportion to the force
5. a force is applied to a body	e. it is transmitted equally throughout the fluid
6. a current passes through a wire	f. a current is induced in the wire
7. a wire cuts a magnetic field	g. it cools down
8. pressure is applied to the surface of an enclosed fluid	h. it sets up a magnetic field around the wire
9. a force is applied to a spring fixed at one end	i. it changes to a liquid

Word study *Verbs and related nouns*

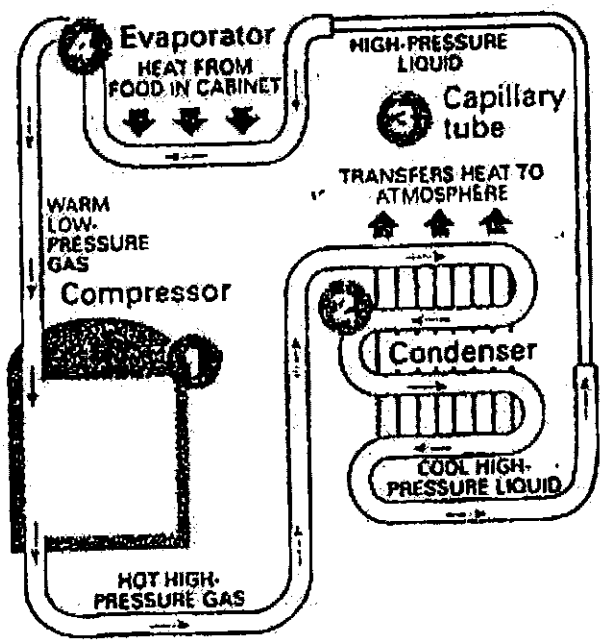
Task 4. Each of the verbs in column. A has a related noun ending in –er or –or in column B. Complete the blanks. You have studied these words in this and earlier units. Use a dictionary to check any spellings which you are not certain about.

A Verbs	B Nouns
For example:	
Refrigerate	refrigerator

A	B
a. condense	
b.	evaporator
c. compress	
d. resist	
e.	charger
f. generate	
g. conduct	
h.	exchanger
i. radiate	
j. control	

Writing *Describing a process, 2: location*

Study this diagram. It describes the refrigeration process.



In unit 2 we learnt that when we write about a process, we have to:

1. Sequence the stages
2. Locate the stages
3. Describe what happens at each stage
4. Explain what happens at each stage

For example

Sequence location *description explanation*

- The refrigeration process begins in the compressor. This compresses the gas so that it heats up.

In this unit we will study ways to locate the stages.

Task 5

Put these stages in the refrigeration process in the correct sequence with the help of the diagram above. The first one has been done for you.

a. The liquid enters the evaporator. ----------

b. The gas condenses back into a liquid. ----------

c. The vapour is sucked back into the compressor. ----------

d. The gas is compressed. 1

e. The liquid turns into a vapour. ----------

f. The gas passes through the condenser.

g. The liquid passes through a capillary tube.

h. The high pressure is maintained.

These are two ways to locate a stage in a process.

1. Using a preposition + noun phrase. For example:
   - The liquid turns to vapour in the evaporator.
   - The gas cools down in the condenser

2. Using a where – clause, a relative clause with where rather than which or who, to link a stage, its location, and what happens there. For example:
   - The warm gas passes through the condenser, where it heats the surrounding and cools down.
   - The refrigerant circulates around the fridge, where it undergoes changes in pressure and temperature.

Task 6. Complete each of these statements.

1. The gas passes through the compressor, where----------
2. It passes through the condenser, where----------
3. The liquid passes through a capillary tube, where ----------
4. The liquid enters the evaporator, where----------
5. The cold vapour is sucked back into the compressor, where--

Task 7 Add sequence expressions to your statements to show the correct order of events. For example:

- First the gas passes through the condenser…

Make your statements into a paragraph adding extra information from the text in Task 2 if you wish. Then compare your paragraph with paragraphs 6, 7, and 8 from the text.

UNIT 3. PORTABLE GENERATOR

Tuning- in

Task 1

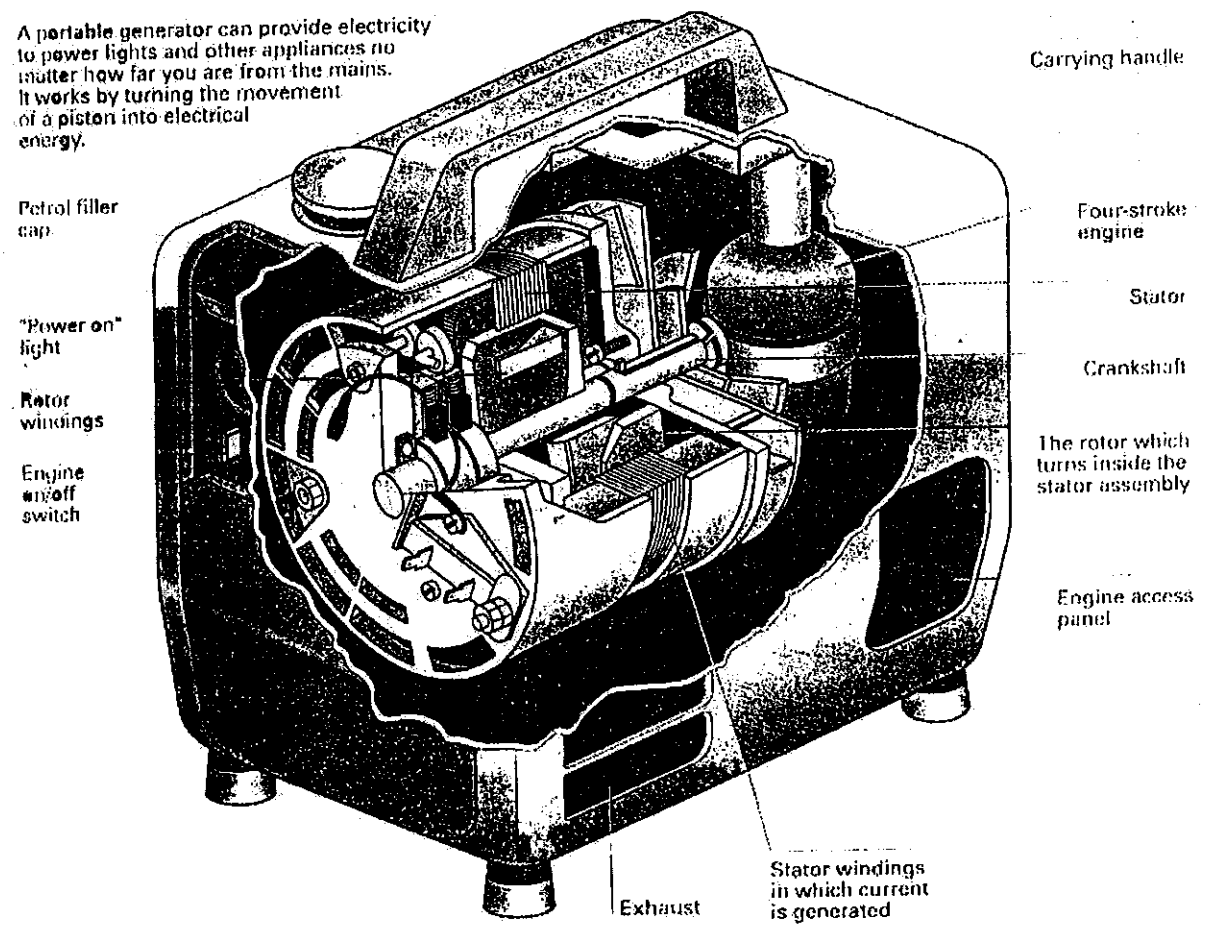
List the different ways in which electricity can be generated

Reading. *Reading diagrams*

Task 2

Study the diagram below of a portable generator. Answer these questions using the diagram and your own knowledge of engineering.

1. What are its main parts?
2. What does the engine run on?
3. What are the four strokes called?
4. What is the function of the crankshaft?
5. What do both stator and rotor have?
6. What is the difference between stator and rotor?



Task 3 Read text to check as many of the answers as you can. You will not find complete answers to all of the questions.

Portable Generator

Although most electricity comes from power stations, power can also be generated by far smaller means. Nowadays, electricity generator can be small enough to be held in the hand.

Portable generators are made up of two main parts: an engine, which powers the equipment, and an alternator, which converts motion into electricity.

The engine shown (Fig.1) runs on petrol. It is started by pulling a cord. This creates a spark inside which ignites the fuel mixture.

In a typical four- stroke engine, when the piston descends, the air inlet valve opens and a mixture of air and petrol is sucked in through a carburettor.

The valve closes, the piston rises on the compression stroke and a spark within the upper chamber ignites the mixture. This mini-explosion pushes the piston back down, and as it rises again the fumes formed by the ignition are forced out through the exhaust valve.

This cycle is repeated many times per second. The moving piston makes the crankshaft rotate at great speed.

The crankshaft extends directly to an alternator, which consists of two main sets of windings- coil of insulated copper wire wound closely around an iron core. One set, called stator windings, is in a fixed position and shaped like a broad ring. The other set, the armature windings, is wound on the rotor which is fixed to the rotating crankshaft. The rotor makes about 3,000 revolutions per minute.

The rotor is magnetized and as it spins round, electricity is generated in the stator windings through the process of electromagnetic induction. The electric current is fed to the output terminals or sockets.

This type of generator can produce a 700 watt output, enough to operate lights, television, and some domestic appliances. Larger versions provide emergency power to hospital and factories.

Task 4

Study this text on the four- stroke cycle. Then label each stroke correctly in Fig. 2 opposite.

In the four – stroke cycle, the piston descends on the intake stroke, during which the inlet valve is open. The piston ascends on the compression stroke with both valves closed and ignition takes place at the top of the stroke. The power or expansion stroke follows. The gas generated by the burning fuel expands rapidly, driving the piston down, both valves remaining closed. The cycle is completed by the exhaust stroke, as the piston ascends once more, forcing the products of combustion out through the exhaust valve. The cycle then repeats itself.

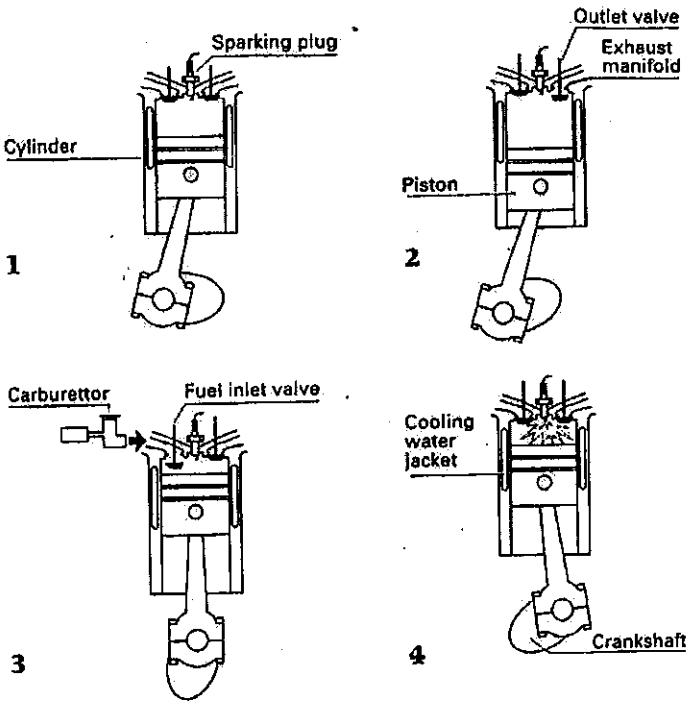


Fig. 2

Language study *Cause and effect*, 2

Study these pairs of actions. What is the link between each pair?

1. The gas expands.
2. This drives the piston down.
3. The piston ascends.
4. This forces the products of combustion out.

These are two links between the actions:

They happen at the same time. We can show this using as.

- 1+2: As the gas expands, it drives the piston down.
- 3+4: As the piston ascends, it forces the products of combustion out.

One is a cause and the other an effect.

1. Cause: The gas expands.
2. Effect: This drives the piston down.
3. Cause: The piston ascends.
4. Effect: This forces the products of combustion out.

We can show both the time link and the cause and effect link like this:

- 1+2: The gas expands, driving the piston down.
- 3+4: The piston ascends, forcing the products of combustion out.

Task 5

Link this action in the same way.

Cause	Effect
1. The piston moves down the cylinder.	This creates a partial vacuum
2. The piston creates a vacuum.	This draws in fuel from the carburettor.
3. The piston moves up the cylinder.	This compresses the mixture.
4. The gas expands quickly.	This pushes the piston down
5. The piston moves up and down	This rotates the crankshaft.
6. The crankshaft spins round	This turns the rotor at 3,000 rpm
7. The armature of the alternator rotates	This induces a current in the stator windings.
8. The alternator runs at a steady 3,000 rpm	This generates around 700 watts.

Word study. *Verbs with –ize/-ise*

Study this statement:

- The rotor is magnetized.

What does it mean? Can you say it another way? We can rewrite this statement as:

- The rotor is made magnetic.

Verbs ending in –ize/-ise have a range of meanings with the general sense of make + adjective.

Task 6

Rewrite these sentences replacing the phrases in the italics with appropriate –ize/-ise verbs.

1. Some cars are fitted with a security device which makes the engine immobile.
2. In areas where the power supply fluctuates, for sensitive equipment a device to make the voltage stable is required.
3. Manufactures seek to keep costs to a minimum and profits to a maximum.
4. Most companies have installed computers to control their production line.
5. Companies may make their operation more rational by reducing the variety of products they make.

Writing *Describing a process, 3: sequence and location*

Task 7

Fig.3 opposite shows the distribution of power from power station to consumer. The statements which follow describe the distribution. Put the statements in the correct order with the help of the diagram. The first one has been done for you.

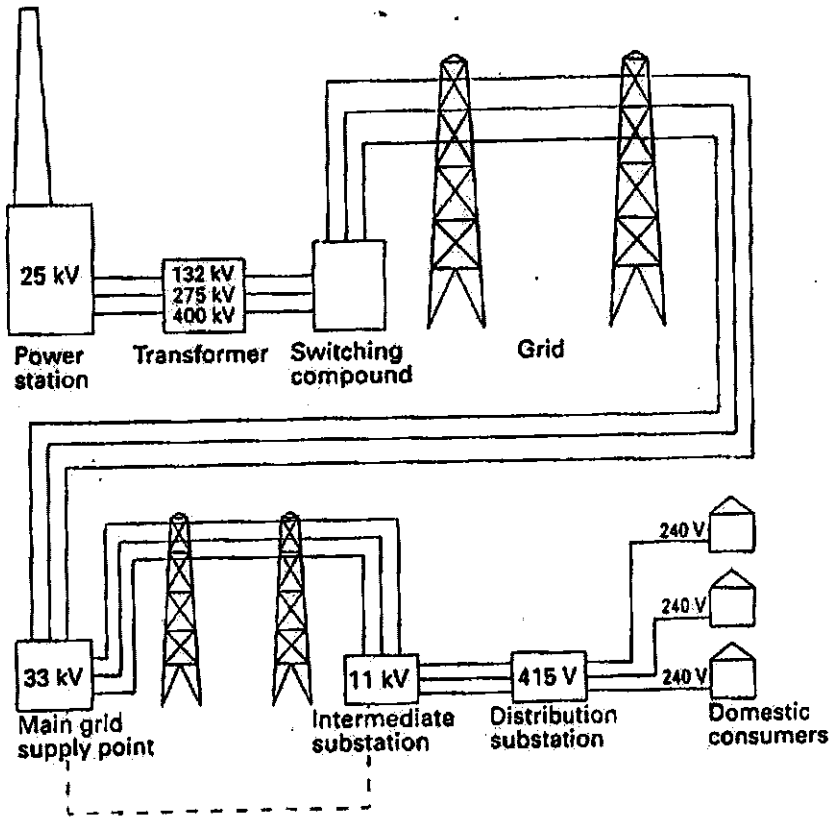


Fig. 3

a. It is fed to distribution substations.

b. It is stepped up by a transformer to high voltage for long-distance distribution.

c. It is distributed via the grid to supply points.

d. It is distributed to the domestic consumer.

e. Electricity is generated at the power station at 25kV. 1

f. It passes via the switching compound to the grid.

g. It is distributed via overhead or underground cables to intermediate substations.

Task 8

Mark the sequence of stages using appropriate sequence words where you think this is helpful: Add the following information to your statements and make them into a text.

1. At the main grid supply point, power is stepped down to 33 kV for distribution to heavy industry.
2. At intermediate substation, power is reduced to 11kV for light industry.
3. At the distribution substations, power is stepped down to 415V, 3-phase, and 240V, 1-phase.

Technical reading

Task 9 : *Wave power*

The two following texts describe two plants for generating electricity from wave power. Note the similarities and differences between the plants.

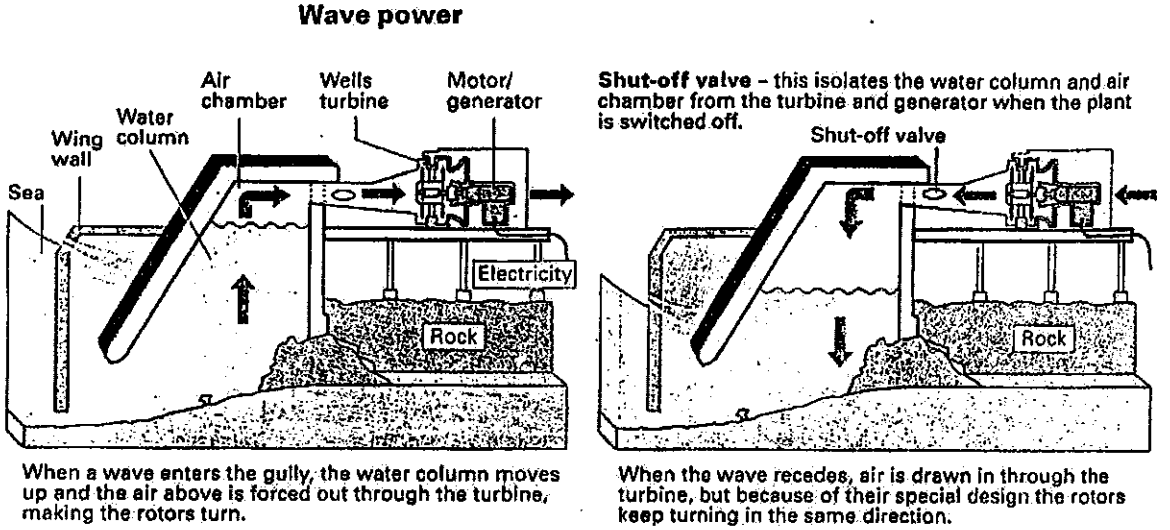


Fig. 4

Wave power

This prototype wave-power plant on the Scottish island of Islay was constructed by building a concrete water column across a natural gully on the shoreline. Waves flowing in and out of the gully cause water in the column to move up and down. As the water moves up it compresses the air above and forces it through a wide tube at the back of the water column. As the water moves down, air is drawn into the water column.

The moving air passes through a turbine coupled to a generator. Both the turbine and generator are unusual. The turbine is a Wells turbine (named after its inventor) which keeps turning in one direction even though the air flow is constantly changing direction. It has two rotors, each with four blades.

The generator is a wound rotor induction motor, which acts as a generator when it is turning at speeds greater than 1,500rpm. Below that speed it operator as a motor and takes power from the grid. This motor/generator is used because the turbine takes some time to build up to a speed where it can generate electricity. When the turbine slows down due to a lull in wave activity, the generator becomes an electric motor and keeps the turbine running at a minimum speed so that it is ready to accept the power from the next batch of waves.

The plant is controlled by a computer. It includes a PLC (programmable logic controller), which monitors the operation of the motor/generator and the amount of electricity going to or being taken from the grid. There is also testing equipment to monitor how much electricity the plant is producing and the efficiency of the water column, turbine, and generator.

This experimental plant generates 150kW. Plans have been approved for the construction of a 1MW scheme.

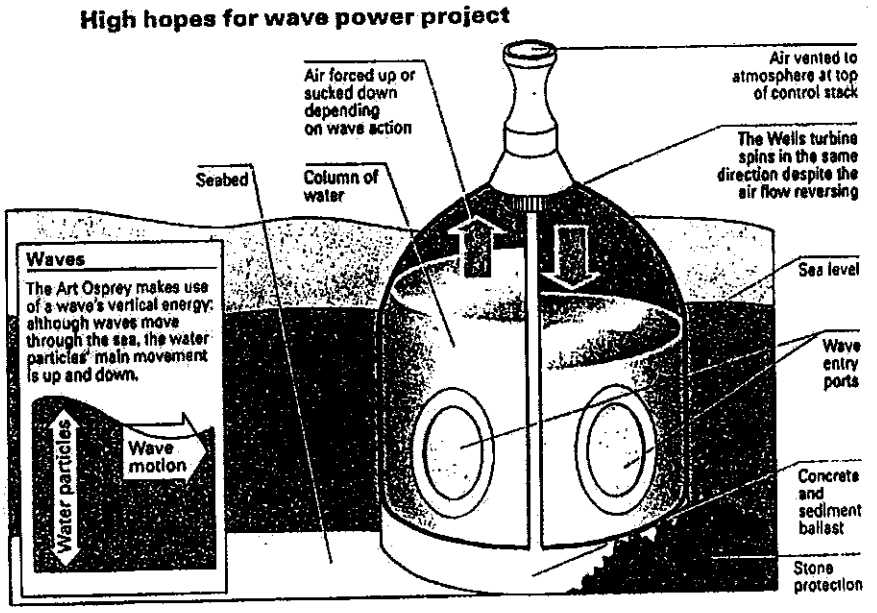


Fig. 5

The world's first power station in the open sea is to be stationed off Dounreay in Scotland. The machine, called Osprey (Ocean Swell-Powered Renewable Energy), will stand in 18 metres of water a kilometre out and not only harvest the larger waves, which produce higher outputs, but also gain power with waves from any direction.

The device is known as an oscillating water column. As a wave rises, air is pushed through an air turbine and sucked back again as the wave falls. The turbine has been designed by Professor Alan Well, of Queen's University, Belfast. It will generate 2 megawatts.

There is potential for 300 Ospreys in Scottish waters which could provide 10 per cent of the country's peak electricity demand.

Task 10: *How electricity is generated*

[1] Fuel (coal, oil or natural gas) is burned in a large [2] boiler, and the walls of the boiler are made up of tubes that carry purified [3] water.

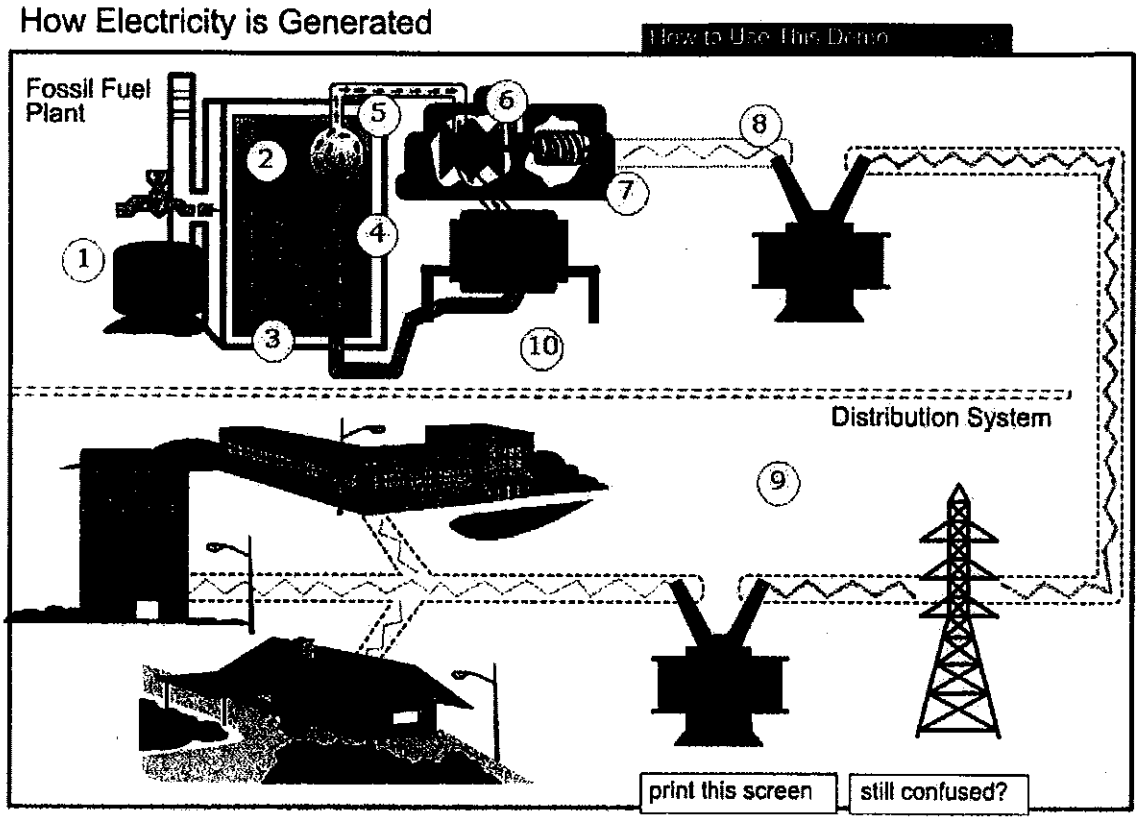
The fuel gives up its chemical heat energy to the tube metal of the boiler. The heat travels by conduction through the walls and is absorbed by the water.

The water temperature increases until it is finally transformed into [4] steam. The steam, now under considerable pressure and at a very high temperature, is piped to a [5] turbine. Where the mechanical energy is produced. The steam strikes the blades of the turbine and spins them, revolving the turbine shaft.

The spinning shaft is connected to the [6] rotor, a large electromagnet. A wire coil called the [7] stator surrounds the rotor. As the rotor revolves within the stator, a flow of electrons, or [8] electricity is produced.

The electricity is then collected at a predetermined voltage and frequency and distributed to you via an elaborate [9] transmission and distribution system. After the steam passes through the turbine, it is led into a steam [10] condenser.

The hot steam is condensed back into water and returned to the boiler to begin the cycle again.



UNIT 4. CAREERS IN ENGINEERING

Tuning - in

Task 1

List some of the jobs in engineering. Combine your list with others in your group

Task 2

Work in group of three A, B, and C. Scan your section of this text, A, B, or C. How many of the jobs in the combined list you made in Task 1 are mentioned in your section?

Jobs in engineering

A

Professional engineers may work as:

Design engineers: They work as part of a team to create new products and extend the life of old products by updating them and finding new applications for them. Their aim is to build quality and reliability into the design and to introduce new components and material to make the product cheaper, lighter, or stronger.

Installation engineers: They work on the customer's premises to install equipment produced by their company.

Production engineers: They ensure that the production process is efficient, that materials are handled safely and correctly, and that faults which occur in production are corrected. The design and development departments consult with them to ensure that any innovations proposed are practicable and cost-effective.

B

Just below the professional engineers are the *technician engineers*. They require a detailed knowledge of a particular technology-electrical, mechanical, electronic, etc. They may lead team of engineering technicians. Technician engineers and engineering technicians may work as:

Test/Laboratory technicians: They test samples of the materials and of the product to ensure quality is maintained.

Installation and service technicians: They ensure that equipment sold by the company is installed correctly and carry out preventative maintenance and essential repairs.

Production planning and control technicians: They produce the manufacturing instructions and organize the work of production so that it can be done as quickly, cheaply, and efficiently as possible.

Inspection technicians: They check and ensure that incoming and outgoing components and products meet specifications.

Debug technicians: They fault find, repair, and test equipment and products down to component level.

Draughtsmen /women and designers: They produce the drawings and design documents from which the product is manufactured.

C

The next grades are craftsmen/women. Their work is highly skilled and practical. Craftsmen and women may work as:

Toolmakers: They make dies and moulding tools which are used to punch and form metal components and produce plastic components such as car bumpers.

Fitters: They assemble components into larger products.

Maintenance fitters: They repair machinery.

Welders: They do specialized joining, fabricating, and repair work.

Electricians: they wire and install electrical equipment.

Operators require fewer skills. Many operator jobs consist mainly of minding a machine, especially now that more and more processes are automated. However, some operators may have to check components produced by their machines to ensure they are accurate. They may require training in the use of instruments such as micrometers, verniers…

Task 3

Combine answers with the others in your group. How many of the jobs listed in Task 1 are mentioned in the whole text?

Task 4

Who would be employed to:

1. test completed motors from a production line?
2. find out why a new electronics assembly does not work?
3. produce a mould for a car body part?
4. see that the correct test equipment is available on a production line?
5. find a cheaper way of manufacturing a crankshaft?
6. repair heating systems installed by their company?
7. see that a new product is safe to use?
8. commission a turbine in a power?

Reading *Inferring from samples*

In Task 5 below and in the Listening (Task 7), you are asked to infer from a small sample of text information which is not clearly started. Use the clues in the samples and the knowledge you have gained from the text Jobs in engineering.

Task 5

As a group, try to identify the jobs these workers from their statements.

> We perform standard chemical and physical tests on samples, usually as a result of a complaint from inspectors on the production line. We are an important part of production. We have the authority to stop the line if we find something seriously wrong. It is interesting work, and we're able to move around from test and chat. Sometimes, admittedly, the work gets a bit repetitive.
>
> All machinists can be difficult. The older blokes especially don't like me telling them their work is not good enough and instructing them to do it again. One or two of them seem to think the inspector is always out to get them. I am constantly having to calm things down.
>
> We measure up the components to see that they are the right size and shape, and we make any minor adjustments ourselves with hand tools or power tools. All along, parts will need adjusting slightly and you have to check things at each stage with measuring instruments and gauges. You have to get a feel for it-clearances have to be just right. Otherwise things won't fit together.
>
> I find my job a very satisfying one. It's never easy to say exactly why one likes a job. I think the basic thing I get out of my profession at the moment is the creativity that is involved in design work. You start from square one with a plain sheet of paper. You draw a component. You design something and perhaps a few moths later you can see the end product. And you gat told whether or not your design works! I think it's that aspect that I find most satisfying.
>
> I enjoy my job. I really enjoy doing the same thing every day-exactly the same job. You know what to look for and how things should be. You know how the machine-or the machines-run, when a machine is working properly and when there is something wrong with it. I really like the routine. I don't have dreams of becoming a supervisor or anything like that. I'm just content running my machines.
>
> My company makes desalination equipment. It takes the salt out of sea water so it can be used for drinking and irrigation. A lot of our customers are in the Middle East. I have to go there whenever new equipment is being set up to make sure it's properly installed and everything is running smoothly.

Speaking practice *Role play*

Task 6

Work in pairs, A and B. Each of you has profiles of three workers in a light engineering plant which supplies car electrical components such as starter motor, fuel pumps, and alternators.

Play the part of one these workers and be prepared to answer questions from your partner about your work. Your partner must try to identify your job from your replies.

In turn, find out about your partner.

Do not give your partner your job title until he or she has found out as much information as possible and has made a guess at your occupation. Try to find out:

1. Age
2. Education
3. Qualifications
4. Nature of work
5. Who he/she is responsible to
6. What he/she feels about his/her work

Listening *Inferring from samples*

Task 7

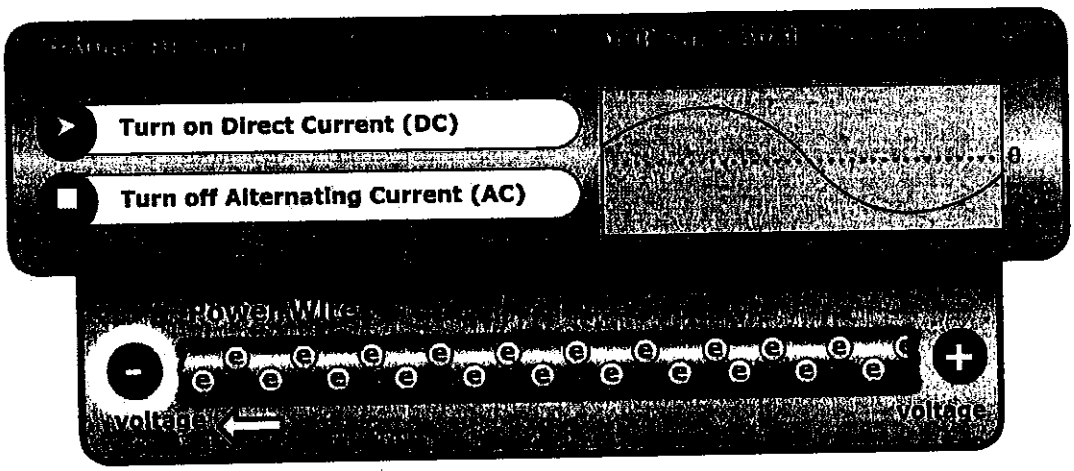
Listen to these workers talking about their jobs. Try to match each extract to one of these jobs.

a. Methods engineer
b. Systems analyst
c. Toolmaker
d. Machine tool development fitter
e. Foreman/ woman
f. Applications engineer

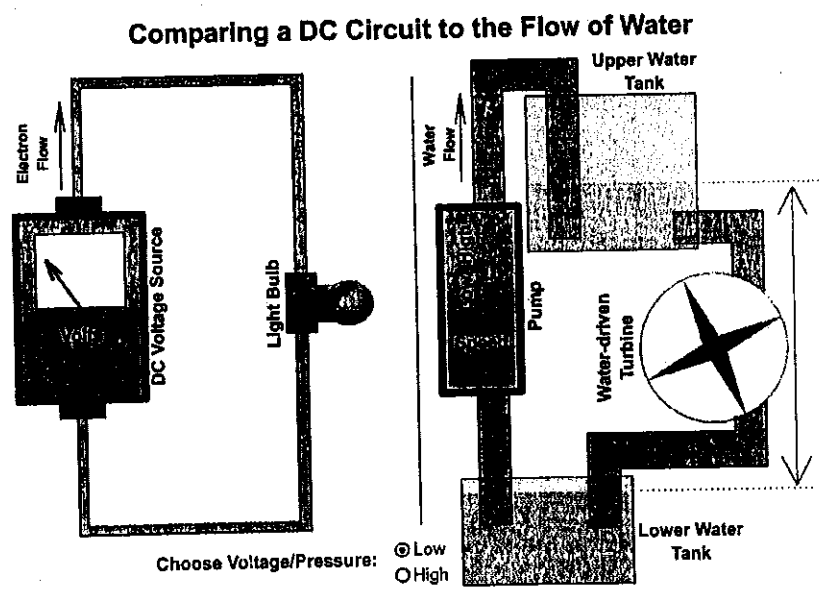
PART III. SPEAKING SKILLS

See the simulation and answer the question:

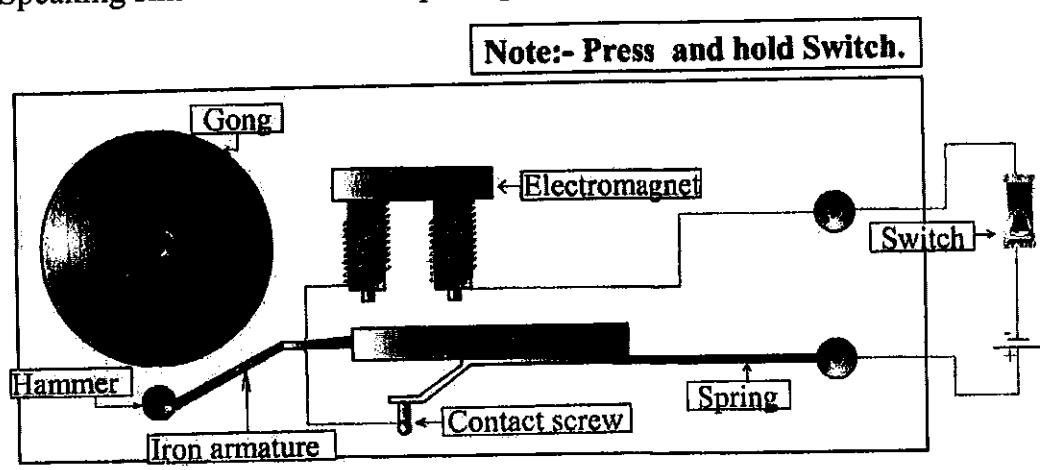
- Speaking skill 1: Talk about the differences between ac and dc current?



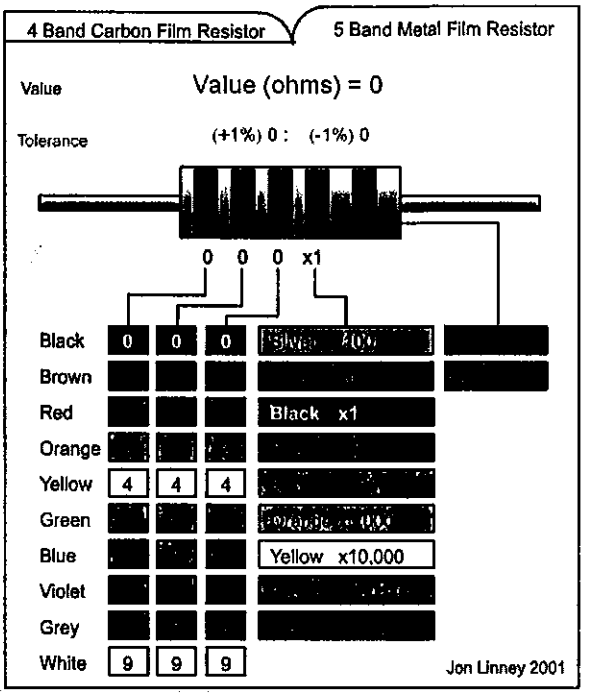
- Speaking skill 2: Compare a dc circuit to the flow of the water?



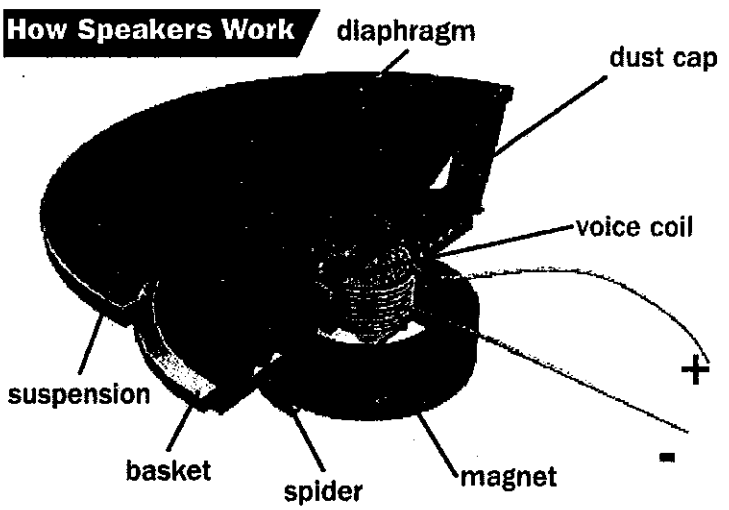
- Speaking skill 3: Describe the principle of an electric bell?



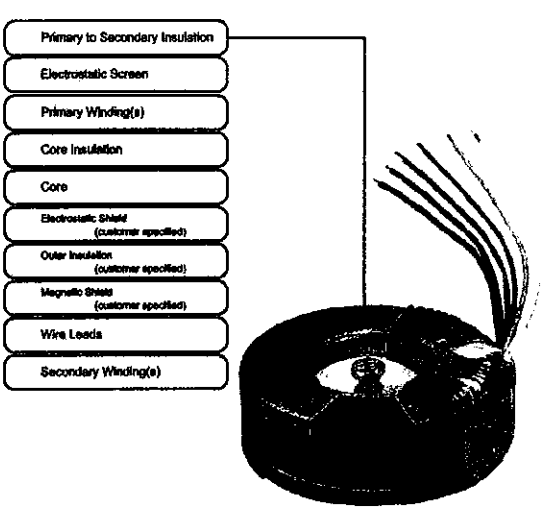
- Speaking skill 4: Read the given value of a resistor?



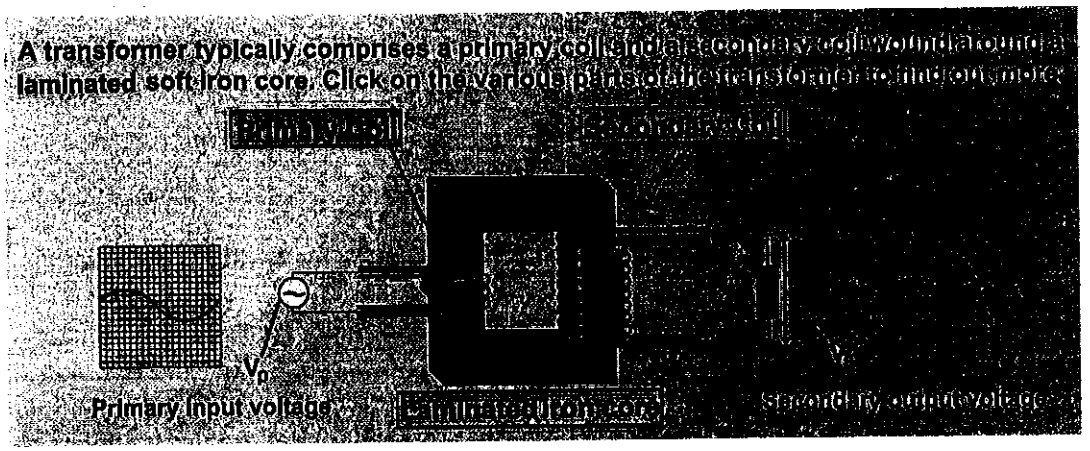
- Speaking skill 5: List the main components of the speaker?



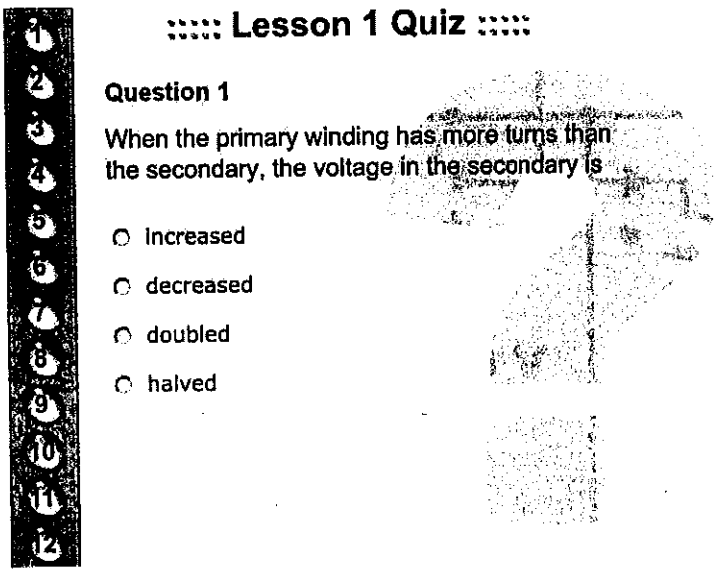
- Speaking skill 6: Describe the structure of the transformer?



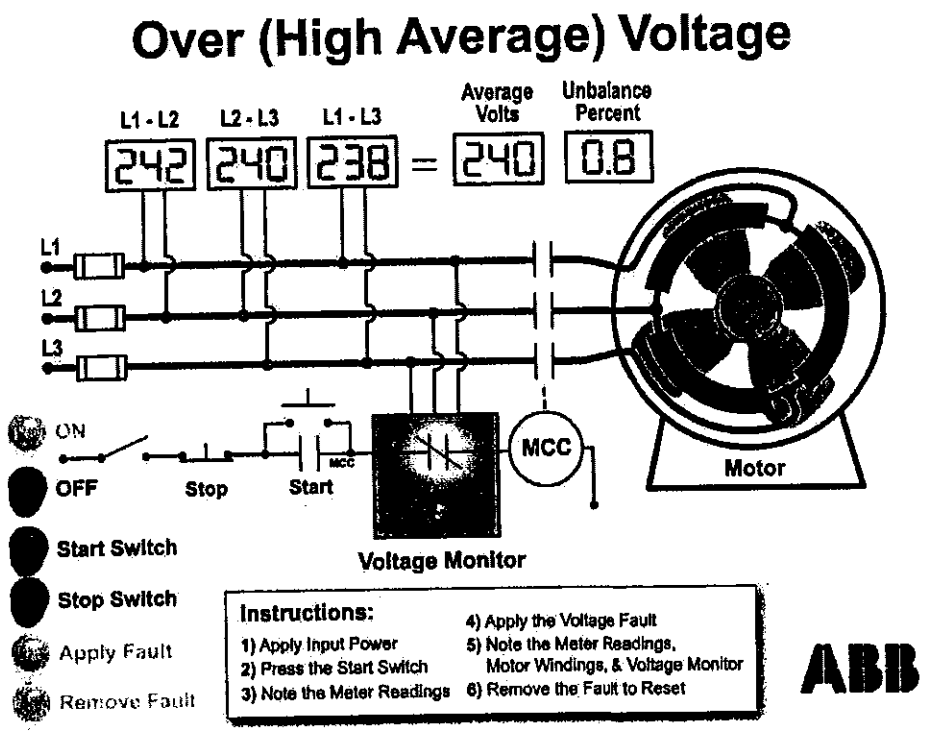
- Speaking skill 7: Talk about the structure of the transformer?



- Speaking skill 8: Answer the questions?

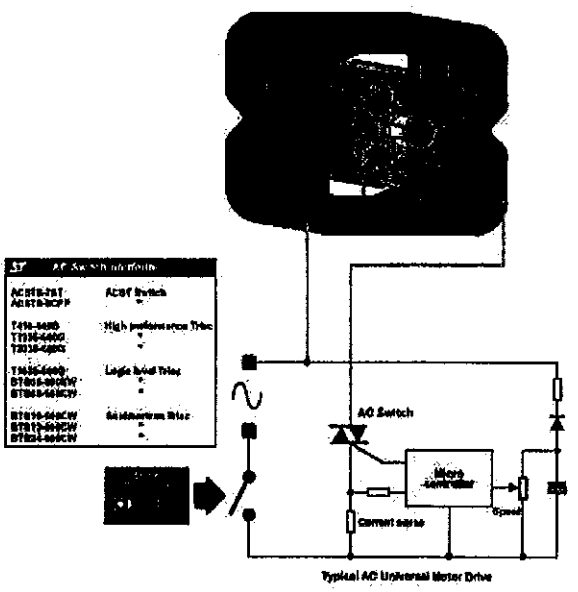


- Speaking skill 9: Talk about the motor failure?

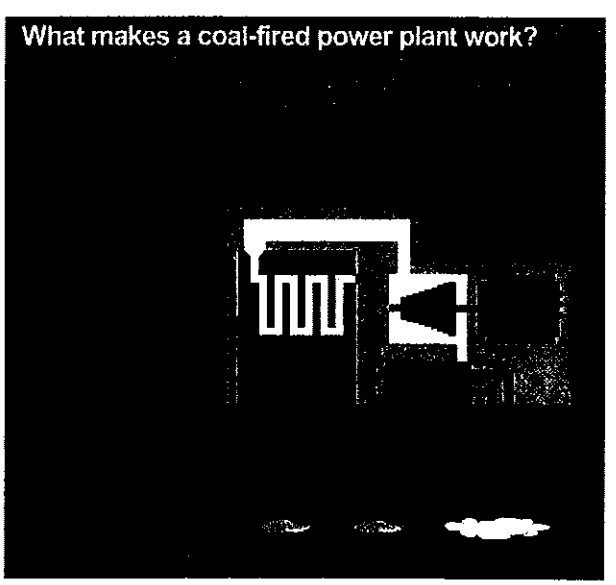


- Speaking skill 10: Talk about the principle of the asynchronous motor?

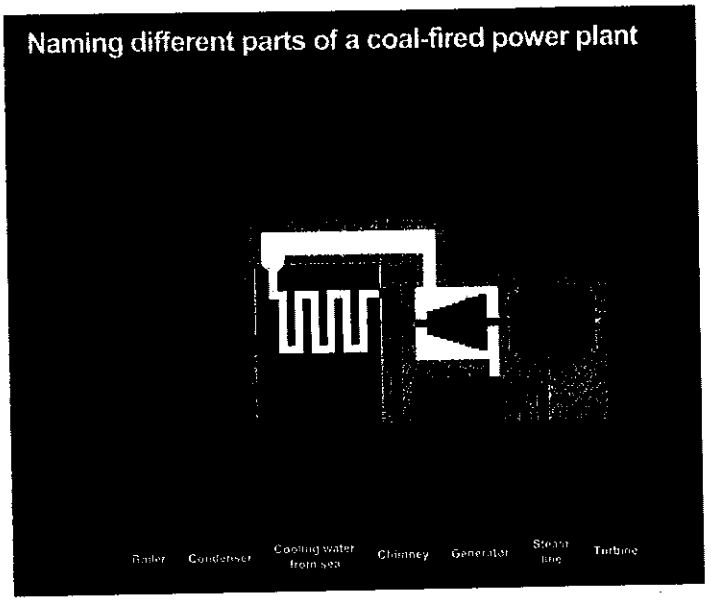
- Speaking skill 11: Talk about the principle of the dc brush motor?



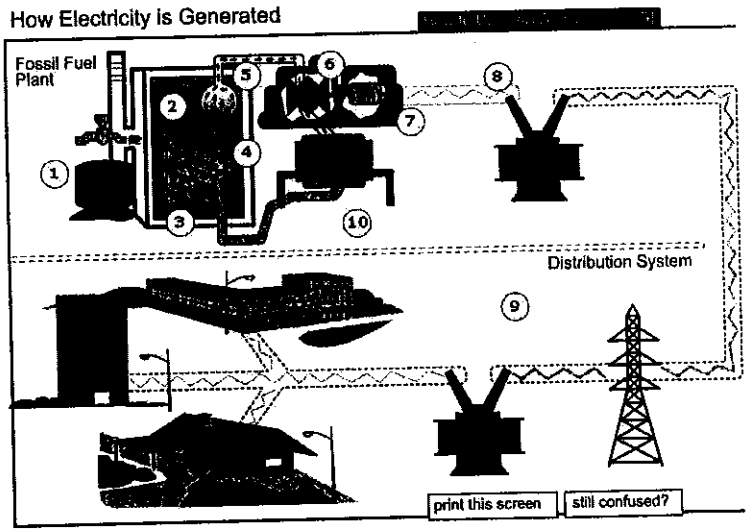
- Speaking skill 12: Drag the following things to the appropriate place in a power plant?



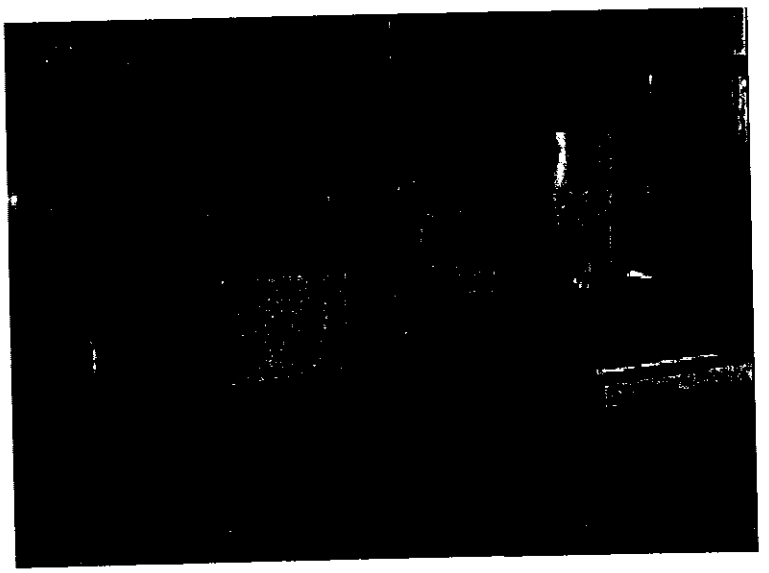
- Speaking skill 13: Name the different parts of a coal-fired power plant and drag correct name to each part of the power plant?



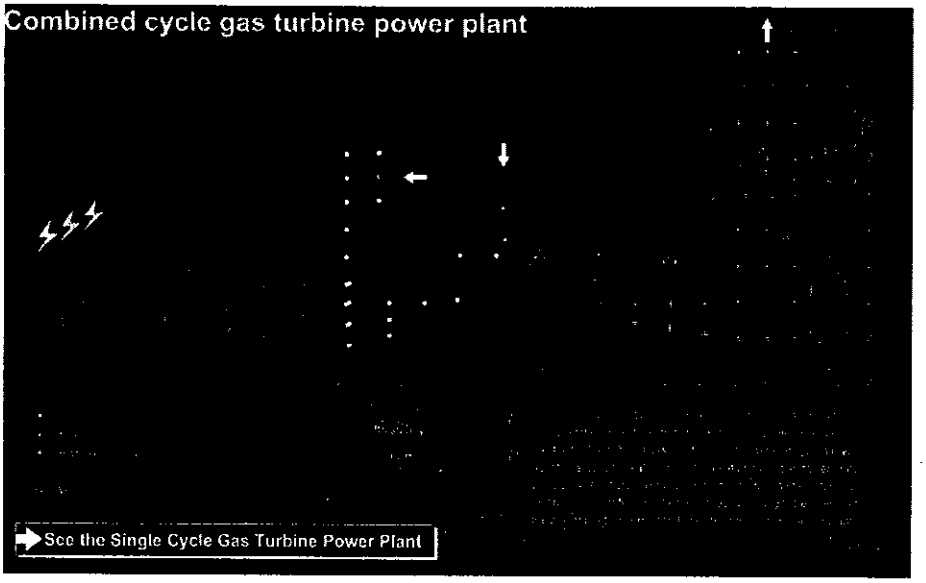
- Speaking skill 14: Describe how electricity is generated?



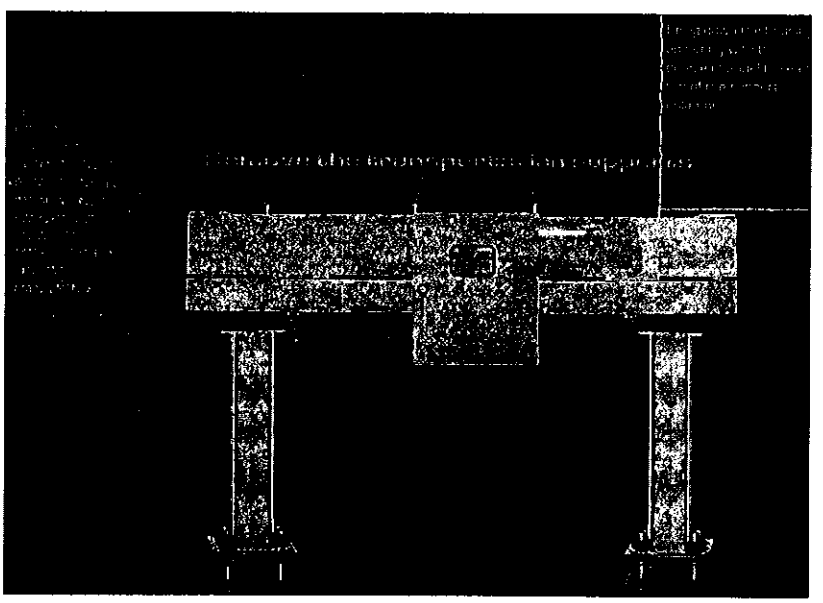
- Speaking skill 15: Describe how a combined cycle gas turbine works?



- Speaking skill 16: Compare the Single cycle gas turbine and Combined cycle gas turbine?



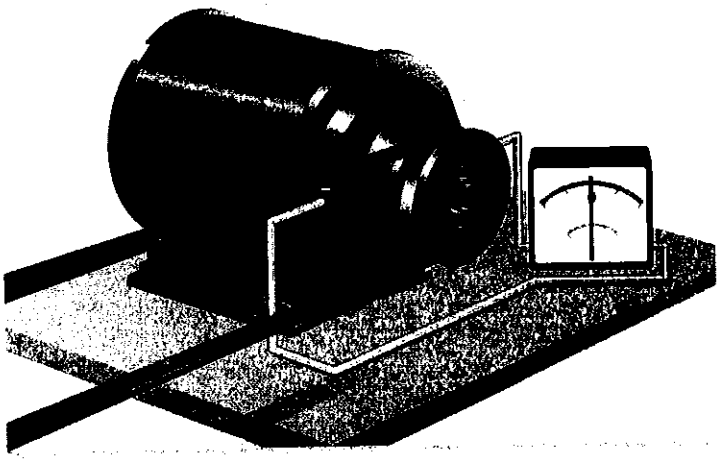
- Speaking skill 17: How to install a SF6 circuit breaker?



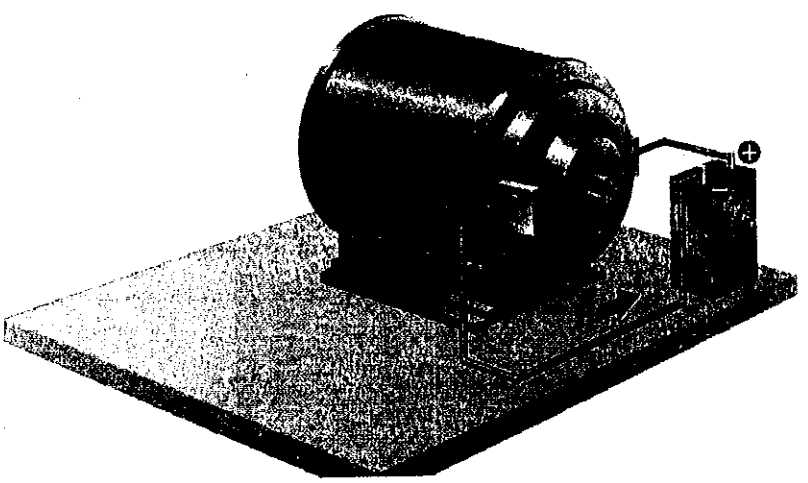
PART IV. LISTENING SKILLS

Listen and answer the question:

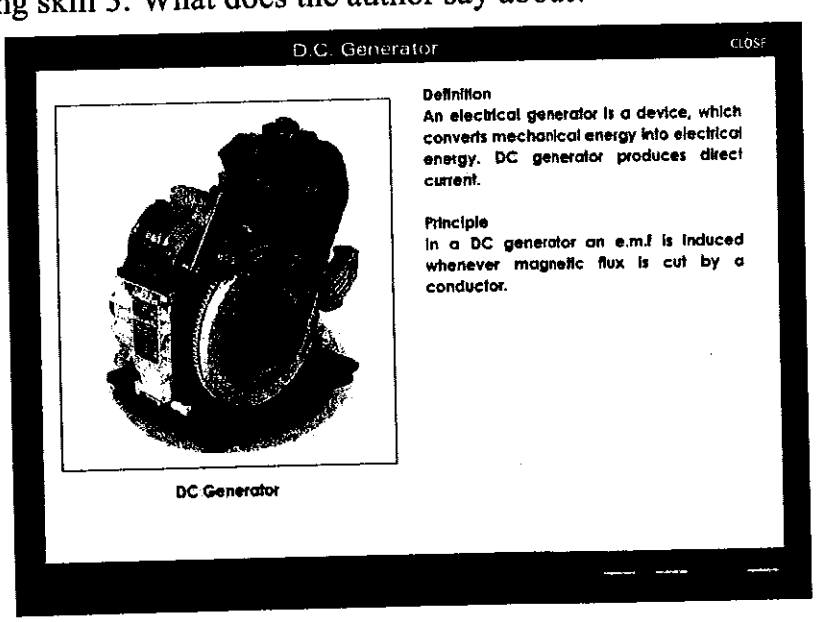
- Listening skill 1: What does the speaker talk about?



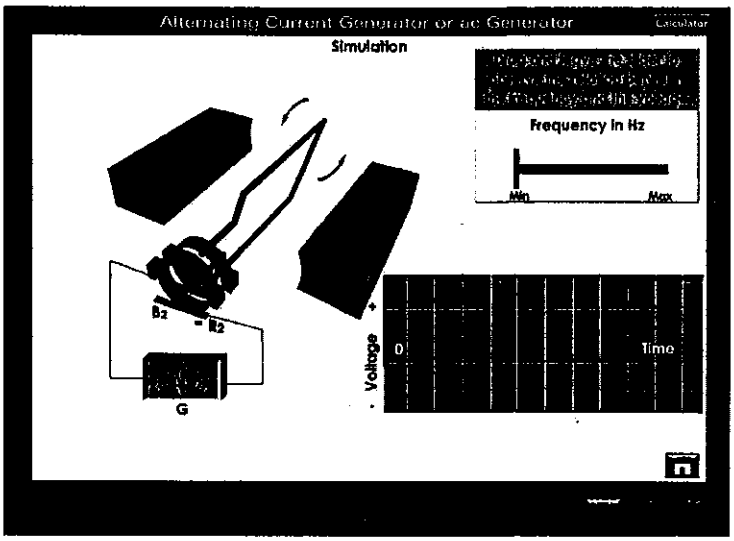
- Listening skill 2: What does the author mean?



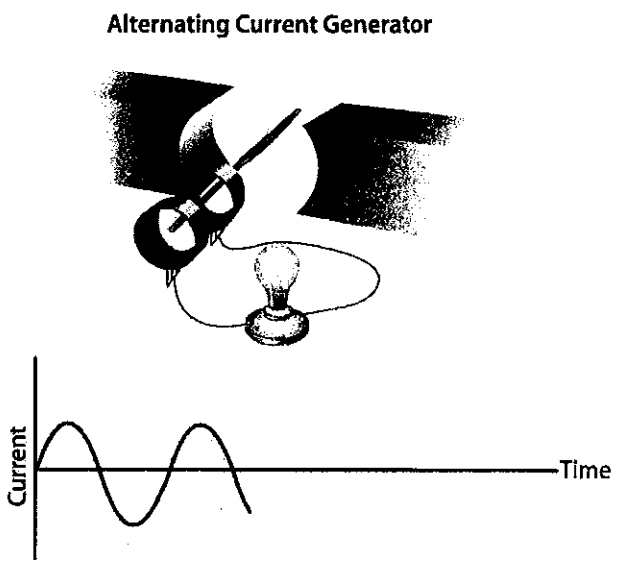
- Listening skill 3: What does the author say about?



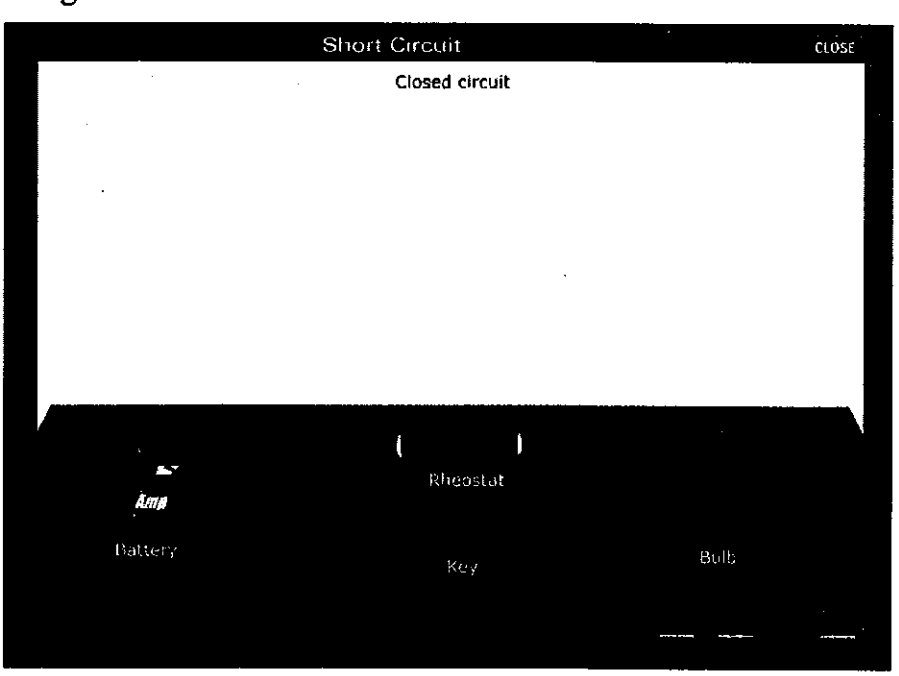
- Listening skill 4: What does the speaker talk about?



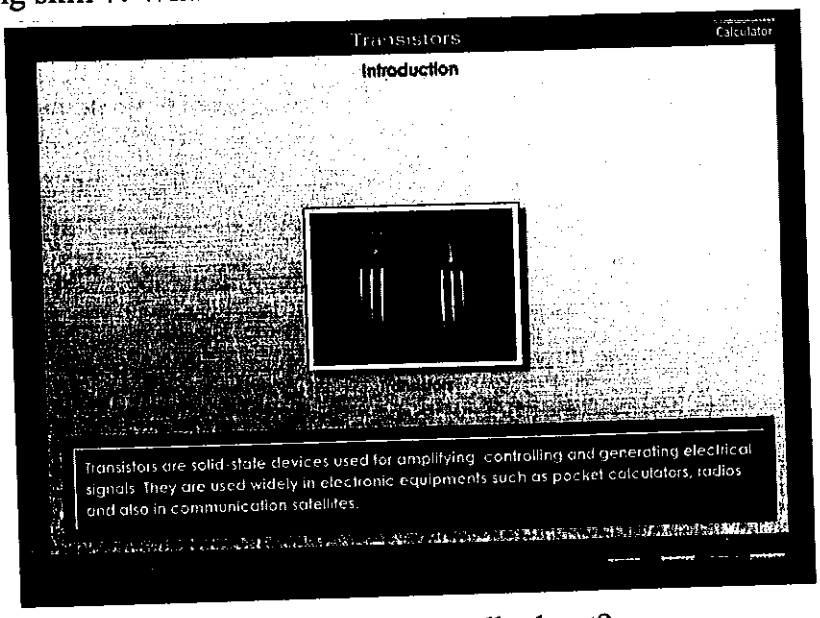
- Listening skill 5: What does the author mean?



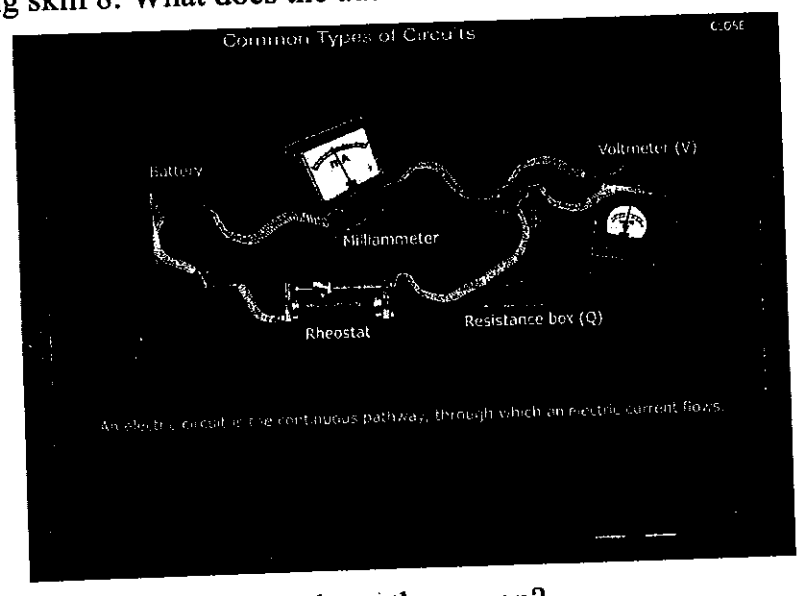
- Listening skill 6: What does the author talk about?



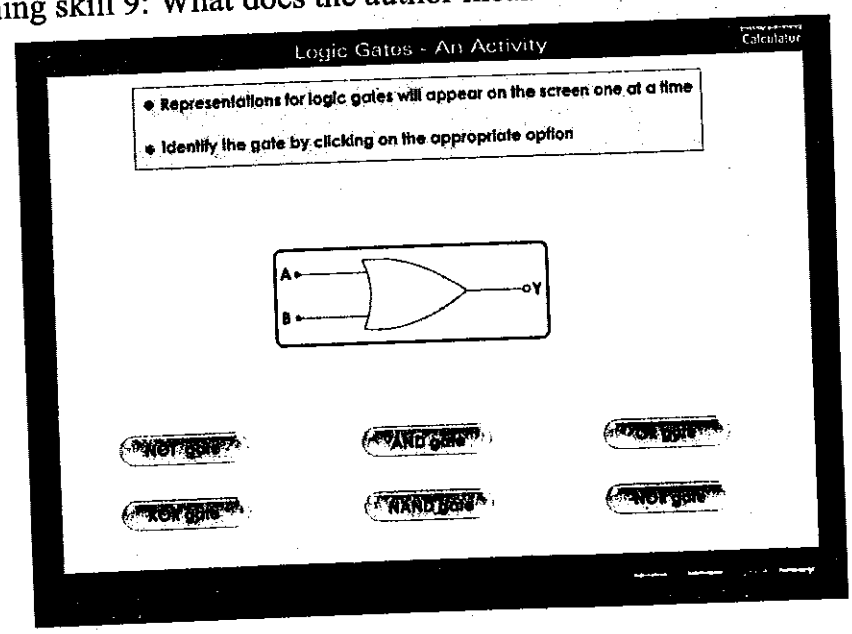
- Listening skill 7: What does the author mean?



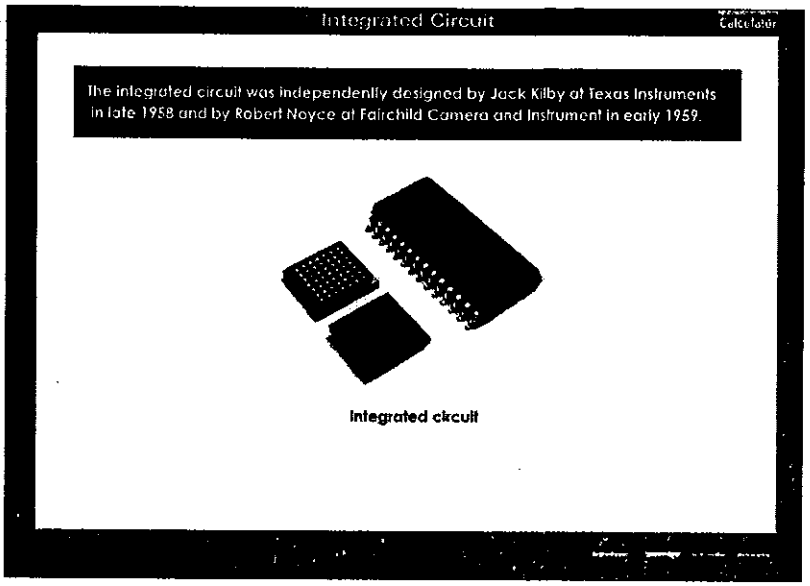
- Listening skill 8: What does the author talk about?



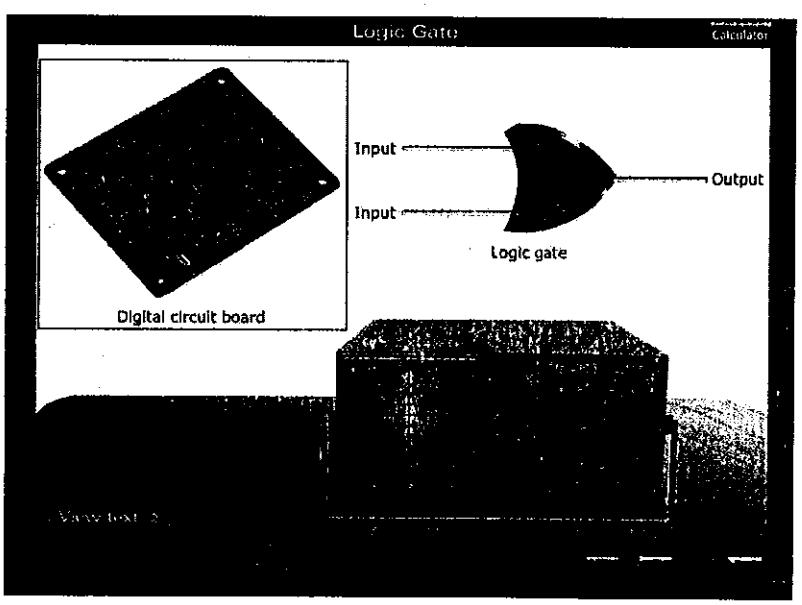
- Listening skill 9: What does the author mean?



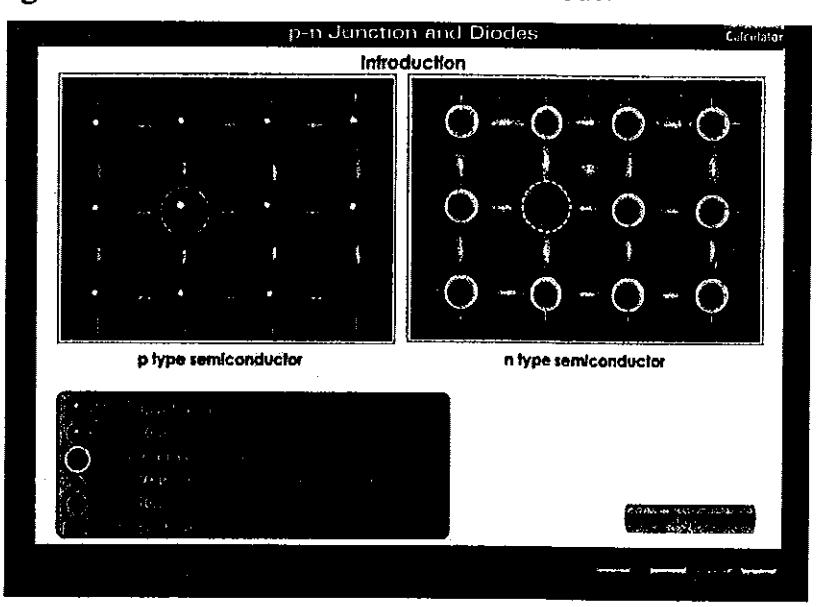
- Listening skill 10: What does the author say about?



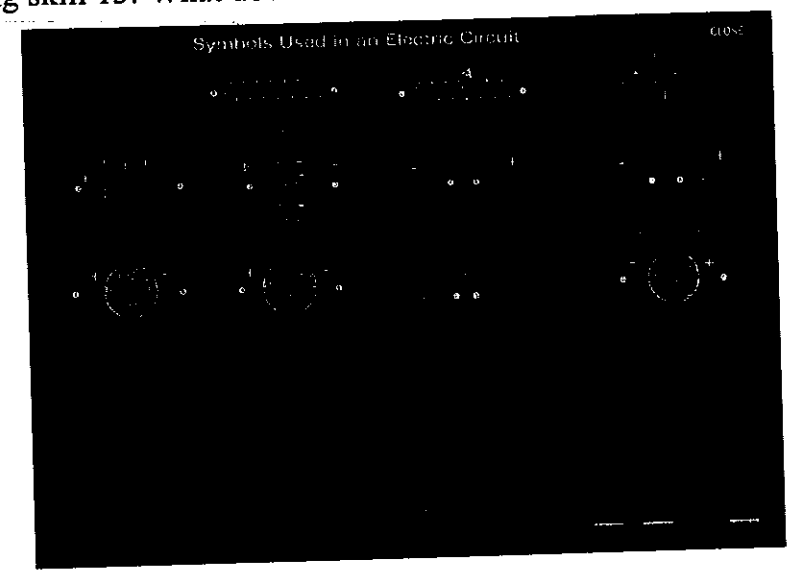
- Listening skill 11: What does the author mean?



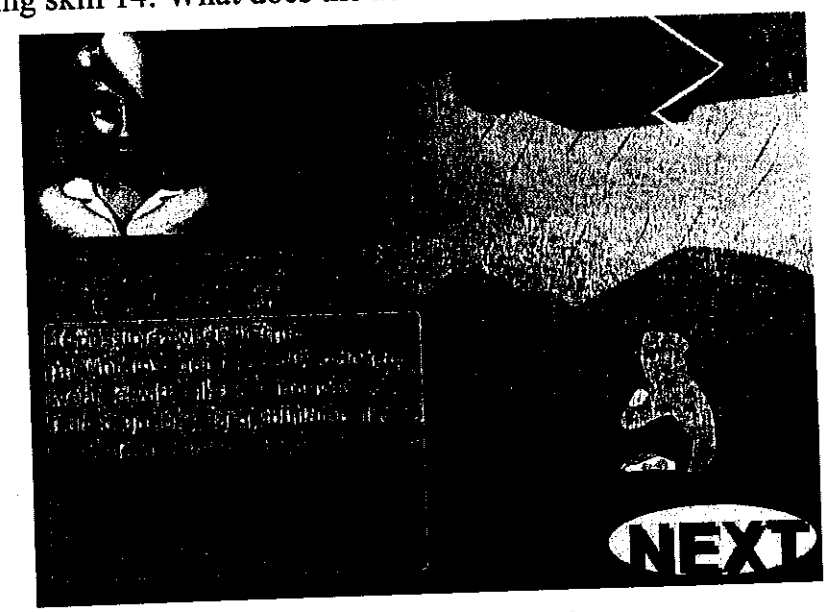
- Listening skill 12: What does the author talk about?



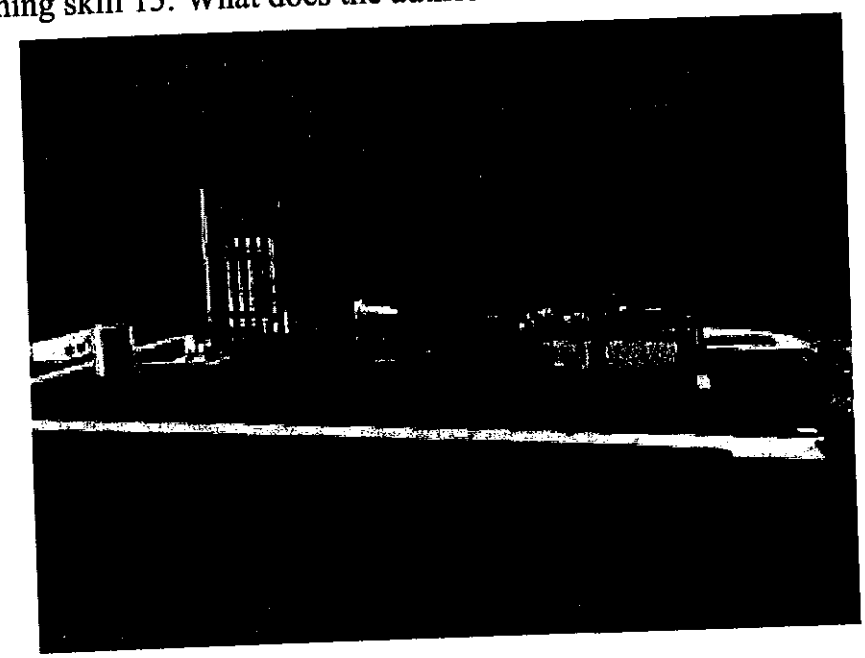
- Listening skill 13: What does the author mean?



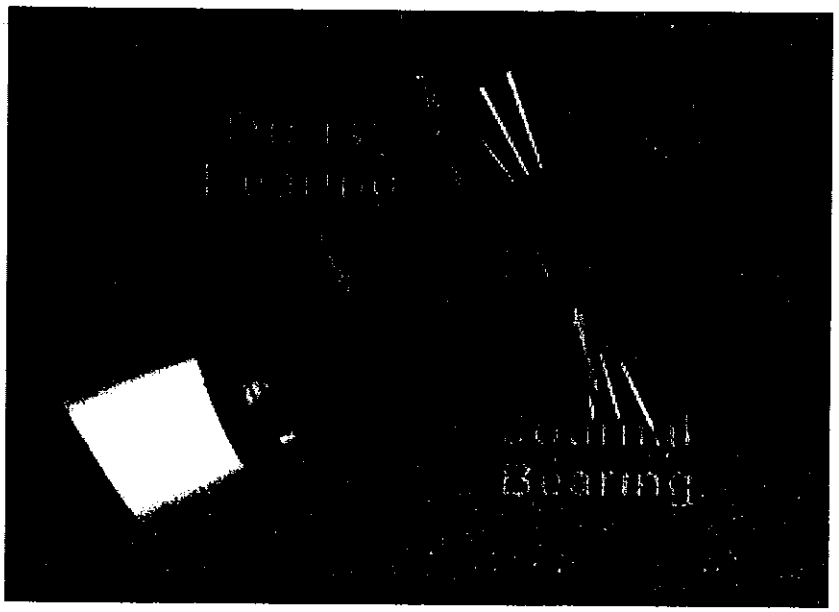
- Listening skill 14: What does the author talk about?



- Listening skill 15: What does the author mean?

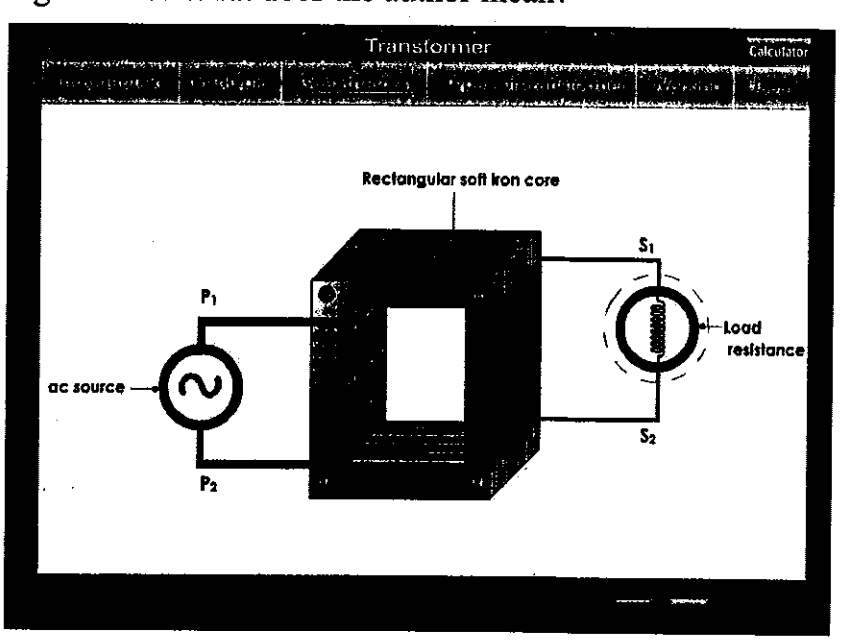


- Listening skill 16: What does the author say about?

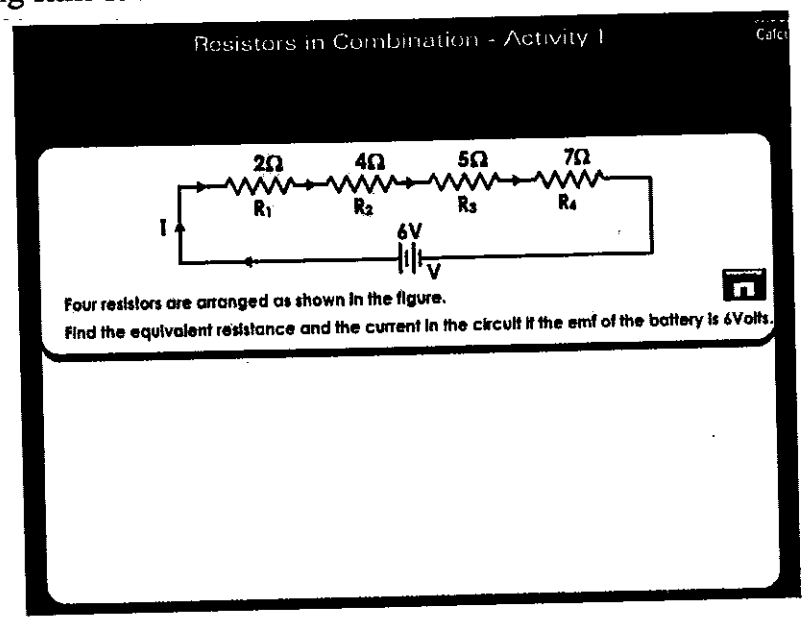


- Listening skill 17: What does the author mean?

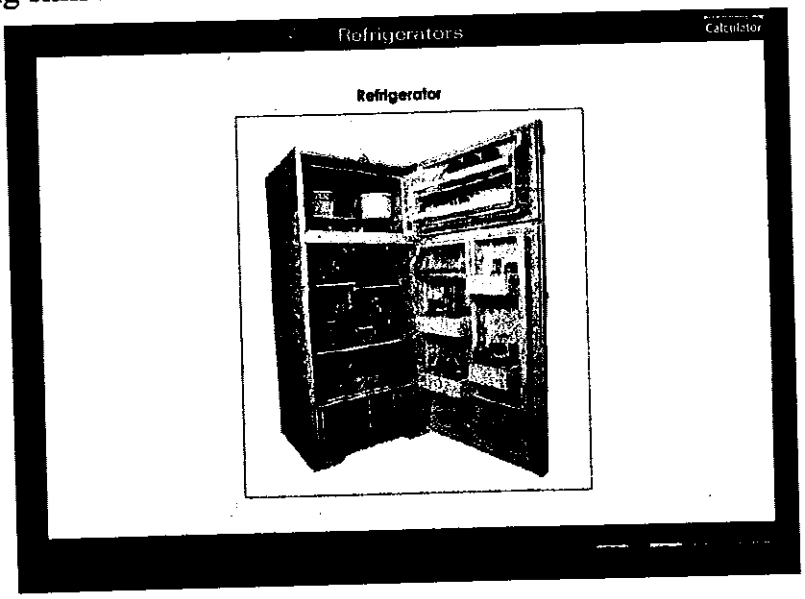
- Listening skill 18: What does the author mean?



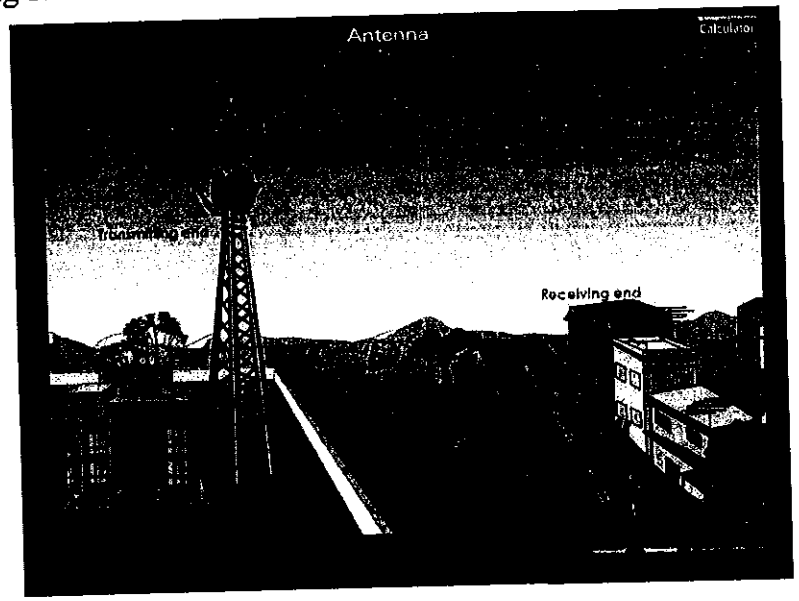
- Listening skill 19: What does the author mean?



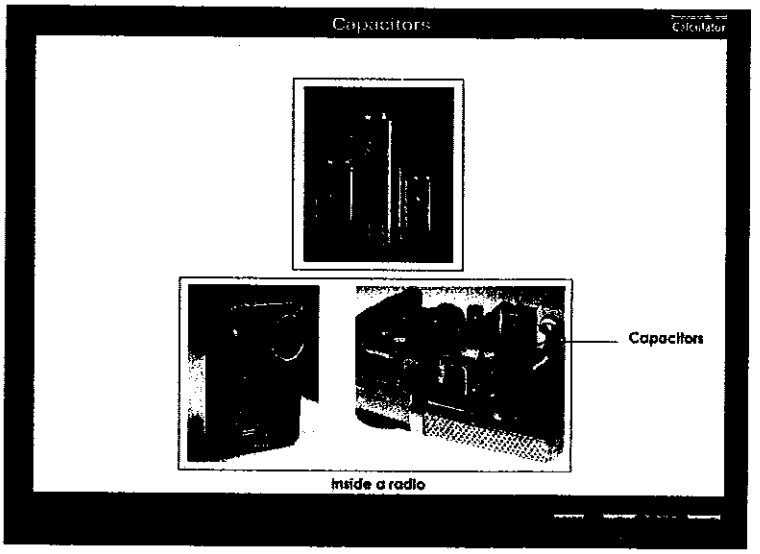
- Listening skill 20: What does the author mean?



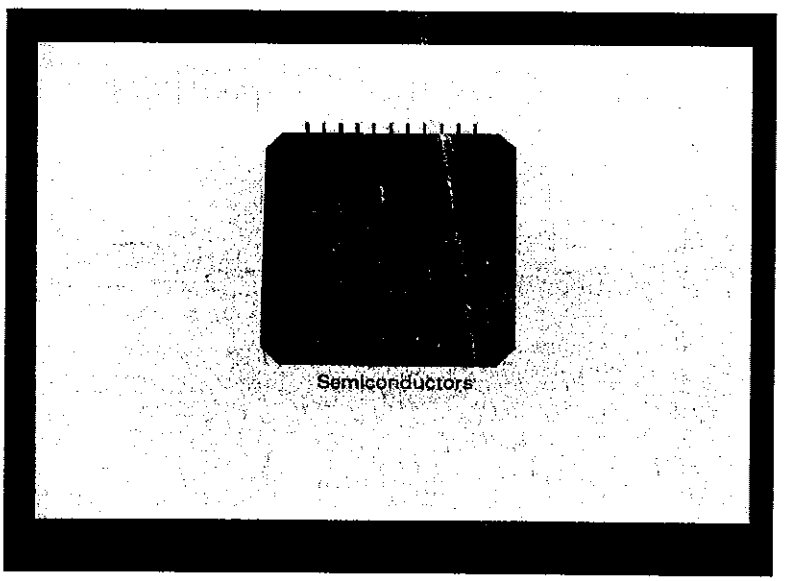
- Listening skill 21: What does the author mean?



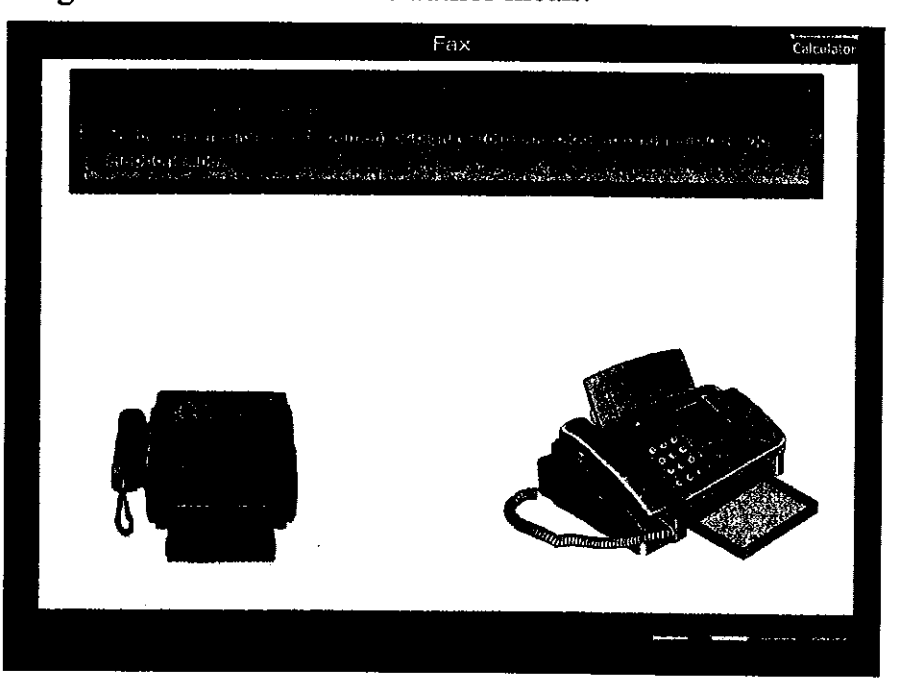
- Listening skill 22: What does the author mean?



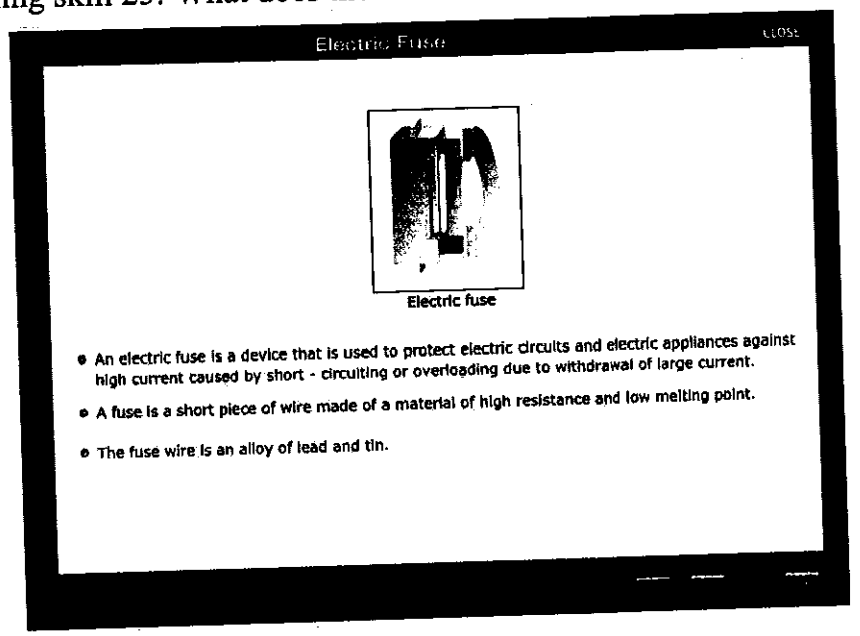
- Listening skill 23: What does the author mean?



- Listening skill 24: What does the author mean?



- Listening skill 25: What does the author mean?

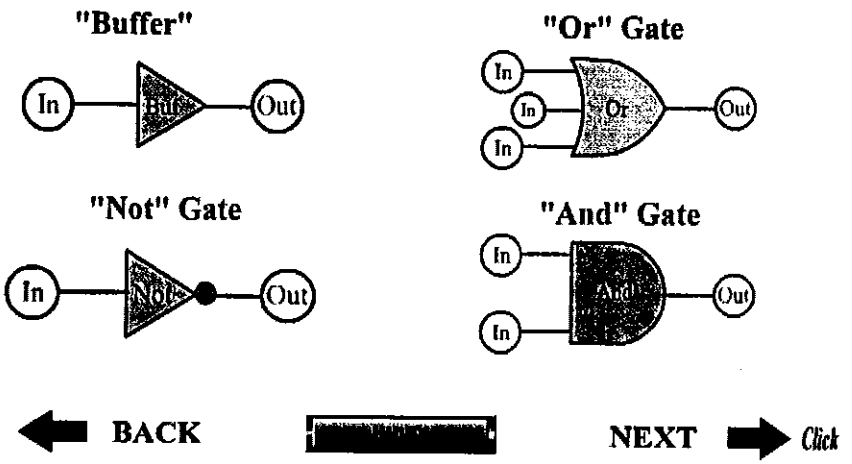


PART V. TRANSLATION

TRANSLATE INTO VIETNAMESE

UNIT 1. INTRODUCTION: DIGITAL LOGIC GATES

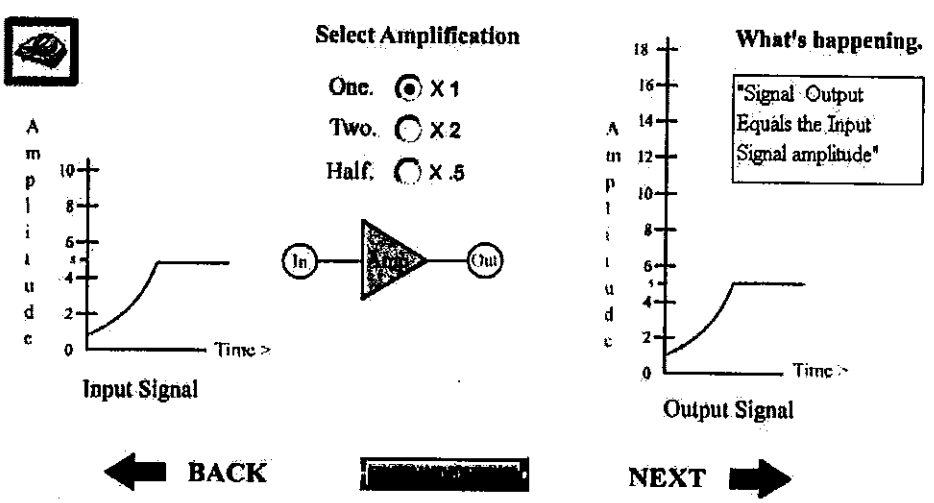
1.1. Basic Logic Gates



Basic logic gates are usually shown as symbols similar to the ones shown here. A gate, as the name implies acts as a barrier to electrical signals so that the output signal is dependent on both the input signal and the particular design function of the gate.

Gates with more complex functions such as the "And" and the "Or" can have multi inputs.

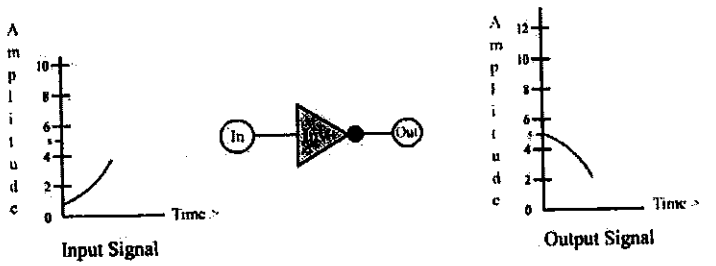
The Amplifier



A fundamental component of logic gates is the "Amplifier" usually based on the transistor semiconductor device. In logic gates its function is to separate and isolate input from output signals. The amplification factor provides the additional power needed to drive several destination gates.

The amplifier symbol is shown together with a simplified version of the transistor and resistor components used to build it. Shown is the "Common Collector" circuit.

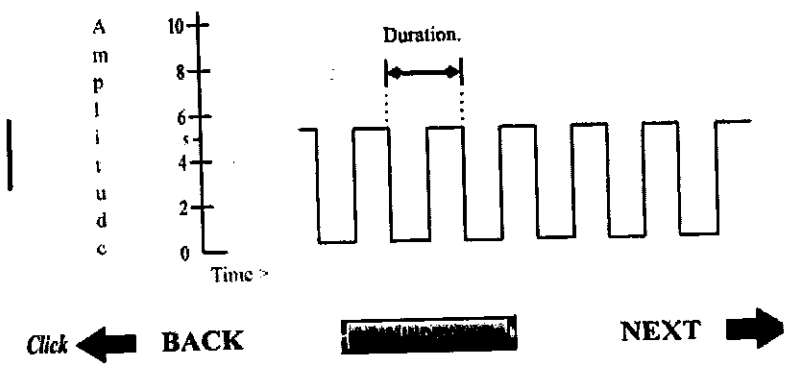
1.2. The Inverter



Taking an amplifier and inverting the output means that as the input signal changes in a positive direction the output signal alters negatively, a negative swing gives a positive output. With the Input at 0 Volts the Output is 5 Volts. As The Input rises towards 5 volts the Output falls to 0 Volts.

Shown below is the basic circuit of the Inverter. A simple transistor with a resistive load in the collector is The "Common Emitter".

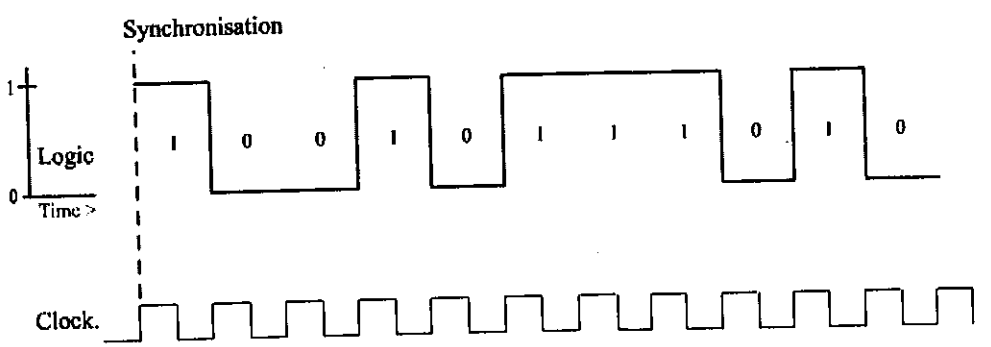
1.3. The Digital Signal



The Signal used to demonstrate the Amplify/Inversion actions was essentially analogue with an exponential increase from 0 volts to 5 volts. The 5V level is shown limited or clipped.

Digital logic is only interested in two states On Off, Hi Lo or a One state and a Zero state. The two states are represented by two voltage levels such as +5 volts for On and 0 volts for Off. Two states logic is called Binary logic. The signal shown is a continuous train of ones (5V) and zeros (0V). It is typical of a system CLOCK signal which defines the Logic signal duration and is used for system synchronization.

1.4. Clock Signals



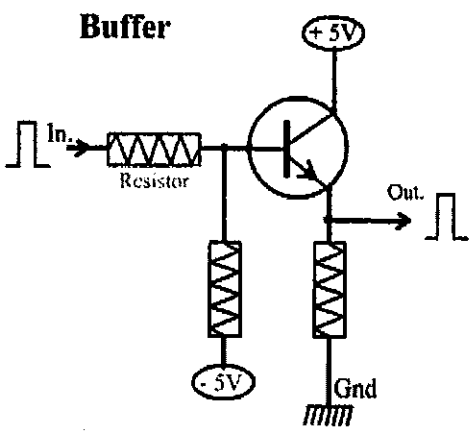
A typical digital logic signal is a series of Ones and Zero's. For Example the logic signal below represents the digital sequence 1 0 0 1 0 1 1 1 0 1 0. In order to regulate and translate the serial information the start of a signal train is system synchronized using the clock.

1.5. The Buffer

BACK NEXT

A development of the Amplifier is the "Buffer". Designed to be an electronic switch it is suitable for the processing of digital signals. The buffer has an output having the same polarity as the input.

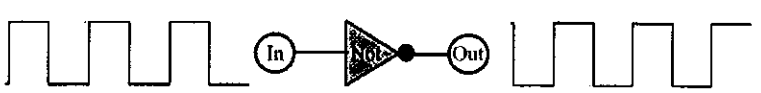
The Buffer Component



Transistor Switch Circuit.

With additional components the input signal causes the transistor to switch between the fully on state and the off state. Shown is a simplified "Common Collector" circuit.

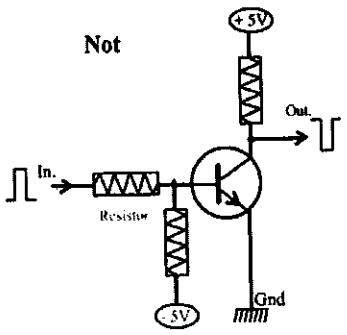
1.6. The Not Gate



BACK NEXT

The Digital equivalent of the Inverter is the "Not gate". As with the Buffer the circuit acts as a switch changing from the fully on state to the fully off state. The Not Gate takes the input signal and inverts it to produce an output of the opposite polarity.

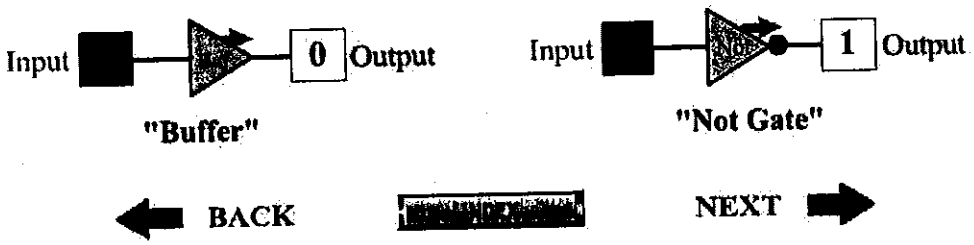
The Not Component



Transistor Switch Circuit.

Taking the output from the collector of the switching transistor causes the input signal to be Inverted at the output. Shown is the "Common Emitter" circuit.

1.7. Function And Signals



a. Function

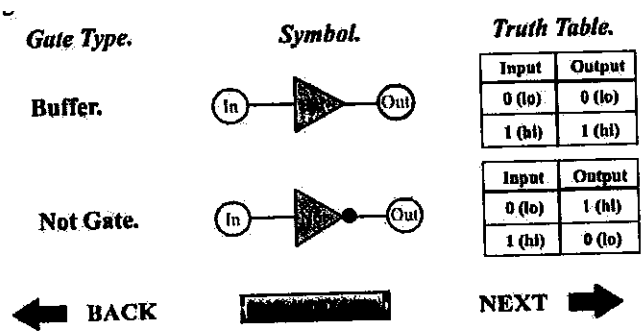
As shown in previous scenes a "Buffer" accepts an input signal and produces a corresponding output, it isolates the signal source from the destination often with an increase in power to allow the signal to drive several gates.

A "Not Gate" takes an input signal of one polarity and changes it to the opposite polarity also acting as a buffer -- The special action of a particular device on incoming signals is known as its FUNCTION.

b. Assertion

In two state devices we have an asserted signal or the absence of a signal. The ASSERTED state (signal present) is conventionally referred to as the ONE state. The UNASSERTED state (signal absent) is the ZERO state.

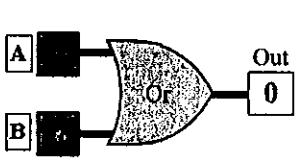
1.8. The True Tables



The conventional method used to show the effects of signals passing through the various Logic gates is in tabular form. Gate activity is shown by mapping the output signal to the input(s) as modified by the logical function of the gate and listing the relationship in a TRUTH TABLE.

As a simple example: Taking gates having a single signal input and a single output such as the "Buffer" and its complement gate the "Not Gate", assuming the signal high state to represent a logical ONE and the low voltage to represent a logical ZERO we get the tables below.

1.9. The Or Function



Truth Table.

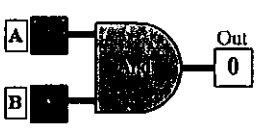
Inputs		Output
A	B	0
0	0	

Expanded Table

BACK NEXT

The "OR" function is the action of a device which takes input signals and performs what is effectively an additive action on the signals. For any asserted input we get a corresponding asserted signal output. The resulting truth table resembles that of an addition table (see the expanded truth table).

1.10. The And Function



Truth Table.

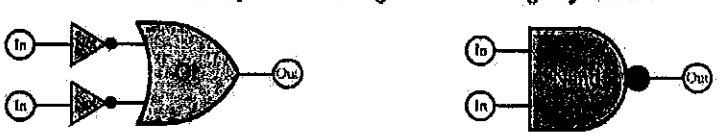
Inputs		Output
A	B	0
0	0	

Expanded Table

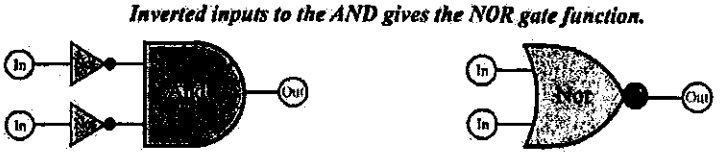
BACK NEXT

1.11. Inverting Gate-Output Inversion

Inverted inputs to the OR gives the NAND gate function.



Inverted inputs to the AND gives the NOR gate function.

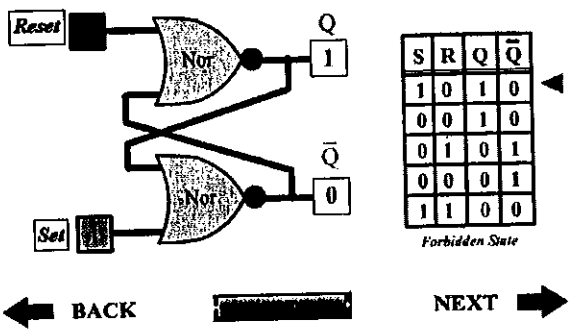


BACK NEXT

An Inverter placed on the output line of a complex gate alters its function and the name changes to reflect the changed action. The "OR" becomes a "NOR" standing for "Negated OR". The Symbol also changes, for example the NOR gate shown below is the OR gate with a Circle on the output. The Circle indicating the Inverting action is called an Inversion Bubble.

Inverters placed on the input lines of a gate changes its function... The "OR" with negated inputs is the logical equivalent of a "NAND" gate. The "AND" with all inputs inverted becomes a "NOR" gate. How can we tell? We Map the varying input signals to the output signals and the resulting equivalence tables are known as truth tables.

1.12. The Nor Bi Stable

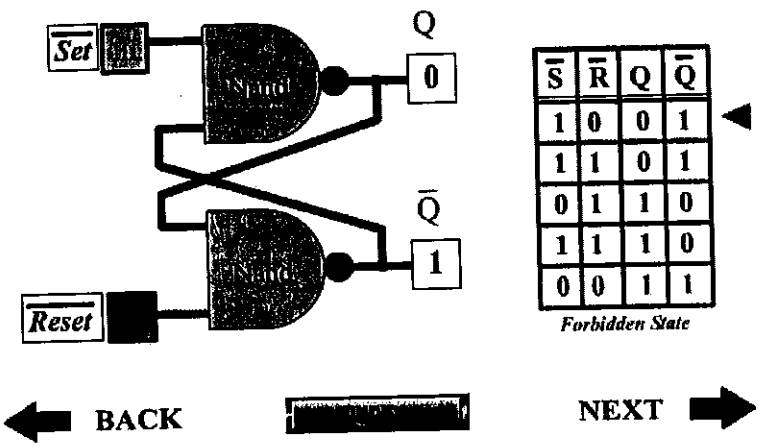


The NOR Bi-Stable Is, as the name implies, a construct of NOR gates which in theory can only adopt one of two stable states. Shown below is the circuit of a primitive NOR Latch. This circuit actually has 3 states, however both inputs set to the One state is regarded as illegal. Additional circuitry is needed to prevent the 0, 0 output state.

When the output of one Nor is a Zero or low voltage level the other Nor is its complement, normally a One, High state. Changes in state are forced by set and reset signals and the device is considered to be SET when the Nor output designated "Q" is One and the other Nor output called "Q' not" is a Zero.

The opposite state is the Bi Stable RESET condition. The activating signal which forces a change of state in the Nor gates is a One voltage level on the appropriate input. Two input zeros should not change its state. A One on both inputs is an illegal condition resulting in an illegal state.

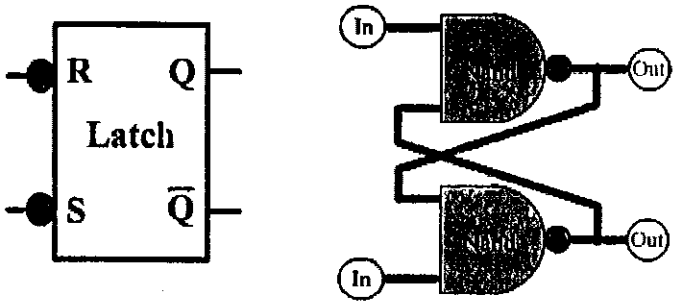
1.13. The Nand Bi-Stable



The NAND Bi-Stable is similar to the NOR Device. The activating signal on the NAND gates is the low voltage level or the input of a Zero to the NAND Set and Reset input controls.

The Nand Bi-Stable is not generally distinguishable from the Nor version they can be designed to operate in exactly the same way. If the activating signals are negative then an Inversion bubble is placed on the inputs. Shown is the symbol for a latch driven by negative level inputs.

1.14. Latches Versus Flip Flops

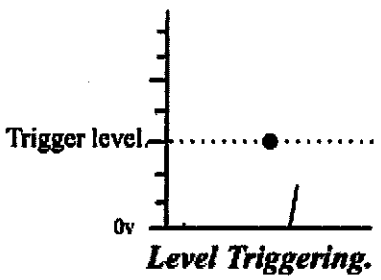


Much of the literature dealing with the subject of Digital Logic makes little or no distinction between the action of the Latch and the Flip Flop. There is a major design difference; the change of state from One to Zero or Set to Reset of the Latch is activated by a particular value of the input voltage being reached. The Latch is Level Triggered and can be designed to take place on either positive to negative or negative to positive level changes.

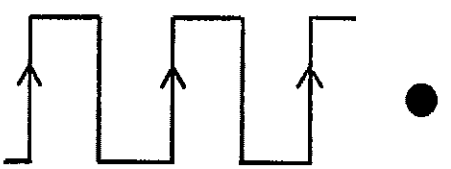
The Flip Flop state change is caused by the input signal transition from one to zero or zero to one dependent on design and takes place during the rising or falling edge of the incoming control signal. The Flip Flop is Edge Triggered.

The Latch is demonstrated below with a primitive gate having a digital input. For brevity the Reset input and Not Output are omitted and the device is assumed to be constantly enabled. Note that the gate changes its state each time the input reaches the Trigger Level of the input voltage.

1.15. The Flip Flop



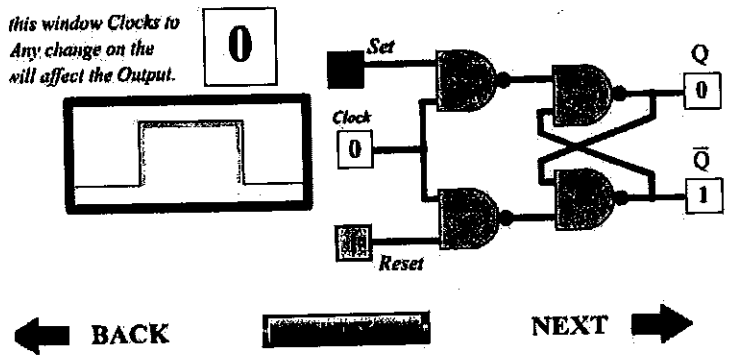
Level Triggering.



Edge Triggering.

The Flip Flop action is demonstrated below using a primitive gate having a clocking input. The device is assumed to be constantly enabled so that the gate changes its state on each upward transition of the clock input

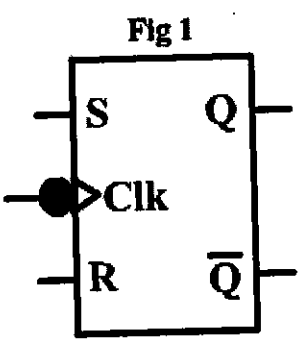
1.16. The clocked rs.

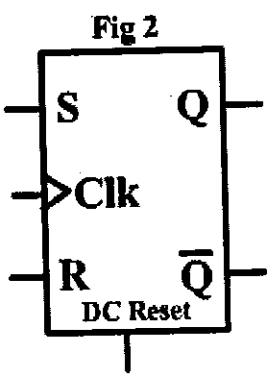


In order to change the state of a Bi stable at specific times the Gated or clocked device is used. The Nand Bi-stable with the gating circuitry is shown below. If the input to the Set and Reset lines are complementary and a positive clock occurs the circuit will adopt the stable state according to which input is at a One value. i.e.: if the One is on the Set line the latch will Set with Q = 1, Q' not = 0.

The problem with this circuit is that if both the Set and Reset lines are at the same level and a clock pulse occurs then the circuit is ambiguous and its next state is indeterminate.

The Clocked Rs Symbols

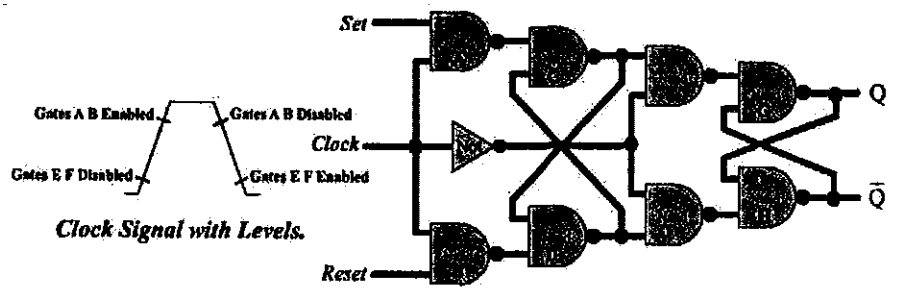




The Clocked RS flip flop Symbols: In Fig.1 the Triangle denotes Edge triggered and the Inversion bubble negative activation. The Flip Flop changes state on the negative going clock edge to the condition determined by the Set Reset controls signals.

Fig 2 shows a typical RS flip flop of slightly different design incorporating an additional DC reset control useful in constructing Counters

1.17. The master slave configuration.

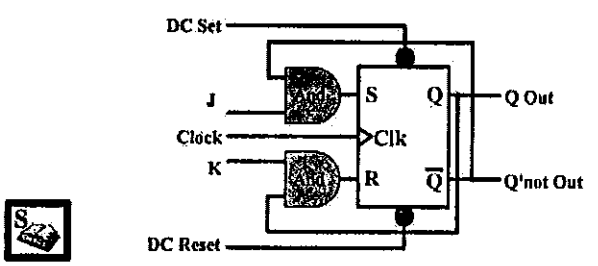


BACK NEXT

To overcome the ambiguity of the level activated clocked RS Latch the Master Slave circuit is used. By driving one Latch circuit by another we achieve an unambiguous edge triggered RS flip flop.

1.18. The Jk Flip Flop

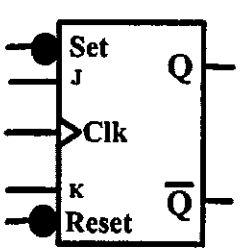
J K Flip Flop Circuit.



BACK NEXT

Another variation of the Flip Flop or Latch is the J K. Illustrated is the basic circuit of the J K Flip Flop comprised of a master slave clocked RS Flip flop driven via AND gates. The Latch version of the J K is similar with AND circuitry steering fed back outputs driving a RS

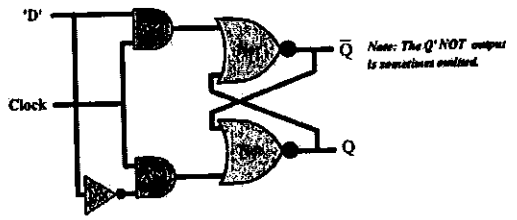
The Jk Flip Flop Symbol



Another variation of the Flip Flop or Latch is the J K. Illustrated is the basic circuit of the J K Flip Flop comprised of a master slave clocked RS Flip flop driven

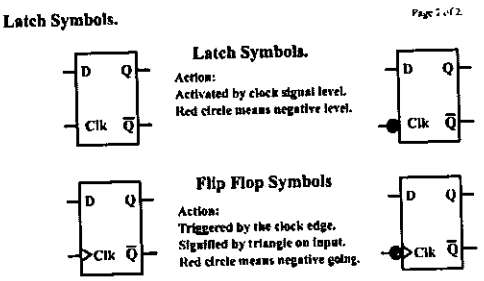
via AND gates. The Latch version of the J K is similar with AND circuitry steering fed back outputs driving a RS

1.19. Latches As Memory Elements

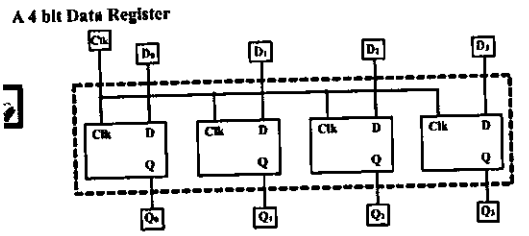


BACK NEXT

The Latch as a bi-stable can be used as a storage device maintaining a ONE or ZERO state as long as power is applied. With additional circuitry to allow reading and writing a typical element of high speed memory is the 'D' Latch which has one Data input 'D' and a clock input to permit the 'D' signal to be "Latched In" and stored.



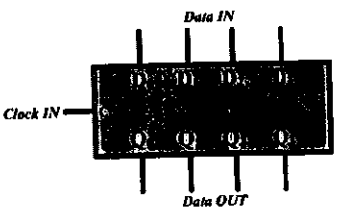
1.20. Register



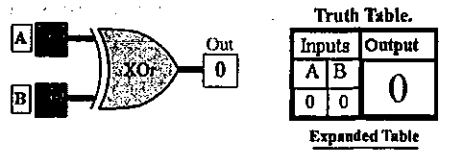
BACK NEXT

An interconnecting group of Gates such as 'D' Latch is called a "Data Register". Registers are heavily used in computer architecture and the Data register is very useful as a temporary high speed store and for use in processing binary words. A typical 4 bit register symbol with simple Data inputs and outputs.

Note that different manufacturers employ slightly different symbol drawing conventions.



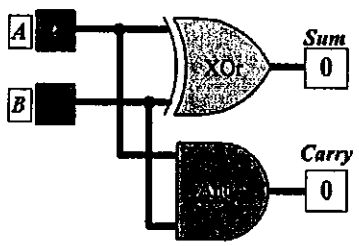
1.21. The Xor logic Gate.



BACK NEXT Click

Another gate design is the "Exclusive Or" commonly referred to as the "XOR". Normally having 2 inputs, it gives an asserted signal out if either input is a One (asserted) but a Zero signal out if both inputs are One. The output is sometimes inverted to give the "XNOR". They are used extensively in Adder and Decode circuits.

1.22. The Half Adder



Truth Table.

Inputs		Outputs	
A	*B*	*Sum*	*Carry*
0	0	0	0

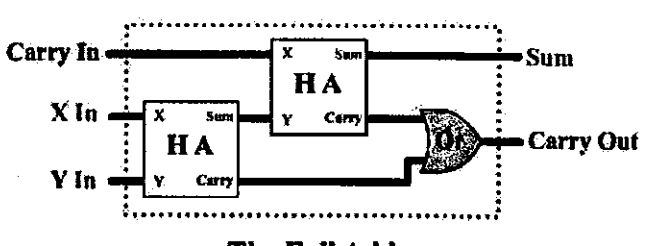
BACK NEXT Click

The Basic unit of the Arithmetic unit is the half adder which takes two binary digit inputs and produces as output either a sum or a carry as dictated by the input values.

i.e. The output Sum = 1 is produced from inputs 0 + 1 0R 1 + 0 whereas the carry can only be obtained from 1 + 1 on the inputs, resulting in Sum= 0.

The "AND" fulfils the logical function of the CARRY with the Exclusive "OR" giving the SUM.

1.23. The Full Adder



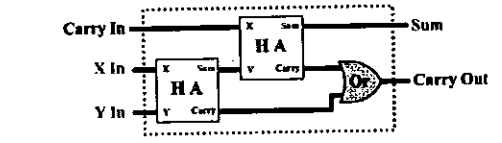
The Full Adder.

BACK NEXT Click

In order to simplify logic diagrams, complex gate assemblies such as adding circuits are represented as one composite symbol comprising the gate components and connections.

Symbols standing for complex functions are normally shown as a block with inputs and output connections labeled to indicate their use.

The example shown is the HALF Adder. Combining principles are used to construct a Full Adder symbol. The truth table with a Carry In and a Carry Out then becomes as shown



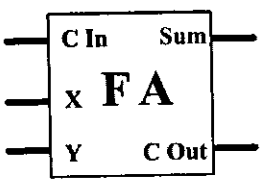
The Full Adder Symbol. Made by combining the components.

Truth Table.

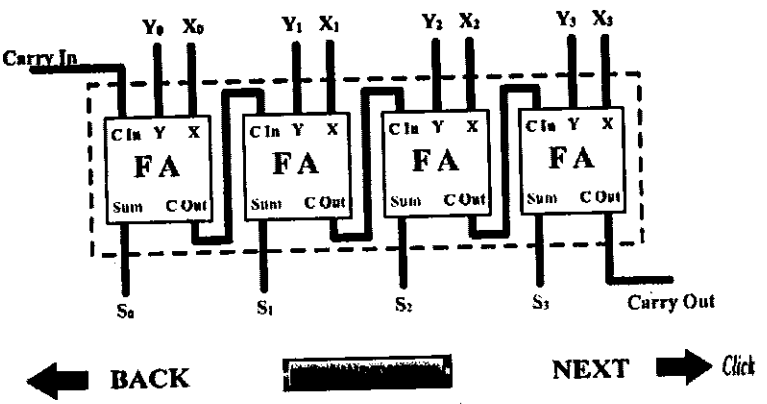
Inputs			Outputs	
X	Y	C	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Click to return to Scene :

Full Adder build



1.24. An Adder Unit



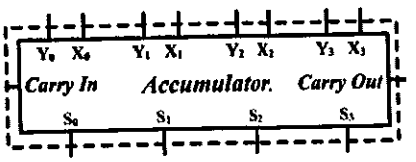
Combining two half adders to create a "Full Adder" symbol, we can then build the units to construct an arithmetic register to add any number of pairs of digits.

Shown is a 4 bit adding unit which could be serially connected to feed another unit to produce an 8 bit adder feeding more units to give any size of add unit. The input and output binary digits are conventially numbered 0 to "N".

1.25. A 4 Bit Accumulator

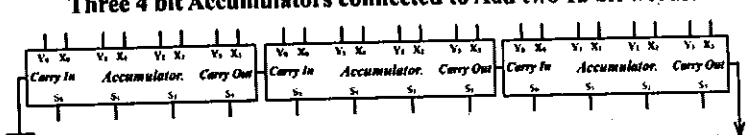
Inputs : 4 bits of number X and 4 bits of number Y and Carry IN.

Adder Unit



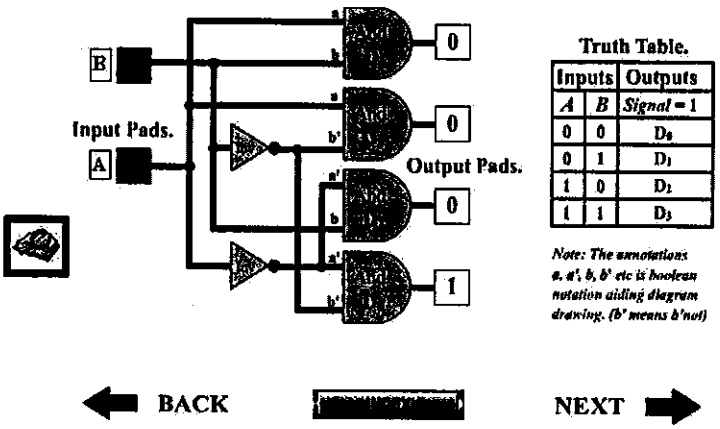
Outputs : 4 bit sum from adding numbers X to Y with Carry Out

Three 4 bit Accumulators connected to Add two 12 bit words.



With additional input and output registers a 4 bit adding register also known as an Accumulator can be constructed. It will add two 4 bit words designated X and Y the Add function producing a 4 bit Sum with a carry.

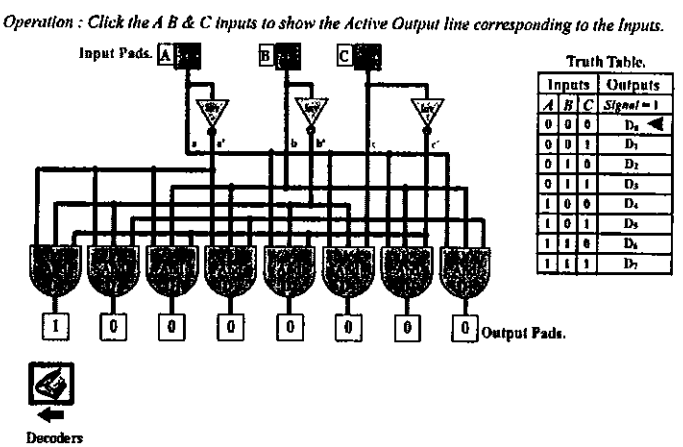
1.26. A 2 Bit Input Decoder



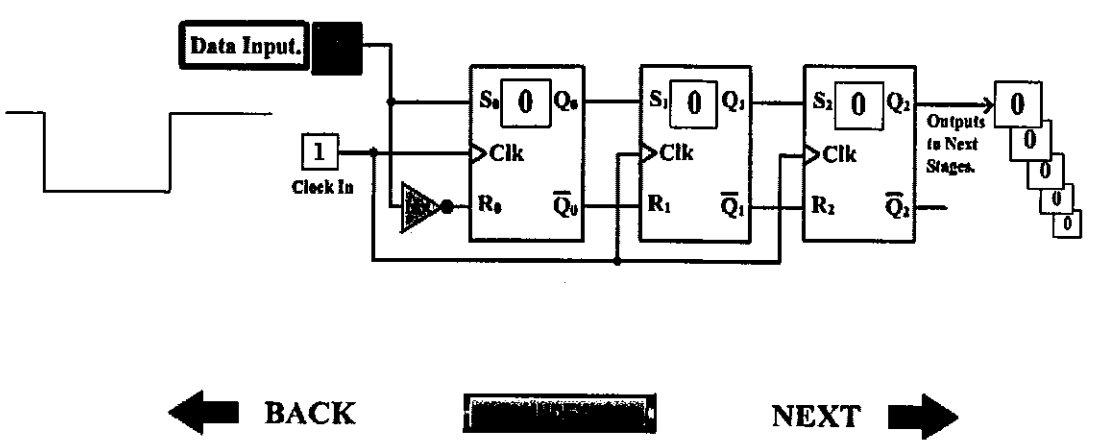
For addressing and producing control lines decoders are used. Shown is a decode circuit which gives 4 active control lines from a 2 bit input.

Decoder with a 3 Bit Input: A decode circuit which gives 8 active control lines from a 3 bit input.

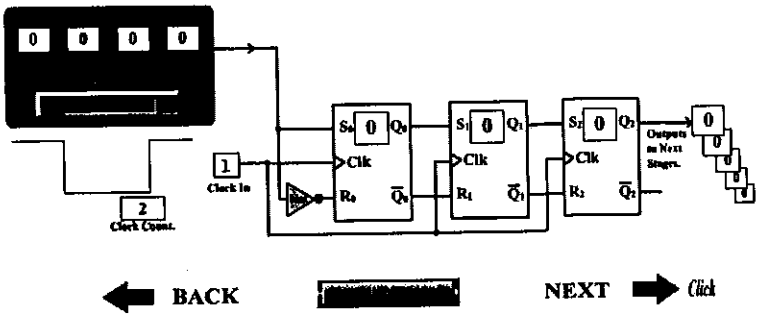
A 2 Bit Input Decoder



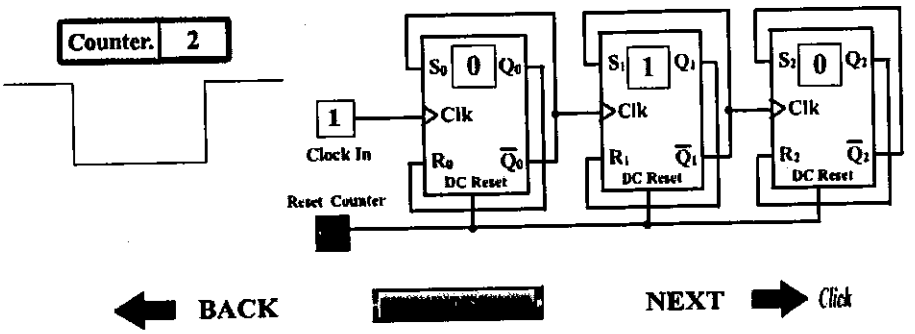
1.27. The Shift Register



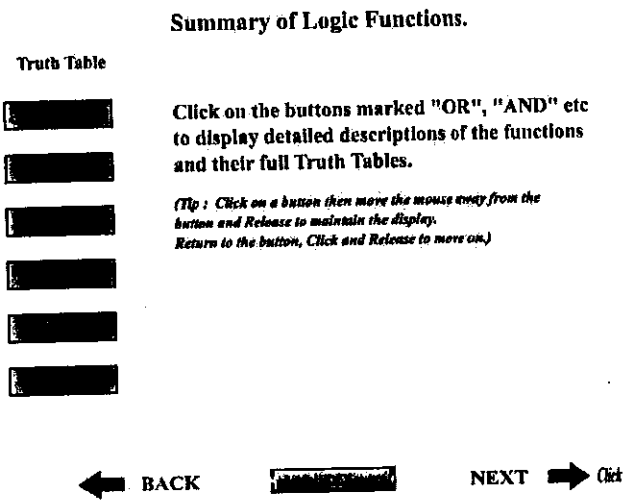
1.28. Action Shift Register



1.29. Counters



1.30. Summaty Of Logic Function

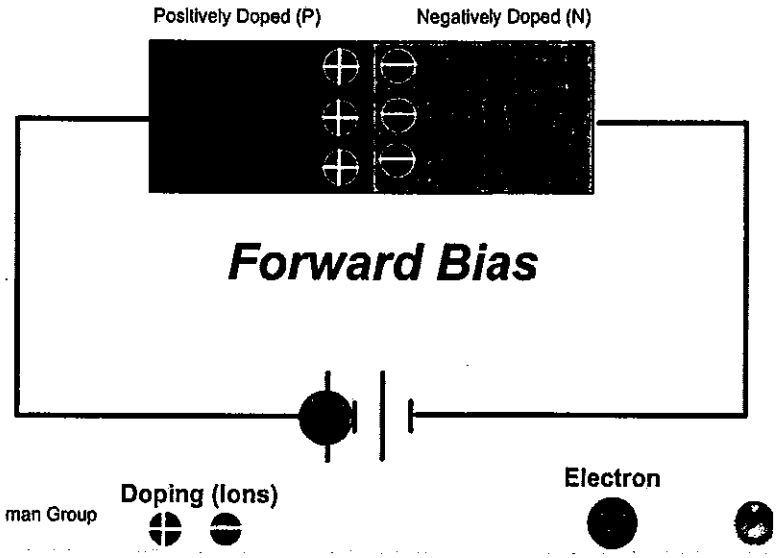


1.31. The Final Scene And Scratch Pads

Truth Table.

Inputs		Outputs
A	*B*	*Signal* = 1
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

UNIT 2. HOW DOES A DIODE WORK?



Different diodes are used for different purposes. However, the basic working of a diode still remains the same. It is a p-n junction semiconductor, that allows current to flow only in one direction. Here, in this article, I will try to explain you how does a diode work?

Before we start answering the question; 'How does a diode work?', let us try to understand, what is a diode? It is also important to understand the practical application of a diode. Lets start answering all these questions one by one.

2.1. What is a diode?

It is very important to answer this question, before we start answering, how do diodes work? A diode is a p-n junction semiconductor, that allows the flow of current in only one direction. A p-type semiconductor is one, which only has positively charged holes. The n-type semiconductor on the other hand is one which has electrons or negatively charged carriers. The p-type and n-type semiconductors are diffused into each other to form a p-n junction. Mostly, silicon is used for the semiconductor material, while in many cases germanium is also used.

The manufacturing process of diodes depends on the purpose for which they are going to be used. For example, a varactor diode, is used as a variable capacitor and a zener diode is operated in the reverse biased mode, hence their manufacturing process is also different. An LED (Light Emitting Diode) is constructed such that the holes and electrons on recombination, release energy in the form of light. Hence, they are manufactured from Gallium Arsenide, Gallium Phosphide etc. instead of Silicon, so as to have higher potential barrier.

2.2. How do diodes work?

To answer the question; 'How does a diode work?', we will need to understand its V-I characteristics. V-I characteristics means, the graph between the voltage and the current, at which the diode is working. A diode is a voltage controlled device. In a diode, Current flows in the forward biased mode, while there is no flow of current when the diode is reverse biased. A diode is said to be in the forward biased mode

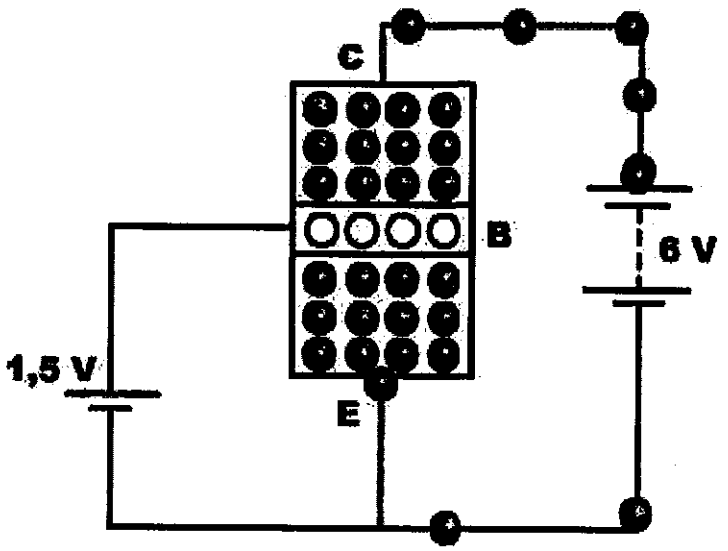
when the positive terminal of the battery is connected to the p-terminal and negative side of the diode is connected to the n-terminal. Once the voltage is applied to the diode in the forward biased mode, the diode immediately does not allow the flow of current. On increasing the voltage, such that it reaches the breakdown voltage, the current flow starts increasing and reaches its maximum. This breakdown voltage is different for different semiconductor materials. For Silicon the breakdown voltage is 0.7 Volt. On applying the voltage the positively charged holes are repelled by the positive terminal of the battery and the negatively charged electrons are repelled by the negative terminal of the battery and start flowing in the opposite directions. This causes the flow of current in positive to negative direction. Recombination of the electrons and holes takes place at the junction and a small region is developed at the junction. It consists of minority carriers, electrons in the p-layer and majority carriers, holes in the n layer. This limited region on both sides of the junctions is known as the depletion region. Once the depletion region is formed, the current flow becomes practically constant. Further increase in voltage can destroy the depletion region and hence the diode. Most diodes when operated in the reverse biased mode, get destroyed on increasing the voltage to a large extent. When a diode is operated in the reverse biased mode, there is practically no flow of current initially. When the voltage is increased and reaches the reverse threshold voltage, current increases indefinitely and flows in the reverse direction, destroying the diode. However, zener diode is operated in the reverse biased mode and finds a wide range of applications.

2.3. Applications Of Diodes

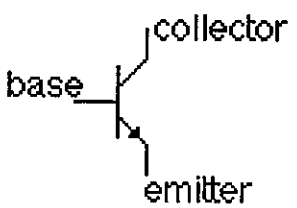
As already mentioned, all diodes are not used for the same purpose, though the basic function of a diode is the same. It allows the flow of current in only one direction. Varactor diode is used in places where they need to solve the purpose of a variable capacitor. Tunnel diode is used in applications where we need the current to increase and decrease alternately. The application of LED lights is known to all. LEDs compulsorily need to operate in the forward biased mode. Zener diode, on the other hand is operated in the reverse biased mode and is used as a voltage regulator.

Diodes are among the most fundamental devices that are used in any electronic kits. Even if you are using a microcontroller or microprocessor to prepare your project, it is most likely that you will need a diode somewhere in the circuit. Knowing the answer to the questions like 'What is a diode?' and 'How does a diode work?' is extremely necessary, before undertaking any electronic project or designing any circuit.

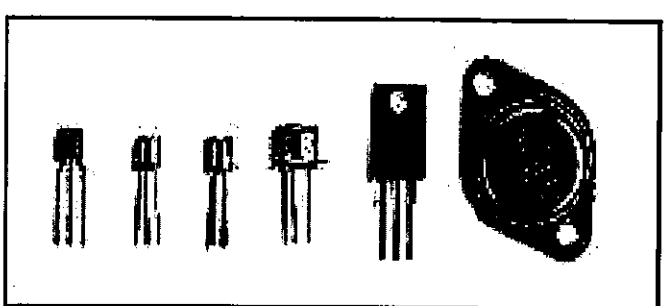
UNIT 3. HOW DOES A TRANSISTOR WORK



The design of a transistor allows it to function as an amplifier or a switch. This is accomplished by using a small amount of electricity to control a gate on a much larger supply of electricity, much like turning a valve to control a supply of water.



Transistors are composed of three parts – a base, a collector, and an emitter. The base is the gate controller device for the larger electrical supply. The collector is the larger electrical supply, and the emitter is the outlet for that supply. By sending varying levels of current from the base, the amount of current flowing through the gate from the collector may be regulated. In this way, a very small amount of current may be used to control a large amount of current, as in an amplifier. The same process is used to create the binary code for the digital processors but in this case a voltage threshold of five volts is needed to open the collector gate. In this way, the transistor is being used as a switch with a binary function: five volts – ON, less than five volts – OFF.

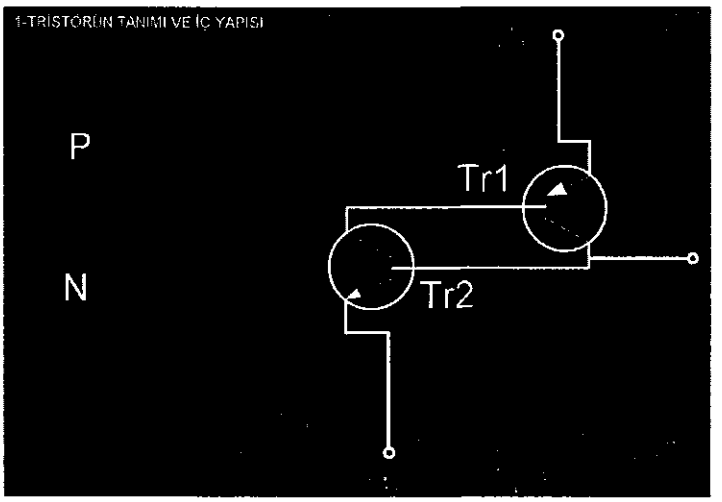


Typical transistor packages

Semi-conductive materials are what make the transistor possible. Most people are familiar with electrically conductive and non-conductive materials. Metals are typically thought of as being conductive. Materials such as wood, plastics, glass and

ceramics are non-conductive, or insulators. In the late 1940's a team of scientists working at Bell Labs in New Jersey, discovered how to take certain types of crystals and use them as electronic control devices by exploiting their semi-conductive properties. Most non-metallic crystalline structures would typically be considered insulators. But by forcing crystals of germanium or silicon to grow with impurities such as boron or phosphorus, the crystals gain entirely different electrical conductive properties. By sandwiching this material between two conductive plates (the emitter and the collector), a transistor is made. By applying current to the semi-conductive material (base), electrons gather until an effectual conduit is formed allowing electricity to pass The scientists that were responsible for the invention of the transistor were John Bardeen, Walter Brattain, and William Shockley. Their Patent was called: "Three Electrode Circuit Element Utilizing Semiconductive Materials."

UNIT 4. HOW DOES A THYRISTOR WORK



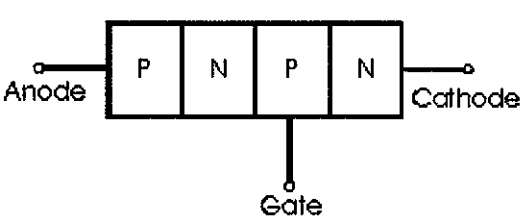
4.1. What is a thyristor?

Thyristors or silicon controlled rectifiers (SCR) as they are sometimes known may appear to be unusual electronics components in many ways, but they are particularly useful for controlling power circuits. As such these electronics components are often used for applications such as light dimmers, and there may be thyristor circuits used in many power supply applications. Thyristors are simple to use and cheap to buy and often thyristor circuits are easy to build and use. All these reasons make thyristors ideal components to consider for many applications.

The idea for the thyristor is not new. The idea for the device was first put forward in 1950 by William Shockley, one of the inventors of the transistor. Although some later investigation of the device was undertaken by others a couple of years later, it was not until the early 1960s when they became available. After the introduction of the thyristor, they soon became popular for power supply circuits.

4.2. Structure Of A Thyristor Or Silicon Controlled Rectifier (Scr)

The thyristor may be considered a rather an unusual form of electronics component because it consists of four layers of differently doped silicon rather than the three layers of the conventional bipolar transistors. Whereas conventional transistors may have a p-n-p or n-p-n structure with the electrodes named collector, base and emitter, the thyristor has a p-n-p-n structure with the outer layers with their electrodes referred to as the anode (n-type) and the cathode (p-type). The control terminal of the SCR is named the gate and it is connected to the p-type layer that adjoins the cathode layer.



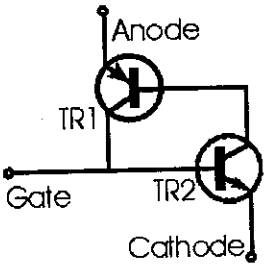
Thyristors are usually manufactured from silicon, although, in theory other types of semiconductor could be used. The first reason for using silicon for thyistors is that silicon is the ideal choice because of its overall properties. It is able to handle the voltage and currents required for high power applications. Additionally it has good thermal properties. The second major reason is that silicon technology is well

established and it is widely used for a variety of semiconductor electronics components. As a result it is very cheap and easy for semiconductor manufacturers to use.

4.3. How does a thyristor work?

The way in which a thyristor operates is different to other devices. Normally no current flows across the device. However if a supply is connected across the device, and a small amount of current is injected into the gate, then the device will "fire" and conduct. It will remain in the conducting state until the supply is removed.

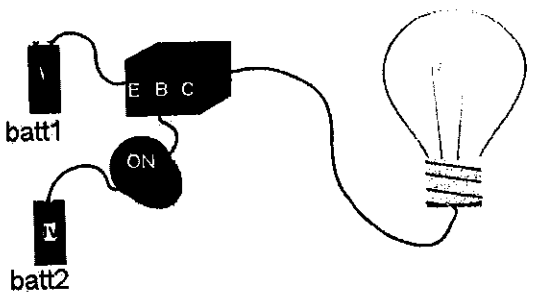
To see how the thyristor operates, it is worth looking at a thyristor equivalent circuit. For the sake of an explanation, the thyristor circuit can be considered as two back to back transistors. The first transistor with its emitter connected to the cathode of the thyristor is an n-p-n device, whereas a second transistor with its emitter connected to the anode of the thyristor, SCR is a p-n-p variety. The gate is connected to the base of the n-p-n transistor as shown below.



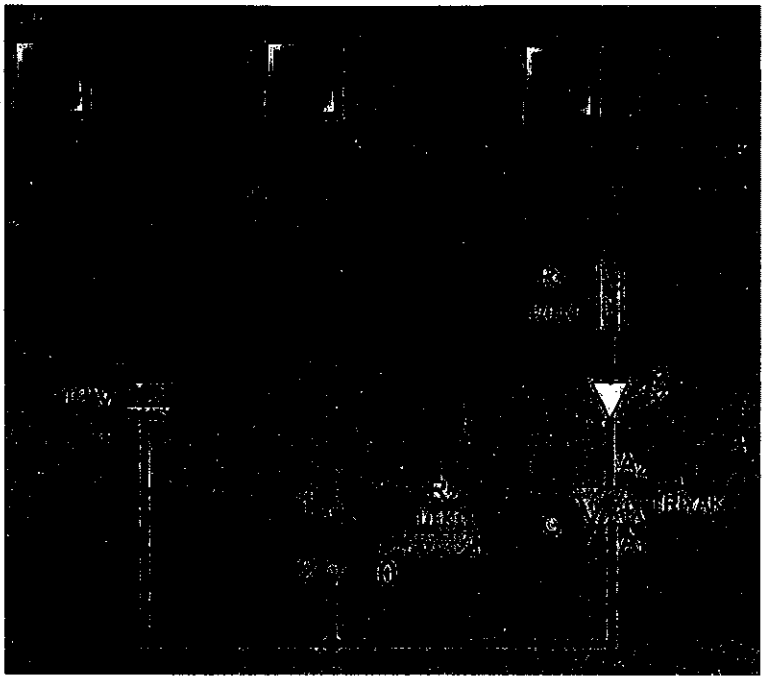
4.4. Thyristor Equivalent Circuit

When a voltage is applied across a thyristor no current flows because neither transistor is conducting. As a result there is no complete path across the device. If a small current is passed through the gate electrode, this will turn "on" the transistor TR2. When this occurs it will cause the collector of TR2 to fall towards the voltage on the emitter, i.e. the cathode of the whole device. When this occurs it will cause current to flow through the base of TR1 and turn this transistor "on". Again this will now try to pull the voltage on the collector of TR1 towards its emitter voltage. This will cause current to flow in the emitter of TR2, causing its "on" state to be maintained. In this way it only requires a small trigger pulse on the gate to turn the thyristor on. Once switched on, the thyristor can only be turned off by removing the supply voltage.

It can be seen that current will only flow in one direction through the thyristor. If a reverse voltage is applied, then no current will flow, even if some gate current is applied. In this way for thyristor circuits used for AC, operation only occurs over one half of the AC waveform. For the other half of the cycle the device remains inoperative and no current can flow.

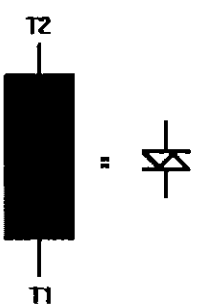


UNIT 5. DIAC AND TRIAC



One of the drawbacks of all of the four-layer diodes is that they all require a dc voltage of the correct polarity in order to operate. It would be nice if we could have some sort of SCR that works for either polarity, so it can be used with an applied ac voltage.

Now, we created the four-layer devices by essentially connecting two transistors back to back in a single silicon crystal. Can we extend this concept and connect two SCRs back to back?



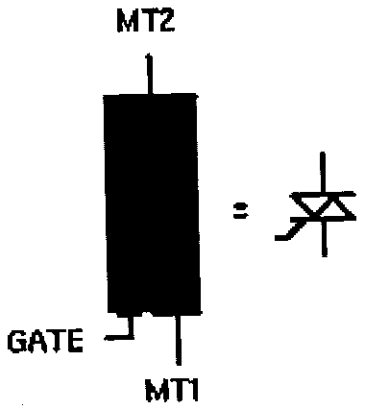
The diagram to the right shows the resulting *five*-layer device, which is known as a *diac*. At first glance, it seems unreasonable or even impossible, considering that each connection to the semiconductor crystal overlaps a pn junction. However, the device does work, and indeed works well.

The terms *anode* and *cathode* no longer apply, so the connections are simply named *terminal 1 (T1)* and *terminal 2 (T2)*. Each terminal can serve as either anode or cathode, according to the polarity of the applied voltage.

That same applied polarity also determines which of the end junctions is active, and which one is bypassed. Thus, if T1 is positive with respect to T2, T1's N-type region is ignored (electrons are pulled away from that junction) and its P-type region

serves as the anode. At the same time, the relative negative voltage at T2 pulls holes from the P-type region towards the terminal (removing them from the next junction), but tends to push electrons from its N-type region across that junction into the P-type region, thus making them available for conduction.

The diac, like the four-layer diode, remains non-conducting until its breakover voltage is reached, at which point it turns on fully and remains on until the applied voltage or circuit current are reduced below the holding values at which conduction can be maintained. Since the diac is normally used in ac circuits, operating as part of the control circuit for devices powered from a household wall socket or similar source, this is not a problem. In such applications, the diac is triggered each half-cycle of ac power, and then turns off at the end of the half-cycle when the line voltage reverses polarity.



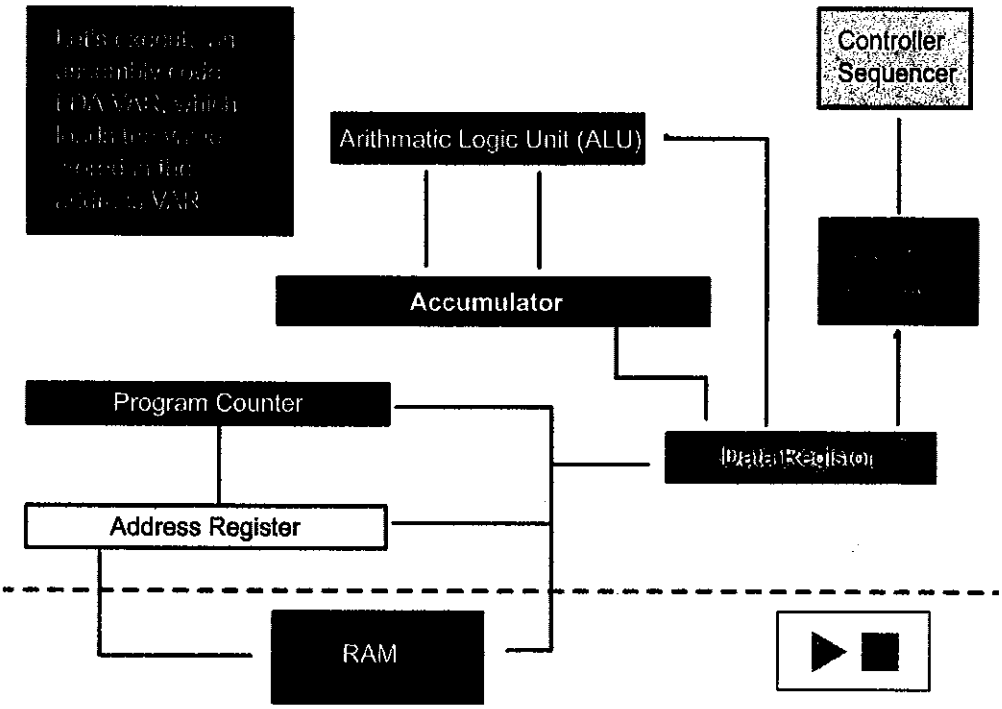
The drawback of the diac is the same as it was for the four-layer diode: it cannot be triggered at just any point in the ac power cycle; it triggers at its preset breakover voltage only. If we could add a gate to the diac, we could have variable control of the trigger point, and therefore a greater degree of control over just how much power will be applied to the line-powered device.

The figure to the right shows the result. This device is known as a *triac*. Here, the main connections are simply named *main terminal 1 (MT1)* and *main terminal 2 (MT2)*. The gate designation still applies, and is still used as it was with the SCR.

The useful feature of the triac is that it not only carries current in either direction, but the gate trigger pulse can be either polarity regardless of the polarity of the main applied voltage. The gate can inject either free electrons or holes into the body of the triac to trigger conduction either way. For this reason, you may see the triac referred to as a "four-quadrant" device.

As with the diac, the triac is used in an ac environment, so it will always turn off when the applied voltage reaches zero at the end of the current half-cycle. If we apply a turn-on pulse at some controllable point after the start of each half cycle, we can directly control what percentage of that half-cycle gets applied to the load, which is typically connected in series with MT2. This makes the triac an ideal candidate for light dimmer controls and motor speed controls. This is a common application for triacs.

UNIT 6. HOW A MICROPROCESSOR WORK



6.1. History

A microprocessor - also known as a CPU or Central Processing Unit - is a complete computation engine that is fabricated on a single chip. The first microprocessor was the Intel 4004, introduced in 1971. The 4004 was not very powerful - all it could do was add and subtract, and it could only do that four bits at a time. But it was amazing that everything was on one chip. Prior to the 4004, engineers built computers either from collections of chips or from discrete components (transistors wired one at a time). The 4004 powered one of the first portable electronic calculators.

The first microprocessor to make it into a home computer was the Intel 8080, a complete 8-bit computer on one chip introduced in 1974. The first microprocessor to make a real splash in the market was the Intel 8088, introduced in 1979 and incorporated into the IBM PC (which first appeared in 1982 or so). If you are familiar with the PC market and its history, you know that the PC market moved from the 8088 to the 80286 to the 80386 to the 80486 to the Pentium to the Pentium-II to the new Pentium-III. All of these microprocessors are made by Intel and all of them are improvements on the basic design of the 8088. The new Pentiums-IIIs can execute any piece of code that ran on the original 8088, but the Pentium-III runs about 3,000 times faster!

6.2. What is a chip?

A chip is also called an integrated circuit. Generally it is a small, thin piece of silicon onto which the transistors making up the microprocessor have been etched. A chip might be as large as an inch on a side and can contain as many as 10 million transistors. Simpler processors might consist of a few thousand transistors etched onto

a chip just a few millimeters square. See How Silicon Chips Are Made for details on how transistors are fabricated on silicon.

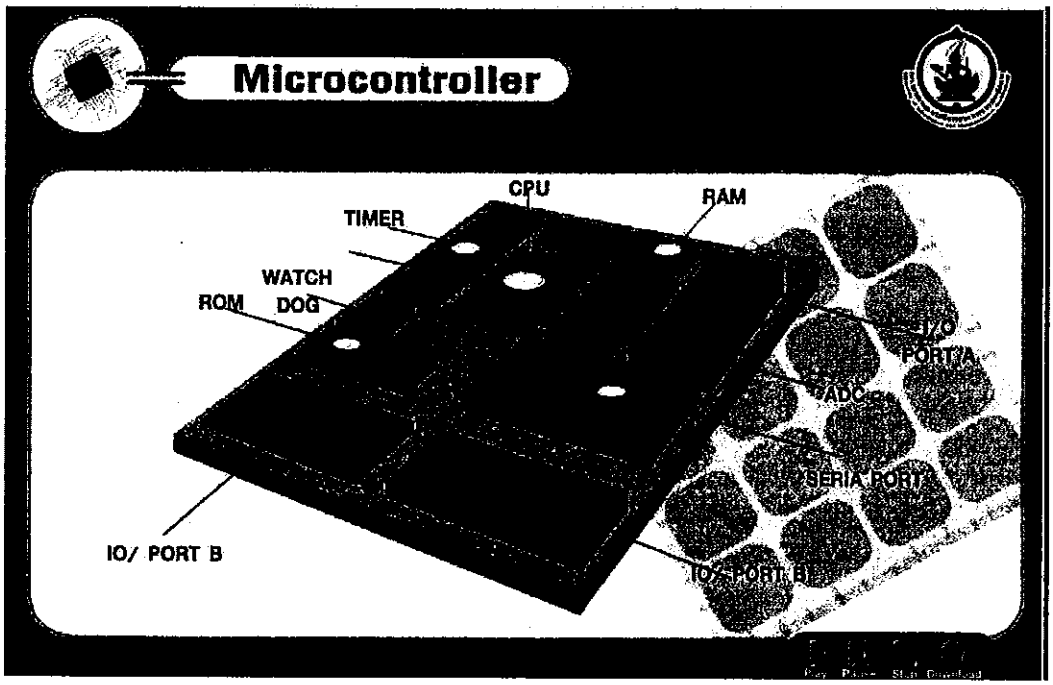
6.3. Inside A Microprocessor

To understand how a microprocessor works, it is helpful to look inside and learn about the logic used to create one. In the process you can also learn about assembly language - the native language of a microprocessor - and many of the things that engineers can do to boost the speed of a processor.

A microprocessor executes a collection of machine instructions that tell the processor what to do. Based on the instructions, a microprocessor does three basic things:

- Using its ALU (Arithmetic/Logic Unit), a microprocessor can perform mathematical operations like addition, subtraction, multiplication and division. Modern microprocessors contain complete floating point processors that can perform extremely sophisticated operations on large floating point numbers.
- A microprocessor can move data from one memory location to another
- A microprocessor can make decisions and jump to a new set of instructions based on those decisions.

UNIT 7. HOW A MICROCONTROLLER WORK



A microcontroller is a computer. All computers -- whether we are talking about a personal desktop computer or a large mainframe computer or a microcontroller -- have several things in common:

All computers have a CPU (central processing unit) that executes programs. If you are sitting at a desktop computer right now reading this article, the CPU in that machine is executing a program that implements the Web browser that is displaying this page.

The CPU loads the program from somewhere. On your desktop machine, the browser program is loaded from the hard disk.

The computer has some RAM (random-access memory) where it can store "variables."

And the computer has some input and output devices so it can talk to people. On your desktop machine, the keyboard and mouse are input devices and the monitor and printer are output devices. A hard disk is an I/O device -- it handles both input and output.

The desktop computer you are using is a "general purpose computer" that can run any of thousands of programs. Microcontrollers are "special purpose computers." Microcontrollers do one thing well. There are a number of other common characteristics that define microcontrollers. If a computer matches a majority of these characteristics, then you can call it a "microcontroller":

Microcontrollers are "embedded" inside some other device (often a consumer product) so that they can control the features or actions of the product. Another name for a microcontroller, therefore, is "embedded controller."

Microcontrollers are dedicated to one task and run one specific program. The program is stored in ROM (read-only memory) and generally does not change.

Microcontrollers are often low-power devices. A desktop computer is almost always plugged into a wall socket and might consume 50 watts of electricity. A battery-operated microcontroller might consume 50 milliwatts.

A microcontroller has a dedicated input device and often (but not always) has a small LED or LCD display for output. A microcontroller also takes input from the device it is controlling and controls the device by sending signals to different components in the device.

For example, the microcontroller inside a TV takes input from the remote control and displays output on the TV screen. The controller controls the channel selector, the speaker system and certain adjustments on the picture tube electronics such as tint and brightness. The engine controller in a car takes input from sensors such as the oxygen and knock sensors and controls things like fuel mix and spark plug timing. A microwave oven controller takes input from a keypad, displays output on an LCD display and controls a relay that turns the microwave generator on and off.

A microcontroller is often small and low cost. The components are chosen to minimize size and to be as inexpensive as possible.

A microcontroller is often, but not always, ruggedized in some way.

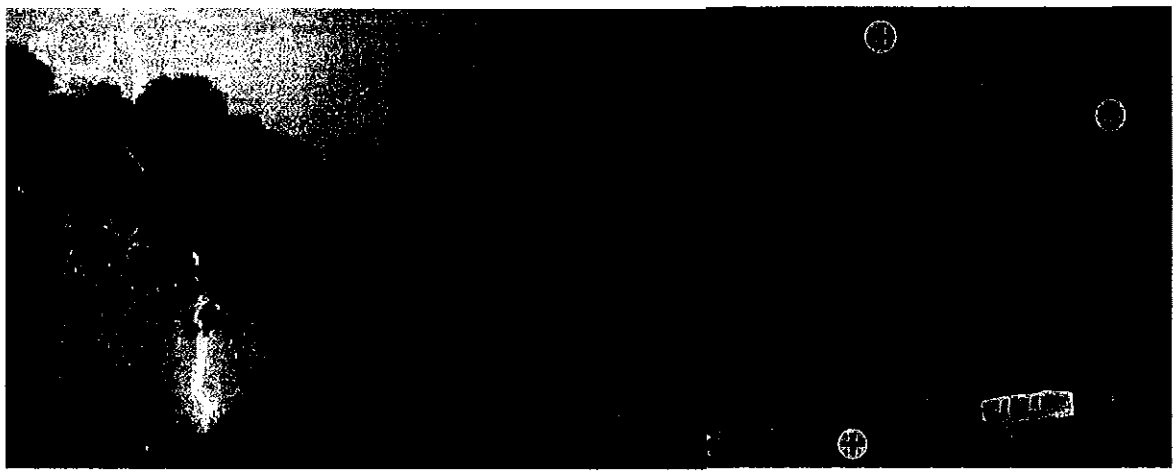
The microcontroller controlling a car's engine, for example, has to work in temperature extremes that a normal computer generally cannot handle. A car's microcontroller in Alaska has to work fine in -30 degree F (-34 C) weather, while the same microcontroller in Nevada might be operating at 120 degrees F (49 C). When you add the heat naturally generated by the engine, the temperature can go as high as 150 or 180 degrees F (65-80 C) in the engine compartment.

On the other hand, a microcontroller embedded inside a VCR hasn't been ruggedized at all.

The actual processor used to implement a microcontroller can vary widely. For example, the cell phone shown on Inside a Digital Cell Phone contains a Z-80 processor. The Z-80 is an 8-bit microprocessor developed in the 1970s and originally used in home computers of the time. The Garmin GPS shown in How GPS Receivers Work contains a low-power version of the Intel 80386, I am told. The 80386 was originally used in desktop computers.

In many products, such as microwave ovens, the demand on the CPU is fairly low and price is an important consideration. In these cases, manufacturers turn to dedicated microcontroller chips -- chips that were originally designed to be low-cost, small, low-power, embedded CPUs. The Motorola 6811 and Intel 8051 are both good examples of such chips. There is also a line of popular controllers called "PIC microcontrollers" created by a company called Microchip. By today's standards, these CPUs are incredibly minimalistic; but they are extremely inexpensive when purchased in large quantities and can often meet the needs of a device's designer with just one chip.

UNIT 8. HOW A LIGHTNING WORK?



While lightning occurs instantaneously, it also takes place over several steps. Cloud-to-ground lightning typically initiates inside the thundercloud. While lightning occurs instantaneously, it also takes place over several steps. Cloud-to-ground lightning typically initiates inside the thundercloud.

Inside the cloud, water droplets collide with ice particles. The friction causes rising droplets to become positively charged and the falling ice particles to become negatively charged. This generates an electric field within the cloud, with the top having a positive charge and the bottom having a negative charge. An electric field is also generated between the bottom of the cloud and the surface of the Earth.

When the bottom of the cloud is charged enough, a charged channel, called the stepped leader, emerges from the cloud. It propagates towards the ground in a series of steps where it "looks" around for a target. If none is "seen", it takes another step, and repeats the process until it "finds" a target. The stepped leader's negative electric field repels all negative charge in the ground. This induces an upward moving positive charge from the ground. When this positive charge is concentrated enough, it forms bolts of ground-to-air lightning known as streamers.

When a streamer contacts a leader, its electric potential is connected to the ground. All other branches of the leader channel start flowing through the newly established ground/cloud connection. An electric current wave then propagates up the channel as a bright pulse.

The air around lightning is heated to as much as 50,000°F. When air molecules are heated, they expand. But when air is heated that much in less than a second, its expansion rate exceeds the speed of sound, and a sonic boom (thunder) results.

UNIT 9. HOW DOES A TRANSFORMERS WORK?

By raising and lowering voltage levels, transformers make power systems versatile

When alternating current (AC) prevailed over direct current (DC) in the late 1800s, one of the deciding factors was the need for voltage levels to be raised and lowered throughout the power system to make the system efficient and safe. There is no simple way of changing DC voltage levels. Because of its time-varying magnetic field, the AC system allows the use of the transformer to change voltage levels as needed.

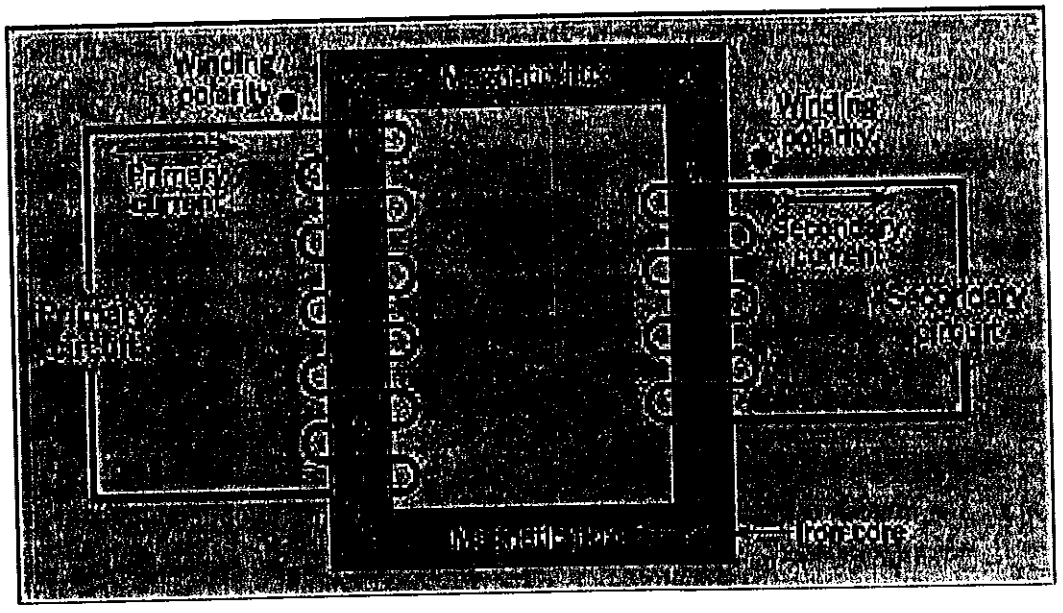
A transformer is an electrical device used to convert AC power at a certain voltage level to AC power at a different voltage, but at the same frequency.

How transformers work.

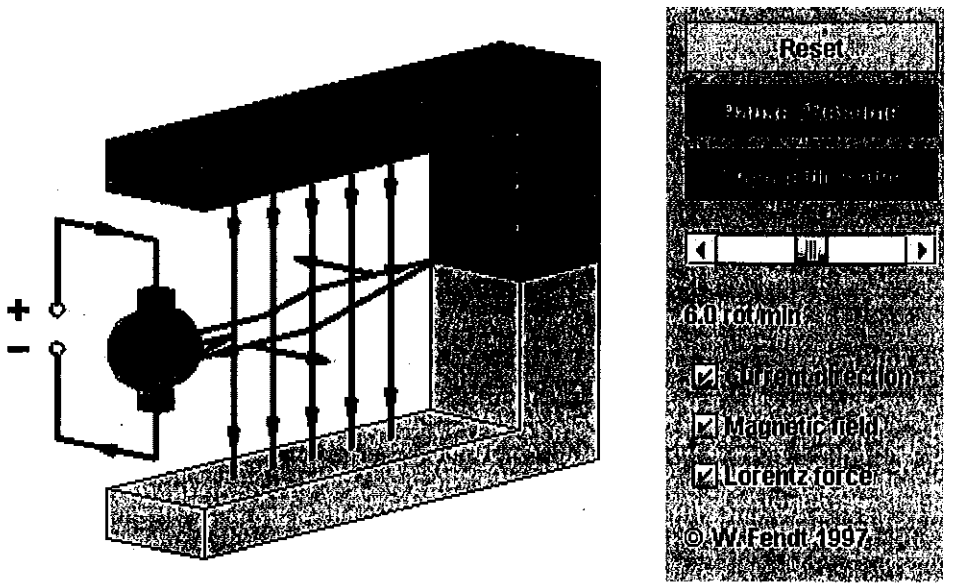
A basic transformer consists of two sets of coils or windings. Each set of windings is simply an inductor. AC voltage is applied to one of the windings, called the primary winding. The other winding, called the secondary winding, is positioned in close proximity to the primary winding, but is electrically isolated from it.

The alternating current that flows through the primary winding establishes a time-varying magnetic flux, some of which links to the secondary winding and induces a voltage across it. The magnitude of this voltage is proportional to the ratio of the number of turns on the primary winding to the number of turns on the secondary winding. This is known as the "turns ratio."

To maximize flux linkage with the secondary circuit, an iron core is often used to provide a low-reluctance path for the magnetic flux. The polarity of the windings describes the direction in which the coils were wound onto the core. Polarity determines whether the flux produced by one winding is additive or subtractive with respect to the flux produced by another winding. A basic two-winding transformer is shown in the Figure below.



UNIT 10. DIRECT CURRENT ELECTRICAL MOTOR



This Java applet shows a direct current electrical motor which is reduced to the most important parts for clarity. Instead of an armature with many windings and iron nucleus there is only a single rectangular conductor loop; the axis the loop rotates on is omitted.

The red arrows indicate the conventional direction of current (from plus to minus). You can recognize the magnetic field lines (directed from the red painted north pole to the green painted south pole) by the blue color. The black arrows represent the Lorentz force which is exerted on a current-carrying conductor in the magnetic field.

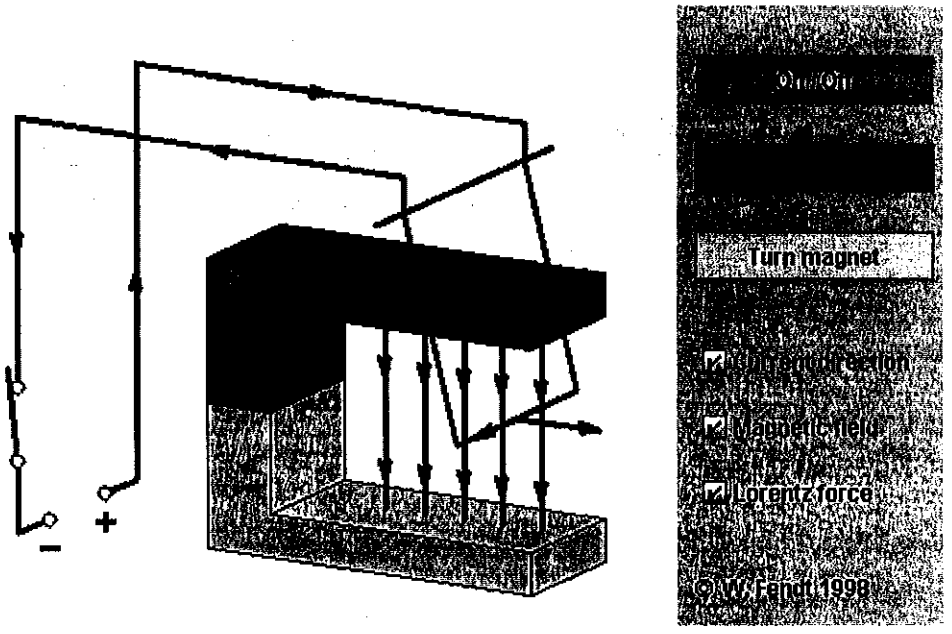
The mentioned Lorentz force is orthogonal to the direction of current and to the magnetic field lines. The orientation of this force results from the well-known three finger rule (for the right hand!):

Thumb: Conventional direction of current

Forefinger: Magnetic field

Middle finger: Lorentz force

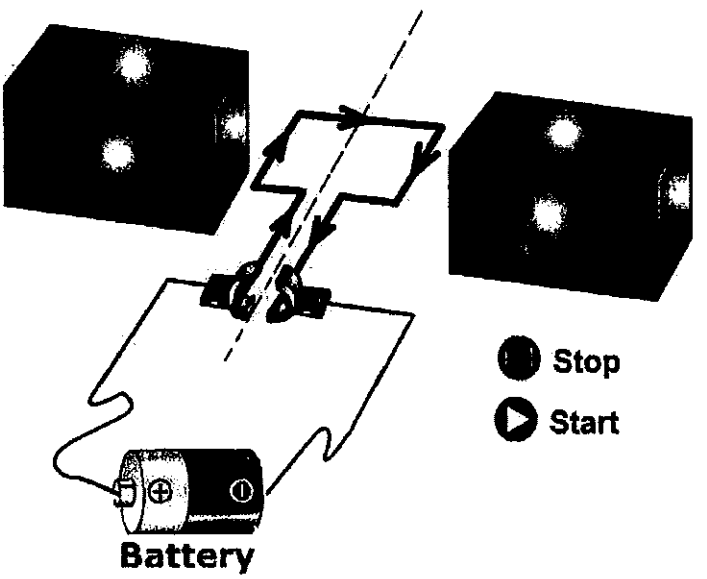
UNIT 11. LORENTZ FORCE



This Java applet demonstrates the Lorentz force, exerted on a current-carrying conductor swing in the magnetic field of a horseshoe magnet.

You can switch on (off) the current by using the upper button ("On / Off"). The other two buttons ("Reverse current" and "Turn magnet") make it possible to change the direction of the current respectively of the magnetic field. If the corresponding checkboxes are selected, the applet will indicate the conventional direction of current (red arrows), the magnetic field lines (blue) and the Lorentz force (black arrow).

UNIT 12. DC MOTOR BASICS



12.1. DC motor basics

DC motors are in countless consumer electronic devices from CD players to computers to radio-controlled airplanes. There are many different kinds of DC motors, but they all work on the same principle. They turn current into pulses of magnetism, which they use to turn a rotor. There are many different kinds of electric m

12.2. Introduction

An electric motor is a device that uses electricity to produce mechanical energy. The energy in an electric current causes the electric motor to spin. Any devices attached to the motor can then take advantage of this spinning motion to create another type of motion. Some motors are powered by direct current (DC), which is the more basic of the two main types of current.

12.3. Creating An Electromagnet

When electricity flows through a coiled wire, it produces a magnetic field. The coiled wire is then called an electromagnet. The electromagnet is the core of the electric motor. Like all magnets, it has a north pole and a south pole.

12.4. Turning The Electromagnet

In order to turn the electromagnet, it is placed between the arms of a horseshoe-shaped magnet. The north pole of the electromagnet is pulled towards the south pole of the horseshoe magnet, and the south pole of the electromagnet is pulled towards the north pole of the horseshoe magnet. Once the magnet is in this position, it will stop unless something else changes.

12.5. Spinning The Electromagnet

To enable the electromagnet to keep on spinning, a commutator is attached to the electromagnet. In a DC motor, the commutator alternates the direction in which the electric current flows into the coiled wire, thereby switching the north and south poles

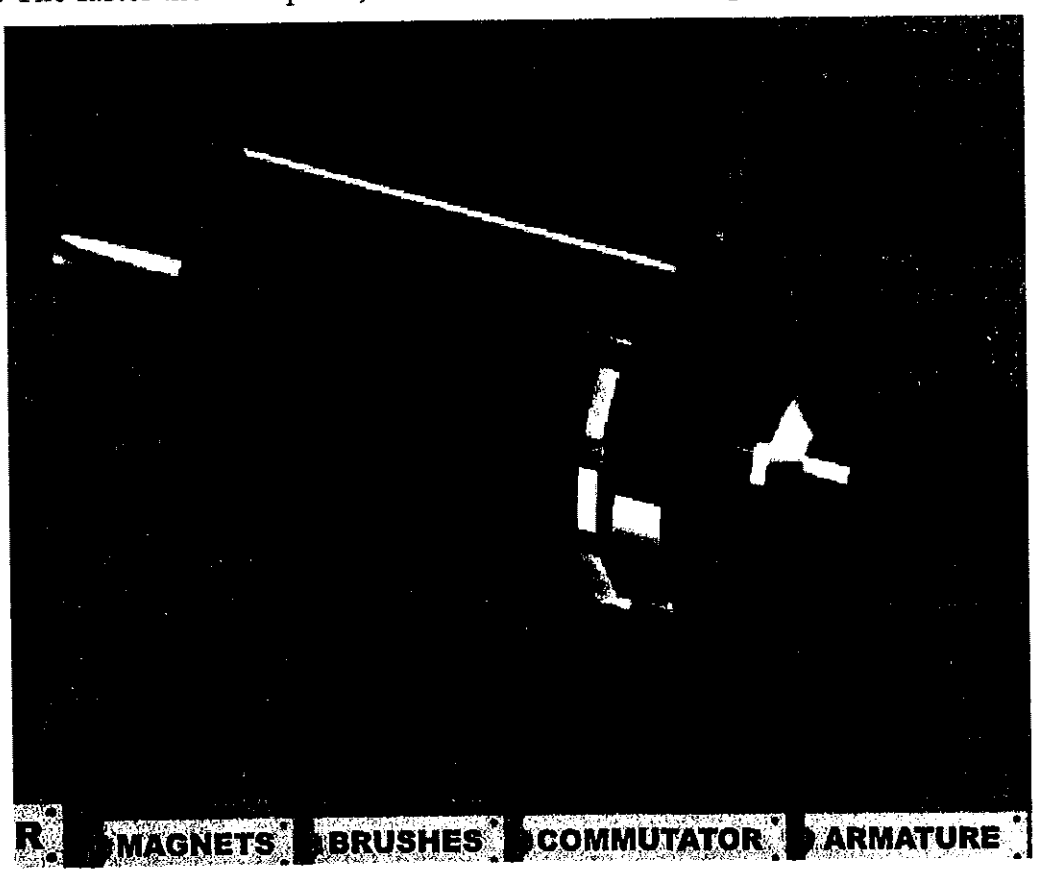
on the electromagnet every fraction of a second. Therefore, the electromagnet continues to spin. This motion causes the electromagnet to act as a motor, and the motion can be perpetuated to electric devices

12.6. Brushed Dc Motors

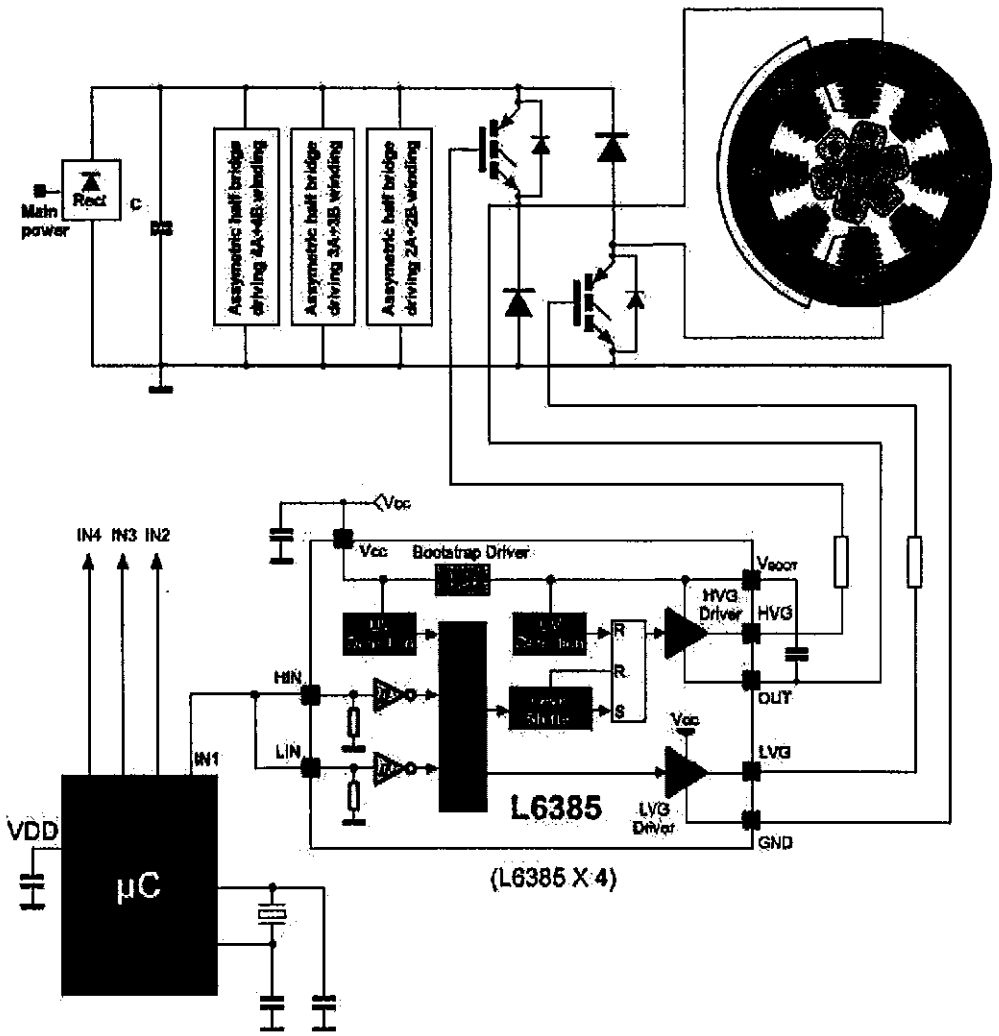
Brushed DC Motors have two coils of wire around a rotor in the middle. Surrounding the coil are two magnets, both facing in the same direction. When the coils are facing the magnets, electricity flows into them. When electricity flows into a coil, it creates a magnetic field, and this magnetic field pushes the coils away from their magnets. As the rotor turns, the current shuts off. When the rotor has turned 180 degrees, each rotor faces the opposite magnet. The coils turn on again, this time with the electricity flowing in the opposite direction. This creates another pulse, pushing the rotor around again. The rotor has electric contacts on it, and there are small metal brushes that bump against the contacts. The brushes send in electricity, turning the motor on and off at the right times.

12.7. Brushless Dc Motors

Brushed motors work reasonably well, but they have a few drawbacks. The brushes create friction, slowing the motor and wasting energy. They also wear out. The brushes corrode or get worn away by friction from the rotor. Brushless motors solve both of these problems. A brushless motor has a permanent magnet on the inside of the rotor, facing so that its north and south poles are perpendicular to the axis of rotation. Around the rotor are coils. The coils work much like they do in a brushed motor. They give out timed pulses to push the magnet, spinning the rotor. Because there are no brushes, however, the motor can't control itself. Instead, it is attached to an electronic speed controller, which gives pulses of electricity at a certain speed to control the motor. The faster the coils pulse, the faster the motor will spin.



UNIT 13. BRUSHLESS DC MOTOR



Remarkable Flexibility

The electronic system allows smooth and accurate control of the translatory movement of small electric vehicles. The microcontroller connected to the power section (MOS,IGBT), allows control of substantial power levels within a small size unit and continuous monitoring of speed & torque even in the braking phase. The absence of brushes and magnets gives the motor a high degree of robustess, and above all, a service limited only by the life of the bearings.

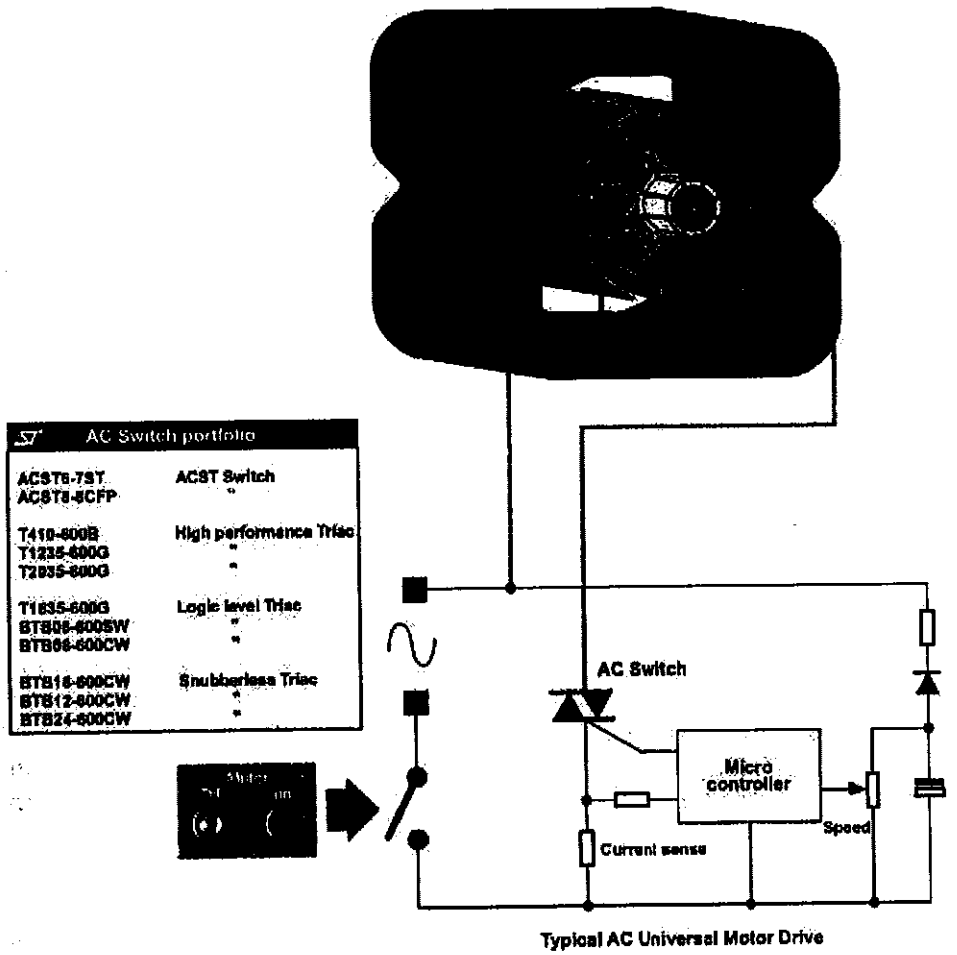
Its design also offers:

- Low inertia and high torque at low speed resulting in rapid starts.
- High rotational speeds.

The stator consists of steel lamination forming salient poles. A series of coil windings, independently connected in phase pairs, envelops the stator poles.

With no windings, the rotor is basically a piece of steel (and laminations) shaped to form salient poles. It is the only motor type with salient poles on both rotor and stator.

UNIT 14. UNIVERSAL MOTOR



Typical AC Universal Motor Drive

An universal motor can be used both on DC and AC source supply because his torque is insensitive to current direction. Close to the brush DC motor principle, an Universal motor is made of:

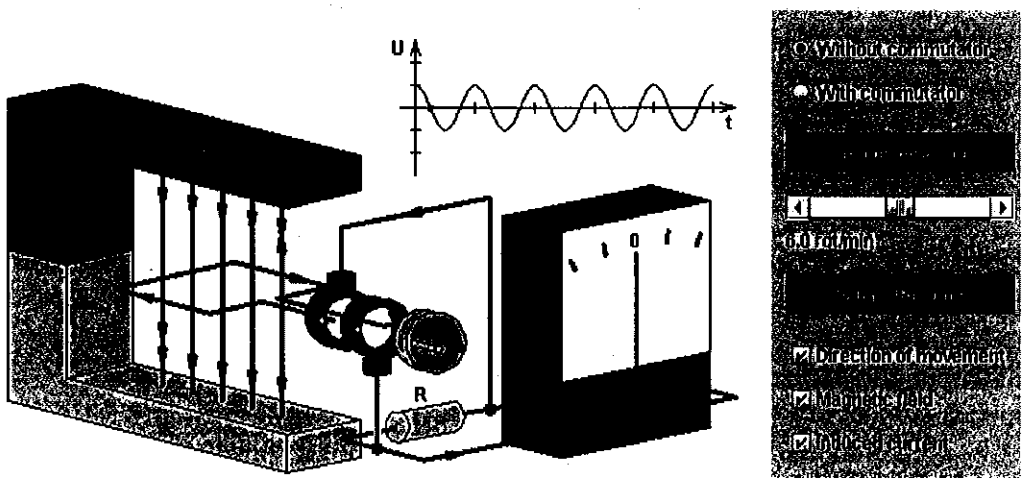
- A stator (field winding)
- A rotor or armature.

The stator carries the winding creates the flux in the magnetic circuit formed by the stator iron and the rotor iron separated by the air gap. The rotor carries a winding on its surface termed the armature in which the electromotive forces are induced.

The armature winding is supplied by a mechanical system formed by the collector on which brushes apply pressure. The collector is mounted on the same shaft as the armature and is connected to the armature winding.

The fixed brushes are connected to the armature terminals. The brush-collector assembly supplies the armature conductors in such a way that the current flows in one direction when they are under a North pole and in the other when they are under a South pole (depending of the instantaneous sinusoidal polarity in the AC application).

UNIT 15. GENERATOR

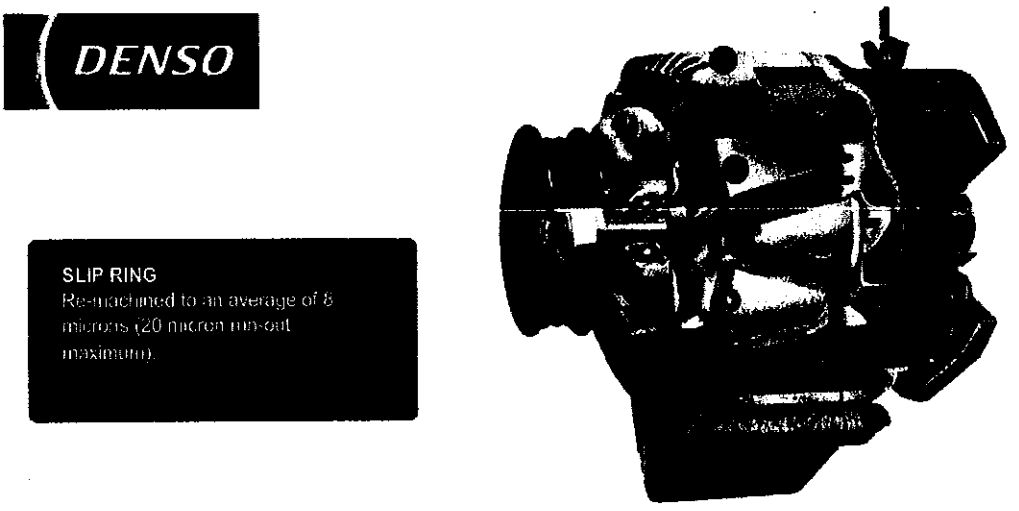


This Java applet simulates a generator which is reduced to the most important parts for clarity. Instead of an armature with many windings and iron nucleus there is only a single rectangular conductor loop; the axis the loop rotates on is omitted.

The radio buttons in the top right corner allow you to choose an AC generator (without commutator), or a DC generator (with commutator). You can change the direction of rotation by using the corresponding button. The sliding control makes it possible to vary the rotational speed. You can stop and continue the simulation with the button "Pause / Resume". This, however, does *not* mean a real stop of the movement, for in this case the induced voltage would be reduced to zero.

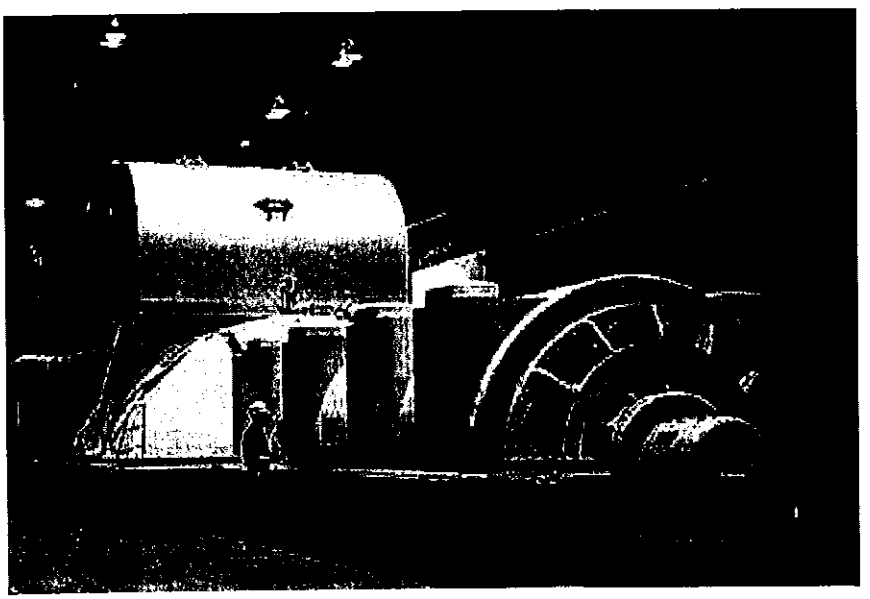
Two black arrows mark the momentary direction of movement. You can recognize the magnetic field lines (directed from the red painted north pole to the green painted south pole) by the blue color. The red arrows represent the direction of the induced current (conventional direction of current).

UNIT 16. ELECTRICAL GENERATOR



In electricity generation, an electrical generator is a device that converts mechanical energy to electrical energy, generally using electromagnetic induction. The reverse conversion of electrical energy into mechanical energy is done by a motor; motors and generators have many similarities.

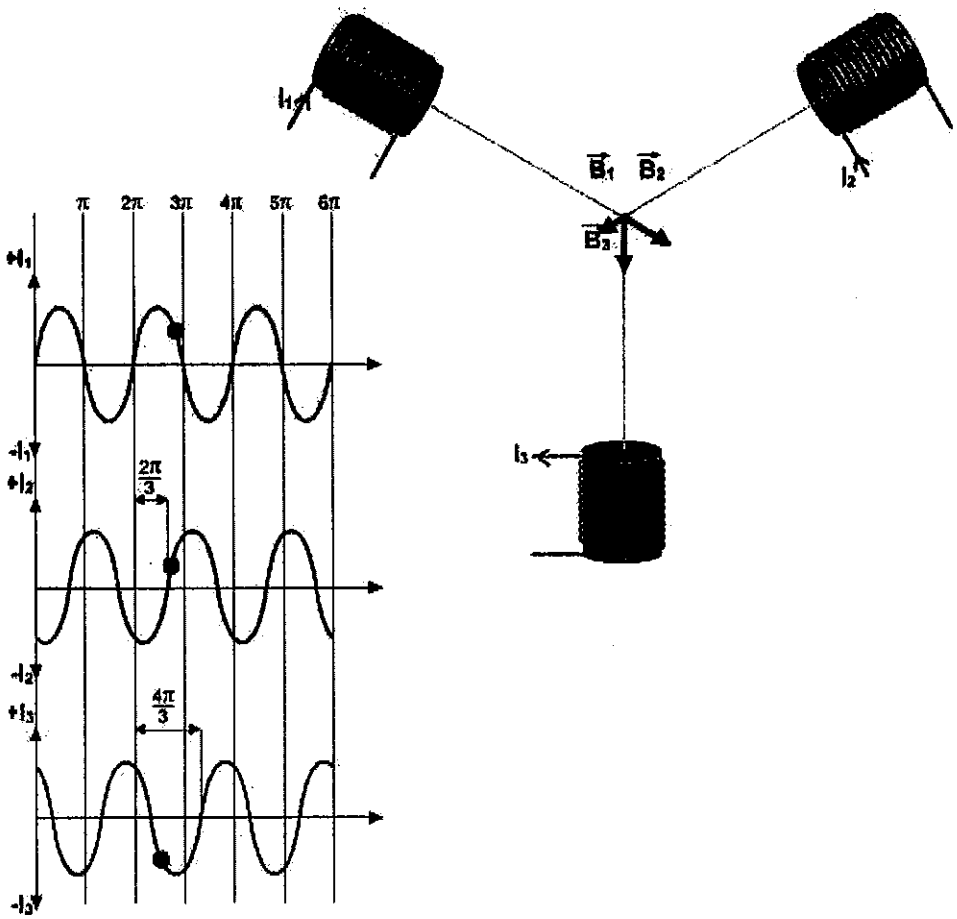
A generator forces electric charges to move through an external electrical circuit, but it does not create electricity or charge, which is already present in the wire of its windings. It is somewhat analogous to a water pump, which creates a flow of water but does not create the water inside. The source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, compressed air or any other source of mechanical energy.



NRC image of Modern Steam Turbine Generator

UNIT 17. THE ASYNCHRONOUS OR INDUCTION MOTOR

Three-phase motor rotating field



The asynchronous or induction motor is the most widely used electric motor in the industry and household appliances today. Its main advantage lies in its lack of sliding electric contacts, which leads to a simple rugged construction which is easy to manufacture and maintain. The power range is from few watts to several megawatts.

Electromagnetic induction occurs when a conductor cuts through a magnetic field. The magnetic field generates a lot of current in the conductor without physical contact.

There are 2 asynchronous motors:

- Three phase motor, mostly used in industry.
- Single phase motor widely used in home appliances.

In a simple speed three phase motor design, the standard stator has three windings, while a single phase motor typically has two windings. The stator is made up of a stack of round pre-punched laminations pressed into a frame which may be made of aluminum or cast iron.

The laminations are basically round with a round hole inside through which the rotor is positioned. The inner surface of the stator is made up of a number of deep slots or grooves right around the stator. It is into these slots that the windings are positioned.

The arrangement of the windings within the stator determines the number of poles that the motor has (multiples of 2). The stator of the three-phase asynchronous motor is analogous to that of synchronous machines. It has a three-phase winding directly connected to the motor's power supply. The asynchronous or induction motor is the most widely used electric motor in the industry and household appliances today.

Its main advantage lies in its lack of sliding electric contacts, which leads to a simple rugged construction which is easy to manufacture and maintain. The power range is from few watts to several megawatts.

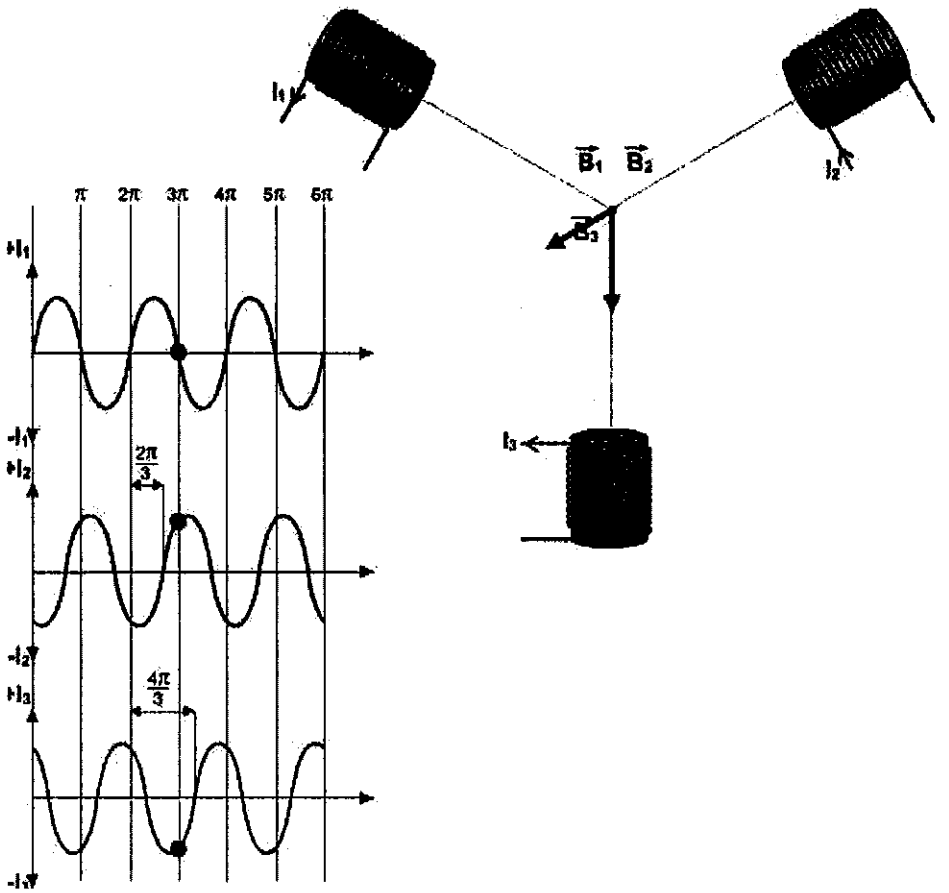
The rotor is cylindrical. It is built up of steel disks slotted around the periphery. A poly phase short-circuited winding is placed in the slots. The rotor winding is not, therefore connected to a supply; the rotor currents are induced currents, hence the name induction motor given to the asynchronous motor. Asynchronous motors have a cage rotor. A copper or aluminium bar is placed in each rotor slot. At each end of the rotor, the bars are connected by a circular conducting ring, hence the name squirrel cage. The current flowing in one bar returns through another bar at a angular distance of p/p (2p= number of poles).

The rotor can therefore be considered as a poly phase winding where the number of phases is equal to the number of pairs of bar in an angle equal to 2p/p. The stator field winding induces a current in the rotor that, in turn generates a magnetic field. The interplay between the magnetic fields induced in the rotor and the magnetic field of the stator, which varies with the AC current, forces the rotor to spin. The number of poles in the stator, along with the frequency of the AC current (50Hz), determines the speed at which the magnetic field attempts to spin the rotor (synchronous speed).

In theory, a 2 pole motor rotates one complete revolution each AC cycles or 3000 rpm. However, the actual speed of a typical induction motor lags behind the synchronous speed. Called slip, this accounts for a real speed about 2850 rpm for the above synchronous speed. The rotor is cylindrical. It is built up of steel disks slotted around the periphery. A poly-phase short-circuited winding is placed in the slots. The rotor winding is not, therefore connected to a supply; the rotor currents are induced currents, hence the name induction motor given to the asynchronous motor.

UNIT 18. THE SYNCHRONOUS MOTOR

Three-phase motor rotating field



The synchronous motor comprises a stator and a rotor.

The various type of three-phase AC machines all have the same type of stator; it is the rotor which is different. The magnetic circuit of the stator comprises sheet disks with slots on the inside. Lamination of these disks produces slots parallel to the machine shaft: the windings are run in these slots. The synchronous motors have the characteristic of constant speed between no load and full load.

The other advantages are:

- High speed
- High torque at start
- Capable of correcting the low power factor of an inductive load when they are operated under certain conditions.

The synchronous motors may be designed as either single-phase or multi-phase machines, but 3-phases machines are mostly used in the industry. The discussion that follows is based on a 3-phase design.

The common rotor is energized with dc (acting as a magnet) but the last synchronous motor designs use magnets on the stator.

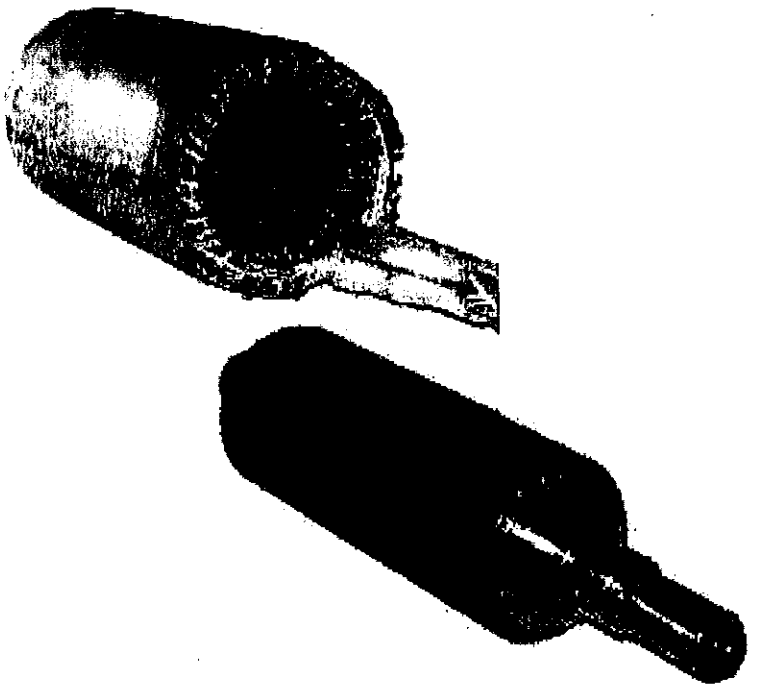
To understand how the synchronous motor works, assume that the application of three- phase ac power to the stator causes a rotating magnetic field to be set up around the stator asc it will see later

The strong rotating magnetic field attracts the strong rotor field. This results in a strong turning force on the rotor shaft. The rotor is therefore able to turn a load as it rotates in steps with the rotating magnetic field.

It works this way once it is started...!

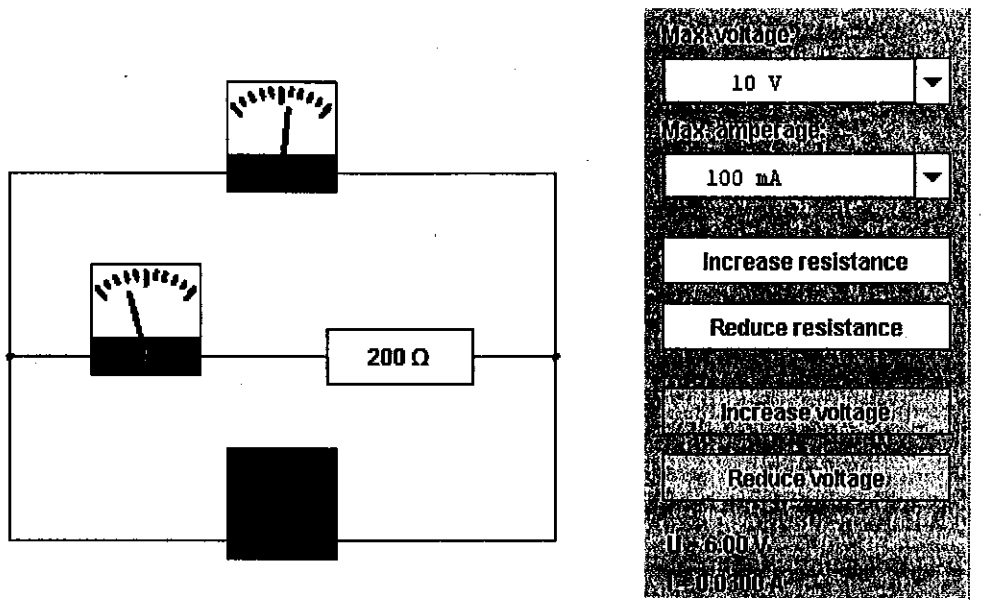
...However, one of the disadvantages of a synchronous motor is that it cannot be started from a standstill by applying 3-phase ac power to the stator.

When ac is applied to the stator, a high-speed rotating magnetic field appears immediately. this rotating field rushes past the rotor poles so quickly that the rotor does not have a chance to get started. In effect, the rotor is repelled first in one direction and then the other. A synchronous motor in its purest form has no starting torque. It has torque only when it is running at synchronous speed.



Typical synchronous motor using magnets on stator: 30KW at 12000 rpm

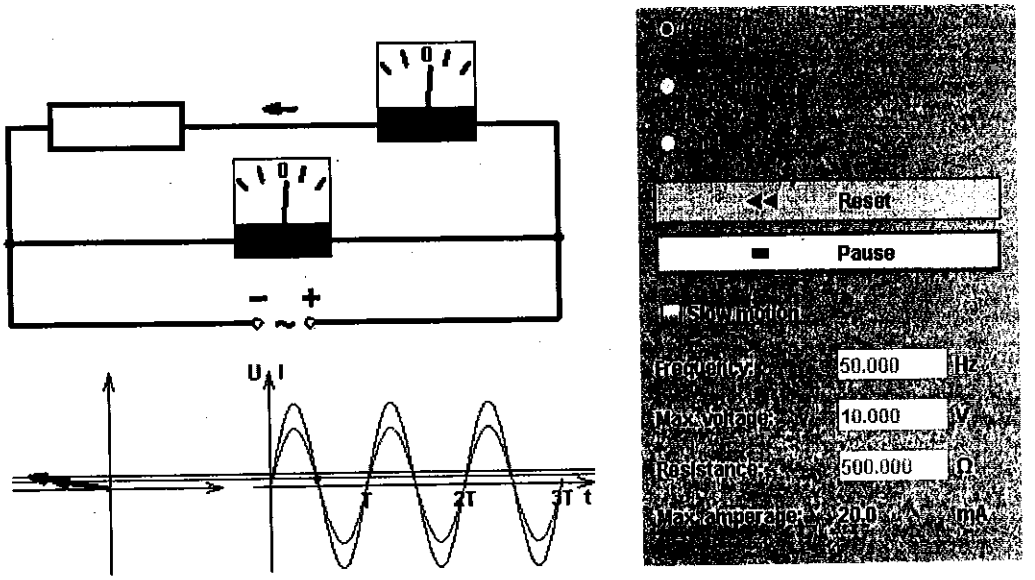
UNIT 19. OHM'S LAW



This applet shows a simple circuit containing one resistor. In addition there is a voltmeter (parallel to the resistor) and an ammeter (in series with the resistor).

You can select the maximum voltage and maximum amperage values tolerated by the meters by using the choose boxes. If you see the warning "Maximum exceeded!", you will have to choose an adequate measuring range. Resistance and voltage can be changed with the four buttons. The values of voltage (U) and amperage (I) are indicated on the bottom right.

UNIT 20. SIMPLE AC CIRCUITS



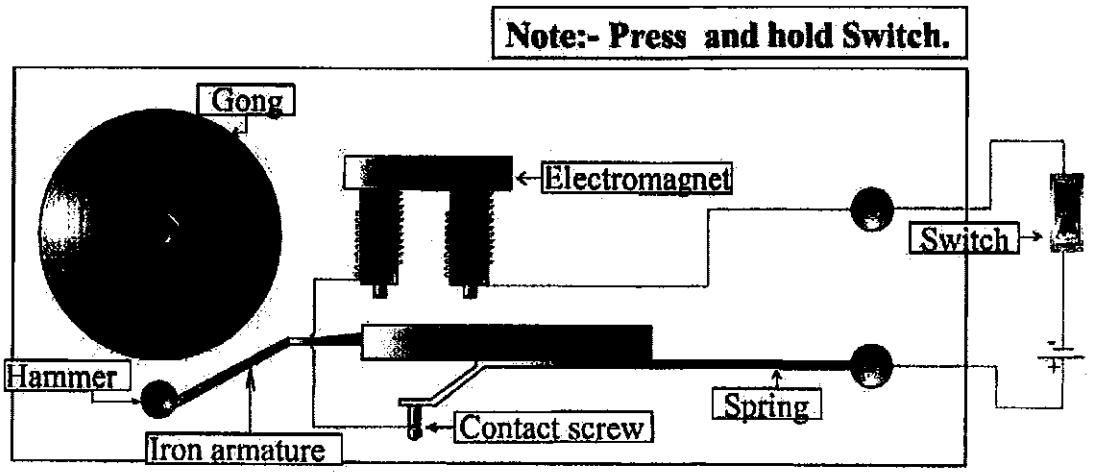
This Java applet shows a simple circuit consisting of an alternating voltage source and, depending on the selected radio button, a resistor (without inductivity), a capacitor or an ideal coil (without resistance). In addition there are meters for the voltage U (blue) and the amperage I (red).

Below the drawing of the circuit you see on the left a phasor diagram; it is possible to read the momentary oscillation phases from the position of the two phasors (voltage blue, amperage red). The projection of a phasor onto the vertical axis corresponds to the momentary value of U respectively I. On the bottom right the dependence of voltage and amperage on the time is illustrated in a diagram.

The "Reset" button brings the circuit to its initial state. You can start or stop and continue the simulation with the other button. If you choose the option "Slow motion", the movement will be five times slower.

It is possible to vary the preselected values of frequency, maximal voltage and resistance respectively capacity or inductivity. The program will indicate the new value of the maximal amperage.

UNIT 21. ELECTRIC BELL

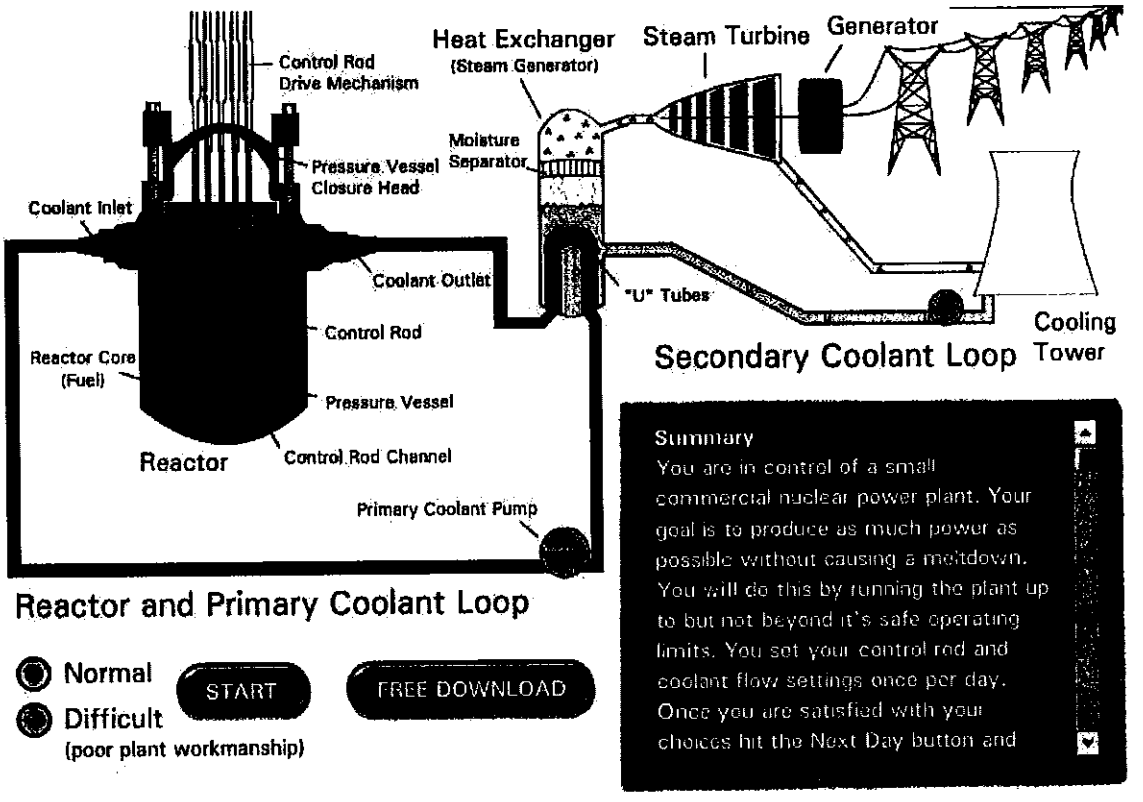


The working of an electric bell is based on the magnetic effect of electric current. The electric bell consists of a gong, an electromagnet, a soft iron rod (called armature) and a contact screw, arranged in an electrical circuit as shown in Figure.

Working Of An Electric Bell

- When current passes through the coil wound on the electromagnet, it acquires magnetism and attracts the armature.
- As the armature bends towards the electromagnet, the gong is struck. But at the same time the contact between the armature and the contact screw is lost and the circuit is broken.
- As the current stops, the electromagnet loses its magnetism and no longer attracts the armature.
- The armature is now pulled back by the spring action. As the armature touches the screw, the circuit is completed, the cycle repeats and the gong is struck once again. Due to this alternate making and breaking of the electrical circuit which takes place rapidly, the bell goes on ringing continuously, so long as the switch is closed.

UNIT 22. HOW A NUCLEAR POWER PLANT WORK



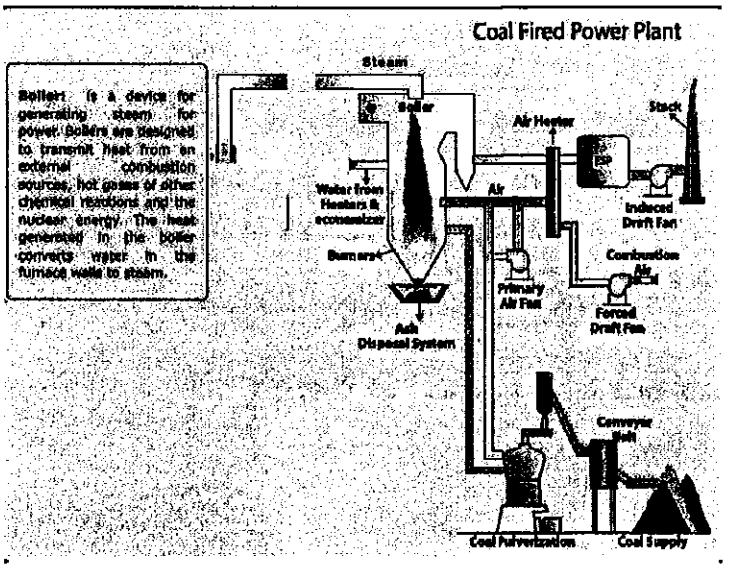
How A Nuclear Power Plant Works

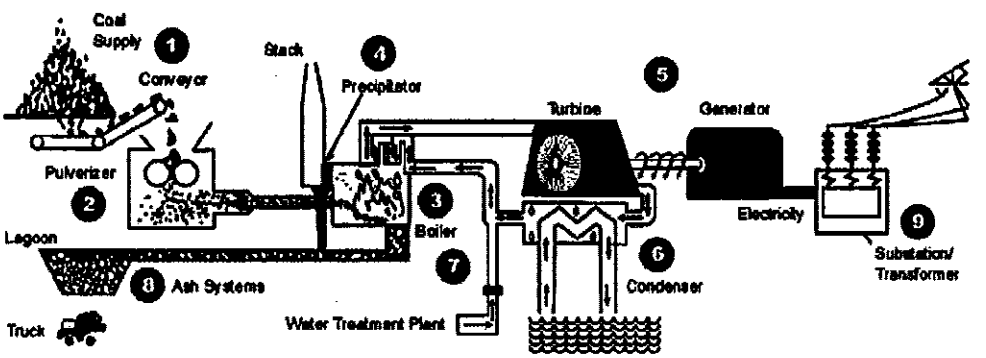
Nuclear power plants run on uranium fuel. In the reactor, uranium atoms are split through a process known as fission. When atoms are spilt, they produce a large amount of energy that is then converted to heat. The heat boils water, creating steam that is used to turn turbines, which spins the shaft of a generator. Inside the generator, coils of wire spin in a magnetic field and electricity is produced.

Nuclear power plants in the United States use two types of reactors to achieve this process: boiling water reactors and pressurized water reactors.

Pressurized Water Reactors (PWR) keep water under pressure, so the water heats but does not boil. The heated pressurized water is run through pipes, which heat a separate water line to create steam. The water to generate steam is never mixed with the pressurized water used to heat it.

UNIT 23. HOW A COAL FIRED POWER PLANT WORK





23.1. Coal supply

- Coal from the mine is delivered to the coal hopper, where it is crushed to five centimetres (2 inches) in size.
- The coal is processed and delivered by a conveyor belt to the generating plant.

23.2. Pulverizer

- The coal is then pulverized, or crushed, to a fine powder, mixed with air and blown into the boiler, or furnace for combustion.

23.3. Boiler

- The coal / air mixture ignites instantly in the boiler.
- Millions of litres of purified water are pumped through tubes inside the boiler.
- Intense heat from the burning coal turns the purified water in the boiler tubes into steam, which spins the turbine (see number four) to create electricity.

23.4. Precipitator, stack

- Burning coal produces carbon dioxide (CO2), sulphur dioxide (SO2) and nitrogen oxides (NOx).
- These gases are vented from the boiler.
- Bottom ash, which is made of coarse fragments that fall to the bottom of the boiler, is removed.

- Fly ash, which is very light, exits the boiler along with the hot gases.
- An electrostatic precipitator (a huge air filter) removes 99.4 per cent of fly ash before the flue gases are dispersed into the atmosphere.

23.5. Turbine, generator

- Water in the boiler tubes picks up heat from the boiler and turns into steam.
- The high-pressure steam from the boiler passes into the turbine (a massive drum with thousands of propeller blades).
- Once the steam hits the turbine blades, it causes the turbine to spin rapidly.
- The spinning turbine causes a shaft to turn inside the generator, creating an electric current.

23.6. Condensers and the cooling water system

- Cooling water is drawn into the plant and circulated through condensers, which cools steam discharged from the turbine.
- Steam from the turbine also passes through the condensers in separate pipes from cooling water.
- The cold water is warmed by the steam, which condenses back into pure water and circulates back to the boiler to begin the process of generating electricity again.
- Cooling water, now warm from the heat exchange in the condensers, is released from the plant.

23.7. Water treatment plant: water purification

- To reduce corrosion, water must be purified for use in the boiler tubes.
- Other wastewater systems within the plant collect water used to clean pipes and other equipment, and sludge from the water purification process and other processes.
- Waste water is pumped out of the plant and into the holding ponds.

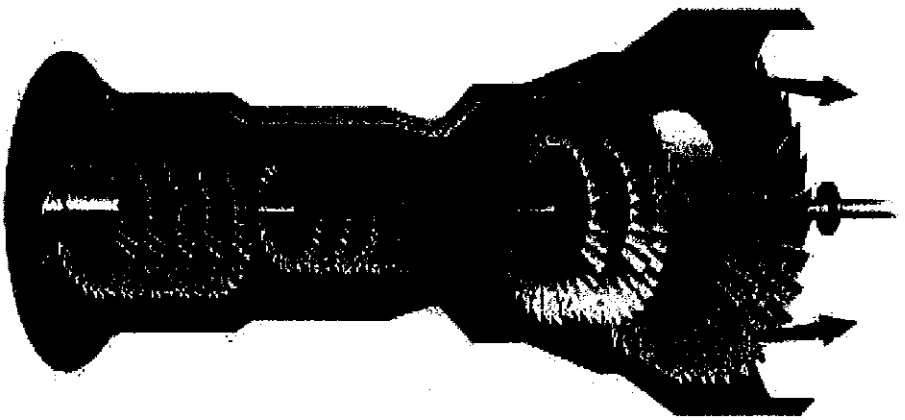
23.8. Precipitator, ash systems

- Ash that builds up on the precipitator's plates is vibrated off and collected in large hoppers or bins.
- Fly ash and bottom ash are removed from the plants and hauled to disposal sites or ash lagoons.
- Depending on the market demand, fly ash produced from TransAlta's three plants is sold to the cement industry for construction.

23.9. Substation, transformer, transmission lines

- Once the electricity is generated, transformers increase the voltage so it can be carried across the transmission lines.
- Once electricity is delivered to substations in cities and towns, the voltage flowing into the distribution lines is reduced, and then reduced again to distribute electricity to customers.

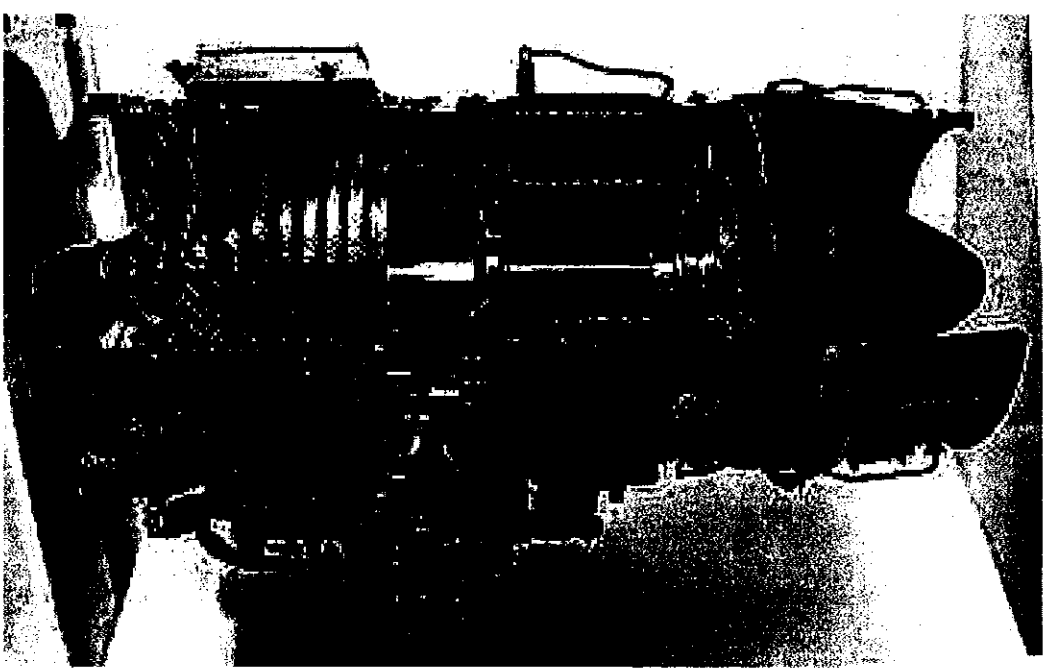
UNIT 24. GAS TURBINE



A gas turbine, also called a combustion turbine, is a rotary engine that extracts energy from a flow of combustion gas. It has an upstream compressor coupled to a downstream turbine, and a combustion chamber in-between. (Gas turbine may also refer to just the turbine element.)

Energy is added to the gas stream in the combustor, where air is mixed with fuel and ignited. Combustion increases the temperature, velocity and volume of the gas flow. This is directed through a nozzle over the turbine's blades, spinning the turbine and powering the compressor.

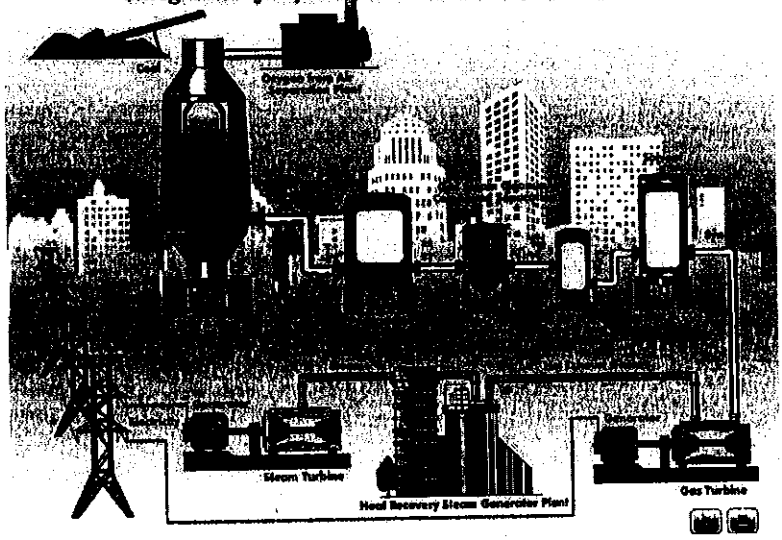
Energy is extracted in the form of shaft power, compressed air and thrust, in any combination, and used to power aircraft, trains, ships, generators, and even tanks.



A typical axial-flow gas turbine turbojet, the J85, sectioned for display

UNIT 25. HOW DOES A COMBINED CYCLE POWER PLANT WORK

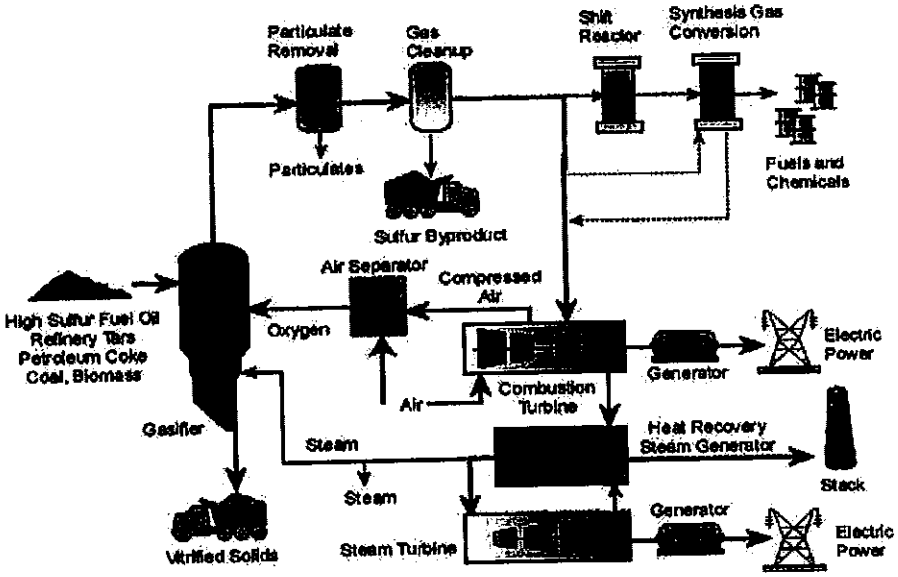
Integrated Gasification Combined Cycle (IGCC)



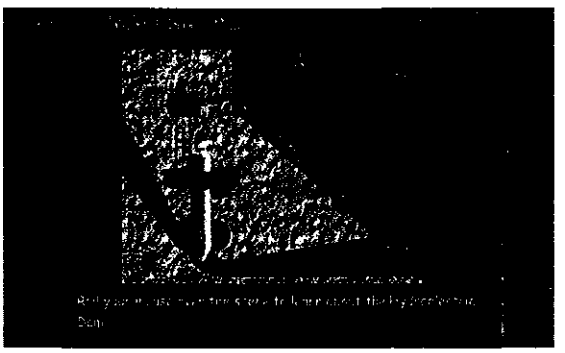
Conventional or 'single cycle' gas fired electricity generators use either steam or hot gas vapours to produce electricity. First, natural gas is burned to create either hot combustion gases or steam, which then passes through a turbine. The turbine then drives a generator to produce electricity. A combined cycle power plant generates electricity more efficiently by combining these two power generation methods.

Combustion gases from the gas turbine exhaust pass through a Heat Recovery Steam Generator to produce steam, which is then fed back to the steam turbine to create additional electricity. The steam is captured and cooled to form water, which is then returned to the boiler to repeat the cycle. The result is a more efficient use of both natural gas and water.

Typical schematic of an IGCC (Integrated Gasification Combined Cycle) power plant:



UNIT 26. HOW DOES A HYDRO POWER PLANT WORK



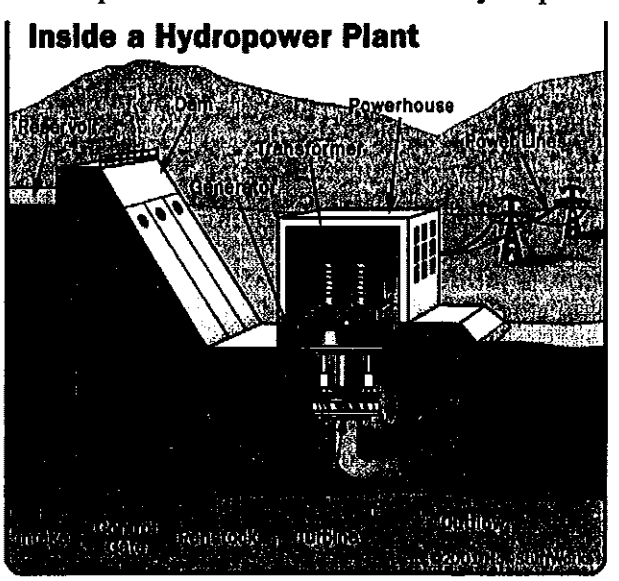
The power of water

Use of hydropower peaked in the mid-20th century, but the idea of using water for power generation goes back thousands of years. A hydropower plant is basically an oversized water wheel.

More than 2,000 years ago, the Greeks are said to have used a water wheel for grinding wheat into flour. These ancient water wheels are like the turbines of today, spinning as a stream of water hits the blades. The gears of the wheel ground the wheat into flour.

When watching a river roll by, it's hard to imagine the force it's carrying. If you have ever been white-water rafting, then you've felt a small part of the river's power. White-water rapids are created as a river, carrying a large amount of water downhill, bottlenecks through a narrow passageway. As the river is forced through this opening, its flow quickens. Floods are another example of how much force a tremendous volume of water can have. Hydropower plants harness water's energy and use simple mechanics to convert that energy into electricity. Hydropower plants are actually based on a rather simple concept -- water flowing through a dam turns a turbine, which turns a generator.

Here are the basic components of a conventional hydropower plant:



1. Dam - Most hydropower plants rely on a dam that holds back water, creating a large reservoir. Often, this reservoir is used as a recreational lake, such as Lake Roosevelt at the Grand Coulee Dam in Washington State.

2. Intake - Gates on the dam open and gravity pulls the water through the penstock, a pipeline that leads to the turbine. Water builds up pressure as it flows through this pipe.

3. Turbine - The water strikes and turns the large blades of a turbine, which is attached to a generator above it by way of a shaft. The most common type of turbine for hydropower plants is the Francis Turbine, which looks like a big disc with curved blades. A turbine can weigh as much as 172 tons and turn at a rate of 90 revolutions per minute (rpm), according to the Foundation for Water & Energy Education (FWEE).

4. Generators - As the turbine blades turn, so do a series of magnets inside the generator. Giant magnets rotate past copper coils, producing alternating current (AC) by moving electrons. (You'll learn more about how the generator works later.)

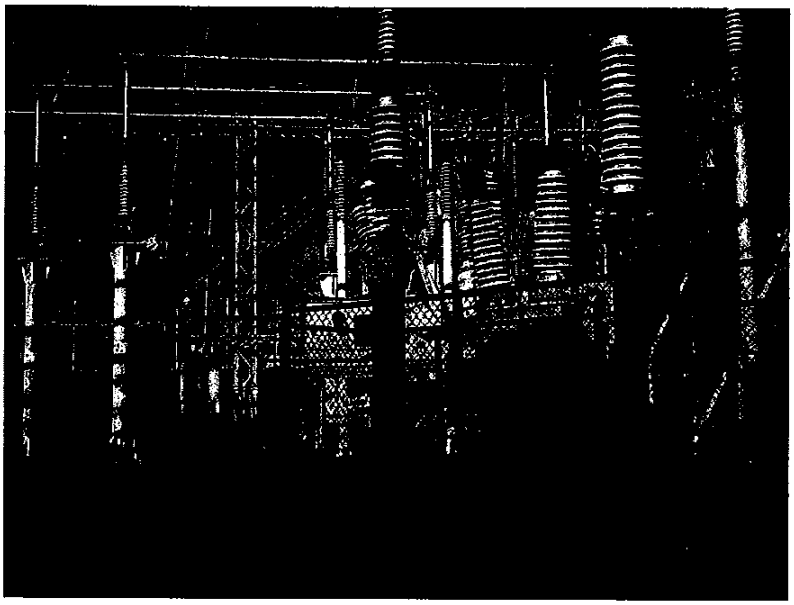
5. Transformer - The transformer inside the powerhouse takes the AC and converts it to higher-voltage current.

6. Power lines - Out of every power plant come four wires: the three phases of power being produced simultaneously plus a neutral or ground common to all three. (Read How Power Distribution Grids Work to learn more about power line transmission.)

7. Outflow - Used water is carried through pipelines, called tailraces, and re-enters the river downstream.

The water in the reservoir is considered stored energy. When the gates open, the water flowing through the penstock becomes kinetic energy because it's in motion. The amount of electricity that is generated is determined by several factors. Two of those factors are the volume of water flow and the amount of hydraulic head. The head refers to the distance between the water surface and the turbines. As the head and flow increase, so does the electricity generated. The head is usually dependent upon the amount of water in the reservoir.

UNIT 27. POWER SUBSTATION



A 115 kV to 41.6/12.47 kV 5000 kVA 60 Hz substation with circuit switcher, regulators, re-closers and control building

An electrical substation is a subsidiary station of an electricity generation, transmission and distribution system where voltage is transformed from high to low or the reverse using transformers. Electric power may flow through several substations between generating plant and consumer, and may be changed in voltage in several steps.

A substation that has a step-up transformer increases the voltage while decreasing the current, while a step-down transformer decreases the voltage while increasing the current for domestic and commercial distribution. The word *substation* comes from the days before the distribution system became a grid. The first substations were connected to only one power station where the generator was housed, and were subsidiaries of that power station.

27.1. Elements Of A Substation

Former electrical substation in Washington, D.C. used by the United States Navy during World War I and World War II.

Substations generally have switching, protection and control equipment and one or more transformers. In a large substation, circuit breakers are used to interrupt any short-circuits or overload currents that may occur on the network. Smaller distribution stations may use re-closer circuit breakers or fuses for protection of distribution circuits. Substations do not usually have generators, although a power plant may have a substation nearby. Other devices such as power factor correction capacitors and voltage regulators may also be located at a substation.

Substations may be on the surface in fenced enclosures, underground, or located in special-purpose buildings. High-rise buildings may have several indoor substations. Indoor substations are usually found in urban areas to reduce the noise from the

transformers, for reasons of appearance, or to protect switchgear from extreme climate or pollution conditions.

Where a substation has a metallic fence, it must be properly grounded (UK: earthed) to protect people from high voltages that may occur during a fault in the network. Earth faults at a substation can cause a ground potential rise leading to a significantly different voltage than the ground under a person's feet; this *touch potential* presents a hazard of electrocution.

27.2. Transmission substation

A transmission substation connects two or more transmission lines. The simplest case is where all transmission lines have the same voltage. In such cases, the substation contains high-voltage switches that allow lines to be connected or isolated for fault clearance or maintenance. A transmission station may have transformers to convert between two transmission voltages, voltage control devices such as capacitors, reactors or Static VAr Compensators and equipment such as phase shifting transformers to control power flow between two adjacent power systems.

Transmission substations can range from simple to complex. A small "switching station" may be little more than a bus plus some circuit breakers. The largest transmission substations can cover a large area (several acres/hectares) with multiple voltage levels, many circuit breakers and a large amount of protection and control equipment (voltage and current transformers, relays and SCADA systems). Modern substations may be implemented using International Standards such as IEC61850.

27.3. Distribution substation

A distribution substation in Scarborough, Ontario, Canada disguised as a house, complete with a driveway, front walk and a mown lawn and shrubs in the front yard. A warning notice can be clearly seen on the "front door".

A distribution substation transfers power from the transmission system to the distribution system of an area. It is uneconomical to directly connect electricity consumers to the high-voltage main transmission network, unless they use large amounts of power, so the distribution station reduces voltage to a value suitable for local distribution.

The input for a distribution substation is typically at least two transmission or sub-transmission lines. Input voltage may be, for example, 115 kV, or whatever is common in the area. The output is a number of feeders. Distribution voltages are typically medium voltage, between 2.4 and 33 kV depending on the size of the area served and the practices of the local utility.

The feeders will then run overhead, along streets (or under streets, in a city) and eventually power the distribution transformers at or near the customer premises.

Besides changing the voltage, the job of the distribution substation is to isolate faults in either the transmission or distribution systems. Distribution substations may also be the points of voltage regulation, although on long distribution circuits (several km/miles), voltage regulation equipment may also be installed along the line.

Complicated distribution substations can be found in the downtown areas of large cities, with high-voltage switching, and switching and backup systems on the low-

voltage side. More typical distribution substations have a switch, one transformer, and minimal facilities on the low-voltage side.

27.4. Collector substation

In distributed generation projects such as a wind farm, a collector substation may be required. It somewhat resembles a distribution substation although power flow is in the opposite direction, from many wind turbines up into the transmission grid. Usually for economy of construction the collector system operates around 35 kV, and the collector substation steps up voltage to a transmission voltage for the grid. The collector substation also provides power factor correction, metering and control of the wind farm.

Collector substations also exist, when there are in a certain area multiple thermal or hydroelectric power plants of comparable output power are in close proximity. In these cases the collector substation uses as these plants have a higher output than wind or solar power plants higher voltages, often even the highest voltage of the grid. Examples for such substations are Brauweiler in Germany and Hradec in Czech, where power of lignite fired power plants nearby is collected.

It is also possible that a collector substation has only one voltage level and no transformers. In this cases the only function of the substation are switching actions for distributing the power. Such substations are called Switching Stations.

27.5. Design

The main issues facing a power engineer are reliability and cost. A good design attempts to strike a balance between these two, to achieve sufficient reliability without excessive cost. The design should also allow easy expansion of the station, if required.

Selection of the location of a substation must consider many factors. Sufficient land area is required for installation of equipment with necessary clearances for electrical safety, and for access to maintain large apparatus such as transformers. Where land is costly, such as in urban areas, gas insulated switchgear may save money overall. The site must have room for expansion due to load growth or planned transmission additions. Environmental effects of the substation must be considered, such as drainage, noise and road traffic effects. Grounding (earthing) and ground potential rise must be calculated to protect passers-by during a short-circuit in the transmission system. And of course, the substation site must be reasonably central to the distribution area to be served.

27.6. Layout

The first step in planning a substation layout is the preparation of a one-line diagram which shows in simplified form the switching and protection arrangement required, as well as the incoming supply lines and outgoing feeders or transmission lines. It is a usual practice by many electrical utilities to prepare one-line diagrams with principal elements (lines, switches, circuit breakers, transformers) arranged on the page similarly to the way the apparatus would be laid out in the actual station.

Incoming lines will almost always have a disconnect switch and a circuit breaker. In some cases, the lines will not have both; with either a switch or a circuit breaker being all that is considered necessary. A disconnect switch is used to provide isolation, since it cannot interrupt load current. A circuit breaker is used as a protection device to

interrupt fault currents automatically, and may be used to switch loads on and off. When a large fault current flows through the circuit breaker, this may be detected through the use of current transformers. The magnitude of the current transformer outputs may be used to 'trip' the circuit breaker resulting in a disconnection of the load supplied by the circuit break from the feeding point. This seeks to isolate the fault point from the rest of the system, and allow the rest of the system to continue operating with minimal impact. Both switches and circuit breakers may be operated locally (within the substation) or remotely from a supervisory control center.

Once past the switching components, the lines of a given voltage connect to one or more buses. These are sets of bus bars, usually in multiples of three, since three-phase electrical power distribution is largely universal around the world.

The arrangement of switches, circuit breakers and buses used affects the cost and reliability of the substation. For important substations a ring bus, double bus, or so-called "breaker and a half" setup can be used, so that the failure of any one circuit breaker does not interrupt power to branch circuits for more than a brief time, and so that parts of the substation may be de-energized for maintenance and repairs. Substations feeding only a single industrial load may have minimal switching provisions, especially for small installations.

Once having established buses for the various voltage levels, transformers may be connected between the voltage levels. These will again have a circuit breaker, much like transmission lines, in case a transformer has a *fault* (commonly called a 'short circuit').

Along with this, a substation always has control circuitry needed to command the various breakers to open in case of the failure of some component.

27.7. Switching Function

An important function performed by a substation is switching, which is the connecting and disconnecting of transmission lines or other components to and from the system. Switching events may be "planned" or "unplanned".

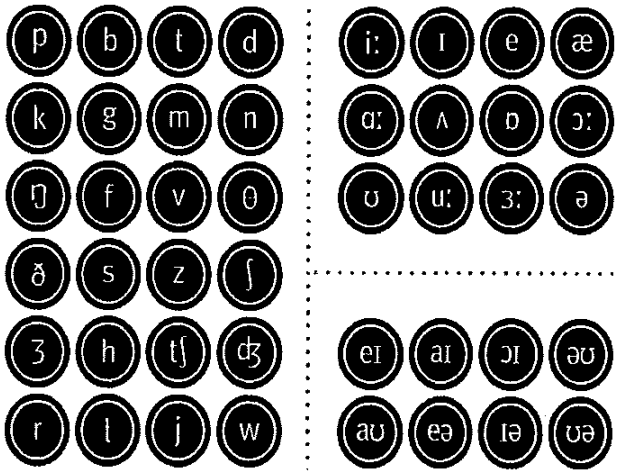
A transmission line or other component may need to be de-energized for maintenance or for new construction; for example, adding or removing a transmission line or a transformer.

To maintain reliability of supply, no company ever brings down its whole system for maintenance. All work to be performed, from routine testing to adding entirely new substations, must be done while keeping the whole system running.

Perhaps more importantly, a fault may develop in a transmission line or any other component. Some examples of this: a line is hit by lightning and develops an arc, or a tower is blown down by a high wind. The function of the substation is to isolate the faulted portion of the system in the shortest possible time.

There are two main reasons: a fault tends to cause equipment damage; and it tends to destabilize the whole system. For example, a transmission line left in a faulted condition will eventually burn down, and similarly, a transformer left in a faulted condition will eventually blow up. While these are happening, the power drain makes the system more unstable. Disconnecting the faulted component, quickly, tends to minimize both of these problems.

Bảng các nguyên âm và phụ âm tiếng Anh



English Consonants

- p
  - pen, copy, happen
- b
  - back, baby, job
- t
  - tea, tight, button
- d
  - day, ladder, odd
- k
  - key, clock, school
- g
  - get, giggle, ghost
- tʃ
  - church, match, nature
- dʒ
  - judge, age, soldier
- f
  - fat, coffee, rough, photo
- v
  - view, heavy, move
- θ
  - thing, author, path
- ð
  - this, other, smooth
- s
  - soon, cease, sister
- z
  - zero, music, roses, buzz
- ʃ
  - ship, sure, national
- ʒ
  - pleasure, vision

- h
  - hot, whole, ahead
- m
  - more, hammer, sum
- n
  - nice, know, funny, sun
- ŋ
  - ring, anger, thanks, sung
- l
  - light, valley, feel
- r
  - right, wrong, sorry, arrange
- j
  - yet, use, beauty, few
- w
  - wet, one, when, queen

English Vowels

- æ
  - trap, bad
- ɑ:
  - start, father
- ʌ
  - strut, mud, love, blood
- ɪ
  - kit, bid, hymn, minute
- i:
  - fleece, sea, machine
- ɒ
  - lot, odd, wash
- ɔ:
  - thought, law, north, war
- ʊ
  - foot, good, put
- u:
  - goose, two, blue, group
- e
  - dress, bed, head, many
- ə
  - about, common, standard
- ɜ:
  - nurse, stir, learn, refer
- i
  - happy, radiate. Glorious
- u
  - thank you, influence, situation
- eɪ
  - face, day, break

- aɪ
  - price, high, try
- ɔɪ
  - choice, boy
- əʊ
  - goat, show, no
- aʊ
  - mouth, now
- ɪə
  - near, here, weary
- eə
  - square, fair, various
- ʊə
  - poor, jury, cure

NORMAL SENTENCE PATTERN IN ENGLISH

John and I ate a pizza last night
Subject⇒verb⇒complement⇒modifier

COUNT AND NON-COUNT NOUNS

A count noun is a one that you can count it.

With count nouns	With non-count nouns
A, an, the, some, any	The, some, any
This, that, these, those	This, that
None, one, two, three…	None
Many	Much
A lot of	A lot of
A large (great) number of	A large amount of
A few, few	A little, little
Fewer than	Less than
More than	More than
There is, there are, there was, there were	There is, there was

Some irregular count nouns:

person⇒ people	*child⇒ children*	*man⇒men*
foot⇒ feet	*mouse⇒ mice*	
woman⇒ women	*tooth⇒ teeth*	

Some non-count nouns:

Sand	*Work*	*Air*
Soap	*Luggage*	*Meat*
Measles	*Accommodation*	*Advertising*
Food	*Advice*	
Soap	*Baggage*	*Mathematics*
Mumps	*Furniture*	*Politics*
Trouble	*Weather*	*Homework*
Chaos	*progress*	*Money*
Bread	*Information*	*Behavior*
Traffic	*Economics*	
Travel	*Physics*	

Note: advertising is a non-count noun, advertisement is a count noun.

1. Some nouns only in plural:
    a. I need some new trousers.
2. These nouns ends in s but they are not usually plural:
    a. mathematics, physics, economics, news..
3. Some singular noun are often used with a plural verb:
    a. government, staff, team, audience, committee, family,

A OR AN BEFORE A NOUN: DEPEND ON YOUR PRONUNCIATION

A house but an hour

The following words begin with a consonant sound and thus they must always be preceded by a:

European	*Home*	
House	*University*	*Half*
Uniform	*Heavy*	*Union*
Eulogy		

The following words begin with a vowel sound and thus they must always be preceded by an:

Hour	*Herbal*	*Unnatural*
Uncle	*Honor*	
Heir	*Understanding*	*Umbrella*

The is used to indicate something that we already know about or something that is common knowledge.

The boy in the corner is my friend.

The earth is round.

Normally, plural count nouns, when they mean every thing with in a certain class, are not preceded by the.

Oranges are green until they ripen.

OTHER

The use of the word other is often a cause of confusion for foreign student.

With count nouns	With non-count nouns
An +other+ singular noun (one more) *Another pencil=one more pencil* The other+ singular noun (last of the set) *The other pencil= the last pencil present.* Other + plural noun (more of the set) *Other pencils=some more pencils* The other+ plural noun (the rest of the set) *The other pencils= all remaining pencils*	Other +non-count nouns (more of the set) *Other water=some water* The other+ non-count nouns (all the rest) *The other water= the remaining water*

TENSES AND ASPECTS

Simple present tense	Simple past tense	Past participle	Present participle
Beat	Beat	Beaten	Beating
Begin	Began	Begun	Beginning
Bind	Bound	Bound	Binding
Bite	Bit	Bitten	Biting
Blow	Blew	Blown	Blowing
Break	Broke	Broken	Breaking
Bring	Brought	Brought	Bringing
Build	Built	Built	Building
Buy	Bought	Bought	Buying
Catch	Caught	Caught	Catching
Choose	Chose	Chosen	Choosing
Do	Did	Done	Doing
Drink	Drank	Drunk	Drinking
Drive	Drove	Driven	Driving
Eat	Ate	Eaten	Eating
Fall	Fell	Fallen	Falling
Feel	Felt	Felt	Feeling
Find	Found	Found	Finding
Fly	Flew	Flown	Flying
Forget	Forgot	Forgotten	Forgetting
Get	Got	Gotten	Getting

Give	Gave	Given	Giving
Hear	Heard	Heard	Hearing
Hide	Hid	Hidden	Hiding
Keep	Kept	Kept	Keeping
Know	Knew	Known	Knowing
Lead	Led	Led	Leading
Leave	Left	Left	Leaving
Lose	Lost	Lost	Losing
Make	Made	Made	Making
Meet	Met	Met	Meeting
Pay	Paid	Paid	Paying
Ride	Rode	Ridden	Riding
Run	Ran	Run	Running
Say	Said	Said	Saying
See	Saw	Seen	Seeing
Sell	Sold	Sold	Selling
Send	Sent	Sent	Sending
Sing	Sang	Sung	Singing
Sink	Sank	Sunk	Sinking
Sit	Sat	Sat	Sitting
Speak	Spoke	Spoken	Speaking
Spend	Spent	Spent	Spending
Stand	Stood	Stood	Standing
Steal	Stole	Stolen	Stealing
Strive	Strove	Striven	Striving
Swim	Swam	Swum	Swimming
Take	Took	Taken	Taking
Teach	Taught	Taught	Teaching
Tear	Tore	Torn	Tearing
Tell	Told	Told	Telling
Think	Thought	Thought	Thinking
Throw	Threw	Thrown	Throwing
Understand	Understood	Understood	Understanding
Wear	Wore	Worn	Wearing

SOME SPECIAL VERBS

Simple present tense	Simple past tense	Past participle	Present participle
Bet	Bet	Bet	Betting
Bit	Bit	Bit	Biting
Cost	Cost	Cost	Costing
Cut	Cut	Cut	Cutting
Fit	Fit	Fit	Fitting
Hit	Hit	Hit	Hitting
Put	Put	Put	Putting
Quit	Quit	Quit	Quitting
Read	Read	Read	Reading

Shut Spread	Shut Spread	Shut Spread	Shutting Spreading

SIMPLE PRESENT TENSE

1. We use the present simple to talk about things in general. We are not thinking about only the present. We use it to say that happens all the time or repeatedly, or that something is true in general. It is not important whether the action is happening at the time of speaking.
   a. The earth goes round the sun.
2. We use do, does to make question or negative sentences:
   a. Do you speak English?
3. We use the present simple when we say how often we do things
   a. I get up at 8 o' clock everyday.
4. When you make a suggestion:
   a. Why don't you go bed early?

This tense is not usually used to indicate present time. However, it is used to indicate present time (now) with the following stative verbs:

Know	*Love*	*Want*
Understand	*Appear*	*Taste*
Have	*See*	*Wish*
Believe	*Like*	*Sound*
Hate	*Seem*	*Own*
Need	*Smell*	
Hear		

Note: the verbs listed above are almost never used in the present or past progressive (continuous), although it is possible in some cases.
Simple present is used to indicate a regular or habitual action.
John walks to school everyday.
Adverb of frequency:

- Always/ everyday
- Usually
- Often
- Sometimes/occasionally
- Now and then, in time
- Seldom
- Rarely
- Never

PRESENT PROGRESSIVE (CONTINUOUS)

1. We use the present continuous when we talk about ST which is happening at the time of speaking.
2. We also use the present continuous when we talk about something which is happening around the time of speaking, but not necessarily exactly at the time of speaking.
3. we talk about a period around the present
   - *You are not playing football this season.*
4. we use the present continuous when we talk about changing situations:
   - *The world population is rising.*

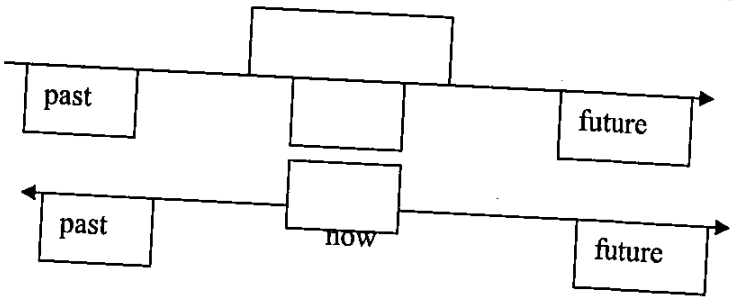
Use the following rule to form the present progressive:

Subject + am, is, are+ verb + ing

The present progressive is used to indicate the present time (now) with all but the stative verbs listed previously.
It is also used to indicate future time
We are leaving for the theater at seven o'clock.

- *Now, at the moment, at the present, today, this season*

Present simple	Present continuous
Use present simple to talk about things in general or things which happen repeatedly. *Water boils at 100 degrees Celsius.* Use the present simple for a permanent situation: *My parent live in London.*	Ta talk about something which happen at or around the time of speaking: *The kettle is boiling.* Use present continuous for a temporary situation: *That machine isn't working.*



Present continuous with future meaning: When you are talking about what you have already arranged to do, use the present continuous. Do not use the present simple.

What are you doing tomorrow morning?

Present simple with future meaning: We use the present simple when we are talking about timetables, programmes : *Tomorrow is Wednesday.*

Going to

1. We use going to do when we say what we have already decided to do, what we intend to do in the future:
   a. There is a film on TV tonight. Are you going to watch it?
2. We use was, were going to say what SO intended to do in the past (but didn't do)
   a. We were going to travel by train but then we decided to go by car.
3. We use going to to say what we think will happen. Usually there is something in the present situation that makes the speaker sure about what will happen.
   a. He is going to fall into the hole.

Will

1. We use will when we decided to do ST at the time of speaking.
   a. I have left the door open. I will go and shut it.
2. Offering to do ST:
   a. I need some money. Don't worry. I will lend you some money.
3. Agreeing or refusing to do something:
   a. You know that book I lent you? I can have back it?
4. Promising to do something:
   a. Thank you for lending me some money.
5. Asking someone to do something:
   a. Will you shut the door, please?

We often use will with these words and expressions:

- ❖ Probably, I am sure, I expect, I think

We can use both shall and will with I and we. Don't use shall with he/she/it/you/they.
Note that we use shall in the questions shall I..? for offer or suggestions:

- o Shall I open the window?

SIMPLE PAST TENSE

The simple past tense is used for a completed action that happened at one specific time in the past. The italicized words in the previous sentence are important because they show that simple past is not the same as past progressive or present perfect.
John went to Spain <u>last year.</u>

<u>Adverbs:</u>
Yesterday, last month, ago…

PAST PROGRESSIVE:

Use the following rule to form the past progressive:
Subject + was, were + verb + ing
The past progressive is used to indicate:

1. An action which was occurring in the past and was interrupted by another action. In this case, the general rule is:

When + subject$_1$ + simple past tense + subject $_2$ + past progressive

When Mark came home, Martha was watching television

Or :

subject$_1$ + past progressive + when + subject$_2$ + simple past tense
Martha was watching television when Mark came home.

2. Two actions occurring at the same time in the past:

In this case, we apply this rule:
While + subject$_1$ + past progressive + subject$_2$ + past progressive
Or:
subject$_1$ + past progressive + While + subject$_2$ + past progressive

Martha was watching television while Mark was reading the book.
The following construction is also possible but it is not as common as the preceding two:
While + subject$_1$ + past progressive + subject$_2$ + simple past
While Martha was watching television, Mark read the book.

3. An action which was occurring at some specific time in the past:
Martha was watching television at seven o'clock last night.

PRESENT PERFECT

We use the following rule to form the present perfect:
Subject + has, have + verb in past participle
The present perfect is used to indicate:

1. An action that happened at an indefinite time in the past

John has traveled around the world (we do not know when)

2. An action that happened more than once in the past

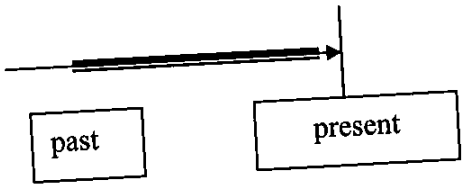
John has seen this movie three times.

3. An action that began in the past and is still occurring in the present.

John has lived in the same house for twenty years.(He still lives there)

Adverbs:

- For, since, already, never, not..yet, till, until, so far, up to now..., lately, recently

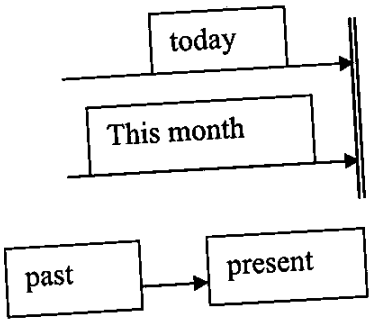


We can use the present perfect with:

- ❖ This is the first time I have driven a car.
- ❖ It is the first time I have been in hospital.

We can use the present perfect with this morning, this evening, today, this week, this term etc.

- o I have smoked ten cigarettes today.
- o John hasn't studied very much this term.



FOR AND SINCE

- Use for + duration of time: for 4 years
- Use since + beginning time: since 1975

YET / ALREADY

These adverbs are used to indicate that something has happened (or has not happened) at an specific time in the past. They are often used with the present perfect.

- Already + affirmative sentences
- Yet + negative sentences and questions.

Note :

- Already usually appears between the auxiliary and the main verb; however, it can appear at the beginning or end of the sentence.
- Yet appears at the end of the sentence.

Subject + has, have+ already = verb in past participle
We have already written our report.
Subject + has, have+ not + verb in past participle + yet
We have not written our report yet.
You should not confused with the coordinating conjunction yet, which means but.
I do not have the money, yet I really need the computer.

PRESENT PERFECT PROGRESSIVE

For an action that began in the past and is still occurring in the present (present perfect third item); it is also possible to use the present perfect progressive. Use the following rule to form this aspect:
Subject +has, have+ been + verb ing
John has been living in the same house for twenty years.

1. We use the present perfect continuous when we talk about an action (quite a long action) which began in the past and has recently stopped or just stopped.
    a. You are out of breath. Have been you running?
2. To ask or say how long something has been happening. This time the action or situation began in the past and is still happening or has just stopped.
    a. It is raining now. It began to rain two hours ago and it is still raining: *It has been raining for two hours.*

Present perfect continuous	Present perfect
We are interested in the action. It doesn't matter whether something has been finished or not. *John' clothes are covered in paint. She has been painting the ceiling.*	We are interested in the result of the action, not in the action itself. *The ceiling was white. Now it is blue. She has painted the ceiling.*
To say how long something has been happening: *John has been writing letters all day.*	To say how much, how many things, how many times we have done something: *I have played tennis three times this week.*

PAST PERFECT

Use the following rule to establish the past perfect

Subject + had+ verb in past participle

The past perfect is used to indicate:

1. An action that happened before another action in the past, there usually are two actions in the sentence.

John had gone to the store before he went home.

The past perfect is usually used with before, after, or when. Study the following formulas:

Subject + past perfect + before +subject + simple past tense

John had gone to the store before he went home

Subject+ simple past tense + after + subject + past perfect.

John went home after he had gone to the store.

Before +Subject +simple past tense+ subject + past perfect

Before John went home, he had gone to the store.

After + subject + past perfect + subject + simple past tense

After John had gone to the store, he went home.

2. A state which continued for a time in the past, but stopped before now. Note that there is no connection with the present.

John had lived in New York for ten years before he moved to California.

Present perfect	Past simple
I have smoked 20 cigarettes today.	I smoked 20 cigarettes yesterday.

PAST PERFECT PROGRESSIVE

This past perfect concept can also be conveyed by the past perfect progressive. Study the following rule:

Subject + had = been + verb ing

John had been living in new York for ten years before he moved to Texas.

1. We use it to say how long something had been happening before something else happened.
    a. Ken had been smoking for 30 years when he finally gave it up.
2. The past perfect continuous is the past of the present perfect continuous:
    a. How long have you been waiting until now?
    b. How long had you been waiting when the bus finally came?

SUBJECT – VERB AGREEMENT

Remember that the subject and verb in a sentence must agree in person and number.

The elevator works very well.

1. Subject separated from the verb

When taking the TOEFL, you must always check the subject and the verb to be sure that they agree. However, sometimes it is difficult to decide exactly what the subject is if the subject and the verb are separated.

Very often , if the subject and the verb are separated, they wil,be separated by a prepositional phrase. The prepositional phrase has no effect on the verb.

Subject + prepositional phrase + verb

The study of *the languages* is very interesting.

The following expressions also have no effect on the verb:

Together with	Along with
Accompanied by	As well as

The actress, *along with her manager and some friends,* is going to the party tonight.

Note: if the conjunction AND is used instead of one of these phrases, the verb would be then plural.

The actress and her manager are going to a party tonight.

2. Words that always take singular verbs and pronouns

Some word are often confused by student as being plural. The following words must be followed by singular verbs and pronouns in formal written English:

Any + Singular noun	Some thing
Any body	Some body
Any one	Some one
Any thing	

No + singular noun

No body
Nothing
No one

Every + singular noun

Every body
Every thing
Every one
Each + singular noun

Some + singular noun

No problem is harder to solve than this one

Note: Either or neither are singular if they are not used with or and nor.

NONE/NO

None can be take either a singular or plural verb, depending on the noun which follow it.

None + of the + non-count noun + singular verb

None of the counterfeit money has been found.

No can take either a singular verb or plural verb depending on the noun which follow it:

No + singular noun or non- count noun + singular verb

No example is relevant to this case.

No + plural noun + plural verb

No examples are relevant to this case.

EITHER/ NEITHER

When either and neither are followed by or and nor, the verb may be singular or plural, depending on whether the noun following or and nor is singular or plural. If or or nor appears alone, the same rule applied. Study the following formulas:

Neither + noun + nor + plural noun + plural verb

Either or

Neither John nor his friends are going to the beach today.
And :
Neither + noun + nor + singular noun + singular verb
Either or
Neither John nor his friend is going to the beach today.

GERUNDS AS SUBJECTS

If a sentence begins with (verb + ing) (gerund), the verb must also be singular:
Dieting is very popular today.

COLLECTIVE NOUNS

Also many words indicating a number of people or animal are singular. The following nouns are usually singular. In some cases they are plural if the sentence indicate that the individual members are acting separately:

Congress	*Jury*	*Club*
Organization	*Group*	*Minority*
Government	*Army*	*Class*
Family	*Majority*	*Crowd*
Team	*Committee*	*Public*

The family was elated by the news.
Our team is going to win the game.

The following nouns are used to indicate groups of certain animals. It is not necessary to learn the nouns; however, they mean the same as group and thus are considered singular:

Flock of birds, sheep	*School of fish*
Herd of castle	*Pride of lions*
Pack of dogs	

The flock of birds is circling overhead.
Collective nouns indicating time, money, and measurement used as a whole are singular:
Twenty-five dollars is too much to pay for that shirt.

A NUMBER OF; THE NUMBER OF

A number of + plural noun + plural verb
A number of = many
A number of students are going to the class picnic.
The number of + plural noun + singular verb
The number of days in a week is seven.

NOUNS THAT ARE ALWAYS PLURAL

The following nouns are always considered plural. They can not be singular. In order to speak of them as singular, one must say " a pair of ..."

Scissors	Eyeglasses	Jeans
Trousers	Pants	Tweezers
Shorts	Pliers	Tongs

The pants are in the drawer.

THERE IS/ THERE ARE

There is, was, has been + singular subject (or non-count noun)
There are, were, have been + plural subject
There is a storm approaching.

PRONOUNS

There are five forms of pronoun in English: subject pronouns, complement pronouns (object pronouns) , possessive pronouns, possessive adjectives, and reflexive pronouns.
Subject pronouns:

singular	plural
I	We
You	
He	You
She	
It	They

It was she who called me.
She and I have seen this movie before.

Complement pronouns

Complement pronouns occur in the complement position, whether they complement a verb or a preposition.

Me	Us
You	You
Him	
Her	Them
It	

The teacher gave him a bad grade.(verb)
The policeman are looking for her.(preposition)

Possessive adjectives

Possessive adjectives are not the same as possessive pronouns. These simply modify, rather than replace, nouns; possessive pronouns replace nouns. Possessive forms indicate ownership.

My	Our
Your	Your
His	
Her	Their
Its	

This is not my book.

Possessive pronouns

These pronouns can not precede a noun. They are pronouns and thus replace the nouns. The noun is understood from the context and is not repeated.

Mine	Ours
Yours	Yours
His	
Hers	Theirs
Its	

This is mine.

Reflexive pronouns

These pronouns usually follow the verb and indicate that the subject is both giving and receiving the action.

Myself	Ourselves
Yourself	Yourselves
Himself	
Herself	Themselves
Itself	

I washed myself.
I myself believe that the proposal is good.

VERBS AS COMPLEMENTS

Verbs that are always followed by the infinitive.

Agree	Expect	Learn
Desire	Intend	Pretend
Hope	Prepare	Want
Plan	Tend	Decide
Strive	Claim	Forget
Attempt	Fail	Need
Refuse	Demand	Offer
Wish	Hesitate	Seem

John expects to learn law next semester.

VERBS THAT ARE ALWAYS FOLLOWED BY THE GERUND

Admit	Miss	Appreciate
Deny	Report	Postpone
Delay	Suggest	Resent
Avoid	Practice	Can not help
Enjoy	Resist	
Finish	Consider	Risk
Quit	Mind	
Resume	Recall	

We enjoyed seeing them again after so many years.

VERBS CAN BE FOLLOWED BY BOTH THE GERUND AND INFINITIVE

Begin	Like	Try
Hate	Start	Dread
Regret	Continue	Prefer
Can not stand	Love	

He started to study after dinner = he started studying after dinner.

VERB + PREPOSITIONS FOLLOWED BY THE GERUND

If a verb + preposition, adjective + preposition, noun + preposition, or preposition alone is followed directly by a verb, the verb will always be in the gerund form. The following list consists of verbs + prepositions.

Approve of	Insist on	Depend on
Give up	Succeed in	Put off
Rely on	Count on	Think of
Worry about	Keep on	
Be better off	Think about	

He succeed in studying math.

Note: the following expressions contain the preposition to. The word to in these expressions must not be confused with the to in the infinitive. The verb + preposition expressions must also be followed by the gerund.

- Object to
- Look forward to
- Confess to

I am looking forward to hearing from you.

ADJECTIVES + PREPOSITIONS FOLLOWED BY THE GERUND

Accustomed to	Interested in	Fond of
Intent on	Capable of	Tired of
Afraid of	Successful in	

I am fond of dancing

NOUNS + PREPOSITION FOLLOWED BY THE GERUND

Choice of	Excuse for	Reason for
Possibility of	Intention on	Method of (for)

Nobody knows the reason for their fighting each other.

ADJECTIVES FOLLOWED BY THE INFINITIVE

Anxious	Easy	Ready
Eager	Prepared	Difficult
Pleased	Common	Hard
Usual	Dangerous	Strange
Boring	Good	Able

It is difficult to solve this problem.

Some verbs can be followed by either the infinitive or the gerund but the meaning changes.

- Stop
- Remember
- Forget

I stopped to smoke ≠ I stopped smoking

PRONOUNS BEFORE THE GERUND OR INFINITIVE

In cases where the infinitive is used as a complement, any noun or pronoun directly preceding it will be in the complement form.
Some common verbs which are followed by the infinitive and which often require an indirect object are listed here:
Subject + verb + complement form (pronoun noun, noun) + to + verb ....

Allow	Urge	Persuade
Invite	Beg	Expect
Remind	Permit	Prepare
Ask	Want	Instruct
Order	Convince	Promise

John ask Mary to call him when she woke up.
However, before the gerund, a noun or pronoun must appear in the possessive form:
Subject + verb + possessive form of noun, possessive adjective + verb ing
He regrets her leaving.
We are looking forward to their coming next year.

THE VERB NEED

Animate being as subject + verb in infinitive
You need to learn Spanish.
Inanimate object as subject + verb ing , to be + verb in past participle

The grass needs cutting = the grass needs to be cut.

IN NEED OF

Subject + be + in need of + noun
I am in need of money.

QUESTIONS

Remember that, when forming a question, one must place the auxiliary or the verb be before the subject. If there is no auxiliary or be, one must use the correct form of do, does, or did. After do, does, or did the simple form of the verb must be used. The tense and the person are shown only by this auxiliary, not by the main verb.

Yes/no questions

The formula:

- Auxiliary
- Be + subject + verb
- Do, does, did

Embedded questions

An embedded question is one which is included in a sentence or another question.
Subject +verb (phrase) + question word +subject + verb
Question: where will the meeting take place?
Embedded question: we have not ascertained where the meeting take place.
The following rule applies if the embedded questions is embedded in another question.
Auxiliary + Subject +verb (phrase) + question word +subject + verb
Do you know where he went?

Tag questions

In the tag question, the speaker make a statement, but is not completely certain of the truth, so he or she uses a tag question to verify the previous statement. Sentences using tag questions should have the main clause separated from the tag by a comma. The sentence will always end with a question mark. Observe the following rules:

1. Use the same auxiliary verb as in the main clause. If there is no auxiliary, use do, does or did.
2. If the main clause is negative, the tag is affirmative ; if the main clause is affirmative , the tag is negative.
3. Do not change the tense
4. Use the same subject in the main clause and the tag. The tag must always contain the subject form of the pronoun.
5. Negative forms are usually contracted. (if they are not, they follow the order auxiliary + subject + not : *he saw this yesterday, did he not?*
6. *there is, there are* and *it is* forms contain pseudo-subject so the tag will also contain there or it as if it were a subject pronoun.
7. The verb *have* may be used as a main verb (I have a new car) or it may be used as an auxiliary (John has gone to class already). When it functions as a main verb in American English, the auxiliary forms *do, does or did* must be used in the tag.
8. Let us go to⇒ shall we ?

9. Open the door ⇒ will you?
10. Something is good ⇒ are not I?

AFFIRMATIVE AGREEMENT

Affirmative statement(be) + and + subject + verb(be) + too
+ so + verb(be) + subject

I am happy, and you are too.
I am happy, and so are you.

Affirmative statement + and+ subject+ auxiliary only+ too
So + auxiliary only+ subject

They will work in the lab tomorrow, and you will too.
They will work in the lab tomorrow, and so will you.

Affirmative statement + and+ subject+ do, does, did+ too.
So + do, does, did + subject

Jane goes to that school, and my sister does too.
Jane goes to that school, and so does my sister.

NEGATIVE AGREEMENT

Negative statement + and+ subject+ negative auxiliary or be + either.
Neither+ positive auxiliary or be + subject

I didn't see Mary this morning, and John didn't either.
I didn't see Mary this morning and neither did John.

NEGATION

To make a sentence negative, add the negative particle not after the auxiliary or verb be. If there is no auxiliary or be , add the appropriate form of do, does, or did and place the word not after that.

Mary likes spinach.
Mary doesn't like spinach.

SOME/ANY

If there is a noun in the complement of a negative sentence, one should add the particle any before the noun.

Some + affirmative sentences.
Any + negative sentences.

John has money.
John doesn't have any money.

HARDLY, BARELY, RARELY, SELDOM...

Remember that in an English sentences it is usually incorrect to have two negatives together. This is called a double negative and it is not acceptable in standard English. The following words have a negative meaning and thus, must be used with a positive verb.

Hardly **Barely** **Scarcely**	→	Almost nothing **Or** **Almost not at all**

Rarely **Seldom** **Hardly**	→	Almost never

John <u>rarely</u> comes to class on time = John <u>usually doesn't</u> come to class on time.
John <u>hardly</u> studied last night= John studied <u>very little</u> last night.

COMMANDS

A command is an imperative statement. One person orders another to do something. It can be preceded by please. The understood subject is you. Use the simple form of the verb.

Close the door.
Please turn off the light.

A negative commands is formed by adding the word don't before the verb.

Don't close the door.

Negative indirect commands.
Subject + verb+ complement+ not+ verb in infinitive.
John told Mary not to close the door.

MODAL AUXILIARY

The modal auxiliary have a number of different meaning. They are generally used to indicate something which is potential or uncertain. Remember that a modal is an auxiliary, and thus is never used with do, does, or did. The modal include:

Present tense	Past tense
Will Can May Shall Must (have to)	Would (used to) Could Might Should (ought to) (had better) Had to

John would like to leave.
John wouldn't like to leave.

QUESTIONS WITH MODALS

To make a question, place the modal at the beginning of the sentence.
Would John like to leave?
Note: a modal is always directly followed by the simple form (verb word). This is infinitive without to.

Infinitive	Simple form
To be To go To have	Be Go Have

This mean that after a modal there can never be: Verb +ing; verb +s; past tense or infinitive.
There are 2 ways that the modal can occur:
Modal +simple form of the verb
Would be, could go, will have
Modal + have+ verb in past participle
Would have been; could have gone; will have had.

WILL

Will indicates future certainty
John will begin the job tomorrow.

CONDITIONAL SENTENCES

Hypothetical situation: if I am not planning anything for this evening, when someone asks me if I want to go to the movies, I say:
If I have time, I will go.
Hypothetical situation: if I don't have time to go to the movies, but I actually want to go to, I say:
If I had a time, I would go.
In the unreal condition, the past tense form of be is always were in a conditional sentence.(never was)
If I were
If you were
If he were

REAL CONDITIONS (POSSIBLY TRUE)

Future time

If + subject+ simple past tense.... + | Will / Can / May / Must | erb in simple form.

If I have the money, I will buy the car.

Habitual

If + subject + simple past tense.... + ... simple past tense

If John has enough time, he usually walks to school.

Command

If + subject+ simple present tense... + command form...

If you go to the post office, please mail this letter for me.

UNREAL CONDITIONS (NOT TRUE)

Present or future time

If + subject+ simple past tense....+ would, could, might + verb in simple form.

If I had the time, I would go to the beach with you this weekend.

(I don't have the time, I am not going to the beach with you).

Past time

If + subject+ past perfect....+ would, could, might + have + verb in past participle.

If we had known that you were there, we would have written you a letter.

If we hadn't lost our way, we would have arrived sooner.

Another form

Had + subject + verb in past participle+...

Had we known that you were there, we would have written you a letter.

AS IF, AS THOUGH

These conjunctions indicate something unreal or contrary to fact and thus are very similar in form to conditional sentences. The verb which follows these conjunctions must be in the past tense or past perfect. Remember that the past tense of BE in a contrary to fact must be were and never was.

Subject + verb (present) + as if, as though + subject + verb (past)...

He acts as if he were rich.

Subject + verb (past) + as if, as though + subject + verb (past perfect)...

John looked as if he had seen a ghost.

HOPE AND WISH

These two verbs, while are similar in meaning, are not at all the same grammatically.

The verb HOPE is used to indicate something that possibly happened or will possibly happen.

The verb WISH is used to indicate something that definitely didn't happen or definitely will not happy.

The verb Hope can be followed by any tense.

The verb wish must not be followed by any present tense verb present tense auxiliary.

Be sure that you understand the difference in the following sentences with hope and wish.

- We hope that they will come.(we don't know if they are coming).
- We wish that they could come.(they are not coming).
- We hope that they came yesterday.(we don't know if they came).

- We wish that they had come yesterday.(they didn't come).

Remember that wish is very similar to a contrary to fact or unreal condition

- Present unreal condition: If I were rich, I would be very happy.
- Present wish: I wish I were rich.

Future wish

Subject + wish + that + subject + (could, would + verb); were + verb + ing

We wish that you could come to the party tonight. (you can not come).

She wishes that she were coming with us. (she is not coming with us).

Present wish

Subject + wish + that +subject + simple past tense ...

I wish that I had enough time to finish my homework.(I don't have enough time).

Past wish.

Subject + wish + that +subject + past perfect (could have + verb in past participle)

I wish that I had washed the clothes yesterday.

She wishes that she could have been there.(she couldn't be there).

Would

Besides its use in conditional sentences, would can also mean a past time habit.

When David was young, he would swim once a day.

Used to

The expression used to means the same as would. Used to is always in this form. It can never be use to.

Subject + used to + verb in simple form..

When Davis was young, he used to swim once a day. (a past time habit).

Subject + [be, get] + used to + verb ing..

John is used to swimming every day.(he is accustomed to swimming every day.).

- Be used to do means to be accustomed to
- Get used to means to become accustomed to

Would rather

Would rather means the same as prefer, except that the grammar is different. Would rather must be followed by a verb, but prefer may or may not be followed by a verb.

- John would rather drink Coca-cola than orange –juice.
- John prefer drinking Coca-Cola to drinking orange- juice.
- John prefers Coca-Cola to orange-juice.

Present

Subject + would rather + verb in simple form

John would rather go to class tomorrow than today.

Past

Subject + would rather + have + verb in past participle...

John would rather have gone to class today than yesterday.

Present subjunctive

Subject + would rather that + Subject $_2$ + verb in simple form.

I would rather that you call me tomorrow.

Present contrary to fact

Subject + would rather that + Subject $_2$ + verb in simple form...

Henry would rather that his girl friend worked in the same apartment as he does.

Past contrary to fact

Subject + would rather that + Subject $_2$ + past perfect...

John would rather that Henry had gone to class yesterday.

Would like

This expression is often used in invitations. It can also mean want.

Subject + would like + to + verb

I would like to visit Japan.

Could/ may / might

The speaker is not sure of the statement made when using these modals.

It might rain tomorrow.

Should

This modal is used to indicate:

- A recommendation, advice, or obligation.
  - John should study tonight.
- Expectation: used to indicate something that the speaker expects to happen.
  - It should rain tomorrow.(I expect it to rain tomorrow.)

Had better, ought to, be supposed to generally mean the same as should.

Must

This modal is used to indicate:

- Complete obligation; this is stronger than should. With should the person has some choice on whether or not to act, but with must the person has no choice.
  - John must call his insurance agent today.
- Logical conclusion: must is used to indicate that the speaker assumes something to be true from the facts that are available but it is not absolutely certain of the truth.
  - John' lights are out. He must be asleep.

Mustn't +infinitive= not allowed

You mustn't smoke here= you are not allowed to smoke here.

Have to

This pseudo- modal means the same as must (meaning complete obligation).

Do you have to work today?

I have to work today.

I don't have to work today.

Did you have to work yesterday?

I didn't have to work yesterday.

Modals + perfective

You have already seen these in the section on conditionals; however, it is also possible to use other modals in this form. The modal + perfective is usually used to indicate past time.

Modal + have+ verb in past participle...

Could, may, might + perfective

Use any of these modal + perfective to indicate a past possibility. Remember that these modal also mean possibility in the present.

It may have rained last night, but I am not sure.

Should + perfective

This is used to indicate an obligation that was supposed to occur in the past, but for some reason it didn't occur.

John should have gone to the post office this morning.(he didn't go to the post office).

The expression was/were supposed to + verb in simple form means much the same as should + perfective.

John was supposed to go to the post office this morning.

Must + perfective

This is not used to indicate a past time obligation. Remember to use only had to, should +perfective, or be supposed to indicate a past obligation. Must + perfective can only mean a logical conclusion in the past.

The grass is wet. It must have rained last night.

Adjectives and adverbs.

Adjectives

Adjectives fall in two categories: descriptive and limiting. Descriptive adjectives are those which describe the color, size, or quality of a person or thing (noun or pronoun). Limiting adjectives places restrictions on the words they modify (quantity, distance, possession…)

Descriptive	Limiting
Beautiful Large Red Interesting Important colorful	Cardinal number (one, two..) Ordinal number (first, second) Possessives (my, his…) Demonstratives (this, that, these, those..) Quantity (few, many, much..) Articles (a, an , the..)

When descriptive adjectives modify a singular countable noun, they are usually preceded by a, an , or the: A pretty girl

Adjectives normally precede the nouns they modify, or follow linking verbs. Adjectives modify only nouns, pronouns and linking verbs

An adjectives answer the question: what kind?

Adverb

Adverb modify verbs (except linking verbs), adjectives or other adverbs. Many descriptive adjectives can be changed to adverbs by adding ly to the adjective base.

Adjectives	Adverbs
Bright Careful Quiet	Brightly Carefully Quietly

The following words are also adverbs: so, very, almost, soon, often, fast, rather, well, there, too…

An adverb answer the question: how?

Note : when adding ly, sometimes the meaning of adjectives is different from their adverbs.

Adjectives	Adverbs (not the same meaning)
Hard Late	Hardly Lately

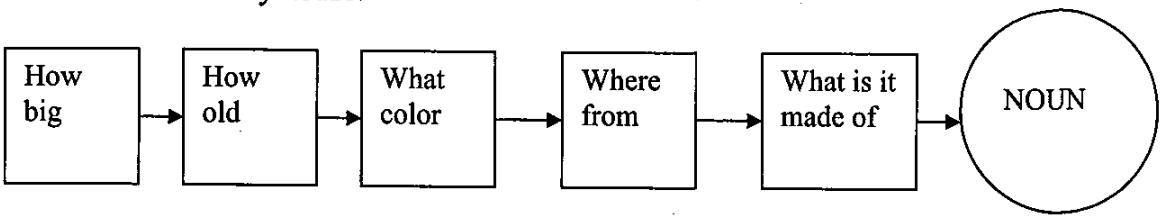
Some adjectives have ly at the end

Friendly; lovely, lively, elderly, lonely, lovely, silly,

Adjectives: word order

Opinion (nice, beautiful, intelligent..) adjectives usually go before fact (sunny, hot, round..) adjectives:

- A nice sunny house.



Adjectives with linking verbs

A special category of verbs connects or links the subject with the subject complement (predicate adjective). Unlike most verbs, these do not show action. They must be modified by adjectives, not adverbs.

Be, become, remain, stay, appear, seem, sound, feel, look, smell, taste

Be, become, and remain can be followed by both noun phrases and adjectives:

John remained chairman of the board despite the opposition.

They remained sad even though I tried to cheer them up.

Feel, look, taste, smell may also be transitive verbs and take a direct object. When they function in this way, they become active and are modified by adverbs. Notice the following pairs of sentences. Those which take objects are active, and those which do not are linking:

The doctor felt the leg carefully to see if there were any broken bones.

COMPARISONS

Equal comparisons

Subject + verb + as + adjectives, adverbs + as + noun, pronoun

He is not as tall as his father.

You are as old as she.

My book is as interesting as yours.

Subject + verb + the same + noun + as + noun, pronoun

My house is the same height as his = my house is as high as his.

Remember:

adjectives	nouns
Heavy, light	Weight
Wide, narrow	Width
Deep, shallow	Depth
Long, short	Length
Big, small	size

Remember that the opposite of the same as is different from. Never use different than.

My nationality is different from hers.

Unequal comparison

This type of comparative implies that the entities are comparable in a greater or lesser degree. The following rules generally apply to this type of comparative:

1. Add er to the adjective base of most one and two syllable adjectives: thick-thicker.
2. Use the form more + adjective for most three syllable adjectives: more beautiful

3. Use the form more + adjectives ending in the following suffixes: ed, ful, ing, ish, ous: more stylish.
4. Double the final consonant of one syllable adjectives which end with in a single consonant (except w, x, and z) and are preceded by a single vowel.(big- bigger).
5. When an adjective ands in a consonant + y, change the y to I and add er. (happy- happier).
6. Simple: simpler or more simple

Remember always to use the subject form of the pronoun after than.
He speaks Spanish more fluently than I (not me).
Subject + verb + far, much + adjective, adverb + er + than + noun, pronoun.
A watermelon is much sweeter than a lemon.
Subject + verb + far, much + more, less + adjective, adverb + than + noun, pronoun.
John' watch is far more expensive than mine
Nouns can also be used in comparisons. Be sure to use the determiners correctly depending on whether the adjectives are countable or non countable.
Subject + verb + as + much, many, little, few + noun + as + noun, pronoun.
He earns as much money as his brother.
Subject + verb + more, fewer, less + noun + than + noun, pronoun.
I have more books than she.
Illogical comparison.
An illogical comparison is one in which unlike entities have been compared. Be sure that the item being compared are the same. These form can be divided into three categories: possessives, that of, and those of.
Incorrect: his drawings are as perfect as his instructor.
Correct: his drawings are as perfect as his instructor' s drawings.
Irregular comparatives and superlatives:
A few adjectives and adverb have irregular forms for the comparative and superlative. Study them.

Adj or adv	comparative	superlative
Far	Farther or further	Farthest or furthest
Little	Less	Least
Much, many	More	Most
Good, well	Better	Best
Bad, badly	worse	worst

I feel much better today than I did last week.
Multiple number comparatives.
Number multiples can include: half, twice, three times, four times...
Subject + verb + number multiple + as + much, many + noun + as + noun, pronoun.
It is incorrect to say: twice more than.
This encyclopedia costs twice as much as the other one.
Double comparative
These sentences begin with a comparative construction, and thus the second clause must also begin with a comparative
The + comparative + subject + verb + the + comparative + subject + verb
The hotter it is, the more miserable I feel.
The more + subject + verb + the + comparative+ subject + verb
The more you study, the smarter you will become.
No sooner

If the expression no sooner appears at the beginning of a sentence , the word than must introduce the second clause. Note also that the auxiliary precedes the subject

No sooner + auxiliary + subject + verb + than + subject + verb

No sooner will he arrive than he will want to leave

No sooner had we started out for California than it started to rain.

Note that no longer means not any more. Never use no longer in a sentence that has this meaning.

John no longer studies at the university= John does not study at the university anymore.

Positives, comparatives, and superlatives

Most descriptive adjectives have three form : the positive(happy), the comparative (happier), and the superlative (happiest).

positive	comparative	superlative
Hot	Hotter	Hottest
Interesting	More interesting	Most interesting
Sick	Sicker	Sickest
colorful	More colorful	Most colorful

The positive shows no comparison. It describes only the simple quality of a person, thing or group: the house is big.

The comparative involves two entities and shows a greater or lesser degree of differences between them:

My dog is smarter than yours.

Write:

- I am twice as rich as you:

never write:

- I am twice more than you (wrong)

Happy : Happier

Simple:

- Simpler
- More simple

It is also possible to compare two entities without using than. In this case, the expression of the two will usually appear someplace in the sentence

Subject + verb+ the + comparative + of the two + noun

Harvey is the smarter of the two boys.

Of the two + noun + subject + verb + the + comparative

Of the two shirts, this one is the prettier.

Remember:

2 entities- comparative.

3 entities- superlative

In the superlative degree, three or more entities are compared, one of which is superior or inferior to the others. The following rule is applied:

subject + verb + the + (adjective +est); (most adjective); (least adjective) + in + singular count noun); of + plural count noun

John is the tallest boy in the family.

Diana is the smartest of the three sisters.

Note: After the expression one of the + superlative, be sure that the noun is plural and the verb is singular.

One of the greatest tennis players in the world is Borg.
Adverbs are not usually followed by er or est. Instead , they are compared by adding more or less for the comparative degree, and by adding most or least to form the superlative.

positive	comparative	superlative
carefully	More carefully Less carefully	Most carefully Least carefully

Noun functioning as adjectives
In English, many nouns can function as adjectives when they appear before other nouns (a wool coat, a gold watch, a history teacher)
We took a tour that lasted five weeks.
We took a five-week tour.
Enough with adjectives, adverbs, and nouns
Enough changes positions depending on whether it is modifying a noun, an adjective or adverb.
Adjective, adverb + enough
She speaks English well enough to understand
Enough + noun
I have enough money to buy a new house.

CAUSE CONNECTORS
Because, because of (due to, owing to)
..... because + subject + verb
there + verb + subject
John was worried because it had started to rain.
The students arrived late because there was a traffic jam.
because of + noun (phrase)
John was worried because of the rain.
Purpose and result (so that)
Subject + verb + so that + subject + verb
He studied very hard so that he could pass the test.
Cause and effect (so, such)
The following constructions are used to indicate a cause and effect (result) relationship.
Subject + verb + so + adjective (adverb) + that + subject + verb.
He sang so well that he received a standing ovation.
She is so nice that many men love her at the first sight.
Subject + verb + so + many, few + plural count noun + that + subject + verb.
The Smith had so many children that they form their own baseball team.
Subject + verb + so + much, little + non- count noun + that + subject + verb.
He has invested so much money in the project that he can not abandon it now.
Subject + verb + so + adjective + a + singular count noun + that + subject + verb.
It was so hot a day that we decided to stay indoors.
Such + a + adjective is the more common of the two
It was such a hot day that we decided to stay indoors.

Subject + verb + such + adjective + plural count noun (non-count noun) + that + subject + verb...

She has such exceptional abilities that everyone is jealous of her.
John has had such bad luck that he has decided not to gamble.
This is such difficult homework that I will never finish it.

Passive voice

A sentence can be either in the active or passive voice. In an active sentence, the subject performs the action, but in the passive voice, the subject receives the action. To make the active sentence into a passive sentence, follow these steps:

1. Place the complement of the active sentence at the beginning of the passive sentence.
2. If there is no auxiliaries in the active sentence, place them immediately after the new subject agreeing in number with the subject.
3. Insert the verb be after the auxiliary or auxiliaries in the same form as the main verb in the active sentence.
4. Place the main verb from the active sentence after the auxili8aris and be in the past participle.
5. Place the subject of active sentence after the verb in the passive sentence preceded by the preposition by (this can be eliminated completely if it is not important or is understood).

Simple present or simple past	
Am Is are Was were	+ verb in past participle

Hurricanes destroy a great deal of property each year.
A great deal of property is destroyed by hurricanes each year.

present or past progressive (continuous)	
Am Is are Was were	+ being + verb in past participle

The committee is considering several new proposals
Several new proposals are being considered by the committee.

present or past perfect	
Has Have had	+ been + verb in past participle

The company has ordered some new equipment.
Some new equipment has been ordered by the company.

modals
Modals + be + verb in past participle

The manager should sign these contracts today.
These contracts should be signed by the manager today.

Modals+ perfect
Modals + have + been + verb in past participle

Somebody should have called the president this morning.
The president should have been called by somebody this morning.

CAUSATIVE VERBS

The causative verbs are used to indicate that one person causes a second person to do something for the first person. One can cause somebody to do something for or her paying, asking opr forcing the person. The causative verbs are have, get, make

Have/ get
Active
Subject + have + complement+ verb in simple form…

or

Active
Subject + get + complement+ verb in simple form…

And

passive
Subject + have, get + complement+ verb in past participle…

Mary had John washed the car.(John washed the car).

Mary got John to wash the car.(John washed the car).

Mary got (had) the car washed.(The car was washed by somebody).

Make

Make can be followed only by a clause in the active voice. It is stronger than have or get. It means force

Subject + make + complement+ Verb in simple form

The robber made the teller give him the money.

The robber forced the teller to give him the money.

Let

Let is usually added to the list of causatives in grammar textbooks. It is not actually causative. It means allow or permit. Notice the difference in grammar.

Subject + let+ complement + verb in simple form

John let his daughter swim with her friends = John allowed his daughter to swim with her friends.

Subject + permit, allow + complement + verb in infinitive

Help

Help is not actually a causative verb either, but it is generally considered with causative verbs in grammar text books. It is usually followed by the simple form, but can be followed by the infinitive in some cases. It means assist

Subject + help + complement + verb in simple form

Verb in infinitive

John helps Mary wash the dishes.

John helps Mary to wash the dishes.

RELATIVE CLAUSE

The relative pronoun

A relative clause is used to form one sentence from two separate sentences. The relative pronoun replaces one of two identical noun phrases and relates the clauses to each other. The relative pronouns and their uses are listed here:

pronoun	Use in formal English
That	Things
Which	Things
Who	People
Whom	People
whose	Usually people

Note: in speaking English, that can be used for people, but not in formal written English .the relative pronoun completely replaces a duplicate noun phrase. There can be no regular pronoun along with the relative pronoun.
Incorrect: This is the book that I bought it at the bookstore.
Correct: This is the book that I bought at the bookstore.
John bought a boat. The boat cost thirty thousand dollars.= John bought a boat that cost thirty thousand dollars.
Who/ whom
Who is used when the noun phrase being replaced is in the subject position of the sentence. Whom is used when it is from the complement position.
Note: in speech, whom is rarely used, but it should be used when appropriate in formal written English. If you have difficulty deciding whether who or whom should be used, remember the following rule:
Who + verb
Whom + noun
The men are angry. The man are in this room
The men who are in this room are angry.
The men are angry. I don't like the men.
The men whom I don't like are angry.
Restrictive and nonrestrictive clauses
A relative clause can be either restrictive or nonrestrictive.
A restrictive clause is one that can not be omitted from a sentence if the sentence is to keep its original meaning.
A nonrestrictive clause is set off from the other clause by commas and a restrictive clauses. That can be used only in restrictive clause. Normally , that is preferred word to use in a restrictive clause, although which is acceptable.
Restrictive: Weeds that float to the surface should be removed before they decay.
We are not speaking of all weeds, only those float to the surface. Thus the sentence is restrictive, if " that float to the surface" were omitted, the sentence would have a different meaning.
Nonrestrictive: My car, which is very large, uses too much gasoline.
The fact that my car is very large is additional information and not important to the rest of the sentence. Notice that it is not possible to use the pronoun that in place of which in this sentence.
Whose
This relative pronoun indicates possession.
John found a cat. The cat' leg was broken.
John found a cat whose leg was broken.
Optional relative clause reduction
In restrictive relative clauses, it is possible to omit the relative pronoun and the verb be (along with any other auxiliaries) in the following cases:

- Before relative clauses in the passive voice:
  - This is the Z value which was obtained from the table areas under the normal curve = This is the Z value obtained from the table areas under the normal curve.
- Before prepositional phrases:
  - The beaker that is on the counter contains a solution=The beaker on the counter contains a solution

- Before progressive verb structures:
  - The girl who running down the street might be in trouble= the girl running down the street might be in trouble.
- It is also possible to omit the relative pronoun and the verb be in nonrestrictive clauses before noun phrases:
  - Mr. John, who is a professor, is traveling in the Middle East this year= Mr. John, a professor, is traveling in the Middle East this year.

THAT –OTHER USES

Optional that

The word that has several uses besides its use in relative clauses. One such use is as a conjunction. Sometimes when that is used as a conjunction, it is optional, and sometimes it is obligatory. That is usually optional after the following verbs: Say, tell, think, believe.

John said that he was leaving next week= John said he was leaving next week.

Obligatory that

That is usually obligatory after the following verbs when introducing another clause: mention, declare, report, state.

John mentioned that he was going to France next year.

That clauses

Some clauses, generally introduced by noun phrases, also contain that. These clauses are reversible.

It is well-known that many resident of the third world countries are dying.

If a sentence begins with a that clause, be sure that both clauses contain a verb.

It surprises me that John would do such a thing.

That John would do such a thing surprises me.

Subjunctive

The subjunctive in English is the simple form of the verb when used after certain verbs indicating that one person wants another person to do something. The word that must always appear in subjunctive sentences. If it is omitted, most of the verbs are followed by infinitive

We urge that he leave now.(not he leaves)

We urge him to leave now

Advise, ask, command, decree, demand, insist, move, order, prefer, propose, recommend, request, require, stipulate, suggest, urge.

In the following rule, verb indicates one of the above verbs:

Subject + verb + that + subject + verb in simple form

The university requires that he take this course.

The simple form of the verb is also used after impersonal expressions with the same meaning as the above verbs. The adjectives that fit into this formula include the following:

Advised, important, mandatory, necessary, obligatory, proposed, recommended, required, suggested, urgent, imperative.

In the following rule, adjective indicates one of the above adjectives;

It + be+ adjective+ that+ subject+ verb in simple form

It is necessary that he find the book.(not he finds)

INCLUSIVES

The expression not only……but also, both….and, and as well as mean in addition to.

Like entities must be used together (noun with noun, adj with adj, adv with adv….)

Not only … but also

Subject + verb + not only +	noun	+ but also +	noun
	Adjective		adjective
	Adverb		adverb
	Prepositional phrase		Prepositional phrase

Or:

Subject + not only + verb + but also + verb

Robert is not only talented but also handsome.

He writes not only correctly but also neatly.

Maria excels not only in mathematics but also in science.

Paul not only plays the piano but also composes music.

As well as

Subject + verb +	noun	+ as well as +	noun
	Adjective		adjective
	Adverb		adverb
	Prepositional phrase		Prepositional phrase

or

Subject + verb + as well as + verb

Robert is talented as well as handsome.

He writes correctly as well neatly.

Paul plays piano as well as composes music.

Both …and

Robert is both good and intelligent.

It is not correct to use both and as well as in the same sentence.

Know and know how

Subject + know how + verb in infinitive

Subject + know + noun

Prepositional phrase

sentence

Despite of / in spite of

despite + noun phrase

in spite of

Despite his physical handicap, he has become a successful businessman.

In spite of his physical handicap, he has become a successful businessman.

Although/ even though/ though

Although

Even though + subject + verb + complement

Though

Problem verb

The verbs lie/ lay; rise/ raise; sit/set cause problems even for native English speakers.

- Transitive verbs take a complement (lay, raise, set)
- Intransitive verbs don't take a complement.(lie, rise, sit)

Intransitive			
Rise Lie sit	Rose Lay sat	Risen Lain sat	Rising Lying sitting

Transitive			
Raise Lay set	Raid Laid set	Raised Laid set	Raising Laying setting

- Rise means to get up, increase:
  - The sun rises early in the summer.
- Raise means to lift or elevate an object or to increase something.
  - The student raised theirs hands in class.
- Lie means to rest, repose or to be situated in a place.(often use with preposition down)
  - If the children are tired, they should lie down for a nap.
- Lay means to put somebody or something on a surface.
  - The boy lays his books on the table every day.
- Sit means to take a seat. (often use with down)
  - We are going to sit in the fifth row at the opera.
- Set means to put somebody or something on a surface or in a place.
  - The little girl helps her father set the table every night.

Some idiomatic expressions with set, lay, raise:

- The company had to lay off twenty- five employees because of a production slowdown.
- Dr. Jacob has set many broken bones in plaster casts.
- John set his alarm for six o'clock.
- The chef is hoping that the Jell-O will set quickly.
- While playing with matches, the children set fire to the sofa.
- That farmer raises the chicken for a living.

STYLE IN WRITTEN ENGLISH

Sequence of tenses

Main clause	Dependent clause
Present tense	Present continuous Will, can or may + verb Past tense Present perfect
Past tense	past continuous or simple past Would, could or might + verb Past perfect

Say or tell

Subject + say (that) + subject + verb
Subject + tell + indirect object + (that)+ subject + verb
John told a story last night
He says that he is busy today.
Tell + a story, a joke, a secret, a lie, the truth, the time..

Antecedents of pronoun

Incorrect: John dislikes politics because he believes that they are corrupt. (politics is singular)
Correct: John dislikes politics because he believes that politicians are corrupt.
Incorrect: Janet visited her friend every day while she was on the vacation.
Correct: While Janet was on the vacation, she visited her friend every day.

The pronoun of <u>one</u> and <u>you</u>

One + verb ... one + verb....
One's noun
He
His noun

If one (meaning a person in general) is used in a sentence, a subsequent pronoun referring to the same person must also be one or he.
If you is used in a sentence, a subsequent pronoun referring to the same person must also be you.

- If one takes this exam without studying, one (he) is likely to fail.
- If you take this exam without studying, you are likely to fail.

Illogical participial modifiers (dangling participles)
By, after, on, before, while...
Incorrect: After jumping out of a boat, the shark bit the man.
Correct : After jumping out of a boat, the man was bitten by a shark.
(Preposition) + (not) + verb ing +... + noun + verb

- Practicing her swing every day, Maria wants to get a job as a golf instructor.(present)
- Practicing her swing every day, Maria wanted to get a job as a golf instructor.(past)
- Practicing her swing every day, Maria will plan to get a job as a golf instructor. (future)

(not) + having+ verb in past participle... + noun + verb
Having written his composition, John handed it to his teacher.
(not) + having been+ verb in past participle... + noun + verb
Having notified by the court, John reported for jury duty.

Participles as adjectives

The crying baby woke Mr. Bill. (The baby was crying)
The sorted mail was delivered to the offices before noon. (The mail had been stored).
The boring professor put the student to sleep.
The bored students went to sleep during the boring lecture.

Redundancy

Advance forward Proceed forward Progress forward	
Return back Revert back	
Sufficient enough	
Compete together	
Reason… because	
Join together	
Repeat again	
New innovations	
Matinee performance	
Same identical	
Two twins	
The time when	
The place where	

Parallel structure

Incorrect: Peter is rich, handsome, and many people like him. (not parallel).
Correct: Peter is rich, handsome, and popular.

Transformation or direct and indirect objects

These verbs:

- Bring, build, buy, cut, draw, feed, find, get, give, hand, leave, lend, make, offer, owe, paint, pass, pay, promises, read, sell, send, show, teach, tell, write.

Subject + verb + direct object + for, to + indirect object
Subject + verb + indirect object + direct object

- I gave the book to Dan.
- I gave Dan the book.

Commonly misused words

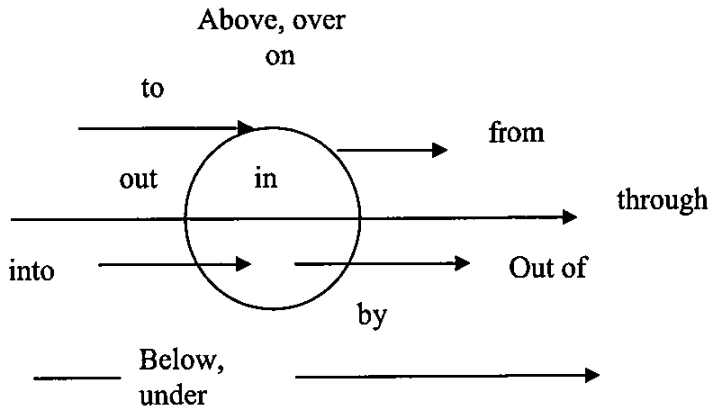
angel	angle
cite	Site sight
Costume	Custom
decent	descent
dessert	Desert dessert
later	latter
loose	lose
passed	past
peace	piece
principal	principle
quiet	Quite

	quit
stationary	stationery
than	then
there	Their They are
to	Two,too
weather	whether
whose	Who's
your	You're

Confusingly related words

accept	Except
access	excess
advice	advise
affect	effect
again	against
already	All ready
among	between
beside	besides
considerable	Considerate
credible	Creditable credulous
detract	distract
device	devise
elicit	illicit
emigrant	immigrant
example	sample
formerly	formally
house	home
imaginary	imaginative
industrial	industrious
intelligent	intelligible
late	lately
liquefy	liquidate
lonely	alone
near	nearly
precede	proceed
sensible	sensitive
special	specially

Use of preposition



During

During is usually followed by a noun indicating time. It indicates duration of time.
During the summer…

From

From a time (place) to a time (place)
From time to time = occasionally

Out of

Out of = to lack, to be without

- Out of money
- Out of date
- Out of work
- Out of question (impossible)
- Out of order (not functioning)

By

Romeo and Juliet was written by Shakespeare.

- By + specific time= before
- By bus, plane, train, ship, car, bike.
- By then= (before a time in the past or future)
- By way of (via)
- By the way= incidentally
- By far= considerably
- By accident/ by chance, by mistake = not intentionally, opposite of on purpose.

In

- In a room
- In month/ year
- In time (not late, early enough)

- In the street
- In the morning, in the afternoon/ evening.
- In the past/ future
- In the beginning/ end
- In the meantime (at the same time)
- In the middle.
- In the army
- In a row
- In the event that (if)
- In case (if)
- In touch with, get in contact with

On

- On a day/ date
- On the bus, train
- On a street
- On time
- On the way (enroute)
- On the right/ left
- On television- on the radio
- On the telephone
- On the whole
- On the other hand
- On sale
- On foot (walking)

At

- At an address
- At night
- At least/ at the minimum
- At once (immediately)
- At present/ at the moment (now)
- At first (initially)

In place of =instead of
For the most part= mainly
Of course= Certainly
All of sudden= suddenly
For good= forever
Off and on = intermittently

Verbal idioms

Break off = end
Bring up = raise
Bring about =cause
Call on = ask
Call off =cancel
Call on =visit
Care for= like
Check out = borrow books

Check out of = leave
Check on = investigate
Come along with= accompany
Draw up = write
Find out= discover
Get by = manage to survive
Get through= finish
Count on =depend on, rely on
Get up =arise
Get aside=né sang bên
Get by= nhường đường
Give up= stop
Go along with= agree
Go for = attack
Keep on = continue
Look after= care for
Look for= search=seek
Look into= investigate
Appear= show up
Pick out = select
Point out = indicate
Put off = post pone
Put off = tolerate
Run across= discover
Run into= meet by accident
Take off= leave the ground to fly
Take over for= substitute for
Talk over= discuss
Try out = test
Go over=review
Let down= fail
Cut down=reduce
Take control: tiếp quản
Take over: occupy
Speak up= speak louder
Turn up= appear
Keep up with
Cut down on

Nouns + prepositions

Equivalent of
Quality of
Pair of
Number of
Reason for
Sample of
Example of
Need for
Demand for
Exception to
Possibility of
Method (of or for)
Hatred (of or for)
Need (of or for)
Means (of or for)
Solution to
key to
cause of
center for (of)
burden to society
ability for
anxiety for
precautions for (against)

a rise, an increase , fall, a decrease in
a photograph, a picture of
damage to ST
a reaction to
a solution, answer, reply, key to
an attitude to
a relationship, a connection, a contact with
a cause of
an advantage, a disadvantage of

Verbs + prepositions

Decide on
Detract from
Emerge from
Participate in
Confide in
Plan on

Engage in
Pay for
Wait for
Escape from
Free from
Remove from
Depend on
Approve of
Succeed in
Mingle with
Rely on
Accuse SO of doing ST
Ask SO for doing ST
Apologize to SO for doing ST
Complain to SO about ST
Borrow ST from SO
Translate a language into another language
Explain ST to SO
Charge SO with
Leave a place for another place
Fall in love with
Damage to
Collide with
Bump into
Crash into
Focus on
Protest
Warn SO of doing ST
Live on pension
Spend (on)
Blame SO for doing ST
Believe in GOD
Shout at SO
Throw at SO
Result in
Die of heart attack
Die from an illness
Die in accident
Die from pain(gián tiếp)
Die of hunger (nguyên nhân trực tiếp)
Compensate for
Think of
Dream about
Impact on
Learn ST from SO
Smile at SO
Compared ST with ST
Substitute SO, ST for SO, ST
Sentence SO to (duration)
Argue with
Agree with SO
Confuse ST, SO with ST, SO
Mistake ST, SO for ST, SO
Deprive of = prevent from
Buy on credit: mua trả góp
Pay official visit to : thăm chính thức
Rescue SO from
Rest on : dựa vào
Run into debt: mắc nợ
Sacrifice ST to SO
See over: xem cẩn thận
Seek for= look for
Starve for= khao khát
Supply ST to SO
Swear at SO: nguyền rủa ai
Wait at table: hầu bàn
Warn SO of danger
Write in ink
Made of
Made from
Respect to
Substitute for
Experience in doing ST
Excuse for a fault
Bargain with SO
Desire for
Demand for
Depart for
Dismiss SO from a position
Exceed in
Extent to
Fall in love with
Fight with
Flirt with SO
Free SO from
Interfere with
Invest in
Keep from smoking
Keep to himself: giữ cho riêng mình
Object to SO: phản đối
Negotiate with SO
Praise SO for ST
Participate in
Prevent SO from doing ST
Prohibit SO from doing ST

Propose ST to SO
Protect SO from ST
Pay for
Refer to
Rely on
Inform SO of ST
Confess to ST
Congratulate SO on ST
Cry for: đòi cái gì
Couple with
Increase in
Decrease in
Buy ST from SO
Combine with
Comment on
Compete with SO for ST
Complain to SO about ST
Advertise for
Advance to: tiến tới
Aim at: nhắm vào
Apply for a job
Attach to
Associate with
Avail oneself of
Bet on ST
Blame SO for ST
Boast of
Approve of
Announce to the public
Beg for
Act on: làm theo
Adapt to
Abstain from wine
Abscond from a place
Absent myself from school: trốn học
Comply with
Lend SO ST
Feel like
Happen to
Base on
Pay attention to

Receive ST from SO
Prevent , stop, keep SO from ST
Invite, force, allow SO to do ST
Pay ST to SO

Dream of
Thank for
Depend on
Prefer ST, SO to ST, SO
Split into
Consist of
Listen to
Save on: tiết kiệm về cái gì
Regard ST as ST
Respond to
Located on
Attend a party: tham dự
Attend to student: phục vụ
Play with, against
Succeed in doing = hoàn thành kế hoạch
Achieve ST: đạt được
Reach ST: đạt đến
Afford : đủ tiền trả.
Concentrate on
Remind SO of SO, ST
Translate from a language into another language.
Ask SO for ST
Charge SO with ST
Congratulate SO on ST
Divide/cut/split ST into
Explain ST to SO
Leave a place for another place
Point/ aim ST at
Search ST, SO for ST, SO
Suffer from an ilness
Wait for
Write to
Laugh/ smile at
Belong to SO
Crash/drive/bump/run into

Adjectives + prepositions

Satisfied with
Divorced from
Guilty of
Interested in
Fond of
Isolated from
Afraid of
Accustomed to
Short of
Full of
Bored with
Crazy about
Tired of
Suspicious of
envious of
satisfied with
nice to SO
good at
bad at
excellent at
engaged to
married to
difficult in
sorry for, about
crowded with
content with
opposite to
scared of
according to
harmful, less to
capable of
careless of
compatible with ST
acceptable to SO
dangerous to SO
disgusted with
eager for
equal to
exclusive of
familiar to SO, ST
guilty of
hostile to
notorious for SO
mature for
safe from danger
rude to SO
sick of

Amenable to
Inferior to
Superior to
Similar to
Different from
The same as
Keen on
Busy at work
new to SO
important to ST
suitable for SO
obliged for SO
successful in
sure of
surprised at
suspicious of
proud of
impossible for
confined to
interested in
famous for
capable, incapable of

Second to
Worried about
Excited with
Proposal to
Similar to
Sorry about
Nice, kind, good, generous, mean, stupid, silly, intelligent, clever, sensible, polite, rude, unreasonable of SO to do ST
Delighted, pleased, satisfied, disappointed with ST
Angry, annoyed, furious about ST, With SO for doing ST
Bored, fed up with ST
Surprised, shocked, amazed, astonished at, by ST
Afraid, frightened, terrified, scared of SO, ST
Proud, ashamed of
Jealous, envious, suspicious of SO, ST
Aware, conscious of ST
Good, bad, excellent, brilliant, hopeless at doing ST
Married, engaged to SO

Reported speech

Now= right away
Next day = the next day
Yesterday= the day before, the previous day
Tomorrow= the day after, the next day, the following day
Last Tuesday= the Tuesday before
This = that
Now= then
Here=there
Ago=before
Today= that day

	Reported speech
Present simple	Past simple
Present perfect	Past perfect
Present perfect continuous	Past perfect continuous
Simple past	Past perfect
Past continuous	Past perfect continuous
future	Future in the past

Tag questions

Let us go= shall we?

Open the door= will you?
Something is good= are not I?

It is not until ..... that .....
It was not until Wednesday that the representative completed his reports.

Transition words and phrases

addition	contrast	result	time
Also Besides Furthermore In addition to Moreover too	However On the other hand In contrast	As a result Consequently Therefore In that case	After a while Afterwards Before Later Meanwhile Then Previously During As

Roots, prefixes, and suffixes

Common roots and their meanings	
cide	kill
cycle	Wheel or circle
Dent	Tooth
Dict	Speak
Fract	Break
Graph	Written, instrument
Manu	Hand
Meter	Measure
micro	small
Mort	Death
Pend	Hang
Phon	sound
Psy	Mind
Scope	See
Script	Write
Sect	Cut
rupt	Break
Common prefixes	
That means no or not	That stands for numbers
Il	Mono, uni=1
Im	Du, bi=2
In	Tri=3
Ir	Quad=4
Un	Penta, quint=5
Anti	Deca=10
Dis	Poly, multi=many
mis	
That stands for relationships	
Ante, anti	before
Circum	Around
Co, com	Together
Inter	Between

Peri	Around
Pre	Before
Post	After
Sub	Under
Sur, super	Above
Sym, syn	Together, same

A few	đếm được
few	o đếm được- một vài
A little	có o nhiều
Little	rất ít, không đủ- not enough
Bored	bị chán
boring	Làm cho chán
In the morning	Vào buổi sáng
On the morning	buổi sáng như thế nào
weather	thời tiết, Cái nhất thời
climate	Khí hậu, từng miền, từng vùng

Expression + V-ing

Do you mind
Be accustomed to=quen với
Be used to
It is no use, no good: o có lợi
It is (not) worth: nó rất đáng
Spend time
Waste time
Cant help: không thể không
Cant stand: không chịu nổi
I have difficulty (in) finding..
There is no point in buying a car if you don't want to dive it.
It is a waste of money (time) reading that book.
Remember doing: an action which was done
Remember to do: hành động sẽ được làm

- I remember locking the door.
- Remember to turn off the fan before leaving the room.

Try to do: to make an effort
Try doing: to do ST as a test
Stop doing
Stop to do
Forget to do: quên làm

- Don't forget to lock the door

Forget doing: quên đã làm

- I forgot (past) locking the door

Regret to do: đã xảy ra
Regret doing: chưa xảy ra
Force SO to do something: buộc ai làm

INVERSION

Here, there, first, last:

- The tank last came→ Last came the tank

Can not be used with a pronoun:

- Here she comes!

Away, off, down, over, in, out, up (trạng từ):

- The runner went away→ Away went the runner.

With adverbs of place: down, from, in, on followed by verbs: stand, lie, go, walk

- My son walk in with his muddy shoes→ In walk my son with his muddy shoes.

With IF clause:

- If I had known that what happened, i would never have left her alone→ Had we known....

With modal verbs or auxiliaries:

- I will never smoke again→ Never will I smoke again.

Never, rarely, seldom, not only...but also, hardly, under no circumstance, no where, not, no longer, by no means, not by any means, neither..nor

With ordinary verb → thêm vào trợ động từ

- We rarely go out→ rarely do we go out.

Only + adverbs:

- Only by chance
- Only after
- Only once
- Only then: chỉ có lúc ấy
- Only in this way
- Only today, yesterday
- Only by luck: chỉ nhờ vào sự may mắn

Adverbials at the beginning of a sentence

Hardly
Rarely
Seldom + auxiliary + subject + verb +
Never
Only

Never have so many people been unemployed as today.
Hardly had he fallen asleep when he began to dream of far away lands.
Seldom does class let out early.

No sooner ... than +clause

No sooner had we started (xảy ra trước) out for Cali than it started to rain.
No sooner had she entered the building than she felt the presence of somebody.

Hardly ... when ⇔no sooner+
Scarely

He had hardly seen me when he ran away. ⇔ He had no sooner seen me than he ran away.
No sooner (scarely) had he seen me than (when) he ran away.

	Small ones
case	Cassette
statue	statuette
disc	diskette

cấu trúc vô chủ:

- It is necessary to
- It is advisable to
- Soon : không phảI chờ lâu
- Early ≠ late: có mốc thời gian (early ⇒7g⇐ late).

Contrasting: but, while, whereas:
Communication by fax is almost instant, whereas letters can take days to arrive.

Do/ play/ go

- He does several sports (general)
- You should do/ take more exercise.
- I do a lot of sport.
- We often go swimming.
- I played a lot of tennis.

Percentage / proportion

- A small percentage of students (plural) drop (plural) out..
- There is a large proportion.
- Use high/low or small/low percentage/ proportion. Don't use big percentage/ proportion.

Game/ match
A football match or a game of football.
Plural expression with number:
We have a ten-year-old daughter.(must use a hyphen -); a two-litre bottle.
%
a third, three out of four, one in three, three- quarter
one in ten, nine out of ten:

- use in to talk about very small proportion, e.g. one in ten
- use out of to talk about large proportion, e.g. 99 out of 100.

First, firstly and first of all introduce the first item in a list or sequence. The next item in a sequence is normally introduce by then or next, and in a list by second/secondly.
At first means at the beginning of an event or period, especially when the situation changes.

- We like living abroad at first, but we got homesick later.

Lastly like finally to introduce the last in a sequence or list.
Use at last when something good happens after a long period of waiting.

- At last the government is doing something about unemployment.

After all can be used to remind SO of a fact they should consider:

- I think we have every right to protest. After all, we live in a democracy.

Affect is a verb meaning " to have an effort on ST"
Effect is a verb meaning " cause to happen"
A journey is the period of travel between two places, especially over a long distance. Use go on or make a journey.
A trip is a return journey, especially for a short visit. Use go on, make or take a trip.
Travel (uncountable noun) is the general activity of moving from place to place.

although	He was arrested even though he had an alibi.
Despite/ in spite of	Despite its poor record, the government was re-elected.
however	He claimed to be a doctor. In reality, however, he had no medical qualifications at all.
Nevertheless	It was only a minor accident. Nevertheless, there could be serious repercussions.
While	While things are improving, there is still along way to go.
whereas	Some people favour devolution, whereas others are bitterly opposed to it.
On the other hand	The new factory will provide employment. On the other hand, it may damage the environment.

Appendix

Noun and verb + s,es

- Watch/ She watches TV
- Match/ Matches (plural)
- Miss/ misses
- Bus/ buses
- Potato/ potatoes
- Do/ does
- Go/ goes
- Baby ⇒ babies
- hurry⇒ hurries/ hurried
- country⇒ countries
- play⇒ played (before a vowel)
- die⇒ dying

Doubling consonant:
Stop ⇒ stopping/ stopped
Plan ⇒ planning/ planned
Prefer ⇒ preferring/ preferred (permit, regret, begin…)
Hot ⇒ hotter
Thick ⇒ thicker
Visit ⇒ visiting/ visited
Develop ⇒ developing/ developed
Listen ⇒ listening/ listened
Start ⇒ starting/ started
Travel ⇒ travelling/ travelled
Boil ⇒ boiling/boiled

Cheap ⇒ cheaper (long vowel)

1. On time = punctual, not late
2. In time= soon enough to do (for something)
    a. will you be home in time for dinner?
3. At the end of something= at the time when something ends.
4. In the end= finally
5. by + a time = not later than
6. in + a period of time= a time in future
    a. the train will be leaving in a few minutes.

It is time

1.It is time for SO to do ST
    a. It is time for me to go home

2.It is time SO did ST
    a. It is time I went home.

for, during and while

1. for + a period of time to say how long something goes on.
    a. I watched TV for 2 hours last night
2. during + noun to say when something happen
    a. I fell asleep during the film
    b. I fell asleep while I was watching TV.

Like= similar to/ the same as

Quite and rather

Quite = less than very but more than a little

Rather is similar to quite but negative meaning:

- He is quite intelligent but rather lazy.

The whole book= all the book

On my own = by myself= alone

Unless, as long as, provided/ providing (that)

Unless= if…not

- I can not hear unless you shout = I can not hear if you don't shout.

As long as, provided, providing (that) = but only if

- You can use my car as long as you drive carefully.

In case/ in case of

- He wears two watches during a game in case one of them stops.
- In case of fire, please leave the building as quickly as possible.

Grammar:

Describing function
Using the Present simple: The function of X is to...
What does an electric motor do?
• An electric motor converts electrical energy to mechanical energy. • ROM holds instructions which are needed to start up the computer
We can emphasize the function like this:
• The function of an electric motor is to convert electrical energy to mechanical energy. • The function of ROM is to hold instructions which are needed to start up the computer.
Used to-infinitive, Used for + -ing form
• ROM is used to hold instructions which are needed to start the computer. • ROM is used for holding instructions which are needed to start up the computer.
Describing structure
A X consists of a Y and a Z. .....is made up of ....is composed of....
• A simple dc motor consists of a field magnet and an armature.
• A transformer consists of two coils, a primary and a secondary.
• The core is made up of thin pieces of soft iron.
• The coil number is composed of loops of wire. • The armature is made up of a loop of wire and a split ring known as a commutator.
Name components
known as
called
• Carbon blocks called brushes.
• The armature is made up of a loop of wire and a split ring known as a commutator.
Locate components
• The armature is placed between the poles.

Connect components
• The loop is connected to the commutator. • Current is supplied to the motor through carbon blocks called brushes.
Describe how components are connected to each other
• A is bolted to B. = A is connected to B with bolts. • A is welded to B. = A is connected to B by welding. • A is fixed to B. = no specific method given. • screwed • soldered • attached • wired • bonded • glued • riveted • welded • brazed • nailed
Principles and laws
If/When (action – present tense), (result- present tense).
• If a liquid is heated, it changes to a gas or vapour. • If a gas is allowed to expand, it cools down. • If a gas is compressed, it heats up.
Verbs and related nouns: er or or

Refrigerate	refrigerator
a. condense	condenser
b.evaporate	evaporator
c. compress	compressor
d. resist	resister
e.charge	charger
f. generate	generator
g.conduct	conductor
h. exchange	exchanger
i. radiate	radiator

j. control	controller
Verbs with –ize/-ise	
• The rotor is magnetized. • The rotor is made magnetic.	
What do these abbreviations mean?	
• MCC: motor control center. • PT: potential transformer. • CT: current transformer.	

Listening

Part I: FORMATION OF COAL

Welcome to a MidAmerican Energy coal – fueled power plant. This plant converts the energy within coal into electricity. The plant's supercritical technology allows boiler and turbine equipment to operate at extremely high temperatures and pressure.

Requiring less coal and resulting in fewer emission for the same electrical output. Most coal was formed hundreds of millions of years ago. When much of the earth covered by steamy swamps. As plants and trees died, their remains sank to the bottom of the swampy areas. Accumulating layer upon layer.

Eventually, a dense, spongy material call peat, formed. The earth's surface gradually changed. Seas and great rivers deposited sand, clay and other mineral. On top of the peat. These deposits formed sandstone and other sedimentary rocks. And buried the peat beneath the earth's surface. Their weight squeezed water from the peat. Over millions of years, continued heat and pressure gradually changed. The peat and sedimentary into coal.

PART II: MINING COAL

There are two common ways to mine coal from the ground. The first method is used when coal lies close to the surface. With surface mining, topsoil and layers of rock are removed to expose the coal. The second method is underground mining, sometimes called deep mining. This method is used when coal is located several hundred feet below the earth's surface.

Underground mines can be up to 1000 feet below ground and require elevator to transport workers to the bottom of the mine. Once the coal is removed from the earth it typically travels by conveyor belt to a preparation plant located at the mining site. Then, it's cleaned and processed to removed unwanted materials such as dirt and rock. After the coal has been processed it's shipped to market most coal in the United States is transported by train. However coal also can be shipped by barge, ship or truck.

PART III: BOILER AND COMBUSTION

The coal arrives at the power plant and is unloaded into a storage area. When needed, it's moved by conveyor belt from the storage area to bunkers in the plant. Bunkers typically hold enough coal to fuel the power plant for approximately half a day. From the bunkers the coal is fed into mills that pulverize it into a very fine powder. The pulverize coal is mixed with hot air and blown into the boiler. Inside the boiler, burners ignite the coal and air mixture to achieve complete combustion and create the maximum amount of heat possible. Coal combustion residue called bottom ash collects on the bottom of the boiler. This ash can be sent to a landfill but is often soled as material for roadway construction.

PART IV: TURBINE AND GENERATOR

The intense boiler heat turns water in tubes into steam that can reach up to 1100 degrees Fahrenheit. Heating the water also cause it to expand and increases the pressure in the pipes up to 3700 pounds per square inch. The steam passes through four turbines before it is turned back into water and used again. The steam first is

piped to a high pressure turbine and then returned to the boiler to be reheated. It then is piped to an intermediate – pressure turbines and finally to two low – pressure turbines. The steam blasts into each turbine, turning blades that are attached to a single shaft. The turning shaft continuous into the adjacent electrical generator. As the shaft rotates, it turns electromagnets within a series of wire coils to produce electricity. The electricity from the generator passes though a step up transformer where it voltage is increased. It then travels through the power lines that carry it to homes and businesses.

PART V: WATER AND STEAM SYSTEM

The water that is heated into steam at coal – fueled power plant is called feed water. This water typically is supplied by wells and passes through as cleaning system to remove minerals and other impurities. After the feed water converts into steam and moves through the low–pressure turbine blades, it passes across tubes within the condenser that turn it back into water. These tubes contain cooler water from a separate circulating water supply.

The circulating water constantly flows between the condenser and an external cooling tower. Fans and exposure to the air within the tower lower the temperature of the circulating water before it returns to the condenser.

PART VI: CONTROLLING EMISSION

Hot exhaust gases from the burning coal-air mixture contain regulated emissions such as nitrogen oxides, sulfur dioxide, mercury, and particles of ash. Before the gases are released into the atmosphere, they go through several processes to remove these materials. The exhaust gases first pass through a selective catalytic reduction unit, or SCR, to break down the nitrogen oxides.

The SCR contains modules with many plates coated with a chemical forming a catalyst. To begin the chemical reduction process, ammonia is injected into the gases. As the ammonia and nitrogen oxides pass through the plates, a chemical reaction breaks them down into nitrogen and water vapor.

Next, the gases pass through an activated carbon injection system to reduce the mercury content. The injection system sprays activated carbon into the gas stream. Mercury in the gases reacts with the activated carbon to form particles that are romoved later in the process. The gases continue on to the spray dryer absorber, or SDA.

As they enter the SDA, the gases are prayed again, this time with a lime and water mixture that reacts with the sulfur dioxide to form particles that are collected downstream.

The remaining particles are collected in the bag-house, an area containing large fabric filter. The bag-house acts like a giant vacuum cleaner to remove carbon, SDA dry product and ash from the exhaust gases. The dry product collected here and in the SDA periodically is removed and taken to a land fill. After the gases pass through the bag-house, they are dispersed into the atmosphere through a tall stack. In the stack, a Continuous Emissions Monitoring System analyzes the gases for sulfur dioxide, nitrogen oxides, carbon dioxide, and carbon monoxide.

If the gases are above permitted levels, the monitoring system trigger an alarm in the control room so an operator can take action to correct the problem. The coal –

fuel power plant uses the supercritical technologies, modern equipments and the strict emission treatment processes. It help to reduce the maximum emission what leave to the atmosphere after all production process.

1. SOURCE OF FUEL

Welcome to one of MidAmerican Energy is combustion turbine power plants. In this plant, combustion turbines convert fuel to mechanical energy to generate electricity. Combustion turbines can be powered by natural gas and fuel oil.

Oil and gas were formed when animals and plants died and sank to the bottom of ancient seas and lagoons. When microscopic bacteria caused the decay of the animal and plant material. Layers of sediment covered them. And as the number of layer increased. So did the pressure and the temperature. This turned the rotting material into hydrocarbons that make up oil and gas. The hydrocarbons mixed with water and sand and gradually seeped through the porous layer of rock along with bubbles of gas. Eventually the oil and gas would encounter a layer of rock that it could not pass through. It became trapped like water in a sponge forming oil and gas deposits.

2. GETTING FUEL TO POWER PLANT

Once natural gas or oil deposits are located, these fuels are taken out of the earth and refined before they are used to generate electricity. Oil and gas are removed from the earth through wells that are drilled down into the deposit. If a well passes through porous rock containing oil and natural gas, internal pressure may force the raw fuels to the surface.

However, this pressure usually subsides and the fuels must eventually be to the surface. When the natural gas and oil have been removed from the ground, they are transported to a treatment plant. At the plant, they go through a process that prepares them to be used as fuels. After treatment, the fuel can be sent to a power plant.

3. COMBINED CYCLE POWER PLANT

The facility is called a combined-cycle power plant. In the first cycle, a combustion turbine burn fuel to power an electrical generator.

In addition to a generating electricity the combustion process also results in a constant flower of hot, high-pressure exhaust gas.

In the second cycle, the hot exhaust gases pass through a heat recovery steam generator where the hot gases convert water into high-pressure steam.

The steam is routed to a steam-power turbine which powers another electrical generator. By recycling the exhaust, additional electricity is generated without the need for additional fuel.

4. FROM FUEL TO ELECTRICITY

Generating electricity with a combustion turbine begins when filtered, outside air is pulled into a compressor. The air is forced through the compression chamber by a series of rotating and stationary blades. As the air travels through the compressor, its pressure and temperature increase as it is forced into a smaller and smaller space.

This increase in pressure force the air through the rest of the combustion turbine. The high-pressure air from the compressor is directed to fuel injectors that release fuel into the air. The fuel and air mixture flows into combustion cans located around the turbine.

Within the cans, a flame ignites the mixture resulting in hot gases that expand into the turbine area. The hot, high-pressure gases then blast through the turbine spinning a series of turbine blades connected to a long shaft. As the shaft turns, it provides mechanical energy to turn the blades of the compressor and also rotates an electromagnet within the electrical generator.

The rotating electromagnet within the generator creates an electrical charge. The electrical charge creates an electrical current that travels through tubular aluminum conductors to a sep-up transformer outside the plant where its voltage is increased. The electricity is then sent to power lines that carry it to homes and businesses.

4. HEAT RECOVERY STEAM GENERATOR

After the hot gases turn the combustion turbine blades, the gases exit from the turbine as exhaust. However, the gases are still hot and the heat can be recycled through a heat recovery steam generator.

The heat recovery steam generator turns water into high – pressure steam. The steam is used to power a steam turbine that generates additional electricity. In the heat recovery steam generator, the hot gases pass over tubes that have water running through them. The hot gases boil the water in the tubes, turning the water into steam.

As the water turns to steam, its pressure increases. This high – pressure steam is piped to a steam power turbine.

As the steam rushes through the turbine, it turns blades attached to a long shaft. The other end of the shaft is connected to an electrical generator. As the turbine turns the shaft, it causes large electromagnets to rotate within the generator, creating an electrical current that is sent to a step – up transformer.

After the steam turns the turbine blades, it leaves the steam turbine and passes through a condenser. The steam is turned back into water as it is cooled by a separate water supply, known as circulating water, flowing through the condenser tubes. The condensed steam is then returned to the heat recovery steam generator where it is again turned into high – pressure steam. The circulating water is piped to a cooling tower to lower its temperature and is then returned to the condenser to be used again.

6. CONTROLLING EMISSION

The hot gases that pass through the combustion turbine contain emissions of carbon monoxide and nitrogen oxide that need to be removed before the gases are returned to be atmosphere.

To accomplish this, the gases first pass through an oxidation catalyst unit within the heat recovery steam generator. This unit has many small plates in it, live a radiator. The plates are coated with a chemical known as a catalyst which interacts which the carbon monoxide.

As the gases pass through the unit, the catalyst converts the carbon monoxide into the carbon dioxide reducing it by approximately 80 percent. Nitrogen oxide emissions are controlled before leaving the heat recovery steam generator (HRSG) as well. As the first step in this process the gases are injected with ammonia

They then pass through the selective catalytic reduction unit, which also contains many small plates coated with a catalyst.

As the hot gases pass over the plates the nitrogen oxide, reacts with the catalyst and ammonia and turns into nitrogen and water. The selective catalytic reduction unit reduces nitrogen oxide emissions by as much as 90 percent.

Muc Lục

DC GENERATOR
ELECTRIC FUSE
INTRODUCTION
REFRIGERATOR
TRANSFORMER
OHM'S LAW- AN ACTIVITY
SYMBOLS USED IS AN ELECTRIC CIRCUIT
SHORT CIRCUIT
SEMICONDUCTORS

DC GENERATOR

Definition:

An electrical generator is a device, which converts mechanical energy into electrical energy. DC generator produces direct current

Principle:

In a DC generator an E.M.F is induced whenever magnetic flux is cut by a conductor.

Shown here is a rectangular copper conductor loop A B C D rotating in a clockwise direction about its own axis in a uniform magnetic field provided by permanent magnets or electromagnets

Two ends of the coil are connected to two slip rings R1 and R2, which are insulated from each other and from the central shaft.

Two collecting brushes B1 and B2 made of carbon or copper, are pressed against the slip rings. Their function is to collect the current induced in the coil.

Electric current is produced whenever the coil rotates between the magnetic poles. The deflection of the galvanometer needle shows that the current is induced.

ELECTRIC FUSE

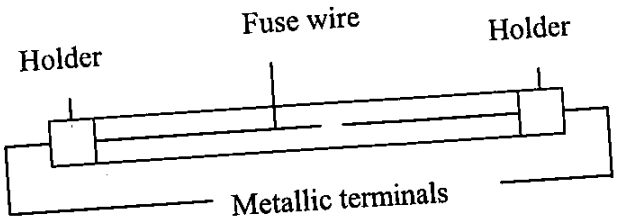
An electric fuse is a device that is used to protect electric circuits and electric appliances against high current caused by short circuiting or overloading due to withdrawal of large current

A fuse is a short piece of wire made of a material of high resistance and low melting point. The fuse wire is an alloy of lead and tin.

The plug fuse consists of two parts namely the porcelain casing and the porcelain grip.

Hollow rectangular block of porcelain.

Rectangular clamp make by copper.



AC GENERATOR

INTRODUCTION

An alternating current generator is a device which converts mechanical energy into electrical energy.

The voltage produced alternately reverses its direction from positive to negative

The AC generator was originally designed by Nicolas Tesla

Nicolas Tesla designed the ac generator. He born in 1856 in Smilax (Austria-Hungary) and emigrated to the U.S in 1884 as a physicist. He pioneered the generation, transmission and use of alternating current, which can be transmitted over much greater distances than direct current.

Tesla's work with radio-frequency waves laid the foundation for today's radio. He experimented with wireless transmission of electrical power and received 112 patent for devices ranging from speedometers to extremely efficient electrical generators to a bladeless turbine still in use today. He suggested that it was possible to used radio waves to detect ships (later developed as RADAR) and his work with special gas-filled lamps set the stage for a creation of fluorescent lighting. He died in 1943.

REFRIGERATOR

In exhaust valve, the water formed by condensing spent steam, it goes to the condenser. Then, the water's pushed by the pump into boiler. In here, it evaporates and follows the way into intake valve. The piston re-pressures stream. It makes crankshaft work.

The water flows back into the expansion valve and the cycle repeats itself.

The water enters the expansion valve. As it passes through, the sudden drop in pressure makes it cool and turn into a gas. The compressor squeezes the water, raising its temperature and pressure. Then, the water follows pipes into the inside of the refrigerator.

The water absorbs the warmth from the air inside the refrigerator and turns back into a low temperature gas, at low pressure. It now starts its journey again through the compressor.

TRANSFORMER

I/ Introduction:

In our life there are many devices to use a transformer such as: the voltage stabilizer, charger, radio...

II/ Concept:

A transformer is an electrical device used to convert AC power at a certain voltage level to AC power at a different voltage but at the same frequency

III/ Principle:

If two coils are inductively coupled and current changes through one of the two coils then e.m.f is induced in the other coil due to mutual induction.

IV/ Structure:

A transformer typically comprises a primary coil and secondary coil wound around a laminated soft iron core

V/ Types of transformer: 2 categories

Step-up transformer:

In a step-up transformer the number of turns in the secondary coil is greater than the number of turns in primary coil.

The primary coil is made of thick copper wire, the secondary coil is made of thin copper wire.

This type of transformer converts low voltage at high current to high voltage at low current.

Step-down transformer:

In a step-down transformer the primary coil has large number of turns then the secondary.

The primary coil is made of thin copper wire, the secondary coil is made of thick copper wire.

This type of transformer converts high voltage at low current into low voltage at high current.

VI/ Uses:

Step-down transformer is used for obtaining large current for electric welding

Transformer is primarily used for transmission of electric energy over long distances

Step-down transformer is also used for production of X-rays.

Transformer is used in voltage regulators and stabilized power supplies.

Small transformer are used in radio sets, television, etc...

OHM'S LAW- AN ACTIVITY

1/ A current of 0,2A flows through a conductor of resistance 4,5Ω. Calculate the potential difference at the ends of the conductor.

Suggested answer

Give:

Current : 0,2 A

Resistance: 4,5 Ω

To find:

Formula : $V = I.R$

Potential difference : $V = 0,2 . 4,5 = 0,9$

Unit of potential difference is "V"

Potential difference at the ends of the conductor = 0,9 V

2/Three resistors of 5Ω, 8Ω, 11Ω are connected in series to battery of potential difference 24V and negligible internal resistors. Identify the appropriate circuit diagram and calculate the current drawn from the cell.

$R = R1 + R2 + R3$

$= 5 + 8 + 11$

$= 24X$

Now let us calculate the current drawn from the circuit

$$I > \frac{V}{R}$$

$$I > \frac{24}{24}$$

I = 1 Unit

Current = 1 A

SYMBOLS USED IS AN ELECTRIC CIRCUIT

Connecting wire: A connecting wire is represented by a strength line. It's usually made of copper and is provided with insulation. The resistance of a connecting wire is considered practically negligible.

Resistor : The resistor is represented by a zigzag line. Two thick dots at the ends, represent brass terminals to which a wire is fixed. The resistor wire is generally made from alloys such as nickrome, mangamin, constantan and eureka.

Variable resistor: A resistor whose magnitude can be altered when desired is called variable resistor

Cell: A thin line represents the positive terminal of a cell, whereas thick and short line represents negative terminal of the cell.

Battery: A combination of two or more cells, here the cell are arranged in series

Battery: A combination of two or more cell, here the cell are arranged paralleled to one another

Closed circuit: current flows through an electric circuit

Open circuit: current does not flows through an electric circuit

Ammeter: It's a device used for measuring current in an electric circuit

Voltmeter: It's a device used for measuring potential difference between two points in a electric circuit

Electric bulb: An electric device, such as in candescent lamp, arc lamp, glow lamp, or fluorescent lamp, that emits light when voltage is applied across the terminals

Alternating current: A current which changes its direction rapidly on its own is called alternating current

SHORT CIRCUIT

Remember: The bulb offers more resistance to the flow of the flow of current than the bare wire.

Short circuit can occur if two main wires in a house come in contact due to wearing out of the insulation or if there is overloading

Series circuit:

A mount of electric current passing through all the components remains the same.

The potential difference across any two points is not the same.

Parallel circuit:

A mount of electric current passing through all the components don't remains the same.

The potential difference across any component of the circuit will be the same.

SEMICONDUCTORS

Classification of materials based on energy band theory

Conduction band:

The range of energies possessed by conduction band electrons is known as conduction band. The valence electrons, which are very loosely attached to the nucleus, are knows as "free electrons". These electrons can be easily removed or detached by applying a small amount of external energy.

These free electrons are responsible for the conduction of current in a conductor

Materials include 3 parts: Conductors, insulators, semiconductors.

Conductors:

Materials that allow electric charges to flow through them are know as electrical conductors

Insulators:

Materials that don't allow electric charges to flow through them are know as non electrical conductors or electrical insulators

Semiconductors:

Materials whose conductivity is less than of the conductors and greater than of the insulation are known as semiconductors.

REVIEW

PART 1. Translate into Vietnamese:

1. The electric motor

1. In an electric motor an electric current and magnetic field produce a turning movement.
2. This can drive all sorts of machines, from wrist-watches to trains.
3. The motor shown in Fig.1 is for a washing machine.
4. It is a universal motor, which can run on direct current or alternating current.
5. An electric current running through a wire produces a magnetic field around the wire.

2. The electric motor

1. If an electric current flows around a loop of wire with a bar of iron through it, the iron becomes magnetized.
2. It is called an electromagnet; one end becomes a north pole and the other a south pole, depending on which way the current is flowing around the loop.
3. If you put two magnets close together, like poles – for example, two north poles – repel each other, and unlike poles attract each other.
4. In a simple electric motor, like the one shown in Fig.2 a piece of iron with loops of wire round it, called an armature, is placed between the north and south poles of a stationary magnet, known as the field magnet.
5. When electricity flows around the armature wire, the iron becomes an electromagnet.

3. The electric motor

1. The attraction and repulsion between the poles of this armature magnet and the poles of the field magnet make the armature turn.
2. As a result, its north pole is close to the north pole of the armature.
3. Then the current is reversed so the north pole of the armature magnet becomes the South pole.
4. Once again, the attraction and repulsion between it and the field magnet make it turn.
5. The armature continues turning as long as the direction of the current, and therefore its magnetic poles, keeps being reversed.

4. The electric motor

1. A simple dc motor consists of a field magnet and an armature.
2. The armature is placed between the poles of the magnet.
3. The armature is made up of a loop of wire and a split ring known as a commutator.

4. The loop is connected to the commutator.
5. Current is supplied to the motor through carbon blocks called brushes.

5. Transformer

1. A transformer is composed of two coils, a primary and a secondary.
2. The coils are wound on a former which is mounted on a core.
3. The coil consists of a number of loops of wire.
4. The core is made up of thin pieces of soft iron.
5. U – and T- shaped pieces are used.

6. The Fridge

1. Refrigeration preserves food by lowering its temperature.
2. It slows down the growth and reproduction of micro-organisms such as bacteria and the action of enzymes which cause food to rot.
3. Refrigeration is based on three principles.
4. Firstly, if a liquid is heated, it changes to a gas or vapour.
5. When this gas is cooled, it changes back into a liquid.

7. The Fridge

1. Secondly, if a gas is allowed to expand, it cools down.
2. If a gas is compressed, it heats up.
3. Thirdly, lowering the pressure around a liquid helps it to boil.
4. To keep the refrigerator at a constant low temperature, heat must be transferred from the inside of the cabinet to the outside.
5. A refrigerant is used to do this.

8. The Fridge (5 points)

1. It is circulated around the fridge, where it undergoes changes in pressure and temperature and changes from a liquid to a gas and back again.
2. One common refrigerant is a compound of carbon, chlorine, and fluorine known as R12.
3. This has a very low boiling point: - 29^0C.
4. At normal room temperature (about 20^0C) the liquid quickly turns into gas.
5. However, newer refrigerants which are less harmful to the environment, such as KLEA 134a, are gradually replacing R12.

9. The Fridge

1. The refrigeration process begins in the compressor.
2. This compresses the gas so that it heats up.
3. It then pumps the gas into a condenser, a long tube in the shape of a zigzag.

4. As the warm gas passes through the condenser, it heats the surroundings and cools down.
5. By the time it leaves the condenser, it has condensed back into a liquid.

10. The Fridge

1. Liquid leaving the condenser has to flow down a very narrow tube (a capillary tube).
2. This prevents liquid from leaving the condenser too quickly, and keeps it at a high pressure.
3. As the liquid passes from the narrow capillary tube to the larger tubes of the evaporator, the pressure quickly drops.
4. The liquid turns to vapour, which expands and cools.
5. The cold vapour absorbs heat from the fridge.

11. Transformer

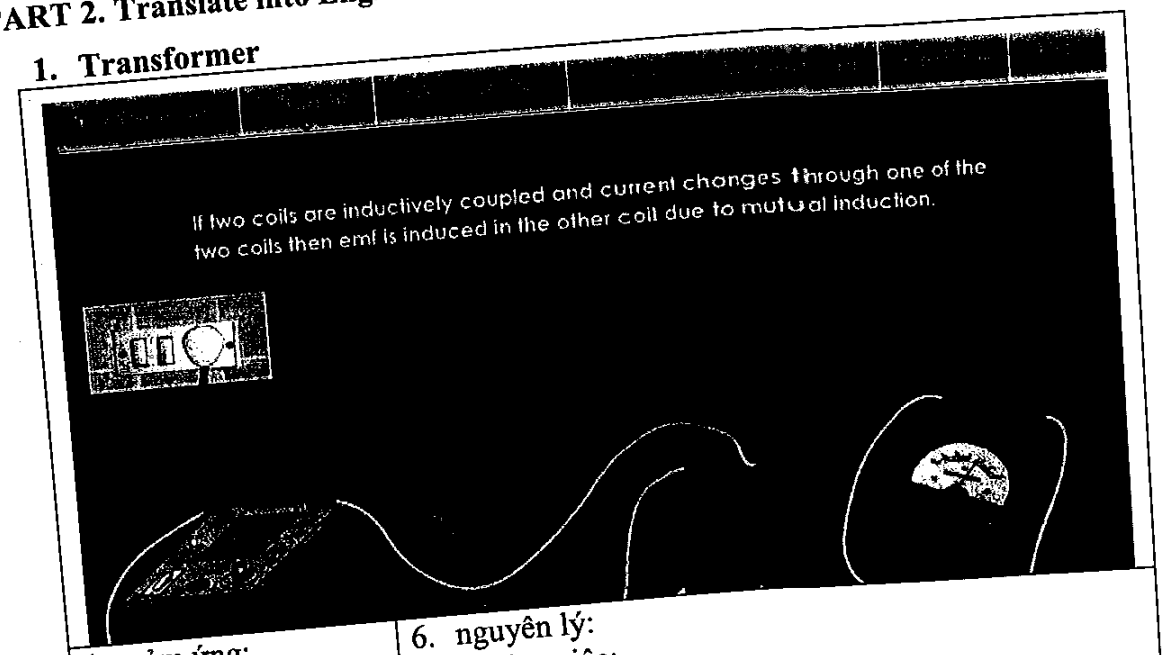
1. Principle: A transformer is an electrical device used to convert AC power at a certain voltage level to AC power at a different voltage but at the same frequency.
2. If two coil are inductively coupled and current changes through one of the two coils then e.m.f induced in the other coil due to mutual induction.
3. Step up transformer: In a step up transformer the number of turns in secondary coil is greater than the number of turn in the primary coil.
4. The primary coil is made of thick copper wire while the secondary coil is made of thin wire.
5. This type of transformer converts low voltage at high current to high voltage at low current.

12. Transformer

1. Step down transformer: In a step down transformer the primary coil has large number of turns than the secondary.
2. The primary coil is made of a thin wire and the secondary coil is made of thick wire.
3. This type of transformer converts a high voltage at low current into low voltage at high current.
4. Step down transformer is used for obtaining large current for electric welding.
5. Transformer is primarily used for transmission of electric energy over long distances.

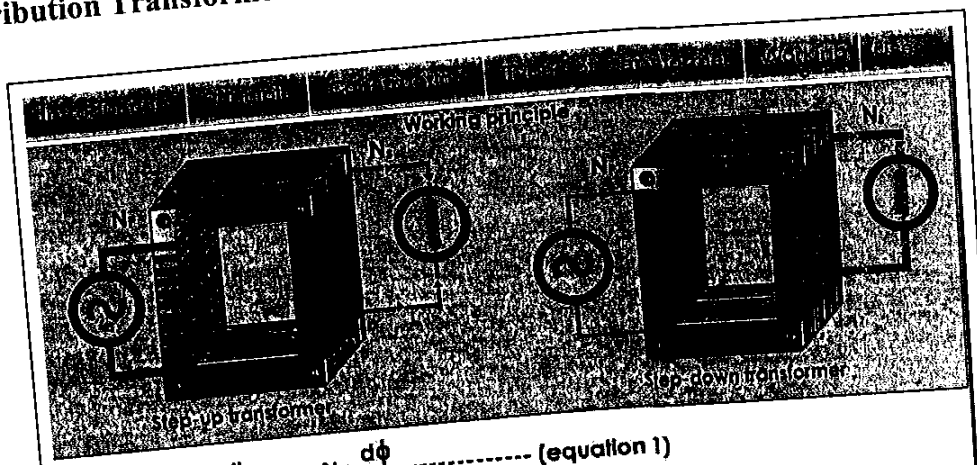
PART 2. Translate into English:

1. Transformer



1. cảm ứng:
2. cuộn dây:
3. dòng điện:
4. thay đổi:
5. cấu tạo:
6. nguyên lý:
7. sự làm việc:
8. liên kết:
9. lực điện từ:
10. các loại máy biến áp:

2. istribution Transformer



For primary coil $E_P = -N_P \frac{d\phi}{dt}$ ---------- (equation 1)

For secondary coil $E_S = -N_S \frac{d\phi}{dt}$ ---------- (equation 2)

$\frac{E_S}{E_P} = \frac{N_S}{N_P} = K$

Where K is called the transformer ratio

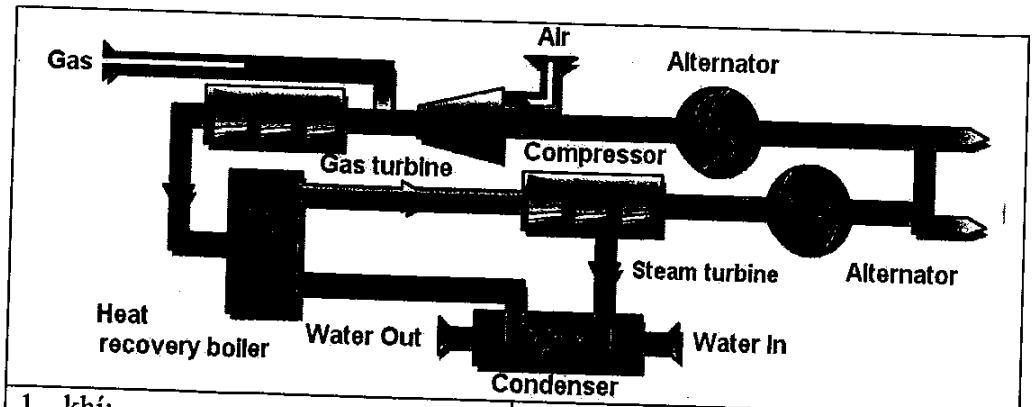
For a step-up transformer $E_S > E_P$ and $K > 1$

For a step-down transformer $E_P > E_S$ and $K < 1$

View text

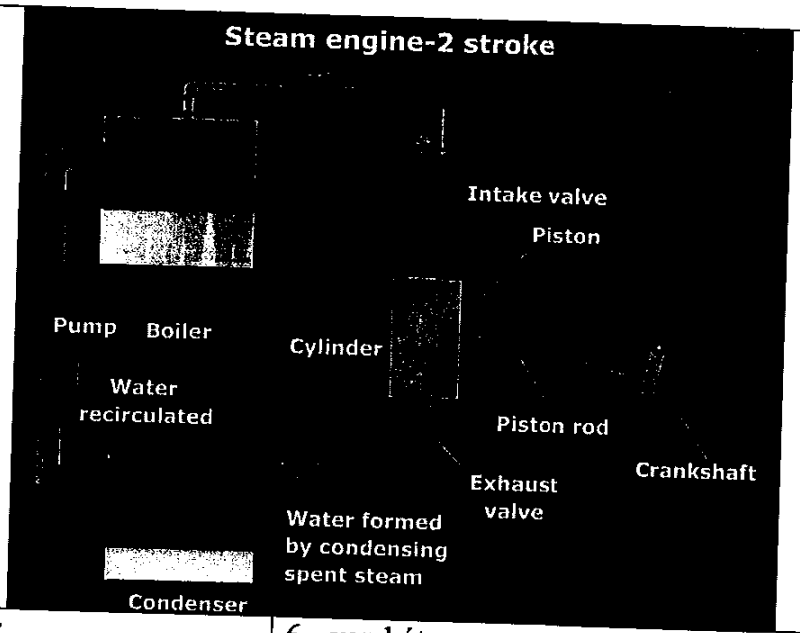
1. cuộn sơ cấp:
2. cuộn thứ cấp:
3. hệ số máy biến áp:
4. máy biến áp tăng áp:
5. máy biến áp hạ áp:
6. nguyên lý làm việc:
7. cấu tạo:
8. phương trình:
9. ứng dụng:
10. giới thiệu:

3. Combined Cycle Power Plant



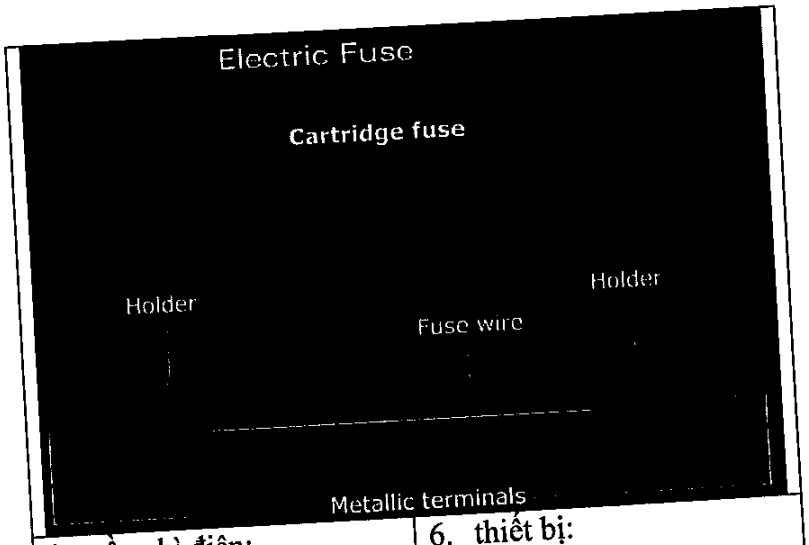
1. khí:
2. gió:
3. tuabin khí:
4. lò thu hồi nhiệt:
5. nước vào:
6. nước ra:
7. bình ngưng:
8. máy nén gió:
9. máy phát xoay chiều:
10. tuabin hơi:

4. Refrigerator



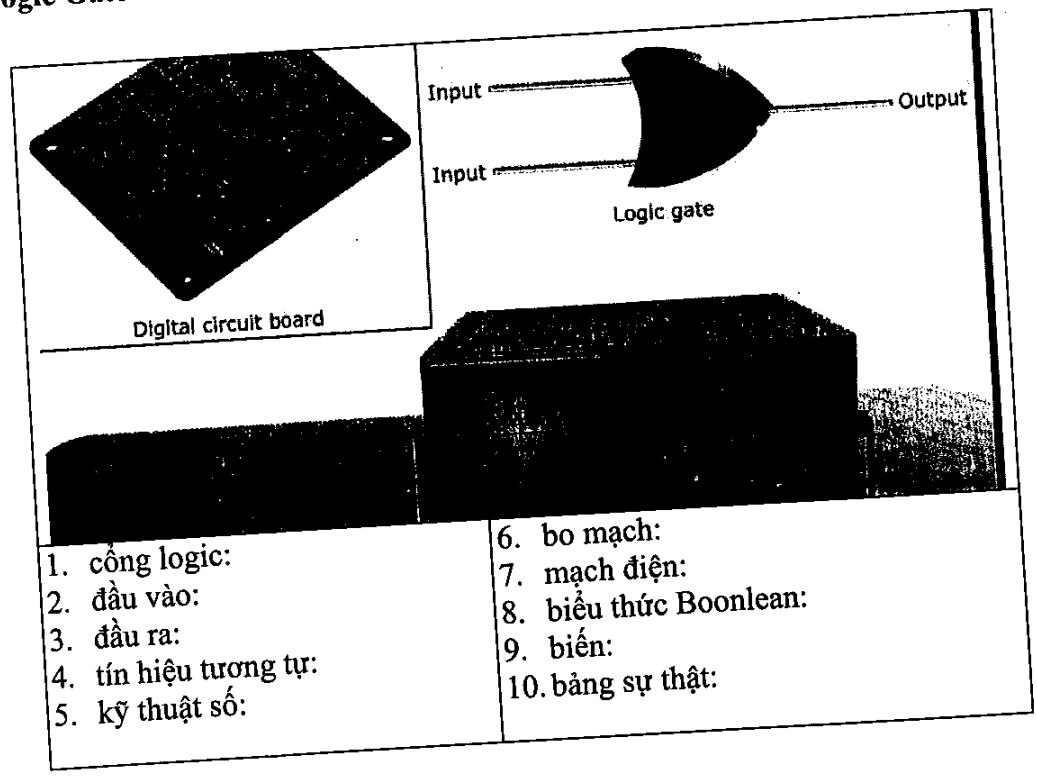
1. bơm:
2. lò hơi:
3. nước được tái tuần hoàn:
4. bộ ngưng:
5. xy-lanh:
6. van hút:
7. van xả:
8. trục khuỷu:
9. động cơ hơi nước 2 thì:
10. nước được tạo thành bằng cách ngưng tụ hơi:

5. Electric Fuse



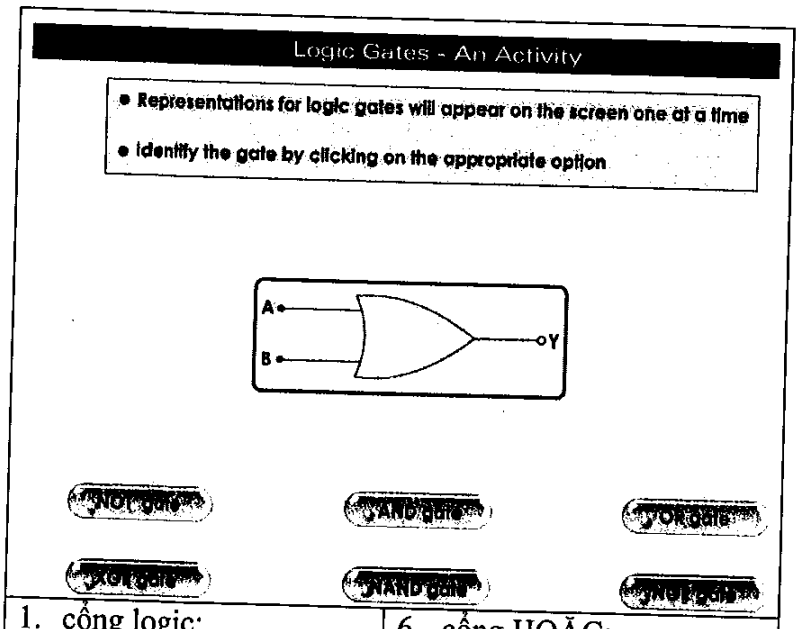
1. cầu chì điện:
2. cầu chì ống:
3. dây chảy:
4. má giữ:
5. cực kim loại:
6. thiết bị:
7. bảo vệ:
8. mạch điện:
9. ngắn mạch:
10. quá tải:

6. Logic Gate



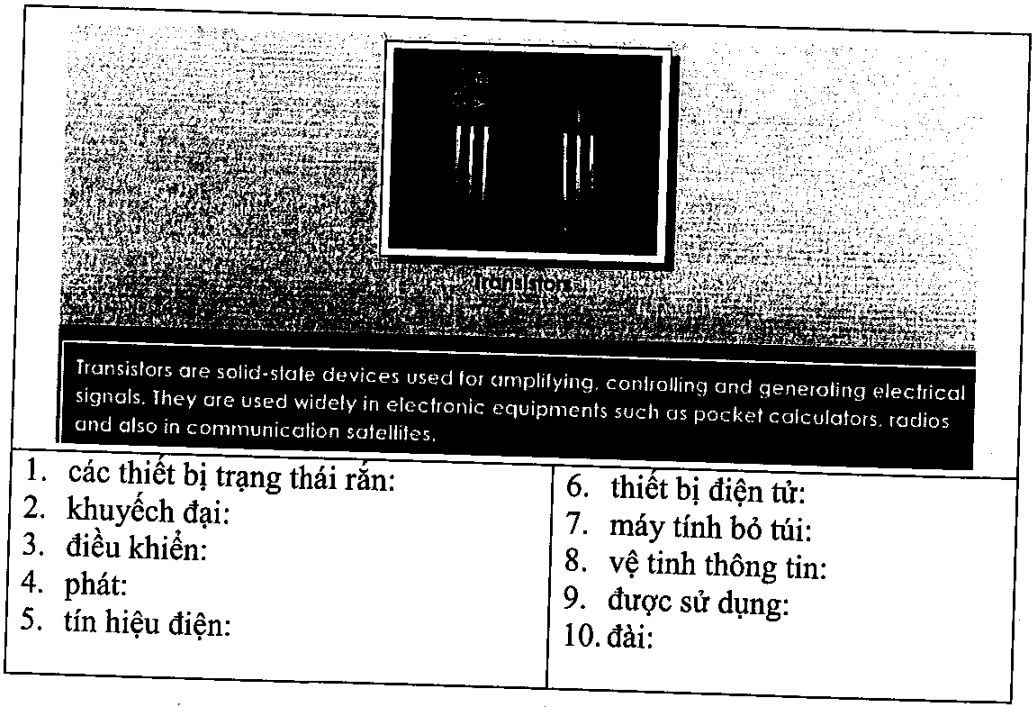
1. cổng logic:
2. đầu vào:
3. đầu ra:
4. tín hiệu tương tự:
5. kỹ thuật số:
6. bo mạch:
7. mạch điện:
8. biểu thức Boonlean:
9. biến:
10. bảng sự thật:

7. Logic Gates- An Activity



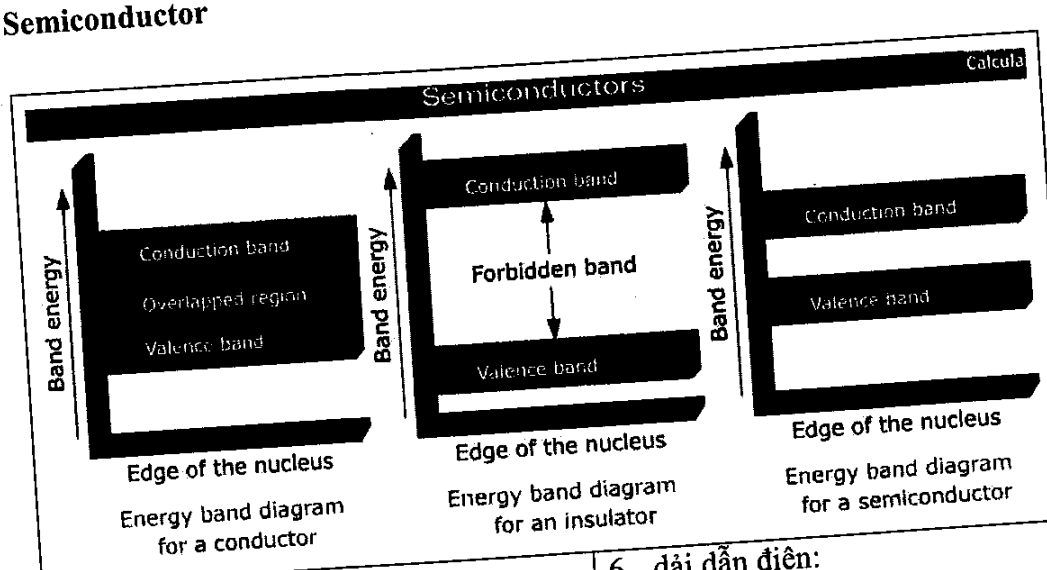
1. cổng logic: 2. hoạt động: 3. sự biểu diễn: 4. phù hợp: 5. lựa chọn:	6. cổng HOẶC: 7. cổng VÀ: 8. nhắp: 9. màn hình: 10. xuất hiện:

8. Transistor



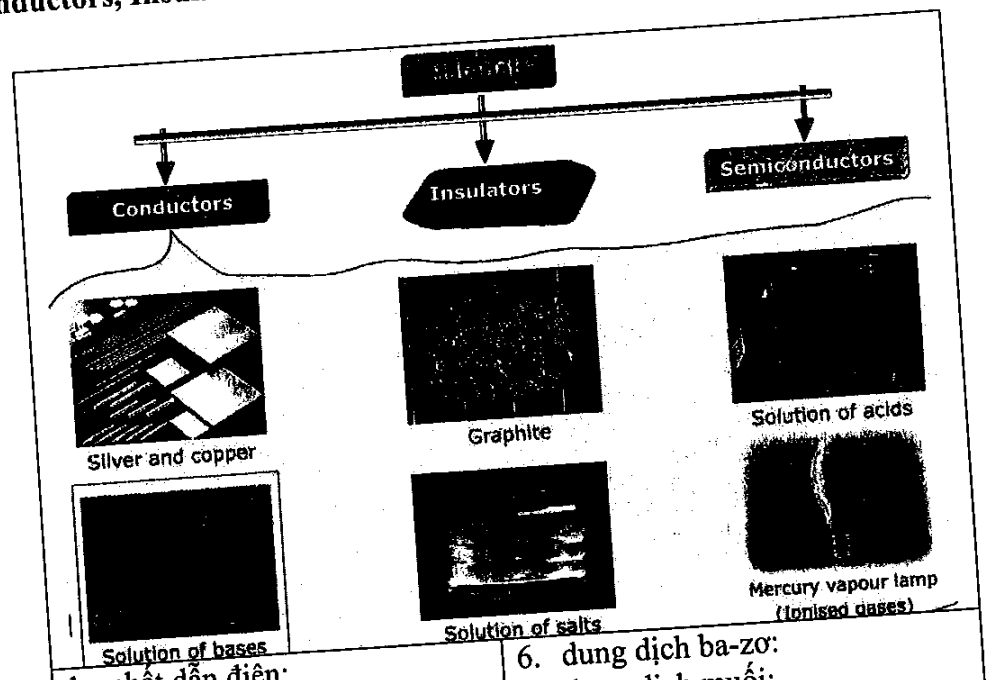
1. các thiết bị trạng thái rắn: 2. khuyếch đại: 3. điều khiển: 4. phát: 5. tín hiệu điện:	6. thiết bị điện tử: 7. máy tính bỏ túi: 8. vệ tinh thông tin: 9. được sử dụng: 10. đài:

9. Semiconductor



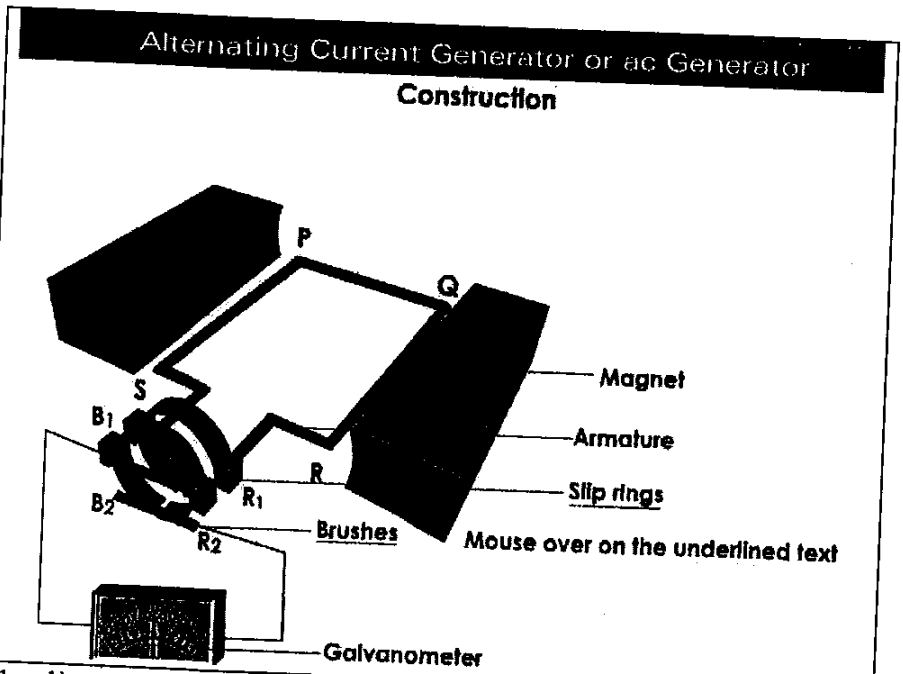
1. dải năng lượng:
2. chất bán dẫn:
3. chất cách điện:
4. chất dẫn điện:
5. vùng lặp:
6. dải dẫn điện:
7. dải hóa trị:
8. hạt nhân:
9. sơ đồ:
10. dải cấm:

10. Conductors, Insulators and Semiconductors



1. chất dẫn điện:
2. chất cách điện:
3. chất bán dẫn:
4. bạc và đồng:
5. than chì:
6. dung dịch ba-zơ:
7. dung dịch muối:
8. dung dịch acid:
9. đèn hơi thủy ngân:
10. các vật liệu:

11. AC Generator



1. dòng điện xoay chiều: 2. máy phát: 3. nam châm: 4. các vành trượt: 5. các chổi than:	6. dụng cụ đo điện: 7. phần ứng: 8. cấu tạo: 9. chữ viết: 10. rà chuột:

12. DC Generator

Definition

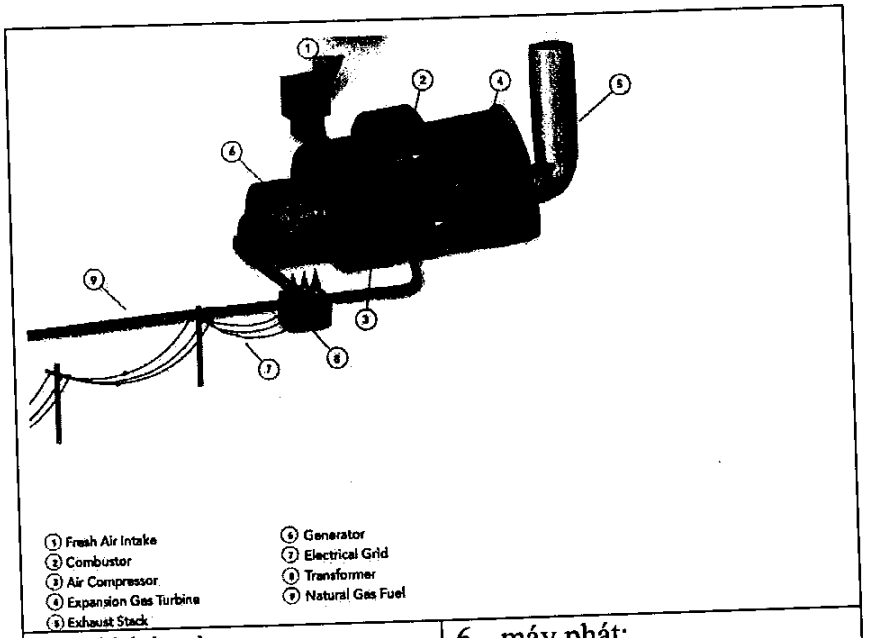
An electrical generator is a device, which converts mechanical energy into electrical energy. DC generator produces direct current.

Principle

In a DC generator an e.m.f is induced whenever magnetic flux is cut by a conductor.

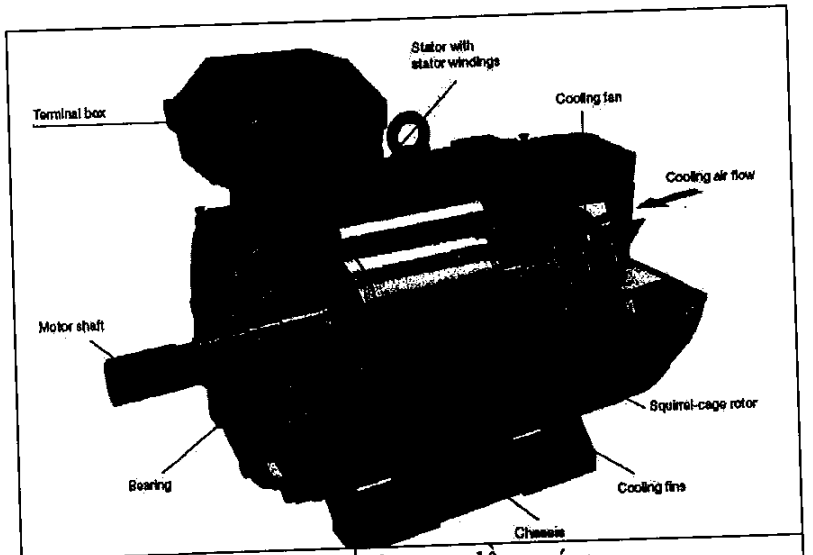
1. dòng điện một chiều: 2. thiết bị: 3. sản xuất: 4. từ thông: 5. cảm ứng:	6. thanh dẫn: 7. nguyên lý: 8. cơ năng: 9. điện năng: 10. chuyển đổi:

13. Gas Turbine



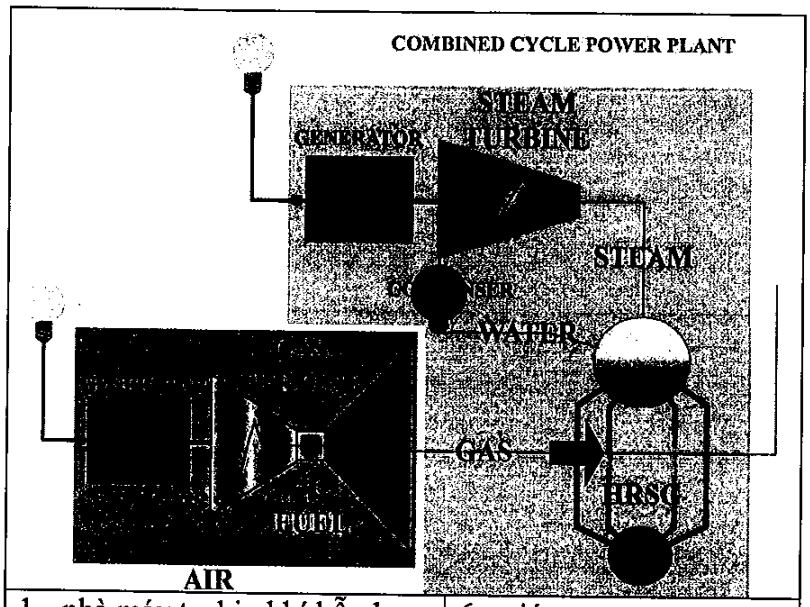
1. gió hút vào: 2. buồng đốt: 3. máy nén gió: 4. tuabin khí giãn nở: 5. ống khói:	6. máy phát: 7. lưới điện: 8. máy biến áp: 9. khí tự nhiên: 10. nhiên liệu:

14. Induction Motor



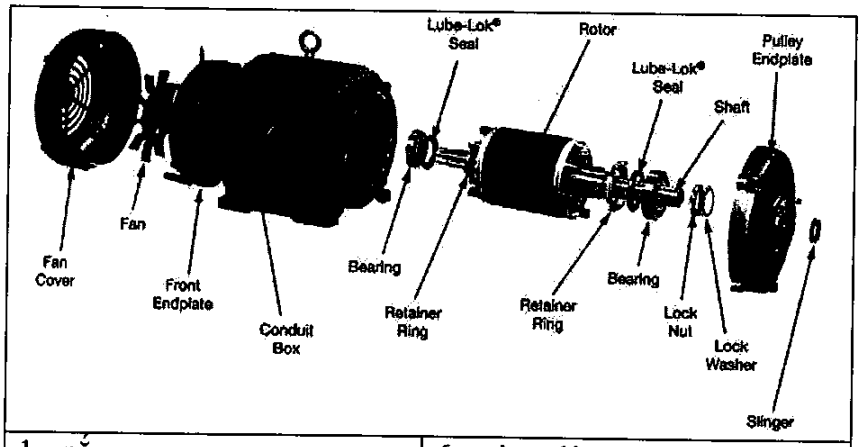
1. hộp đấu dây: 2. trục động cơ: 3. bạc đạn: 4. bệ: 5. rãnh làm mát:	6. roto lồng sóc: 7. lưu lượng gió làm mát: 8. stator với dây quấn: 9. hộp che quạt: 10. quạt làm mát:

15. Combined Cycle Power Plant



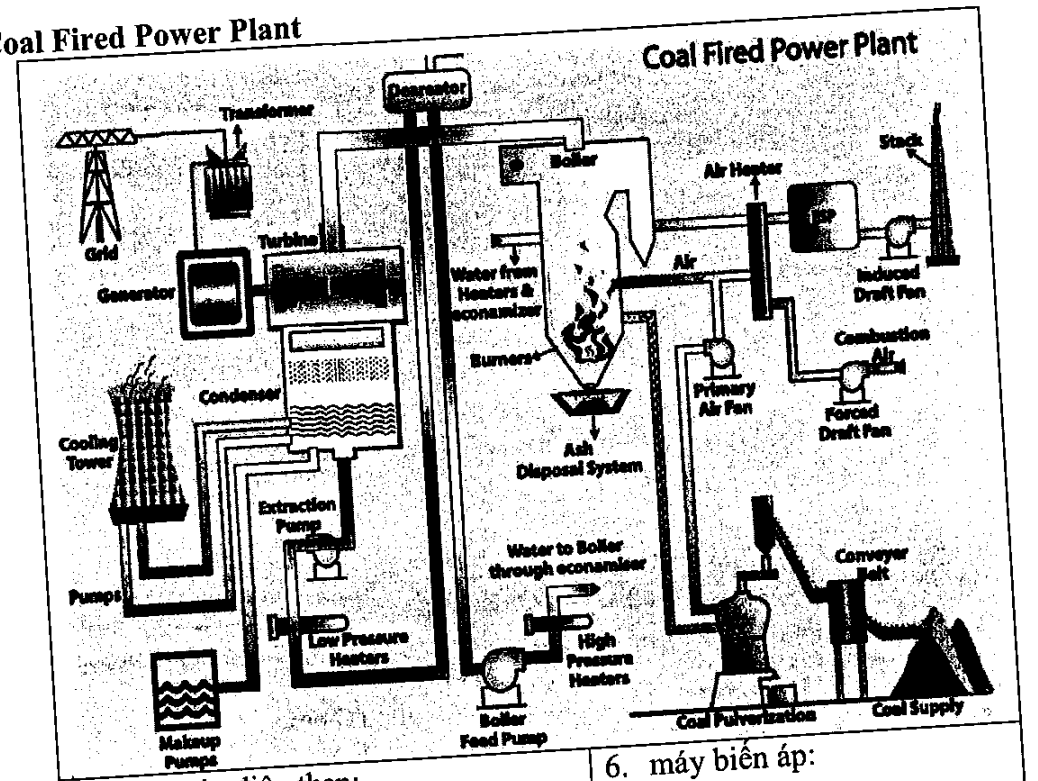
1. nhà máy tuabin khí hỗn hợp: 2. máy phát: 3. bình ngưng: 4. nước: 5. khí:	6. gió: 7. nhiên liệu: 8. hơi: 9. lò thu hồi nhiệt: 10. tuabin khí:

16. AC Motor



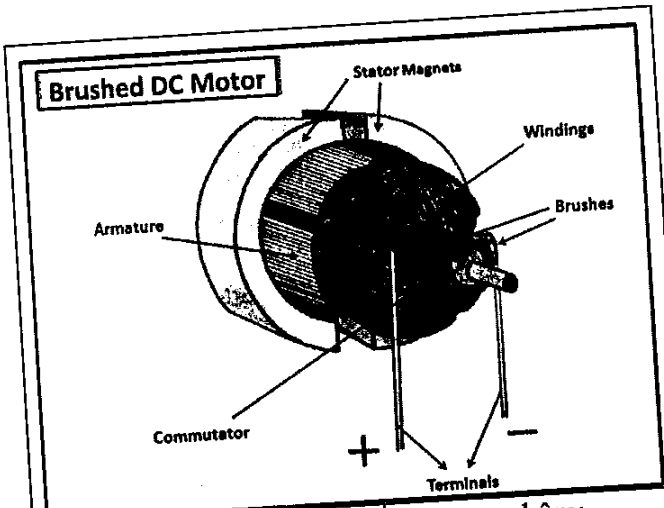
1. nắp sau: 2. hộp đấu dây: 3. bạc đạn: 4. roto: 5. đai ốc khóa:	6. vòng đệm: 7. nắp trước: 8. trục: 9. hộp che quạt: 10. dây quấn:

17. Coal Fired Power Plant



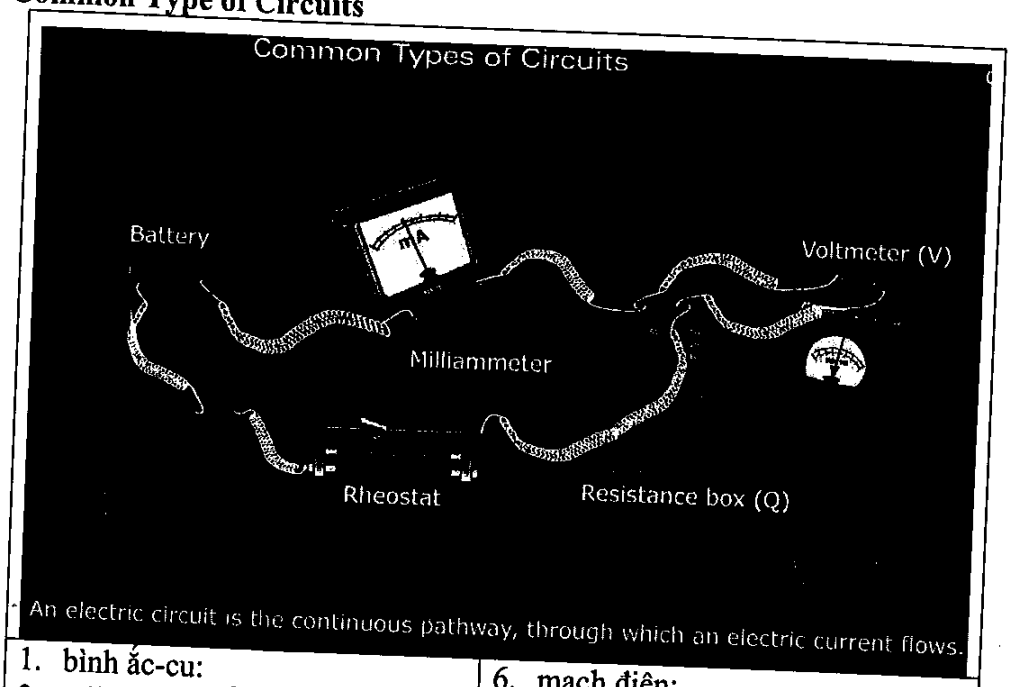
1. nhà máy điện than:
2. ống khói:
3. bơm:
4. lưới điện:
5. vòi đốt:
6. máy biến áp:
7. quạt gió:
8. băng tải:
9. bình ngưng:
10. máy phát:

18. DC Motor



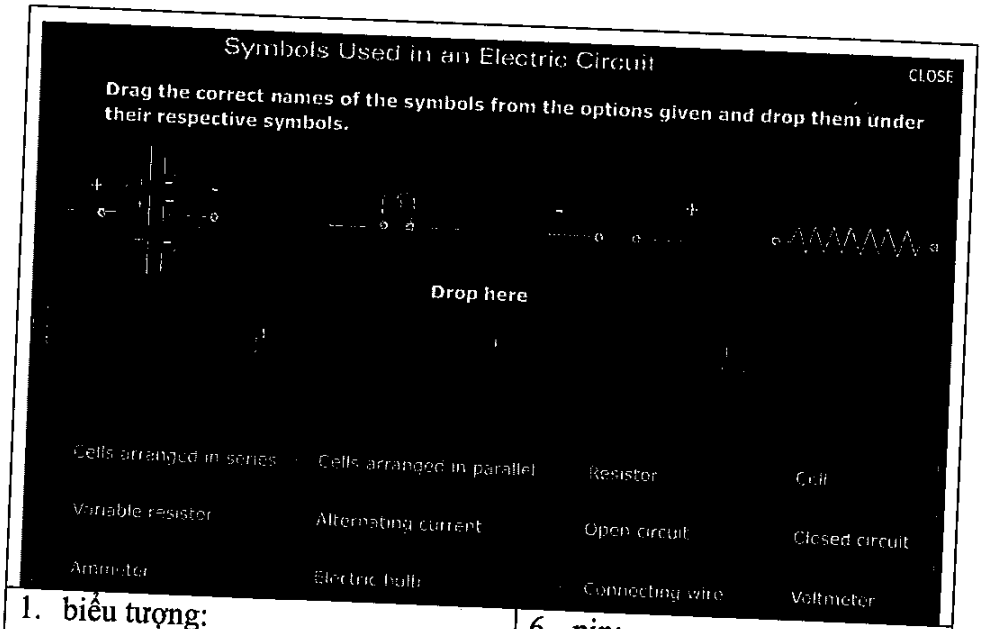
1. cổ góp:
2. phần ứng:
3. dây quấn:
4. chổi than:
5. nguồn cấp điện:
6. nam châm:
7. động cơ dc:
8. trục:
9. bạc đạn:
10. từ trường:

19. Common Type of Circuits



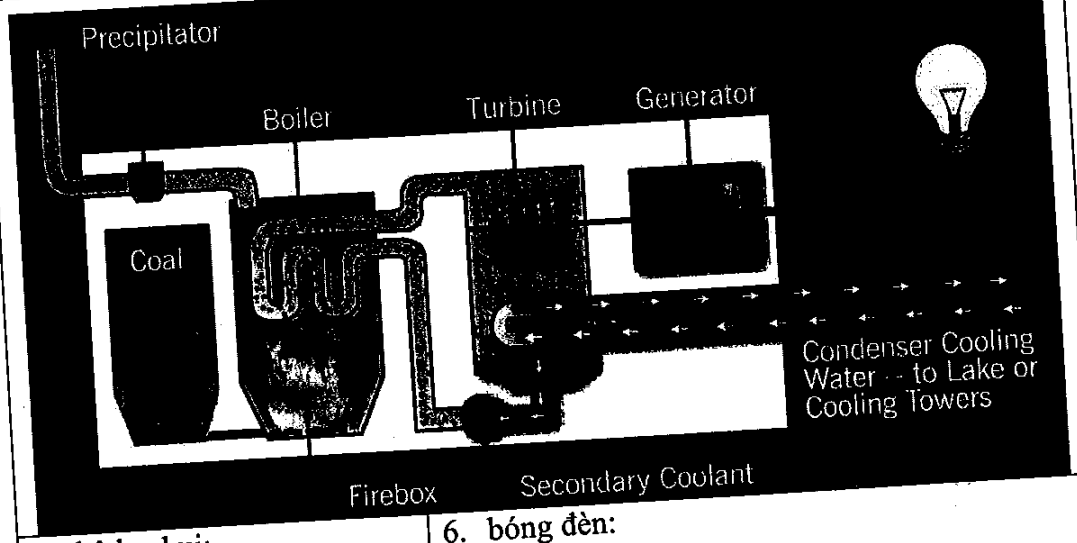
1. bình ắc-cu: 2. mili am-pe kế: 3. hộp điện trở: 4. biến trở: 5. vôn kế:	6. mạch điện: 7. dòng điện: 8. liên tục: 9. chảy qua: 10. đường dẫn:

20. Symbols Used In An Electric Circuit



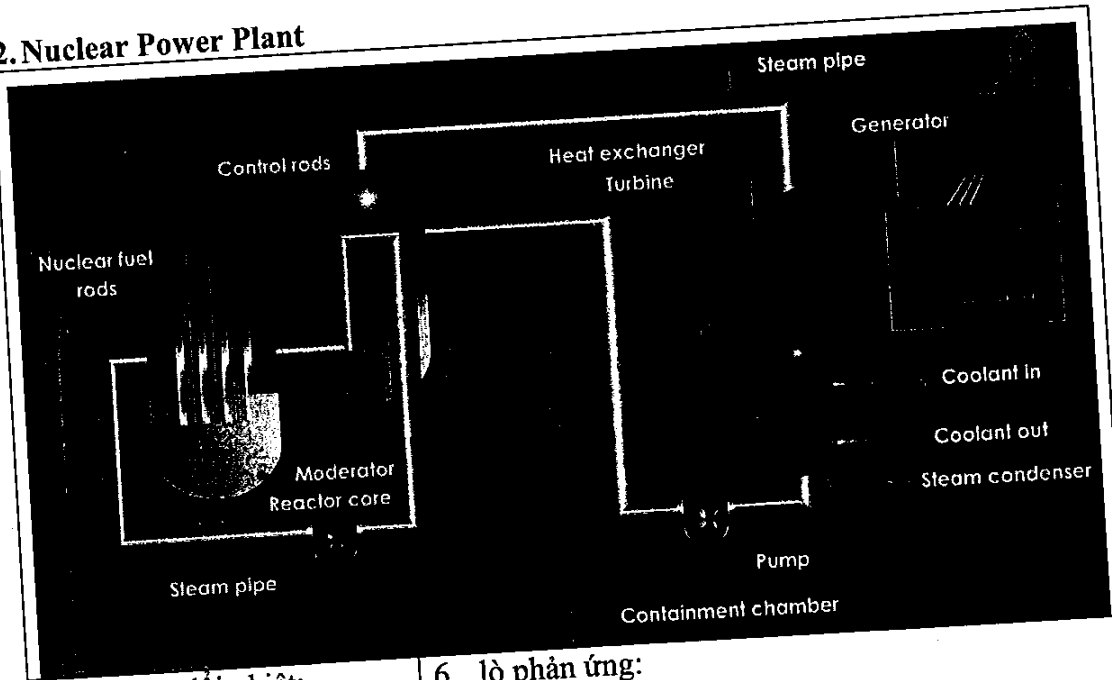
1. biểu tượng: 2. bóng đèn: 3. dòng điện xoay chiều: 4. mạch hở: 5. điện trở:	6. pin: 7. mạch kín: 8. biến trở: 9. dây nối: 10. biến trở nối tiếp:

21. Thermal Power Plant



1. bộ lọc bụi:
2. than:
3. lò hơi:
4. tua bin:
5. buồng đốt:
6. bóng đèn:
7. máy phát:
8. nước làm mát bình ngưng lấy từ hồ:
9. chất làm mát thứ cấp:
10. tháp:

22. Nuclear Power Plant



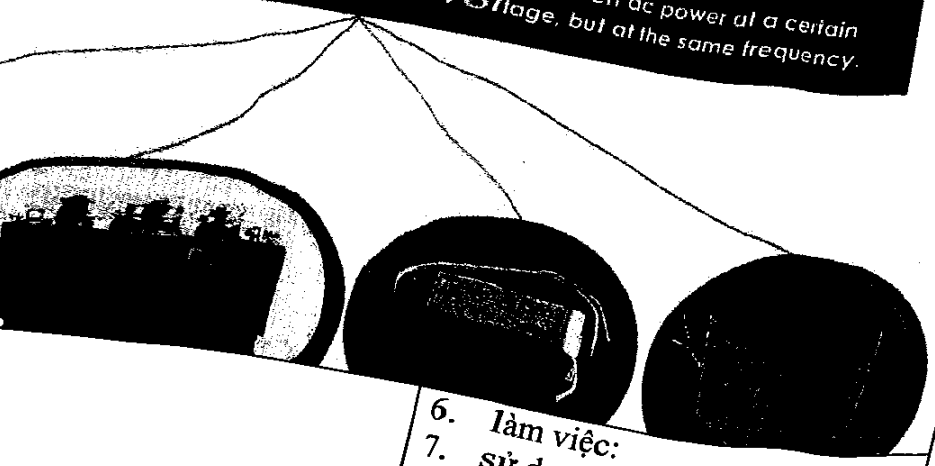
1. bộ trao đổi nhiệt:
2. thanh nhiên liệu:
3. thanh điều khiển:
4. ống hơi:
5. chất trung gian:
6. lò phản ứng:
7. máy phát:
8. bơm:
9. bình ngưng hơi:
10. chất làm mát vào:

rmer

Transformer

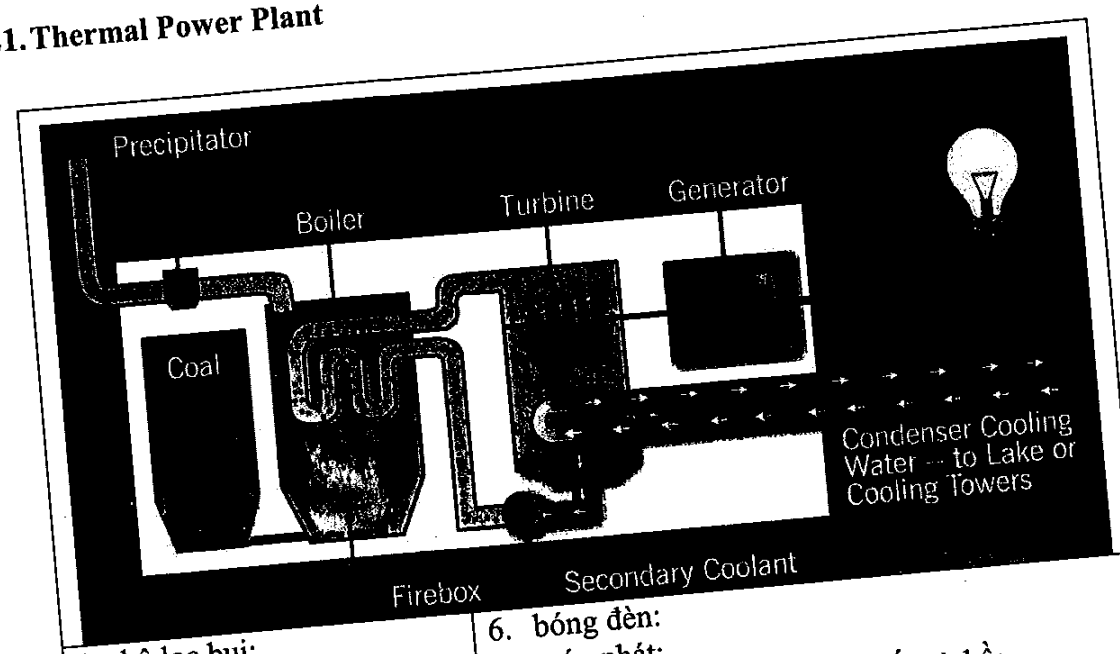
Calculator

an electrical device used to convert ac power at a certain ac power at a different voltage, but at the same frequency.



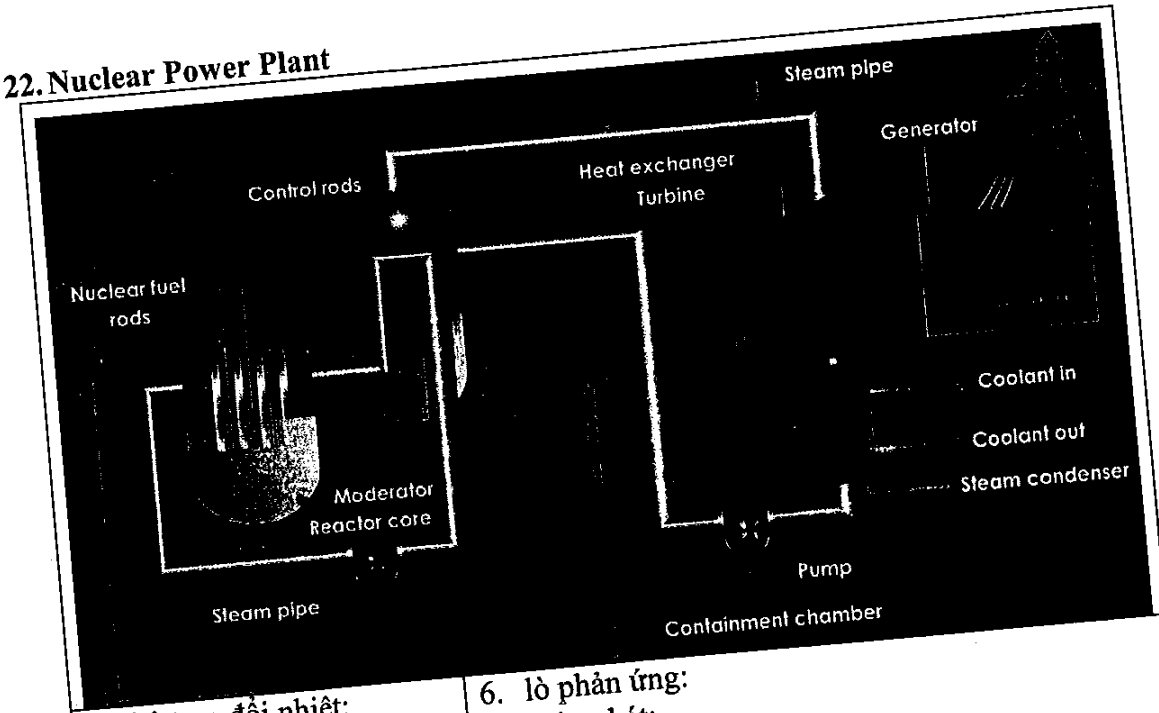
6. làm việc:
7. sử dụng:
8. thiết bị điện:
9. tần số:
10. chuyển đổi:

21. Thermal Power Plant



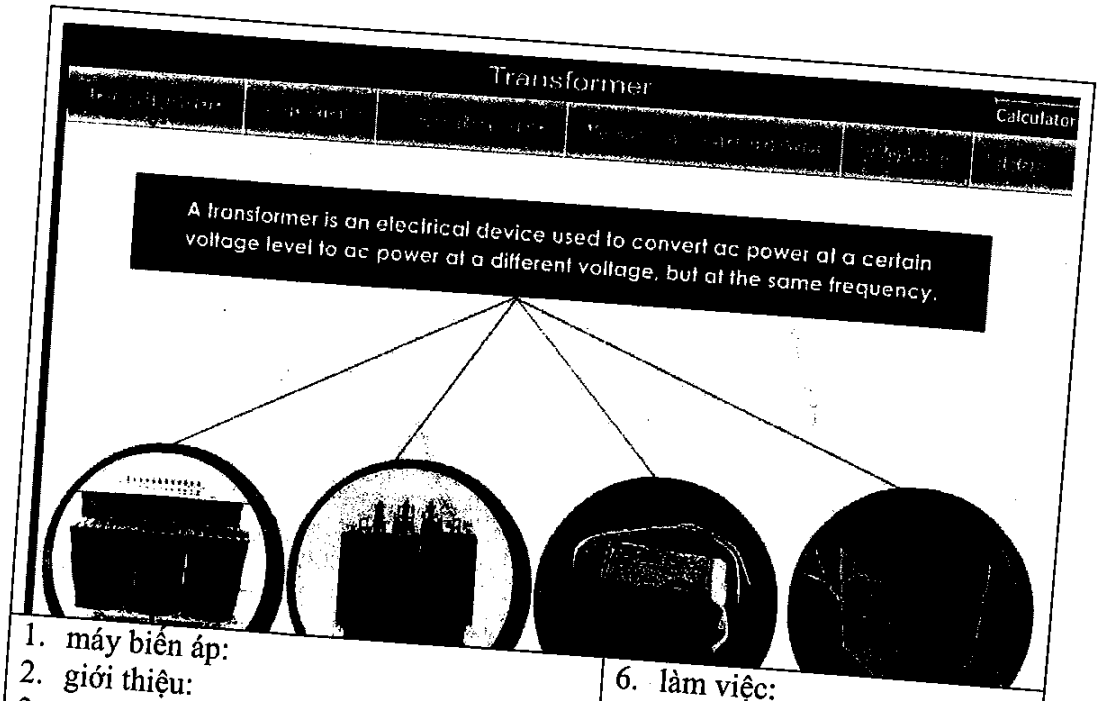
1. bộ lọc bụi:
2. than:
3. lò hơi:
4. tua bin:
5. buồng đốt:
6. bóng đèn:
7. máy phát:
8. nước làm mát bình ngưng lấy từ hồ:
9. chất làm mát thứ cấp:
10. tháp:

22. Nuclear Power Plant



1. bộ trao đổi nhiệt:
2. thanh nhiên liệu:
3. thanh điều khiển:
4. ống hơi:
5. chất trung gian:
6. lò phản ứng:
7. máy phát:
8. bơm:
9. bình ngưng hơi:
10. chất làm mát vào:

23. Distribution Transformer



1. máy biến áp:
2. giới thiệu:
3. nguyên lý:
4. cấu tạo:
5. phân loại máy biến áp:
6. làm việc:
7. sử dụng:
8. thiết bị điện:
9. tần số:
10. chuyển đổi:

Part 3. Answer Questions

1. Why do you like technical English?
2. How often do you practise technical English?
3. Do you think technical English is important to you?
4. How can you improve your technical English?
5. Why do you think technical English is difficult to learn?

PART 4. Translate into English

1. Động cơ điện

1. ở động cơ điện, dòng điện và từ trường sẽ tạo ra một chuyển động quay.
2. Điều này đúng cho tất cả các loại máy móc từ cái đồng hồ điện cho đến xe điện.
3. Động cơ điện ở hình 1 dùng cho máy giặt.
4. Đó là một động cơ vạn năng, nó có thể hoạt động được với cả dòng điện một chiều và xoay chiều.
5. Một dòng điện chạy qua một dây dẫn sẽ tạo ra một từ trường xung quanh dây dẫn.

2. Động cơ điện

1. Nếu có một dòng điện chạy qua một dây dây quấn trên một lõi thép thì lõi thép sẽ bị từ hóa.
2. Nó được gọi là một nam châm điện; một đầu mang cực bắc và đầu còn lại mang cực nam, phụ thuộc vào chiều dòng điện chạy qua dây dẫn.
3. Nếu ta để 2 nam châm gần nhau, cùng cực chẳng hạn như cùng cực bắc thì chúng sẽ đẩy nhau, còn khi khác cực thì chúng sẽ hút nhau.
4. Trong một động cơ điện đơn giản, giống như hình 2, một bộ phận của lõi thép với dây quấn quấn xung quanh được gọi là phần ứng, được đặt giữa 2 cực của một nam châm đứng yên còn gọi là nam châm tạo trường.
5. Khi dòng điện chạy qua dây quấn phần ứng, lõi thép trở thành một nam châm điện.

3. Động cơ điện

1. Lực hút và đẩy giữa các cực của nam châm phần ứng này và các cực của nam châm tạo trường làm phần ứng quay.
2. Kết quả là cực bắc tiến lại gần cực bắc của phần ứng.
3. Sau đó dòng điện sẽ đảo chiều nên cực bắc của nam châm phần ứng sẽ trở thành cực nam.
4. Một lần nữa, lực hút và đẩy giữa nó và nam châm tạo trường sẽ làm nó quay.
5. Phần ứng tiếp tục quay cho đến khi chiều của dòng điện chưa đổi, và cứ như vậy cả các cực từ của nó, giữ ở trạng thái tiếp tục đảo chiều.

4. Động cơ điện

1. Một động cơ một chiều đơn giản bao gồm một nam châm tạo trường và một phần ứng.
2. Phần ứng được đặt giữa các cực của nam châm.
3. Phần ứng được tạo thành từ 1 khung dây, một vòng chia được gọi là cái đổi chiều (hay cổ góp).
4. Khung dây được nối đến cổ góp.
5. Dòng điện được cấp đến động cơ thông qua các khối cạc- bon gọi là chổi than.

5. Máy biến áp

1. Một máy biến áp được tạo thành từ 2 cuộn dây, cuộn sơ cấp và thứ cấp.
2. Các cuộn dây được quấn trên một cái khung bằng thép.
3. Cuộn dây gồm nhiều vòng dây.

4. Lõi thép được làm từ nhiều lá thép mỏng.
5. Các lá hình chữ U hay T thường được sử dụng.

6. Tủ lạnh

1. Tủ lạnh bảo quản thức ăn nhờ nhiệt độ thấp của nó.
2. Nó làm chậm đi sự phát triển và sự sinh sản của các vi sinh vật chẳng hạn như các vi khuẩn và hoạt động hóa học làm hư thực phẩm.
3. Sự làm lạnh được dựa trên 3 nguyên lý.
4. Đầu tiên, nếu một chất lỏng được gia nhiệt, nó sẽ chuyển trạng thái sang khí hay hơi.
5. Khi chất khí bị làm lạnh, nó sẽ chuyển ngược trở lại thành chất lỏng.

7. Tủ lạnh

1. Thứ hai, nếu ta cho một chất khí giãn nở, nó sẽ nguội dần.
2. Nếu nén một chất khí, nó sẽ nóng lên.
3. Thứ 3, làm giảm áp suất một chất lỏng sẽ làm nó sôi.
4. Để giữ nhiệt độ tủ lạnh ở một nhiệt độ thấp không đổi, nhiệt phải được chuyển từ bên trong hộc tủ ra bên ngoài hộc tử.
5. Một chất làm lạnh được sử dụng cho mục đích này.

8. Tủ lạnh

1. Nó được tuần hoàn khắp tủ lạnh, nơi mà nó bị thay đổi về áp suất và nhiệt độ và thay đổi trạng thái từ một chất lỏng sang một chất khí và ngược lại.
2. R12 là một chất làm lạnh thông dụng, là hợp chất của cạcbon, cờlo và fờlo.
3. Nó có nhiệt độ sôi rất thấp: -29°C.
4. ở nhiệt độ phòng bình thường (khoảng 20°C) chất lỏng nhanh chóng chuyển sang trạng thái khí.
5. Tuy nhiên các chất làm lạnh đời sau thường ít gây độc hại đối với môi trường như KLEA 134a, đã dần dần thay thế chất R12.

9. Tủ lạnh

1. Tiến trình làm lạnh bắt đầu tại máy nén.
2. Máy nén sẽ nén khí sao cho nó nóng lên.
3. Tiếp theo nó sẽ bơm khí vào trong một bộ ngưng, đó là một ống dài có hình dạng ziczac.
4. Khi khí ấm đi ngang qua bộ ngưng, nó gia nhiệt cho xung quanh và nguội xuống.
5. Lúc nó rời bộ ngưng, nó ngưng tụ trở lại thành chất lỏng.

10. Tủ lạnh

1. Chất lỏng rời bộ ngưng phải đi ngang qua một ống hẹp (ống mao dẫn).
2. Điều này để ngăn ngừa chất lỏng rời bộ ngưng quá nhanh và giữ nó ở áp suất cao.
3. Khi chất lỏng đi ngang qua ống mao dẫn hẹp đến ống lớn hơn của bộ bốc hơi, áp suất giảm nhanh.
4. Chất lỏng chuyển thành hơi, nó giãn nở và nguội đi.

5. Hơi lạnh hấp thu nhiệt từ tủ lạnh.

11. Máy biến áp

1. Nguyên lý hoạt động: Máy biến áp là một thiết bị dùng để chuyển đổi dòng điện xoay chiều ở một cấp điện áp nhất định sang dòng xoay chiều ở một cấp điện áp khác nhưng tần số không đổi.
2. Nếu 2 cuộn dây đươc đặt gần nhau thì khi dòng điện biến thiên trong một cuộn sẽ tạo ra từ trường cảm ứng trong cuộn còn lại do hiện tượng hỗ cảm.
3. Máy biến áp tăng áp: Máy biến áp tăng áp có số vòng dây ở cuộn thứ nhiều hơn số vòng dây ở cuộn sơ cấp.
4. Cuộn sơ cấp được quấn bằng dây đồng to trong khi cuộn thứ cấp được quấn bằng dây đồng nhỏ.
5. Loại máy biến áp này biến đổi điện áp thấp với dòng lớn sang điện áp cao với dòng nhỏ.

12. Máy biến áp

1. Máy hạ áp: Máy biến áp hạ áp có số vòng dây ở cuộn sơ nhiều hơn số vòng dây ở cuộn thứ cấp.
2. Cuộn sơ cấp được quấn bằng dây đồng nhỏ trong khi cuộn thứ cấp được quấn bằng dây đồng to.
3. Loại máy biến áp này biến đổi điện áp cao với dòng nhỏ sang điện áp thấp với dòng lớn.
4. Máy biến áp hạ áp được dùng để tạo ra dòng lớn trong lĩnh vực hàn điện
5. Máy biến áp được sử dụng ưu tiên trong việc truyền tải điện năng ở khoảng cách lớn.

Part 2. Translate into Vietnamese

1. **Transformer**

1. induction	6. principle
2. coil	7. working
3. current	8. couple
4. change	9. electro magnetic force
5. construction	10. types of transformer

2. **Distribution Transformer**

1. primary coil	6. working principle
2. secondary coil	7. construction
3. transformer ratio	8. equation
4. step-up transformer	9. uses
5. step-down transformer	10. introduction

3. **Combined Cycle Power Plant**

1. gas	6. water out
2. air	7. condenser
3. gas turbine	8. air compressor
4. heat recovery boiler	9. alternator
5. water in	10. steam turbine

4. **Refrigerator**

1. pump	6. intake valve
2. boiler	7. exhaust valve
3. water recirculated	8. crankshaft
4. condenser	9. steam engine -2 stroke
5. cylinder	10. water formed by condensing spent steam

5. **Electric Fuse**

11. electric fuse	16. device
12. cartridge fuse	17. protection
13. fuse wire	18. electric circuit
14. holder	19. short- circuit
15. metallic terminals	20. overload

6. **Logic Gate**

1. logic gate	6. circuit board
2. input	7. electric circuit
3. output	8. Boolean expression
4. analog signal	9. variables
5. digital	10. true table

7. Logic Gates- An Activity

1. logic gate	6. OR gate
2. activity	7. AND gate
3. representation	8. click
4. appropriate	9. screen
5. option	10. appear

8. Transistor

1. solid-state devices	6. electronic equipments
2. amplify	7. calculator
3. control	8. communication satellites
4. generate	9. used
5. electrical signal	10. radio

9. Semiconductor

1. energy band	6. conduction band
2. semiconductor	7. valence band
3. insulator	8. nucleus
4. conductor	9. diagram
5. overlapped region	10. forbidden band

10. Conductors, Insulators and Semiconductors

1. conductors	6. solution of bases
2. insulators	7. solution of salts
3. semiconductors	8. solution of acids
4. silver and copper	9. mercury vapour lamp
5. graphite	10. materials

11. AC Generator

1. alternating current	6. galvanometer
2. generator	7. armature
3. magnet	8. construction
4. slip rings	9. text
5. brushes	10. mouse over

12. DC Generator

1. direct current	6. conductor
2. device	7. principle
3. produce	8. mechanical energy
4. magnetic flux	9. electrical energy
5. induced	10. convert

13. Gas Turbine

1. fresh air intake	6. generator
2. combustor	7. electrical grid
3. air compressor	8. transformer
4. expansion gas turbine	9. natural gas
5. exhaust stack	10. fuel

14. Induction Motor

1. terminal box	6. squirrel-cage rotor
2. motor shaft	7. cooling air flow
3. bearing	8. stator with stator windings
4. chassis	9. fan cover
5. cooling fins	10.cooling fan

15. Combined Cycle Power Plant

1. combined cycle power plant	6. air
2. generator	7. fuel
3. condenser	8. steam
4. water	9. HRSG: heat recovery steam generator
5. gas	10. gas turbine

16. AC Motor

1. front end plate	6. lock washer
2. conduit box	7. pulley endplate
3. bearing	8. shaft
4. rotor	9. fan cover
5. lock nut	10. winding

17. Coal Fired Power Plant

1. coal fired power plant	6. transformer
2. stack	7. induced draft fan
3. pump	8. conveyer belt
4. grid	9. condenser
5. burner	10. generator

18. DC Motor

1. commutator	6. magnets
2. armature	7. dc motor
3. windings	8. shaft
4. brushes	9. ball bearing
5. terminals	10. magnetic field

19. Common Type of Circuits

1. battery 2. milliammeter 3. resistance box 4. rheostat 5. voltmeter	6. electric circuit 7. electric current 8. continuous 9. flow 10. pathway

20. Symbols Used In An Electric Circuit

1. symbols 2. electric bulb 3. alternating current 4. open circuit 5. resistor	6. cell 7. closed circuit 8. variable resistor 9. connecting wire 10. cells arranged in series

21. Thermal Power Plant

1. precipitator 2. coal 3. boiler 4. turbine 5. fire box	6. light 7. generator 8. condenser cooling water to lake 9. secondary coolant 10. tower

22. Nuclear Power Plant

1. heat exchanger 2. nuclear fuel rod 3. control rod 4. steam pipe 5. moderator (coolant)	6. reactor core 7. generator 8. pump 9. steam condenser 10. coolant in

23. Distribution Transformer

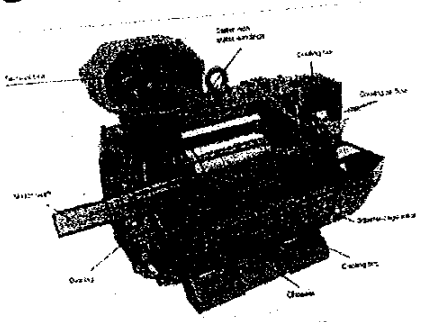
1. transformer 2. introduction 3. principle 4. construction 5. types of transformer	6. working 7. uses 8. electrical device 9. frequency 10. convert

Vocabulary

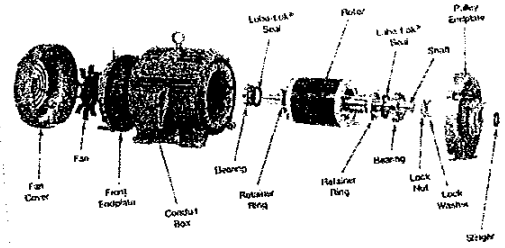
AC motor

1. hộp đấu dây
2. trục động cơ
3. bạc đạn
4. đế
5. rãnh làm mát
6. roto lồng sóc
7. luồng gió làm mát
8. stato với dây quấn stator

AC motor



AC motor



AC motor

1. terminal box: hộp đấu dây
2. motor shaft: trục động cơ
3. bearing: bạc đạn
4. chassis: đế
5. cooling fins: rãnh làm mát
6. squirrel cage rotor: rôto lồng sóc
7. cooling air flow: luồng gió làm mát
8. stator with stator windings: stato với dây quấn stator

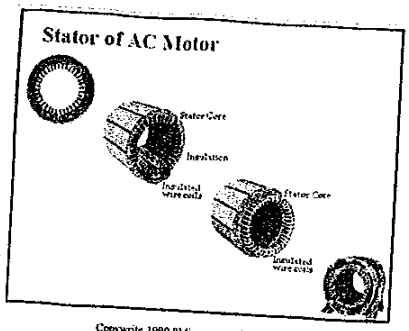
AC motor

1. fan cover: hộp che quạt
2. fan: quạt
3. end plate: nắp sau
4. conduit box: hộp đấu dây
5. bearing: bạc đạn
6. lube-lock seal: chèn bạc đạn
7. retainer ring: vòng giữ
8. rotor: roto-phần quay

AC motor

9. lock nut: đai ốc khóa
10. lock washer: vòng đệm
11. pulley end plate: nắp trước
12. slinger: chèn cốt
13. shaft: trục

AC motor



AC motor

1. hộp che quạt
2. quạt
3. nắp sau
4. hộp đấu dây
5. bạc đạn
6. chèn bạc đạn
7. vòng giữ
8. roto-phần quay

AC motor

1. stator of ac motor: stato của động cơ xoay chiều
2. stator core: lõi thép stator
3. insulation: lớp cách điện
4. insulated wire coils: các cuộn dây quấn có cách điện

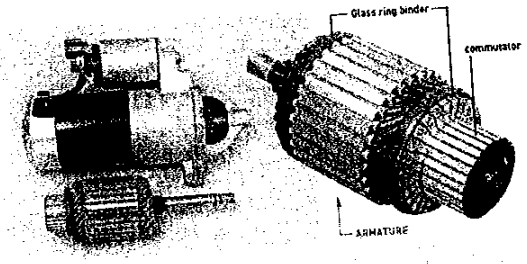
AC motor

9. đai ốc khóa
10. vòng đệm
11. nắp trước
12. chèn cốt
13. trục

AC motor

1. stato của động cơ xoay chiều
2. lõi thép stator
3. lớp cách điện
4. các cuộn dây quấn có cách điện

DC motor



DC motor

DC motor

1. armature: phần ứng
2. commutator: cổ góp
3. glass ring binder: vòng kẹp dây

DC motor

1. ball bearing: bạc đạn
2. coil: cuộn dây
3. iron core: lõi thép
4. coil insulation: cách điện cuộn dây.
5. coil commutator interconnection: phần giữa dây quấn ra cổ góp
6. insulation between segments: cách điện giữa các phiến góp
7. commutator copper segment: các phiến góp bằng đồng tạo thành cổ góp.

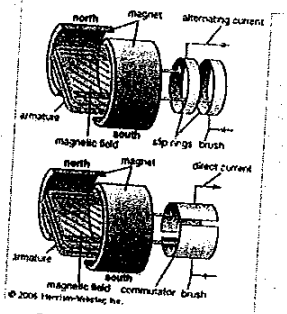
DC motor

1. phần ứng
2. cổ góp
3. vòng kẹp dây

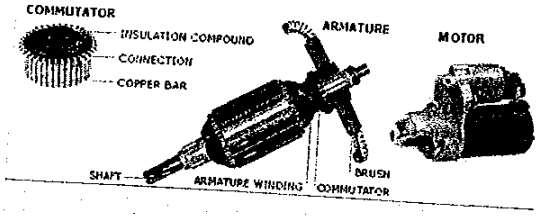
DC motor

1. bạc đạn
2. cuộn dây
3. lõi thép
4. cách điện cuộn dây.
5. phần giữa dây quấn ra cổ góp
6. cách điện giữa các phiến góp
7. các phiến góp bằng đồng tạo thành cổ góp.

AC and DC generator



DC motor



AC and DC generator

1. north: cực bắc
2. south: cực nam
3. magnet: nam châm
4. slip rings: vòng trượt
5. alternating current: dòng điện xoay chiều
6. brush: chổi than
7. magnetic field: từ trường
8. armature: phần ứng
9. direct current: dòng điện một chiều

DC motor

1. commutator: cổ góp
2. connection: chỗ nối
3. copper bar: phiến góp
4. shaft: trục
5. insulation compound: hợp chất cách điện
6. brush: chổi than
7. motor: động cơ
8. armature winding: cuộn dây phần ứng

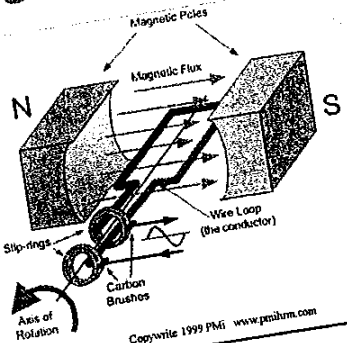
AC and DC generator

1. cực bắc
2. cực nam
3. nam châm
4. vòng trượt
5. dòng điện xoay chiều
6. chổi than
7. từ trường
8. phần ứng
9. dòng điện một chiều

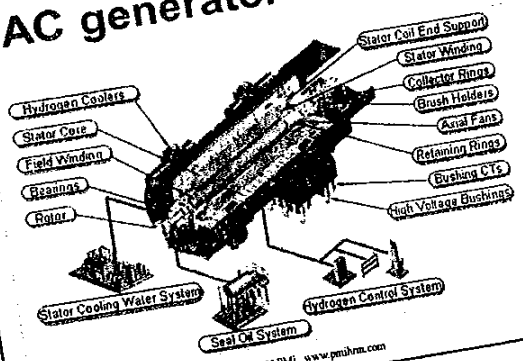
DC motor

1. cổ góp
2. chỗ nối
3. phiến góp
4. trục
5. hợp chất cách điện
6. chổi than
7. động cơ
8. cuộn dây phần ứng

AC generator



AC generator



AC generator

1. magnetic poles: các cực từ
2. magnetic flux: từ thông
3. wire loop (the conductor): khung dây (thanh dẫn)
4. carbon brush: chổi than bằng cạc bon
5. axis of rotation: chiều quay
6. slip rings: vòng trượt

AC generator

1. hydrogen cooler: bộ làm mát hydro
2. stator core: lõi thép stator
3. field winding: cuộn dây kích từ
4. bearing: bệ trục
5. rotor: phần quay
6. stator cooling water system: hệ thống nước làm mát stato.
7. seal oil system: hệ thống dầu chèn
8. hydro control system: hệ thống điều khiển hydro

AC generator

1. các cực từ
2. từ thông
3. khung dây (thanh dẫn)
4. chổi than bằng cạc bon
5. chiều quay
6. vòng trượt

AC generator

9. stator coil end support: khung đỡ 2 đầu cuộn dây
10. stator winding: cuộn dây stator
11. collector rings: các vòng góp kích từ
12. brush holder: giá đỡ chổi than
13. axial fan: quạt hướng tâm
14. retaining rings: các vòng giữ.
15. bushing CTs: các biến dòng chân sứ
16. high voltage bushing: sứ cao thế

AC generator

1. bộ làm mát hydro
2. lõi thép stator
3. cuộn dây kích từ
4. bệ trục
5. phần quay
6. hệ thống làm mát stato.
7. hệ thống dầu chèn
8. hệ thống điều khiển hydro

AC generator

1. VPI system: hệ thống VPI
2. improved end winding support system with sliding mechanism: hệ thống giá đỡ đầu các cuộn dây được cải tiến với cơ cấu trượt.
3. high stability bearing: bệ trục ổn định cao
4. effective vibration insulation with spring plate structure: chống rung hiệu quả với cơ cấu đĩa lò xo.
5. compact stator frame: khung stator vững chắc

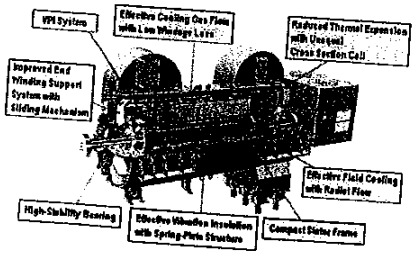
AC generator

9. khung đỡ 2 đầu cuộn dây
10. cuộn dây stator
11. các vòng góp kích từ
12. giá đỡ chổi than
13. quạt hướng tâm
14. các vòng giữ.
15. các biến dòng chân sứ
16. sứ cao thế

AC generator

6. effective field cooling with radial flow: làm mát kích từ hiệu quả với dòng hướng kính.
7. reduced thermal expansion with unequal cross section coil: giảm giãn nở nhiệt với cuộn dây không cân bằng.
8. effective cooling gas flow with low windage loss: dòng làm mát hiệu quả với tổn thất gió thấp.

AC generator



AC generator

1. hệ thống VPI
2. hệ thống giá đỡ đầu các cuộn dây được cải tiến với cơ cấu trượt.
3. bệ trục ổn định cao
4. chống rung hiệu quả với cơ cấu đĩa lò xo.
5. khung stator vững chắc

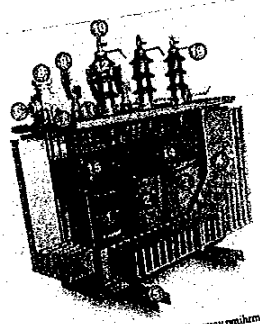
AC generator

6. làm mát kích từ hiệu quả với dòng hướng kính.
7. giảm giãn nở nhiệt với cuộn dây không cân bằng.
8. dòng làm mát hiệu quả với tổn thất gió thấp.

Transformer components

10. High Voltage Terminal: đầu nối cao thế
11. Low Voltage Bushing: sứ hạ thế
12. High Voltage Bushing: sứ cao thế
13. Arcing Horn: chống sét sừng
14. Off-Load Tap Changer: bộ đổi nấc không tải
15. Upper Steel Clamp: khung giữ lõi thép trên

Transformer components



Transformer components

1. mạch từ
2. cuộn dây hạ thế
3. cuộn dây cao thế
4. vỏ mba
5. bệ mba
6. đồng hồ mực dầu
7. móc treo
8. rờ le quá áp (63P)
9. đầu nối hạ thế

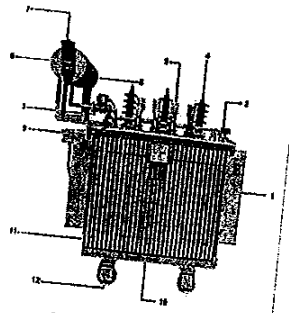
Transformer components

1. Magnetic Core: mạch từ
2. Low Voltage Winding: cuộn dây hạ thế
3. High Voltage Winding: cuộn dây cao thế
4. Corrugated Tank: vỏ mba
5. Transformer Base: bệ mba
6. Oil Level Gauge: đồng hồ mực dầu
7. Lifting Eye: móc treo
8. Pressure Relief Device: rờ le quá áp (63P)
9. Low Voltage Terminal: đầu nối hạ thế

Transformer components

10. đầu nối cao thế
11. sứ hạ thế
12. sứ cao thế
13. chống sét sừng
14. bộ đổi nấc không tải
15. khung giữ lõi thép trên

Transformer components



Transformer components

1. vách thùng mba
2. đồng hồ nhiệt độ có tiếp điểm.
3. rơ le hơi
4. sứ cao thế
5. sứ AG
6. bồn dầu phụ
7. bộ thở rút ẩm

Transformer components

1. Corrugated Wall: vách thùng mba
2. Thermometer With Contact: đồng hồ nhiệt độ có tiếp điểm.
3. Buscholiz Relay: rơ le hơi
4. HV Insulator: sứ cao thế
5. AG Insulator: sứ AG
6. Oil Extension Tank: bồn dầu phụ
7. Dehydrating Breather: bộ thở rút ẩm

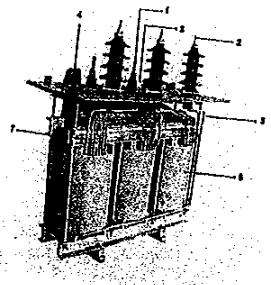
Transformer components

8. bộ chỉ thị mực dầu bằng từ.
9. hộp đấu dây
10. nhãn- bảng tên
11. van xả đáy
12. bánh xe

Transformer components

8. Magnetic Oil Level Indicator: bộ chỉ thị mực dầu bằng từ.
9. Junction Box: hộp đấu dây
10. Label: nhãn- bảng tên
11. Oil Drain Valve: van xả đáy
12. Wheels: bánh xe

Transformer components



Transformer components

1. LV Insulator: sứ hạ thế
2. HV Insulator: sứ cao thế
3. Tap Changer: bộ đổi nấc
4. Lifting Lugs: móc nâng
5. Yoke- Windings: gông-cuộn dây
6. Connection Cables: cáp nối

Electrical tower

1. overhead ground wire: dây chống sét
2. cross arm: tay xà
3. suspension insulator string: sứ chuỗi
4. beam gantry: đà ngang
5. ground wire peak: đỉnh nối dây chống sét
6. bundle: bó (khung định vị)
7. pylon window: cửa
8. node: điểm giao
9. K-frame: khung chữ K

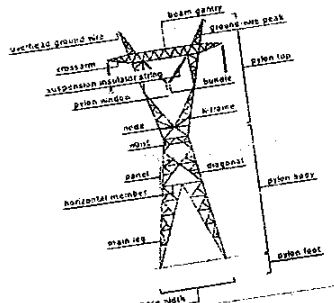
Transformer components

1. sứ hạ thế
2. sứ cao thế
3. bộ đổi nấc
4. móc nâng
5. gông-cuộn dây
6. cáp nối

Electrical tower

10. waist: co, eo
11. panel: bảng, tấm
12. horizontal member: phần tử nằm ngang
13. diagonal: thanh giằng xéo
14. main leg: chân chính
15. base width: chiều rộng đế, móng
16. pylon body: thân trụ
17. pylon top: đỉnh trụ
18. pylon foot: chân trụ

Electrical tower



Electrical tower

1. dây chống sét
2. tay xà
3. sứ chuỗi
4. đà ngang
5. đỉnh nối dây chống sét
6. bó (khung định vị)
7. cửa
8. điểm giao
9. khung chữ K

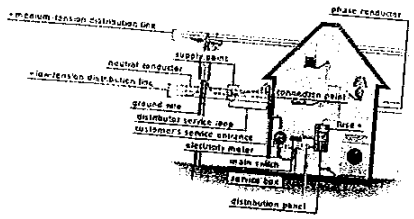
Electrical tower

10. co, eo
11. bảng, tấm
12. phần tử nằm ngang
13. thanh giằng xéo
14. chân chính
15. chiều rộng đế, móng
16. thân trụ
17. đỉnh trụ
18. chân trụ

electrical supply

7. customer' s service entrance: khu vực đưa điện vào nhà khách hàng
8. electricity meter; đồng hồ điện (công tơ)
9. main switch: CB tổng (cầu dao tổng)
10. service box: hộp công dụng
11. distribution panel: tủ phân phối
12. fuse: cầu chì
13. connection point; điểm đấu nối
14. phase conductor: dây nóng (dây pha)

electrical supply



electrical supply

1. đường dây phân phối trung thế
2. điểm cung cấp điện
3. dây trung tính
4. đường dây phân phối hạ thế
5. dây nối đất
6. khu vực cấp điện cho khách hàng

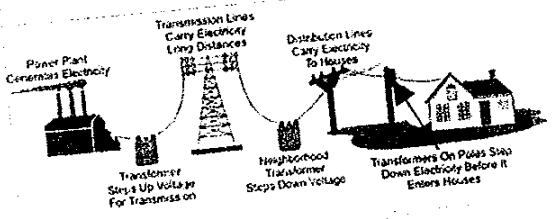
electrical supply

1. medium tension distribution line: đường dây phân phối trung thế
2. supply point: điểm cung cấp điện
3. neutral conductor: dây trung tính
4. low tension distribution line: đường dây phân phối hạ thế
5. ground wire; dây nối đất
6. distributor service loop: khu vực cấp điện cho khách hàng

electrical supply

7. khu vực đưa điện vào nhà khách hàng
8. đồng hồ điện (công tơ)
9. CB tổng (cầu dao tổng)
10. hộp công dụng
11. tủ phân phối
12. cầu chì
13. điểm đấu nối
14. dây nóng (dây pha)

Power transmission



Power transmission

1. nhà máy điện phát ra điện
2. mba nâng điện áp cao lên để truyền tải.
3. các đường dây truyền tải mang điện đến các vùng xa.
4. mba tại khu vực sẽ hạ điện áp xuống.

Power transmission

1. power plant generates electricity: nhà máy điện phát ra điện
2. transformer steps up voltage for transmission: mba nâng điện áp cao lên để truyền tải.
3. transmission lines carry electricity long distances: các đường dây truyền tải mang điện đến các vùng xa.
4. neighborhood transformer steps down voltage: mba tại khu vực sẽ hạ điện áp xuống.

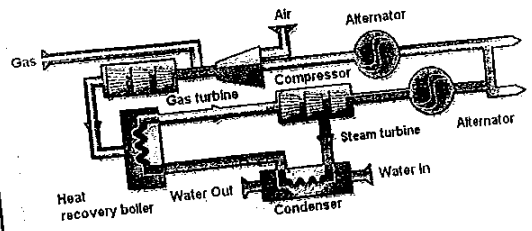
Power transmission

5. các đường dây phân phối sẽ cấp điện đến các hộ gia đình.
6. các mba trên các trụ sẽ hạ điện áp xuống trước khi cấp điện cho các hộ gia đình.

Power transmission

5. distribution lines carry electricity to houses: các đường dây phân phối sẽ cấp điện đến các hộ gia đình.
6. transformers on poles step down voltage before it enters houses: các mba trên các trụ sẽ hạ điện áp xuống trước khi cấp điện cho các hộ gia đình.

Combined cycle gas turbine



Combined cycle gas turbine

1. gas: khí
2. air: gió
3. gas turbine: tuabin khí
4. heat recovery boiler: lò thu hồi nhiệt
5. water in: nước vào
6. water out: nước ra
7. condenser: bình ngưng
8. compressor: máy nén gió
9. alternator: máy phát xoay chiều
10. steam turbine: tuabin hơi

Gas turbine

1. fresh air intake: gió rút vào
2. combustor: buồng đốt
3. air compressor: máy nén gió
4. expansion gas turbine: tua bin khí
5. exhaust: khí thoát
6. generator: máy phát
7. electrical grid: lưới điện
8. transformer; máy biến áp

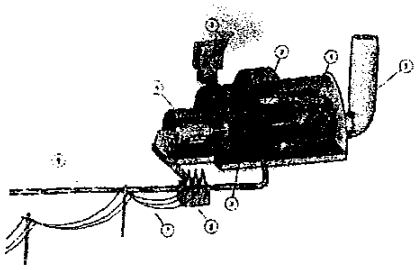
Combined cycle gas turbine

1. khí
2. gió
3. tuabin khí
4. lò thu hồi nhiệt
5. nước vào
6. nước ra
7. bình ngưng
8. máy nén gió
9. máy phát xoay chiều
10. tuabin hơi

Gas turbine

9. natural gas fuel: khí tự nhiên
10. HRSG: heat recovery steam generator: lò thu hồi nhiệt
11. exhaust stack: ống khói
12. superheated steam: hơi quá nhiệt
13. boiler feed water pump: bơm tiếp nước
14. cooling tower: tháp giải nhiệt
15. cooler: bộ làm mát

Gas turbine



Gas turbine

1. Gió rút vào
2. buồng đốt
3. máy nén gió
4. tua bin khí
5. khí thoát
6. máy phát
7. lưới điện
8. máy biến áp

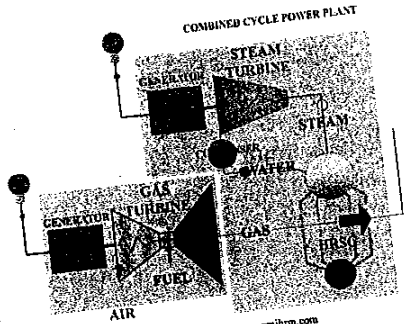
Gas turbine

9. khí tự nhiên
10. lò thu hồi nhiệt
11. ống khói
12. hơi quá nhiệt
13. bơm tiếp nước
14. tháp giải nhiệt
15. Bộ làm mát

combined cycle power plant

9. HRSG: heat recovery steam generator: lò thu hồi nhiệt
10. gas turbine: tuabin khí
11. steam turbine: tuabin hơi

combined cycle power plant



combined cycle power plant

1. nmd tua bin khí hỗn hợp
2. máy phát điện
3. bình ngưng
4. nước
5. khí
6. không khí (gió)
7. nhiên liệu
8. hơi

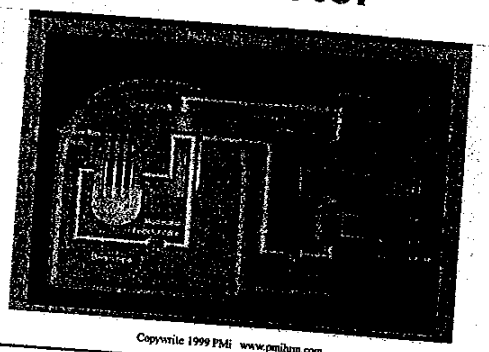
combined cycle power plant

1. combined cycle power plant: nmd tua bin khí hỗn hợp
2. generator: máy phát điện
3. Condenser: bình ngưng
4. water: nước
5. gas: khí
6. air: không khí (gió)
7. fuel: nhiên liệu
8. steam: hơi

combined cycle power plant

9. lò thu hồi nhiệt
10. tuabin khí
11. tuabin hơi

nuclear reactor



nuclear reactor

10. coolant in: nước làm mát vào
11. coolant out: nước làm mát ra
12. generator: máy phát
13. heat exchanger: bộ trao đổi nhiệt
14. turbine: tuabin
15. steam pipe: đường ống dẫn hơi
16. steam tower: tháp hơi

nuclear reactor

1. a nuclear reactor is a device or a furnace where controlled fission chain reaction is carried out and the energy released is used to generate electricicty: lò phản ứng hạt nhân là một thiết bị hay một lò, tại đây chuỗi phản ứng hạt nhân được kiểm soát và năng lượng phát sinh ra sẽ được dùng để sản xuất điện năng.
2. pellet: mẩu nhiên liệu
3. nuclear fuel rod: thanh nhiên liệu

nuclear reactor

1. lò phản ứng hạt nhân là một thiết bị hay một lò, tại đây chuỗi phản ứng hạt nhân được kiểm soát và năng lượng phát sinh ra sẽ được dùng để sản xuất điện năng.
2. mẩu nhiên liệu
3. thanh nhiên liệu

nuclear reactor

3. control rod: thanh điều khiển
4. steam pipe: đường ống dẫn hơi
5. moderator (coolant): chất trung gian (chất làm mát)
6. reactor core: lõi lò phản ứng hạt nhân
7. containment chamber: buồng chứa lò phản ứng hạt nhân
8. pump: bơm
9. steam condenser: bình ngưng hơi

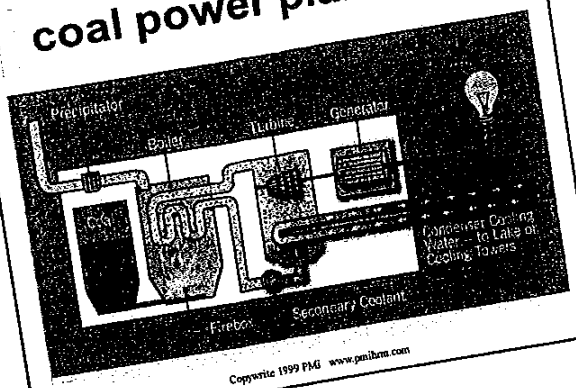
nuclear reactor

3. thanh điều khiển
4. đường ống dẫn hơi
5. chất trung gian (chất làm mát)
6. lõi lò phản ứng hạt nhân
7. buồng chứa lò phản ứng hạt nhân
8. bơm
9. bình ngưng hơi

nuclear reactor

10. nước làm mát vào
11. nước làm mát ra
12. máy phát
13. bộ trao đổi nhiệt
14. tuabin
15. đường ống dẫn hơi
16. tháp hơi

coal power plant



Hydro power plant

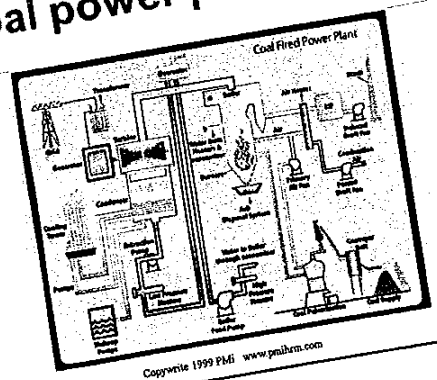
coal power plant

1. precipitator: bộ lọc bụi tĩnh điện
2. coal: than
3. boiler: lò hơi
4. turbine: tua bin
5. fire box: buồng đốt
6. secondary coolant: chất làm mát thứ cấp
7. generator: máy phát điện
8. condenser cooling water to lake or cooling tower: nước làm mát bình ngưng lấy từ hồ hay tháp giải nhiệt.

Hydro power plant

1. reservoir: bể chứa
2. dam: đập chắn
3. flood gate: cổng chắn
4. penstock: ống dẫn nước áp lực
5. turbine: tuabin
6. power house: gian máy phát
7. long distance power line: đường dây truyền tải
8. genarator: máy phát
9. river: sông

coal power plant



coal power plant

1. coal fired power plant: nhà máy điện đốt than
2. stack: ống khói
3. pump: bơm
4. air heater: bộ xông gió quay
5. boiler: lò hơi
6. ash deposal system: hệ thống xử lý tro xỉ
7. induced draft fan: quạt hút
8. forced draft fan: quạt đẩy gió
9. air: gió

coal power plant

26. low pressure heater: bình hâm hạ áp
27. high pressure: bình hâm cao áp
28. water to boiler through economizer: nước đến lò hơi thông qua bộ tiết nhiệt

coal power plant

10. primary air: gió sơ cấp, dùng để thổi than
11. coal supply: cung cấp than
12. conveyer belt: băng chuyền than
13. coal pulverization: máy nghiền than
14. ESP: electro static Precipitator: bộ xử lý bụi tĩnh điện
15. boiler feed pump: bơm tiếp nước
16. extraction pump: bơm nước ngưng
17. make up water: nước bổ sung

coal power plant

18. cooling tower: tháp giải nhiệt
19. condenser: bình ngưng
20. turbine: tua-bin
21. generator: máy phát
22. transformer: máy biến áp
23. grid: lưới điện
24. deaerator: bình khử khí
25. water from heaters and economizers: nước từ các bình hâm và bộ tiết nhiệt