BST BASIC TECCHNOLOGY, JSS 2

A Standard Text On The UBE Scheme As Prepared By The Nigerian Educational Research and Development Council (NERDC) For Measurement And Evaluation. A Result Of Thorough Research Into The General Principles Of Basic Technology

For Junior Secondary Schools JSS 2.

(A Combined Text And Workbook for the Hard Copy Version)

BST Basic Technology Made Easy

Making Learning Fun

By

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DEDICATION

This book is dedicated to my understanding wife, Nduka for believing in me and my kids for encouraging me to follow my dreams.

She will always say, ***"Give Every Dream an Opportunity."***

PREFACE

This e-series has been designed to reflect the 2013 Nigerian Educational Research and Development Council (NERDC) national Basic Technology for Junior Secondary School years 1, 2 and 3.

While preparing this edition of Basic Technology, I ensured that where appropriate, review questions that contain emerging national and global issues such as is available in engineering, health, information technology and entrepreneurship.

The book has been divided into three broad parts, each showing the scheme for the term and scaled into lessons for the student and teacher for easy access.

I have retained popular features, such as lesson objectives, exercises and basic geometrical construction practical sessions. In addition, this edition contains a most interesting and new feature-the first of its kind in Nigeria-where the student and teacher has access to **Practical Step-By-Step Videos on Geometrical Construction** as contained in the curriculum.

While preparing this edition, I made sure I retained the style and rigour of imputing illustrations and images in each lesson. Again, at the end of the text-book, there are 190 objective test questions and answers for the student and teacher to revise with.

Acknowledgement

I wish to express my appreciation to my students who encouraged me to put up a material like this for them. I also appreciate a number of teachers far and near, who encouraged me with their appreciation through the edited.

I wish in particular to express my gratitude to Mrs. Adebimpe Delano, the amiable principal of Fountain Heights Secondary School, for her drive towards e-learning which was the brain behind this book.

I must thank Mrs. Eunice Emmanuel who always made her generator available for me during the writing of this book. You are one of a kind ma'am. Thank you.

P.S. I must state that this edition is subject to upgrading based on any unified change in the curriculum in the future. This is to meet national and global standard.
Image Credit: www.googleimage.com

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PART ONE

JSS2 SCHEME-1ST TERM

LESSONS **PAGE**

LESSON 1.1

FIRST AID AND MATERIALS

Introduction

Welcome to the first lesson in JSS 2. You have learned a lot while you were in JSS 1. In this lesson, you will be exposed to first aid and the materials applied when carrying out first aid on any injured student at the workshop. You will also learn about the ABC of first aid and how to administer first aid to a victim of accident in any setting.

OBJECTIVES: At the end of this lesson, student should be able to:

1. Define first aid
2. Define first aid box
3. State at least three reasons for administering First Aid
4. List at least six materials required for administering first aid.
5. State five medicinal materials and their uses in first aid administration
6. Explain at least six steps to take when administering first aid to an accident victim.

Definition:

First aid treatment can be defined as the immediate and temporary care given to an accident victim or sick person before the arrival of the doctor or before taking the victim to the hospital.

First Aid Box: This is a simple box made of wood or plastic. The box usually contains the necessary materials needed to carry out first aid. The size is usually 30 x 25 x40cm. e.g.

First Aid Box

Reasons for First Aid

i. First aid is administered so as to reduce pain.
ii. It arrests bleeding.
iii. First aid prevents injuries from getting worse.
iv. First aid can be a source of information to the doctor.

First Aid Non-Medicinal Materials

The materials used in administering first aid are as follows:

(i). Bandages: This material is used to wrap wound and protect wound from infection. E.g.

Bandage

(ii). Forceps: This material is used for holding cotton wool when dressing wounds. E.g.

Forceps

(iii). Cotton Wool: Cotton wool is used in dressing wounds and cuts. E.g.

Cotton wool

(iv). Plasters: The plaster is used to cover wounds and cuts directly, while holding the cotton wool in place. E.g.

Elastoplasts

(v). Safety Pins: These are pins used to fasten the bandage in place on wounds. E.g.

Safety pins

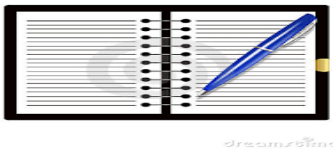
(vi). Razor Blade: In first aid administration, the razor blade is used for cutting plaster and bandages where there is no scissors. E.g.

Razor

(vii). Sterile Gauze: It is used for sterilizing wounds so as to avoid germs and infections. e.g.

Sterile gauze

(viii). Record Book and Pen: With this, the name, sex, age, class of the student, the nature of injury and the type of treatment given can be recorded. E.g.



Record book

(ix). Disposable Hand Gloves: This material can protect against direct contact with blood and dirt. E.g.

Disposable hand gloves

Medicinal Materials used in First Aid

(i). Analgesics: These are pain relievers like paracetamol, panadol, aspirin and any other pain reliever or pain killers. E.g.

Analgesics

(ii). Antiseptics: These are cleansers like Dettol, TCP, Izal, etc. They are used against germs. E.g.

Antiseptics

(iii). Gentian violet: This is a chemical substance used on burns as a coolant. It is in the form of blue ink. E.g.

Gentian violet

(iv). Iodine: Iodine is used to stop blood flow or bleeding in minor in wounds. E.g.

Iodine

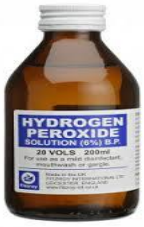
(v). Methylated spirit: The methylated spirit is used to disinfect wounds and skin before administering injections. E.g.

Methylated spirit

(vi). Smelling salt: The name does not indicate that this substance has an offensive ordour. It is a substance used for reviving fainting victims. E.g.

Smelling salt

(vii). Hydrogen peroxide: It is sometimes used in the place of the methylated spirit, to disinfect wounds. E.g.



Hydrogen peroxide

(viii). Embrocation: Emprocation is used as balm on sprains.

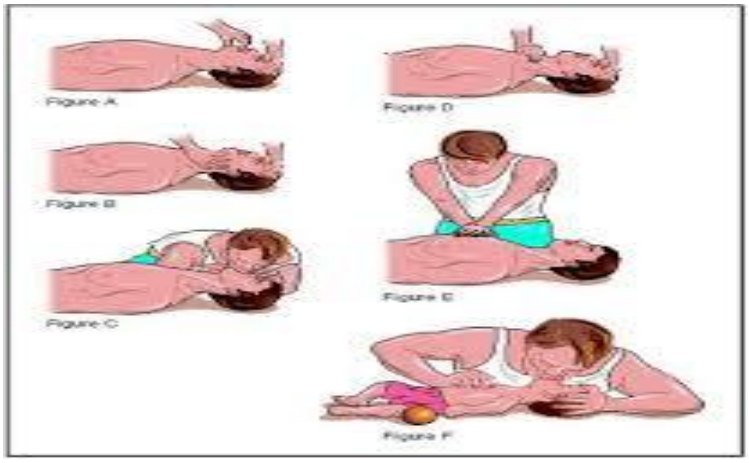
Embrocation

ABC in First Aid

i. **A = Airways:** Before administering first aid, make sure the patient's airways is clear, that the patient is breathing. Check if the breathing is normal.

ii. **B = Breathing:** Ensure that the patient is breathing. If the person is conscious, sitting will be better. If unconscious, turn the patient on his side and then listen for breathing.

iii. **C = Circulation:** This is the technique of checking for pulse so as to know if the victim is breathing. If an adult is unconscious and not breathing, lay the patient flat on his back then place the heel of one hand on his chest and your other hand on top and press firmly. E.g. **(See the Downloaded Video on ABC in First Aid)**



First Aid ABC.

Steps in Administering ABC of First Aid

(i). Check the injury and the extent of damage (is the injury a burn, cut, fracture, electric shock, loss of breath or fainting?).

(ii). No matter the gravity of the injury, be cool and calm.

(iii). Immobilize the injured part. i.e. hold the affected part firmly so as to avoid movement by that part.

(iv). Prevent the victim from seeing his blood.

(v). Give the victim the urgent needed help.

(vi). Never give fluid (any fluid).

(vii). Carry out the first aid treatment with utmost care.

(viii). Do not allow too many people around as fresh air is very essential.

(ix). Arrange for a medical personnel.

REVIEW QUESTIONS

1. Define first aid

2. Define first aid box

3. State at least three reasons for administering First Aid

4. List at least six materials required for administering first aid.

5. State five medicinal materials and their uses in first aid administration

6. Explain at least six steps to take when administering first aid to an accident victim.

LESSON 1.2

RESCUE OPERATIONS

Introduction

Now that you have been acquainted with first aid administration and the steps involved in administering first aid, let us turn your attention to rescue operations in Nigeria.

In this lesson, you are going to learn about rescue operation, the different aspects of rescue operation and the steps you must take in an event of rescuing a victim from a dangerous situation.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Explain the meaning of rescue operations

2. Identify different aspects of rescue operation

3. Describe the steps involved in each aspect of rescue operation.

Definition:

Rescue operation can be defined as an organized operation free of danger during a dangerous situation. It usually involves many people performing various actions.

Aspects of Rescue Operations

1.Highway Operations and Vehicle Rescue:

When carting out highway and vehicle rescue operations, you must be careful to follow the steps below:

a. Redirect traffic by calling the attention of other drivers to the incident.

b. Make use of emergency lighting like the use of double traficator.

c. Make sure you position a C-caution sign on the road.

d. Make sure you are wearing a reflective jacket or clothing. E.g.

Highway Rescue in Canada & Nigeria

2.Urban Search and Rescue:

This type of operation involves victims trapped in collapsed buildings, mines, collapsed trenches, areas where natural disasters have stricken, etc.

Since this type of operation involves multi-tasking, most rescue teams are multi-disciplinary and may include personnel from emergency medical services, police and fire fighters. E.g.


Urban Search and Rescue in China & Nigeria

3.Surface Water Rescue Operation:

Victims that float on the surface of a body of water may need to be rescued in this type of operation.

Surface water rescue operation requires knowledge and skill where rescue teams are trained with multiple technical disciplines. For instance, rescue operations may have to include search techniques, emergency patient care, rope-work, rigging and dive recovery. E.g.


Surface Water Rescue Operations in Cuba & USA

4.Air-Sea Rescue Operation:

This is a rescue operation that is referred to as a coordinated search and rescue for survivors of victims at sea or rivers who may be floating. Air-sea operations can involve a wide variety of resources including seaplanes, submarines, helicopters, rescue boats and ships. E.g.


Air-Sea Rescue Operations in USA

5.Vehicle –Extrication Rescue Operation:

This type of operation has to do with rescuing trapped vehicular victims, where conventional means of exit is impossible. To avoid injury to the victims' body parts, rescue team must be conscious of the following:

-hearing and respiratory protection
-protective shielding
-eye protection
-protective blankets

Immediately the vehicle has been rescued and access to the victim, he should be taken for medical care immediately. E.g.


Vehicle –Extrication Rescue Operations in the US

6. Fire Rescue Operation:

Fire outbreak is common in every society. Among other things, fire outbreak can be caused by electricity, chemical, wood, paper and cloth.

Depending on the type of fire, rescue operation usually involves a lot of fire fighting equipment such as fire extinguishers, sand bucket, fire blanket and fire alarm.

In an event of fire outbreak only trained personnel should be called for such rescue operations especially when victims are trapped. E.g.


Fire Rescue Operation in Brazil

7. Confined Space Rescue:

Confined spaces are narrow, constricting and oxygen-deficient environments. Confined spaces are generally very difficult to access by rescuers, as such they pose a number of potentially fatal threat.

They are usually unlit or poorly lit which makes rescuers provide their own light source. Again, confined spaces contain hazardous materials in liquid or gas form which can be harmful or fatal to humans. E.g.

Confined Space Rescue at SPDC in Port-Harcourt

8. Rope Rescue:

This is the use of nylon ropes, friction repel devices, anchoring and belaying devices for hauling systems and specialized equipment to reach victims and safely recover them to safety. E.g.

Rope Rescue in the UK

9. Ground Search and Rescue Operations:

The search for the Chibok girls since 2015 in Nigeria, is a clear example of this type of operation. A ground search and rescue operation is the search for people who are missing on land or inland waterways. In some ground search operations, rescue teams make use of search and rescue dogs. E.g.


Ground Search and Rescue Operations in Japan

Rescue Operations Procedures

1. Rescue team should arrive at the scene and size-up i.e. take control of the situation.
2. **Hazard Control:** In hazardous terrain rescues, helicopters can be useful.
3. **Patient Access:** Rescue team must be made to gain access to victims in danger.
4. **Medical Treatment:** Rescued victims must be treated by administering first aid.
5. **Disentanglement:** Materials used for carrying survivors must be removed, such as rope.

REVIEW QUESTIONS

1. **What is rescue operation?**
2. **State SIX different aspects of rescue operation.**
3. **What do you understand by confined space rescue?**
4. **List FOUR problems that may hinder easy rescue operation in a confined space.**
5. **State FOUR rescue operation procedures.**

LESSON 1.3

USES OF MATERIALS-Wood

Introduction

In the last lesson, you learned about rescue operations in diverse ways and the procedures involved in carrying out rescue operations.

In this lesson, you are going to learn about one of the most important materials in basic technology. That material is wood. You will learn about types of wood, advantages and disadvantages of using wood as well as the different species of wood.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define wood
2. Mention at least five examples each of hardwood and softwood.
3. State at least five advantages of using wood over other materials.
4. State at least five disadvantages of using wood.
5. State at least five uses of wood.

Definition: Wood can be defined as a fibrous material used for fuel or timber. In JSS 1, we discussed about the types of wood and gave examples. In this lesson, let us remind ourselves some examples of both hardwood and softwood.

Examples of Hardwood

a. Mahogany: This hardwood is used for crafting.
b. Maple: This wood is resistant to shock and often used for flooring and electric pole.
c. Oak: This is the most popular hardwood used for crafting American and English country designs.
d. Walnut: This is a cabinet-making wood with excellent woodworking qualities and takes polishes easily.
e. Teak: Teak is used for carving. But because of its high value, it is used generally used as veneer.

Hardwood Chart

Examples of Softwood

a. Beech: This softwood is much like maple. It is used for frames and a variety of bent and turned parts.

b. Fir: It is used for general woodwork like in furniture, door and window frames, veneer and for plywood.

c. Pine: Known as Christmas tree, is generally used for furniture work.

d. Redwood: This wood is used for crafting outdoor furniture and for decorative carvings.

e. Spruce: This wood is best for crates, boxes, masts and for general woodwork. E.g.

Uses of Wood

Wood is used in many different ways, especially when dried and splinted into plank of different sizes:

(i). As Fuel: This is when burnt wood produces heat which can be used for cooking and warming of the home during cold season.

(ii). Farm Implements: Agricultural implements like yokes, barns, handles of cutlasses and hoes are all produced from wood.

(iii). Building construction: Wood is used in roofing, window and door frames and casting concrete pillars, beams and floors.

(iv). Furniture Making: Beds, chairs, settees, tables, shelves, stools, are all made of wood.

(v). Industrial packaging: Bottled drinks, machines, spare parts, are all packaged in crates, pallets made of wood.

(vi). Tool Making: Handle of chisels, hammers, gauge, pick axes, screw drivers, are made of wood.

(vii). Medicinal Use: Most African herbs are produced from wood. Some artificial limbs and arms are made from wood.

(viii). Vehicle Body Construction: Bodies of lorries, railway wagons and coaches are built from wood.

(ix).Pulp and Paper: Wood is usually processed into pulp(tissue paper) and other forms of paper work.

(x). Musical Instruments: Wood can be used to make musical instruments like piano, guitar, bell, drum, etc.

(x). Others: Other uses of wood include bridges built across gutters, electric poles, etc.

Advantages of Using Wood

i. Wood is generally non-toxic, as such it is not dangerous to handle.
ii. Wood has low density. As such, it is easier to transport.
iii. Wood is strong, light and fairly easy to work with.
iv. Wood when dried is an insulator. There's no fear of being electrocuted.
v. Wood can last a very long time.
vi. Wood is somehow inexpensive, widely available and adaptable to make many wonderful things.
vii. Wood has beautiful grains and coloration when used craft furniture work.
viii. The cost of disposing wood is relatively low.
ix. Finally, wood has low resistance to stress concentration since nails and screws do not weaken it.

Disadvantages of Using Wood.

i. Wood is highly combustible.
ii. Wood is susceptible to disease and rot.
iii. Water and heat can change the dimension of wood. So, wood is dimensionally unstable.
iv. Wood cannot be used at high temperatures.
v. When wet, wood strength decreases.

REVIEW QUESTIONS

1. Define wood
2. Mention at least five examples each of hardwood and softwood.
3. State at least five advantages of using wood over other materials.
4. State at least five disadvantages of using wood.
5. State at least five uses of wood.

LESSON 1.4

USES OF MATERIALS-Metals

Introduction

In the last lesson, you learned about the uses of wood, the advantages and disadvantages of using wood as a technological material.

Recall that in JSS 1, you were exposed to metals, types of metals, properties of metals and alloys of metals. In this lesson, we are going to learn about the uses of metals both in households and in the industry. You will also learn about what alloys are and their uses as well.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. State metals that can be used to fabricate household utensils.

2. Identify metals that can be used in engineering industry.

3. Identify metals that are corrosion resistant.

Uses of Metals

a. Aluminium: It is light in weight and does not rust. It can used to manufacture electrical cables, cooking utensils and aircraft parts.

b. High Carbon Steel: It is often referred to as shear resistant. It is used for manufacturing cutting tools, pliers, drills, punches and hammer heads.

c. Mild Steel: Mild steel is soft to work with. It is used for manufacturing bolts, nuts, structural work, and non-cutting tools.

d. Cast Iron: Cast iron is made from pig iron. It is wear resistant. It is used for producing piston rings and cylinder blocks.

e. Wrought Iron: This metal can withstand sudden shock. It is used for making gates, railings, chains, shackles and couplings.

f. Copper: Copper is malleable and can be used for electrical cable, domestic heating systems, soldering-iron bits and for decoration.

g. Zinc: Zinc is used as a coating for steel and for roofing since it is resistant to corrosion.

h. Tin: Tin is used in the production of enamel. Enamel is used to protect metals from corrosion and to protect car bodies.

Uses of Ferrous Alloys

1. Steel: Steel is the mixture of iron and carbon. It is used for making automobile bodies, tools, screws and nails.

2. Nichrome: This is the composition of nickel, iron and chromium. It can be used to manufacture electrical resistance wire. E.g. Ring boiler.

3. Stainless steel: It is the mixture of iron + chromium + carbon + nickel. Stainless steel does not

rust and can be used for food processing and for storing chemical.

Uses of Non-Ferrous Alloys

1. Solder: This is the mixture of tin + lead. Solder is used for joining metals.

2. Brass: Brass is the mixture of copper + zinc. It is generally used for decorative work and for ammunition.

3. Duralmin: This is the composition of aluminium + copper + manganese + magnesium. This alloy is best for building aircraft bodies, railway coaches and ship bodies.

4. Bronze: Bronze is the mixture of copper + tin. It is used for manufacturing machineries and for decorative metal work like sculpturing.

5. Coins: This is the mixture of copper + tin +zinc. This material is used for making metal currencies also known as coins and other decorative metal works.

REVIEW QUESTIONS

1. State metals that can be used to fabricate household utensils.

2. Identify metals that can be used in engineering industry.

3. Identify metals that are corrosion resistant.

LESSON 1.5

USES OF BRASS and BRONZE

Introduction

This is a continuation of our last lesson. In the last lesson, you learned about the uses of metals generally.

In this lesson, you are going to learn about the specific uses of brass and bronze. You will learn about the characteristics of both metals, properties, uses and the differences between brass and bronze.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define what brass is.
2. State at least five properties of brass.
3. State at least three characteristics of brass.
4. Define bronze.
5. State at least 5 properties of bronze.
6. State at least three characteristics of bronze.
7. State at least five differences between bronze and brass.
8. State at least five uses each of brass and bronze.

Definition

Brass is a metal alloy made of copper and zinc. The proportions of zinc and copper can be varied to create a range of brasses with varying properties.

Properties of Brass

1. Brass offers good corrosion resistance from water and heat and resists attack from salt water and acids, minerals and peaty soils contained in water.
2. Brass has higher malleability than bronze or zinc.
3. Brass is non-magnetic.

Uses of Brass

1. Brass is used for decoration for its bright gold-like appearance.
2. It is used extensively in brass musical instruments such as horns and bells.
3. Brass is also used for applications where low friction is required such as locks, gears, bearings, doorknobs, ammunition casings and valves.
4. It is used for plumbing and electrical applications.
5. It is also used in zippers.

6. Brass is used in engineering work such as in fittings and tools used near flammable or explosive materials.

A Brass statue

Bronze

Definition: Bronze is principally an alloy of copper and tin. However, bronze and brass may also include small proportions of a range of other elements including arsenic, phosphorus, aluminium, manganese, and silicon.

Properties of Bronze

1. Bronze is insoluble in water it can (it can melt in water).
2. Bronze is ductile (it can be stretched like a thin wire when heated).
3. Bronze is a good conductor of heat.
4. Bronze is a good conductor of electricity.
5. Bronze is harder than copper or iron.
6. Bronze has low friction properties.
7. Bronze resists seawater corrosion.
8. Bronze can react with strong acids, producing hydrogen gas.
9. Bronze is stable at room temperature.
10. It is both stronger and harder than its parent metals

Uses of Bronze

1. Bronze metal is used in doors, windows, mail boxes, trim, furniture and rails.
2. Bronze used in architecture.
3. It is used in hardware manufacture.
4. Bronze is also used for sculpturing. E.g.

A Bronze sculpture

Difference Between Brass and Bronze

Brass	Bronze
1. It has low melting point (900 c); flows when melted.	Has higher melting point (950 c); flow depends on the amount of tin.
2. Brass is any alloy of copper and zinc.	Bronze is a metal alloy consisting primarily of copper, usually with tin as the main additive.
3. The colour of brass is muted yellow, somewhat similar to gold, but duller.	Bronze is reddish brown.
4. Used for decorations, plumbing, musical instruments and ammunitions.	Used in boat and ship fittings, propellers and submerged bearings because of resistance to salt water corrosion.
5. Brass was first known to exist in about 500 BC.	Bronze dates to about 3500 BC.

REVIEW QUESTIONS

1. Define what brass is.
2. State at least five properties of brass.
3. Define bronze.
4. State at least 5 properties of bronze.
5. State at least five differences between bronze and brass.
6. State at least five uses each of brass and bronze.

LESSON 1.6

USES OF CERAMICS AND GLASS

Introduction

In the last lesson, you learned about the uses of metals and alloys. In this lesson, you will be learning about the uses of ceramics and glasses. These materials can be seen in virtually every household, offices and eateries. I want to believe you equally make use of ceramics and glasses also. Let us explore more on the importance of these materials.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. State what ceramics are.
2. State at least five articles that ceramics can be processed into.
3. State at least five products made of ceramics.
4. State at least five uses of glass.

Definition: Ceramics are products made from clay. Ceramics may be glass, plasters, clay and cement materials which can be processed into one of the following:

i. Bricks
ii. Blocks
iii. Glass windows
iv. Plaster of Paris (which is used medically for holding broken bones)
v. Pottery
vi. Cement
vii. Bottles.

Uses of Ceramics

1. Ceramics is used for manufacturing asbestos roofing sheets.
2. Ceramics is used for manufacturing breakable plates.
3. It is used for making tea-cups and mugs.
4. It is used for making Plaster of Paris (POP) for holding broken bones in place.
5. Ceramics is used for making water closets and sinks.
6. Ceramics can also be used for manufacturing cement.
7. It is used making oven linings.
8. Ceramics is used for making concrete, blocks, bricks and spark plug.
9. Ceramics is used also for making electric socket and other electrical accessories.
10. Ceramics is used for producing wall and floor tiles.

Glasses

Definition: Glass is a type of ceramics. It is composed of silica (sand), soda and lime. When these ingredients are mixed and melted to such a temperature where all gases are removed, a clear liquid known as glass is obtained.

Uses of Glass

1. Glass is used for computer screens, TV screens, diodes, fuses, etc.
2. Glass is used for electrical insulator as in glazed types used on high tensions.
3. Glass is used for windows, doors and mirrors.
4. It can also be used for bottles, lenses, cups, bulbs and fluorescent tubes.
5. Glass is used for building walls.

REVIEW QUESTIONS

1. State what ceramics are.
2. State at least five articles that ceramics can be processed into.
3. State at least five products made of ceramics.
4. State at least five uses of glass.

LESSON 1.7 & 1.8

USES OF PLASTICS AND RUBBER

Introduction

You are already well-acquainted with the uses of ceramics and glasses. Let us now give attention to the uses of two other very important materials in our lives. These materials are plastics and rubber. This lesson will expose some of the uses of plastics and rubber to you.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. **Identify plastics.**
2. **State the types of plastics.**
3. **State at least five uses of plastics.**
4. **Identify rubber.**
5. **State the types of rubber.**
6. **State at least five uses of rubber.**

Definition

Plastics are produced from petroleum products known as monomers. When a great number of monomers are combined through chemical reactions, polymers are formed. It is this polymers that are referred to as plastics. The process of combining monomers is known as polymerization. The major component of plastic is resin. Resin is a material which softens and flows and can be moulded.

Types of Plastics

i. **Thermosetting:** This is the type of plastic produced from thermosetting resin. This type of plastic cannot be remoulded when exposed to heat. Examples are polyester, amino formaldehyde and Bakelite used for producing the handle of enamel pots and dishes. E.g.

Thermoset plastic on Enamel Dish

ii. **Thermoplastic:** These are plastics made from resin that does not set rigidly heating. They soften on heating and can be remoulded into other shapes. E.g. plastic buckets. E.g.

Thermoplastic as frame

Processing of Plastic

A more detailed process of producing plastic will be discussed in JSS 3. However, be rest assured that some methods of production of plastic include:

(i). Injection moulding
(ii). Compression moulding
(iii). Extrusion moulding
(iv). Calendering.

Uses of Plastics

(i). Plastics are used for dinnerware (dishes).
(ii). Used for electric switchboxes and switches.
(iii). Used for trays, cutlery handles, brushes and baby dishes.
(iv). Plastic is used for funnels, radio and television cabinets.
(v). Mobile phone casing, automobile accessories and spectacle (eye-glass) frames.
(vi). Used for roofing sheets, refrigerator doors and air-conditioning housing.
(vii). Plastic is used for electric iron and cooking pot handles.
(viii). Used for containers for liquids, computer housing cases, ball-point pen casing.

Rubber and Their Uses

Definition: Rubber is an elastic material that can be stretched but can return to its original state.

Types of Rubber

(i). Natural Rubber: Natural rubber is obtained from the sap of rubber tree (Hevea brasiliensis). When the rubber tree is tapped, the milky-white liquid obtained is called the rubber latex. Natural rubber can be improved upon by adding other chemical at high temperature. This process is called vulcanization.

(ii). Synthetic Rubber: This class of rubber is known as elastomers. They are produced from petroleum products. Synthetic rubber cannot be vulcanized.

Uses of Rubber

(i). Rubber can be used as shock dampers (absorbers) and as engine mounting.
(ii). Rubber is used for making tubes and tyres.
(iii). It is used for producing bathroom slippers.
(iv). Rubber is used for water proofing.
(v). Rubber is used as electrical insulator.
(vi). Products such as vee-belts, hoses, shoe heels and soles, tyres, footballs are all made from rubber.

REVIEW QUESTIONS

1. **Identify plastics.**
2. **State the types of plastics.**
3. **State at least five uses of plastics.**
4. **Identify rubber.**
5. **State the types of rubber.**
6. **State at least five uses of rubber.**

LESSON 1.9

GEOMETRICAL CONSTRUCTION- Circles And Parts Of A Circle.

Introduction

In the last lesson, you learned about the uses of plastics and rubber, types and

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define a circle.

2. Explain the properties of circles.

3. State the types of circles.

Definition:

A circle can be defined as a plane figure bounded by a curved line called the circumference that is equidistant from the centre.

Properties of a Circle

(i). Diameter: This is a straight line drawn through the centre of a circle, meeting the circumference at both ends.

(ii). Radius: This is a straight line drawn from the centre to the circumference.|

(iii). An Arc: This is any part of the circumference.

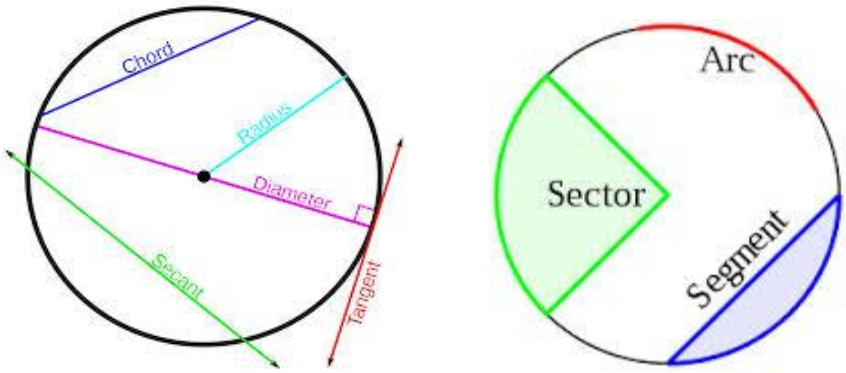
(iv). Chord: This is any straight line drawn across the circle, meeting the circumference at both ends.

(v). Tangent: A tangent is straight line which touches the circumference at a point. It is always at right angles to the radius.

(vi). A Segment: This is a part of a circle bounded by an arc and a chord.

(vii). A Sector: This is a part of a circle that is bounded by two radii and an arc.

(viii). A Quadrant: This is a part of a circle that is bounded by two radii at right angles and an arc. E.g.

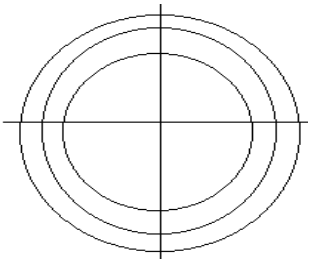


Properties of Circles

(See **Downloaded Video Titled "CIRCLES"** for Demonstration).

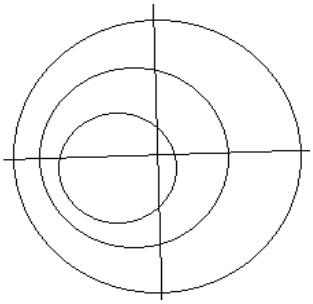
Types of Circles

i. **Concentric Circles:** These are circles that have the same centre but different radii. e.g.



Concentric Circles

ii. **Eccentric Circles:** These are circles that have different centres and different radii. E.g.



Eccentric Circles

REVIEW QUESTIONS

1. Define a circle.
2. Explain the properties of circles.
3. State the types of circles.

LESSON 1.10

GEOMETRICAL CONSTRUCTION- Dividing Circles Into Equal Parts

Introduction

You have just been introduced to circles, types of circles and properties of circles. This lesson is a continuation of the last one.

In this lesson, you will be engaged in a more practical aspect of dividing circles into a number of equal parts of 4, 8 and 12.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Divide a circle into 4-equal parts.

2. Divide a given circle into 8-equal parts using a set-square.

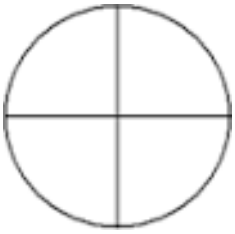
3. Divide a given circle into 12-equal parts using a set-square.

1. **Dividing a Circle With Radius 40mm Into 4-Equal Parts**

   (i). Use your Tee square and set square to draw a horizontal and vertical lines to intersect at O.

   (ii). With O as centre and the given radius, draw the given circle. The quadrant 1, 2, 3 and 4, is the required division.

   (See video at…) e.g.



See Downloaded Video

2. **Dividing a Circle With Radius 40mm Into 8-Equal Parts**

   (i). Use your Tee square and set square to draw a horizontal and vertical lines to intersect at O.

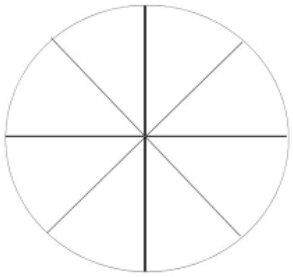
   (ii). With O as centre and the given radius, draw the given circle.

   (iii). With the aid of the 45^0 set square, draw a line to pass through O.

   (iv). Rotate the set square and repeat the process at (iii) above.

   (v). Label the divisions 1, 2, 3-8 to obtain the required circle.

   (See the video at….) e.g.



See Download Video

3. **Dividing a Circle With Radius 40mm Into 12-Equal Parts**

Procedure:

(i). Use your Tee square and set square to draw a horizontal and vertical lines to intersect at O.

(ii). With O as centre and the given radius, draw the circle.

(iii). With the 30^0 set square draw a slant line to pass through O.

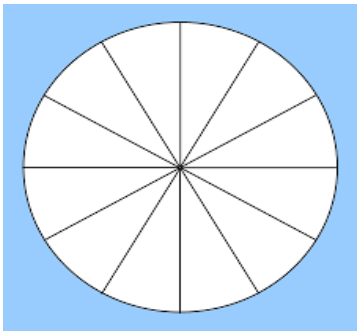
(iv). Rotate the set square and repeat the process.

(v). With the aid of the 60^0 set square, draw a slant line to pass through O.

(vi). Rotate the 60^0 set square and repeat the process at (v).

(vii). The numbered parts 1, 2, 3,…12 completes the required divisions.

(See the video at …. For demonstration). E.g.



See Downloaded Video

REVIEW QUESTIONS

1. Divide a circle with radius 30mm into 4-equal parts.

2. Divide a given circle with radius 35mm into 8-equal parts using a set-square.

3. Divide a given circle with radius 40mm into 12-equal parts using a set-square.

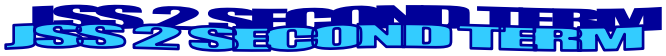
LESSON 1.11

REVISION

LESSON 1.12

EXAMINATION

PART TWO NEXT



LESSON 2.1

REVISION OF LAST TERM WORK/POLYGONS

(Teacher Reviews Last Term's Work With Students)

OBJECTIVES: At the end of this lesson, the student should be able to:

1. State at least six lessons covered in the previous term.

2. Define polygon.

3. State the difference between regular and irregular polygons.

Definition of Polygon

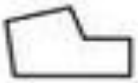
A polygon is defined as a plane figure bounded by more than four sides. For instance:
A 5- sided polygon is known as a Pentagon.
6-sided polygon = Hexagon;
7-sided polygon = Heptagon;
8-sided polygon = Octagon;
9-sided polygon = Nonagon and
10-sided polygon = Decagon.

Types of Polygons

i. **Regular Polygons:** These are polygons with equal sides and angles. They include the ones listed above. E.g.

ii. **Irregular Polygons:** These are polygons that do not have equal sides and angles. E.g.

Regular and Irregular Polygons

Name	Regular	Irregular
Triangle		
Quadrilateral		
Pentagon		
Hexagon		
Octagon		

Examples of Regular and Irregular Polygons

1. **State at least six lessons covered in the previous term.**
2. **Define polygon.**
3. **State the difference between regular and irregular polygons.**

LESSON 2.2

GEOMETRIC CONSTRUCTION OF POLYGONS

Introduction

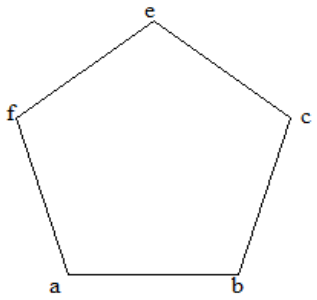
Polygons are plane figures with more than four sides. They can be constructed by following a step-by-step procedure in this lesson.

This is what you will be learning in this lesson. Make sure you have all your drawing instruments with you.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. **Construct a regular pentagon using the External 360^0/N rule.**
2. **Construct a regular hexagon using a set square.**
3. **Construct a regular hexagon using the circle method.**
4. **Construct a regular octagon using a set square.**
5. **Construct a regular octagon using across flat method.**
6. **Construct a regular octagon using the circle method.**
7. **Constructing a number of regular polygons using the General Method.**

1. **PENTAGON.**
   Construct a Pentagon With Side 40mm Using the 360^0/N Rule.
   PROCEDURE:
   (i). Divide $360^0/5 = 72^0$.
   (ii). Draw a horizontal line and mark off AB = 40mm.
   (iii). With the aid of a protractor, locate angle 72^0 at A and B respectively.
   (iv). Draw lines from A and B in turns to meet the located angles.
   (v). With A and B centres and radius AB, cut arcs along the lines at C and D.
   (vi). With C and D as centres and the same radius, cut arcs to intersect at E.
   (vii). Draw lines from C and D in turn to meet at E to complete the Pentagon.
   (See Demonstration Video at…..) e.g.



See Downloaded Video

2. **HEXAGON (I)**

   Construct a Regular Hexagon With Side 40mm Using the $30^0/60^0$ Set Square.

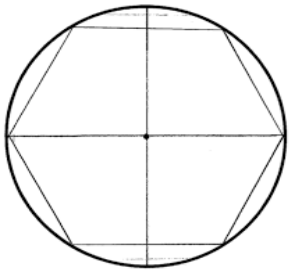
   PROCEDURE:

   (i). Draw a horizontal line and mark-off AB = 40mm

   (ii). With the aid of the set square, draw lines and mark-off C and D in turn = AB

   (iii). At C and D, use the set square to draw lines and mark-off E and F = AB

   (iv). Join EF to complete the required Hexagon. (See Video for Demonstration at…) e.g.



See Downloaded Video

3. **HEXAGON (II)**

   Construct a Regular Hexagon With Side 40mm Using the Circle Method.

   PROCEDURE:

   (i). Draw a horizontal and vertical diagonals with centre O.

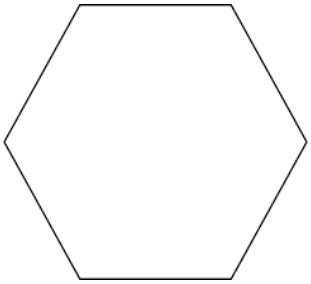
   (ii). With O as centre and radius 40mm, draw a circle.

   (iii). Label the horizontal diameter AB.

   (iv). With A and B as centres in turn cut arcs above and below the circle at 1, 2, 3 and 4.

   (v). Join 2-3, 3-A, A-4, 4-1, 1-B, B-2 to complete the required hexagon.

   (See Demonstration at …..) e.g.



See Downloaded Video

4. **OCTAGON**

   Construct a Regular Octagon With Side 60mm Using the 45^0 Set Square.

   PROCEDURE:

   (i). Draw a horizontal and mark off AB = 40mm

   (ii). At A and B, draw lines, using the 45^0 set square

   (iii). With the pair of compasses, cut off CD = 40mm

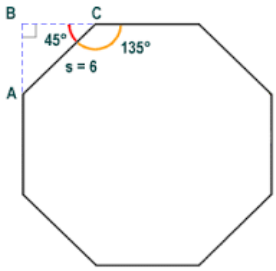
   (iv). Draw vertical lines at C and D respectively and mark off EF

   (v). At E and F, draw lines with 45^0 set square again

   (vi). Mark off GH = 40mm.

   (vii). Join G to H to complete the required Octagon. (See Demonstration at …….)

   E.g.



See Downloaded Video

5. **To Construct a Regular Octagon Given the Distance Across Flats.**

   PROCEDURE:

   (i). Draw a horizontal and vertical diameters AB and CD respectively.

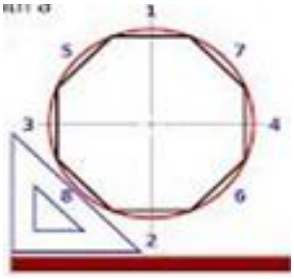
   (ii). Draw a circle whose diameter is equal to the distance across flat.

   (iii). Draw diameters EF and GH at 45^0.

   (iv). Draw vertical tangents through A and B and horizontal tangents through C and D.

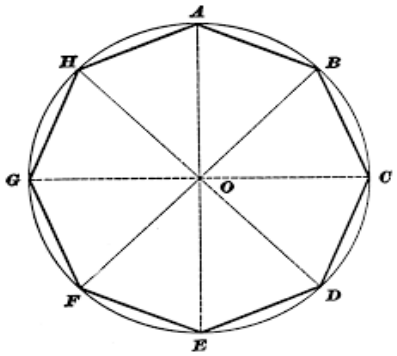
   (v). Draw tangents through E, F, G and H to complete the required octagon.

   (See Demonstration @.....). e.g.



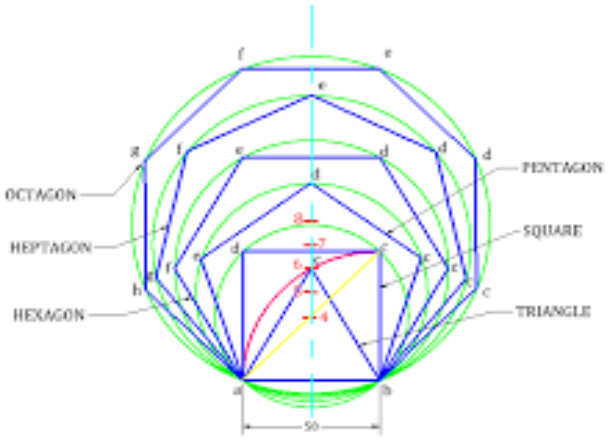
See Downloaded Video

6. **To Construct a Regular Octagon Using The Circle Method.**
   PROCEDURE:
   (i). Draw a horizontal and a vertical diameters with centre O.
   (ii). With O as centre and the given radius, draw a circle.
   (iii). With the aid of the 45^0 set square, divide the circle into 8-equal parts.
   (iv). Join all the divisions to acquire the required octagon.
   (See Demonstration @.....). e.g.



See Downloaded Video

7. **To Construct a Number of Polygons on a Base Using the General Method.**
   PROCEDURE:
   (i). Draw a horizontal line and mark-off AB equal to the given side.
   (ii). Bisect line AB at O produced.
   (iii). At A, use the 45^0 set square to draw a line to touch the bisector at 4.
   (iv). At B, use the $30^0/60^0$ set square to draw a line to meet the bisector at 6.
   (v). Bisect points 4-6 to derive a point at 5.
   (vi). To draw a Pentagon, get radius 5A and draw a circle with 5 as centre.
   (vii). Take radius AB and step-off to cut the circle into 5-equal parts.
   (viii). Join the divisions to acquire the pentagon.
   (ix). To draw a hexagon, take point 6 as centre and with radius 6A, draw a circle.
   (x). Take radius AB again and step-off to divide the new circle into 6-equal parts.
   (xi). Join all the divisions to complete the hexagon.
   For any other polygon you want to draw, repeat the same process. (See Demonstration @....). e.g.



See Downloaded Video

REVIEW QUESTIONS

1. Construct a regular pentagon with side 6cm using the External 360^0/N rule.

2. Construct a regular hexagon with side 35mm using a set square.

3. Construct a regular hexagon with side 40mm using the circle method.

4. Construct a regular octagon with side 52mm using a set square.

5. Construct a regular octagon with side 50mm using across flat method.

6. Construct a regular octagon with side 58mm using the circle method.

7. Constructing a number of regular polygons up to nonagon using the General Method.

LESSON 2.3

PLANE FIGURES- QUADRILATERALS

Introduction

In the last lesson, you learned about how to construct polygons. In this lesson, you are going to learn about quadrilaterals and how to construct them.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define a quadrilateral
2. Identify at least five types of quadrilaterals
3. Construct a square
4. Construct a given rectangle
5. Construct a trapezium

Definition:

A quadrilateral may be defined as a plane figure bounded by four straight sides.

Types of Quadrilaterals

(i). Parallelogram (Rhomboid): This is a quadrilateral with a pair of opposite sides parallel and equal. E.g.

Rhomboid.

(ii). Square: This is a quadrilateral that has all sides and angle equal. The angle is always at right angles. E.g.

Square

(iii). Rhombus: This is a quadrilateral that has all its sides equal. Its angles are other than right angles. E.g.

Rhombus

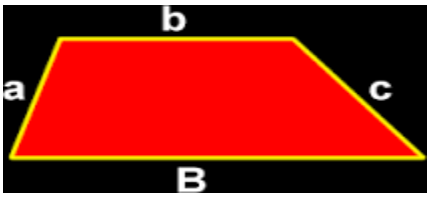
(iv). Rectangle: A quadrilateral that has its opposite sides equal and all its angles are right angles. E.g.

Rectangle

(v). Trapezium: A trapezium is a quadrilateral that has two opposite sides parallel. E.g.

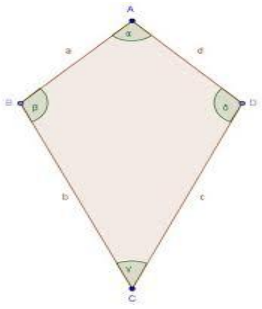
Trapezium, AB//CD

(vi). Trapezoid: This is a quadrilateral that has four unequal sides and angles. E.g.



Trapezoid B≠b

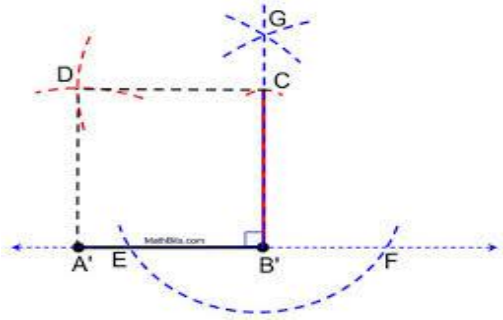
(vii). Deltoid: It is sometimes referred to as a kite. It is a quadrilateral that has its adjacent pairs of sides that are of equal lengths. E.g.



Deltoid

Construction of Quadrilaterals

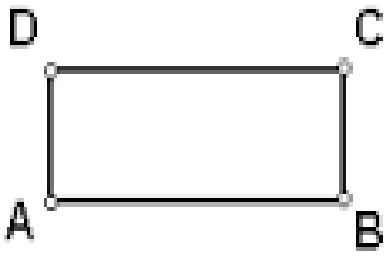
1. **To Construct a Square Given the Length of Sides.**
   (i). Draw a horizontal line and mark off AB =50mm.
   (ii). Construct a right angle at B.
   (iii). With B as centre and radius AB draw an arc to cut the perpendicular at C.
   (iv). With B and C in turn and the same radius draw arcs to intersect at D.
   (v). Join CD and DA to complete the required square. (See Demonstration @.....) . E.g.



Constructed Square

2. **To Construct a Square Given the Length of its Diagonal**
   PROCEDURE:
   (i). Draw a horizontal and vertical lines to intersect at O.
   (ii). With O as centre and radius equal to half of the given diagonal, cut the horizontal line at A and B and the vertical line at C and D.
   (iii). Join AD, DB, BC and CA to obtain the required square. (See Downloaded Video).

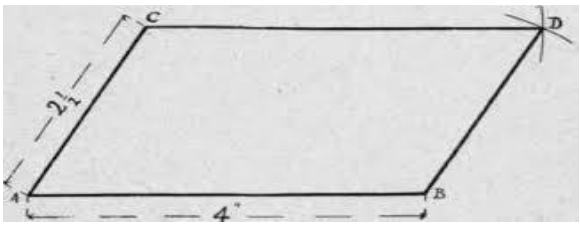
3. **To Construct a Rectangle Given the Length its Length and Breadth**
   PROCEDURE:
   (i). Draw a horizontal line and mark off AB equal to the given length
   (ii). Construct a right angle at A
   (iii). With B as centre and radius 45mm, cut a mark at D
   (iv). With D as centre and the given length, cut an arc parallel to AB
   (v). With B as centre and given breadth, cut the previous arc at C.
   (vi). Join DC and BC to obtain the required rectangle. E.g.



Constructed Rectangle

4. **To Construct a Rectangle Given its Diagonal and One Side.**
   PROCEDURE:
   (i). Draw a line and mark-off AB equal to the given diagonal.
   (ii). Bisect AB at C, and with centre C draw a circle with AB as diameter.
   (iii). With centre A and a radius equal to the given side of the rectangle, cut the circle on any side of AB at D.
   (iv). With centre B and the same radius, cut the circle on the other side of AB at E.
   (v). Join AE, EB, BD and DA to obtain the required rectangle. (See Downloaded Video).

5. **To Construct a Parallelogram (Rhomboid) Given the Length of the Two Sides and One Angle at 60^0.**
   (i). Draw one side AB=80mm.
   (ii). Construct the given angle at B = 60^0**.**
   (iii). With B as centre and radius = 40mm, draw an arc to cut BC at C.
   (iv). With A as centre and radius BC draw an arc.
   (v). With C as centre and radius AB draw an arc to cut the previous one at D.
   (vi). Join AD and DC. E.g. (See Downloaded Video).



Constructed Rhomboid

6. **To Construction of Rhombus Given its Side and a Diagonal.**
   PROCEDURE:
   (i). Draw a line and mark-off AB equal to the given diagonal.
   (ii). With centre A and a radius equal to the given side, strike arcs above and below AB.
   (iii). With centre B and the same radius, cut the previous arcs at C and D.
   (iv). Join AD, DB, BC and CA to obtain the required rhombus.
   (See Downloaded Video).

REVIEW QUESTIONS

1. Define a quadrilateral

2. Identify at least five types of quadrilaterals

3. Construct a square

4. Construct a given rectangle

5. Construct a trapezium

LESSON 2.4

PLANE FIGURES-ENLARGEMENT AND REDUCTION

Introduction

Plane figures involves a lot of constructions from what you may have observed from the earlier lessons. Interestingly, in this lesson, you will be learning about enlargement and reduction of plane figures.

Cameras and other appliances used for capturing images make use of the principle of reduction and enlargement.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define enlargement of plane figure.

2. Define reduction of plane figure.

3. Enlarge plane figures in any given proportion.

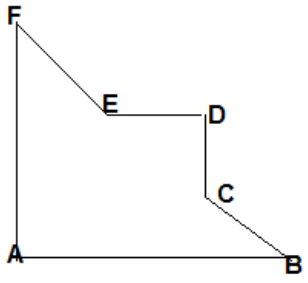
4. Reduce plane figures into any given ratio.

Enlargement

Definition: Enlargement of regular plane figures can be defined as the technique of representing figures in a similar but larger shape using a given proportion.

Example 1:

To Construct a Figure Similar to the Given Figure ABCDEF Shown Below With Sides in the Ratio of 7:4.

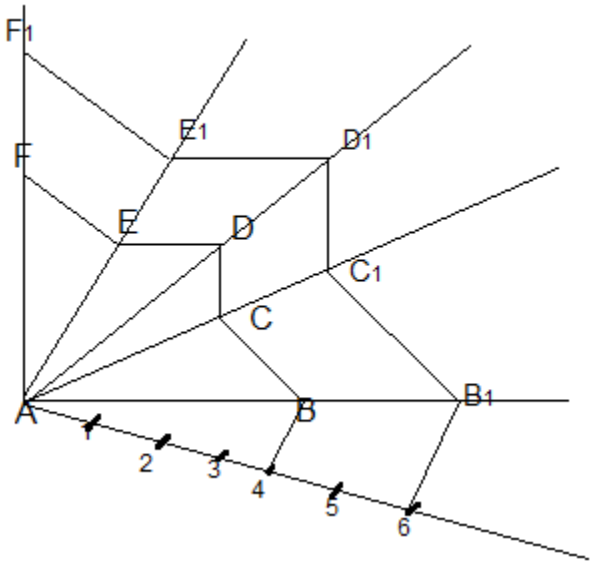


PROCEDURE:

(i). Draw the given figure ABCDEF.

(ii). Produce AB at B and AF at F.

(iii). Radiate lines at AC, AD, and AE.
(iv). Draw a convenient angle at AG and divide it into 7-equal parts.
(v). Join the point 4 to B and draw $7B^1$ parallel to 4B.
(vi). B^1C^1, C^1D^1,and D^1E^1 parallel to BC, CD and DE respectively to complete the required figure. E.g.



See Downloaded Video on Enlargement

Reduction

Definition: Reduction of regular plane figures can be defined as the technique of representing figures in a similar but in a smaller shape using a given proportion.

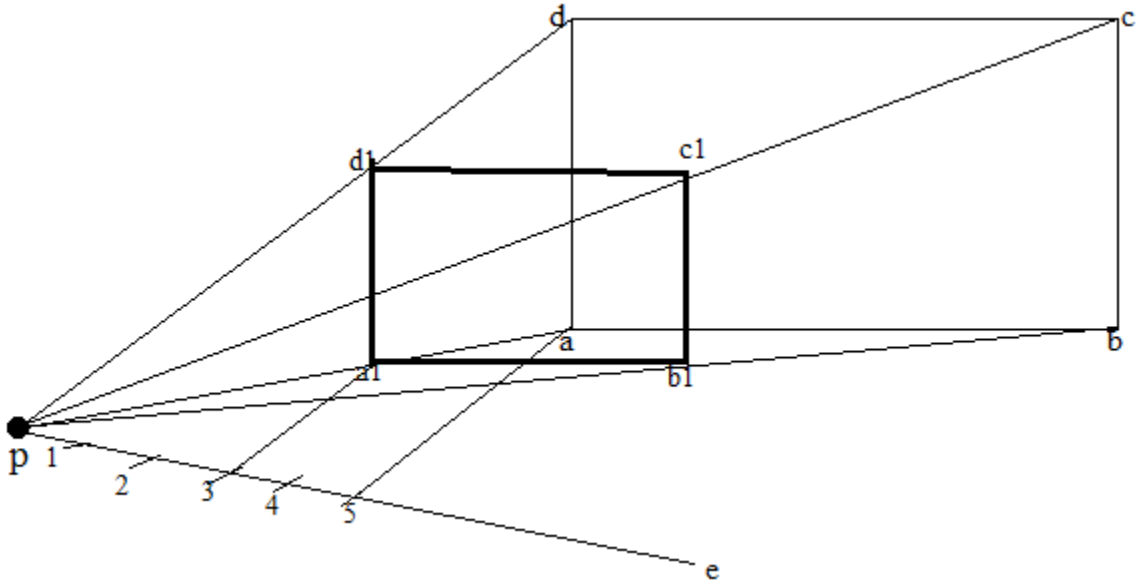
Example 2:

To Reduce the Size of a Given Rectangle ABCD Shown Below by a Given Proportion of 3:5.

PROCEDURE:

(i). Draw the given rectangle ABCD.
(ii). Choose a point P at any convenient distance from the rectangle, and from it radiate line to A, B, C and D.
(iii). Draw any convenient angle at PE and divide into 5-equal parts.

(iv). Draw point 5 to A and draw point 3 to B^1 parallel to 5A.
(v). Draw A^1D^1, D^1C^1, C^1B^1 and B^1A^1 parallel to AD, DC, CB and BA respectively to complete the required reduction. E.g.
(See Demonstration @.....)



REVIEW QUESTIONS:

1. Define enlargement of plane figure.
2. Define reduction of plane figure.
3. Enlarge the plane figure (i) shown below in the proportion of 7:4.
4. Reduce the plane figure (ii) shown below into the ratio 3:7.

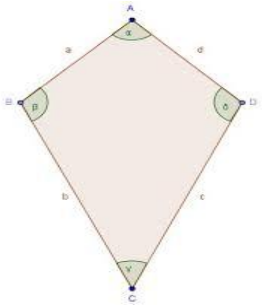


Fig. (i)

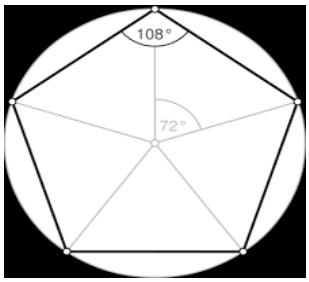


Fig. (ii)

LESSON 2.5

WOODWORK MACHINES (I)

Introduction

In the last lesson, you learned about basic geometric construction of plane figures. In this lesson, you will learn about woodwork machines, the difference between portable and heavy woodwork machines and their uses.

OBJECTIVES: At the end of this lesson, the students should be able to:

1. Define woodwork machine.
2. Identify five portable power hand tools.
3. Identify four machine tools.
4. State the uses of wood working machines.

Definition: Woodwork machines are specially designed machines used for wood operations in furniture work. There are two basic classes of wood working machines in use. They are:

1.Portable Power Hand Tool Machines (Electrically powered)

2. Stationary / Heavy Woodwork Machines.

1. Portable Power Hand Tool Machines include the following:

(i).Hand Drill: This is an electrically powered tool used for boring holes in wood. It contains the chuck which turns the drill bit clockwise and anti-clockwise. E.g.

Portable drilling machine

(ii).Belt Sander: This machine is used for sanding (smoothening) the surface of wood. Abrasive is used to coat the rollers in this electrically powered tool. E.g.

Belt sander

(iii).Circular Saw: The circular saw is used for cross-cutting timber, for cutting depth and for forming grooves on timber. It is electrically powered also. It can be adjusted to any desired position. E.g.

Circular saw

(iv). Saber Saw: This is a flexible saw used for cutting complex shapes like curves on plywood. Like the curves found on loudspeakers. E.g.

Saber saw

(v).Nailing Gun: As the name implies, this machine is used instead of the hammer, in sticking nails into wood. E.g.

Nailing gun

(vi). Router: This portable machine can be used instead of a jigsaw. Since it contains a router bit it can be used to create patterns and curved edges. You can maneuver to any shape. E.g.

(vii). Fret Saw: Although this has been discussed earlier in JSS 1, just for emphasis we will like to state that this saw is used to cut complex shapes in veneers and plywood. E.g.

Fret Saw

2. Stationary / Heavy Woodwork Machines (Woodwork Heavy Machines)

The machines covered in this section are fixed to the floor in engineering workshops, since they are stationary in nature. They include the following:

(i). Circular Sawing Machine: It is used for both cross-cutting and ripping operations during wood work. E.g.

Circular sawing machine

(ii). Band Sawing Machine: This machine uses the band saw. It is used for cutting straight lines, circular and irregular curves on timber and plywood. E.g.

Band sawing machine

(iii). Thicknessing Machine: This is the machine used for forming the required thickness for stool and table legs. E.g.

Thicknessing machine

(vi). Surface Planer: The surface planer is designed for planning operations, especially planks. It can also be adopted for rebating and tenoning jobs. It has a wide, flat surface for supporting any load laid on it. E.g.

Surface planers

(v). Drill Press: This machine has multiple applications. It is primarily used for drilling operations, for boring holes on wood and metals. It can also be used for sanding, shaping and mortising. E.g.

Drill press

(vi). Wood Lathe: This is the father of all machines. Primarily, it is used for turning operations to form table legs and lamp stands or stool stands. It is used also for scraping, sanding, grooving, etc. E.g.

Wood Lathe

REVIEW QUESTIONS

1. **Define a woodwork machine.**
2. **Identify at least five portable power hand tools.**
3. **Identify at least four stationary machines.**
4. **Explain the uses of the following wood working machines.**
   i. Band saw
   ii. Fret saw
   iii. Thicknessing machine
   iv. Surface planner
   v. Nailing gun

LESSON 2.6

WOODWORK MACHINES (II)

Introduction:
In the last lesson, woodwork portable and heavy machines and their functions was discussed.
In this lesson, attention will be focused on turning operations using the wood lathe.
You will be exposed to the different types of wood lathe operations, wood turning and the functions of the various cutting tools when turning operation is in progress.

OBJECTIVES: At the end of this lesson, the student should be able to:
1. State at least two major methods of turning wood.
2. List at least five turning operations.
3. State the use of gouges, skew chisel and scrapper tools in wood lathe operations.
4. State at least five ways of caring for woodwork machines.

Definition of Wood Turning
Turning is a cutting process. The workpiece encompasses a turn. Chips are removed by the hand-wielded tool during turning. This process is also called turning and is one of the oldest wood processing techniques.

Steps Involved in Wood-Turning Operation

i. **Select a Lathe Suitable for your Project.** Bench top lathes can be ideal for turning small projects like ink pens and yo-yos while larger machines may be used for making spindles used in furniture and handrail styles.

ii. **Choose the Lathe Operation you are Going to Begin With.** A simple task might be to turn a square or irregularly shaped piece of wood to a true cylindrical shape, this often the first step to forming a spindle or other round items.

iii. **Select the Correct Cutting Tools for your Project.** Lathe tools are called chisels. They feature long, round, curved handles to afford a solid grip and sufficient leverage to enable the turner to control the cutting edge accurately with minimal fatigue.

Tools for Turning Operation

1. **Wood Lathe:** The wood lathes is the primary tool used to create functional furniture components, beautiful decorative wood projects such as candlesticks and bowls, or even toys such as tops.

These machines range in size from hobby models that fit on a work bench to large industrial-sized machines.

Some turning operations on a wood lathe include the following:
i. turning a cylindrical shape
ii. parting off with a parting toolo
iii. turning a bowl shape
iv. turning a hollow with a gouge. E.g.

Wood Lathe

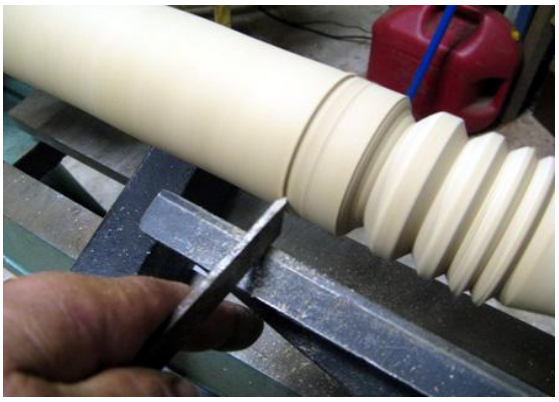
2. Gouges. These are cutting tools with specially shaped cutting edges for performing particular cuts, such as *bowl gouges*, with concave, curved cutting edges to form the smooth, curved surface of a bowl, or *vee*, or *knurling gouges* for cutting grooves or knurls in wooden spindles. E.g.

A Vee-Gouge

Spindle Gouge

3.Scrapers. These are often flat or slightly curved chisels for removing wood from flat or cylindrical shapes, or for roughing out a shape.

4. **Parting tools:** These are thin, vee tipped tools for cutting off work pieces.



5.Spoon cutters: These are cutting tools that have a *spoon shaped* cutting edge and are also often used for shaping bowls.

6. **Skew chisels:** Skew chisels are used for making square-grooves, it can also plane and shape many other profiles during turning operations. E.g.

Skew Chisel

Care/Maintenance of Woodwork Tools

Turning tools are subject to considerable albeit varying strain when processing differing wood types. Thus, certain basic requirements must be met by sound tools.

i. It must be of high-grade steel which is sufficiently hard and elastic.
ii. The most suitable taper angle must be ground for the respective wood type.
iv. The tool must possess sufficient heat conductivity capacity. The subsequently arising frictional heat can cause structural changes to the tool cutting edge. This would denote a softening of the tool.
v. The tool must be extremely sharp.
vi. The tool must be easy to handle as regards its form and size.
vii. Clean and properly sharpen tools. Thes are an essential precondition for sound quality of the workpieces being processed and for accident-free operations.
viii. Tools subject to considerable wear and tear are ground on the abrasive wheel. When grinding by means of dry-operating abrasive wheels the tools should be placed in water at short intervals otherwise they can easily anneal.
ix. Tools are only ground anew once resharpening by means of oilstoning is no longer possible.
x. Blunt tools require considerable cutting forces. This increases the risk of accidents and inferior surface quality results.

REVIEW QUESTION

1. State at least two major methods of turning wood.
2. List at least five turning operations.
3. State the use of gouges, skew chisel and scrapper tools in wood lathe operations.
4. State at least five ways of caring for woodwork cutting tools.

LESSON 2.7 & 2.8

REVIEW ON GEOMETRIC CONSTRUCTION (CIRCLES) AND WOODWORK MACHINES

Introduction

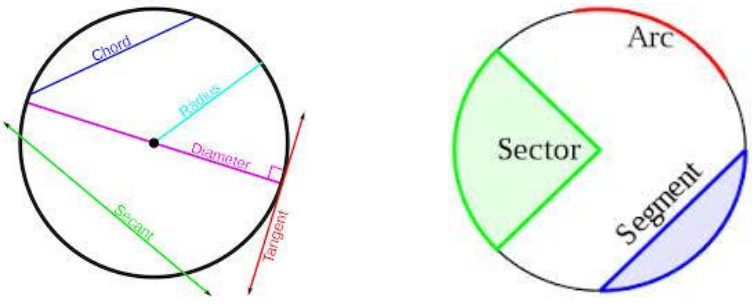
Let us recall that in lesson 9 and 10 in part one of this book, you learned about geometric construction that involved circles, its properties and divisions.

In this second term, in lesson 5 and 6, woodwork hand tools was covered. In this Lesson 7 and 8, we will be reviewing briefly these lessons covered already.

OBJECTIVES: At the end of this lesson, the student should be able to:
1. State the properties of circles.
2. Demonstrate how to divide a circle into 4, 8, and 12 equal parts.
3. State the functions of the different types of woodwork machines.
4. State how to care and maintain woodwork machines.

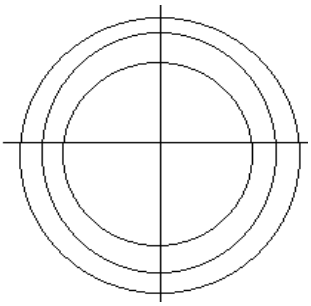
1. **Circle**
   Definition:
   A circle was defined as a plane figure bounded by a curved line called the circumference that is equidistant from the centre.

Properties of a Circle

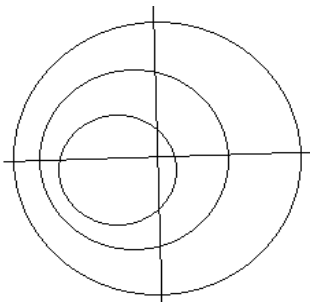


Properties of Circles

Types of Circles



Concentric Circles



Eccentric Circles

Dividing Circles Into 4, 8 and 12 equal parts

For a detailed demonstration on how to carry out the division of circles, see page… of this text book or better still see the demonstration video at the links below:

i. Dividing a Circle Into 4-Equal Parts…
ii. Dividing a Circle Into 8-Equal Parts…
iii. Dividing a Circle Into 12-Equal Parts…

2. **Woodwork Machines**

Definition: Woodwork machines was defined as machines used for wood operations in furniture work. There are two basic classes of wood working machines in use. They are:

1.Portable Power Hand Tool Machines(Electrically powered)

2.Wood- work machines.

As a review, name, classify and state one use each of the following woodwork machines as either portable or as heavy machines in woodwork operation:


DELTA
DC-580 Planer


wiseGEEK


faceplate
headstock
tail stock
lathe bed
motor
gearbox
POWERMATIC
adjustable rest


G.S. PAIK
Thickness Machine
gspaik.com

REVIEW QUESTIONS

1. State the properties of circles.
2. Demonstrate how to divide a circle into 4, 8, and 12 equal parts.
3. State the functions of the different types of woodwork machines.

LESSON 2.9

METALWORK MACHINES

Introduction

With the review on some lessons completed in the last lesson, let us now pay attention to metalwork machines.

In this lesson, you are going to learn about what metalwork machines are, types of metalwork machines and their functions. You will also learn how to sketch these machines.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define metalwork machines.

2. State at least identify five types of metalwork machines.

3. State at least one function of metalwork machines identified.

4. Sketch metalwork machines.

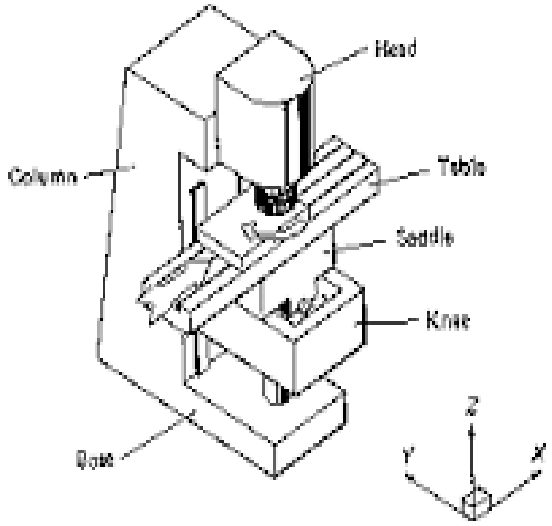
Definition:

Metalwork machines are devices that are driven by electricity to perform different operations on metals.

The machines used in metalwork operations are generally referred to as metalwork machines. They are of different types and sizes.

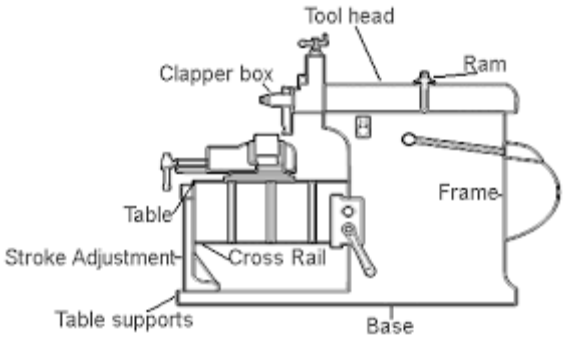
Types of Metalwork Machines

1.Milling machine: This machine is used for cutting gears, grooves slots and to cut splines in shafts of metal rods. e.g.



Horizontal milling machine

2.Shaper and Planers: The shaper is used to generate flat surfaces while the planner is used for producing flat surfaces which the milling machine cannot achieve. E.g.



A Shaping machine

3.Power Sawing machine: This is an electrically powered sawing machine used in cutting soft metal materials, by using hack-saw blade with coarse tooth. The coarse blade is used so as to avoid clogging of the teeth by metal chips. E.g.

power sawing machine

4.Pedestal grinder: This machine is used for grinding (sharpening) the cutting edges of cutting tools. It can also be used to grind scribers, cold chisels and drills. They are of two types, namely, the floor type and the bench type. E.g.

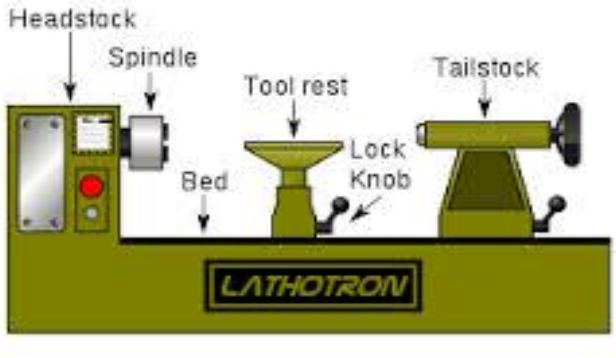
Pedestal grinders

5.Drill press: The drill press is used for boring holes in thick metals. Drill bits are fitted into its chuck that has different sizes. E.g.

Drill press

6.Centre Lathe Machine: As mentioned earlier, the lathe machine is an all-purpose machine, used for the following operations:

(i).generate cylindrical, flat and conical surfaces;
(ii).cut holes in geometrical shapes;
(iii).cut threads on screws, bolts and nuts;
(iv).reduce the size of geometrical shapes.
(v).used for milling, turning, shaping and planing. E.g.



Centre Lathe

Work-Holding Methods on the Lathe

In metal work involving the use of the lathe machine, work pieces are held firmly in place through the use of the following tools:

(i).The chuck: The 3-jaw chuck is used to hold triangular and round work pieces while the 4-jaw chuck is used for holding square-shaped work pieces. E.g.

3-Jaw Chuck

4-Jaw Chuck

(ii).Driving plates: The driving plate is used when a slender work piece is to be machined and held between two centers. E.g.

A Driving Plate

(iii).Face plates: When a work piece has an awkward or irregular shape, the work plate is used for turning the work piece. However, if the work piece is to be turned at parallel or right angle to a flat surface, the face plate is applied for turning. E.g.

A Face Plate

Operations on the Lathe Machine

The lathe machine is used to carry out four major operations, namely:

(i).Facing: This the generation of a plane or flat surface by the lathe machine.

(ii).Plain turning: This is the method of producing cylindrical surfaces by the lathe machine.

(iii).Stepped: This operation is similar to the plain turning operation. In the stepped operation, a different cutting tool is applied when a different shape is desired.

(iv).Taper turning: This is the method of reducing the diameter along the length of any round work piece.

Care of the Lathe Machine

(i). The moving parts of the lathe machine must be oiled or greased regularly.
(ii). Coolant lubricant should be directed at the cutting spot during cutting operations.
(iii). The work piece must always be held or clamped rigidly before it is turned on the lathe.
(iv). Appropriate speed must be applied to any of the operations so as to avoid damage to both work pieces and the lathe machine.

REVIEW QUESTIONS

1. Define metalwork machines.
2. State at least two classes of metalwork machines.
3. Identify and state the different types of metalwork machines.
4. State the uses of metalwork machines.
5. State at least eight parts of a centre lathe machine.
6. Explain the following terms:
(a). Facing
(b). Stepped
(c). Taper turning
(d). Plain turning
7. State five ways you may care for a lathe machine.

LESSON 2.10

CARE AND MAINTENANCE OF METALWORK MACHINES

Introduction

You have been exposed to metalwork tools and machines and their functions in the last couple of lessons.

In this lesson, you are going to learn about how to care and maintain these metalwork machines and tools. This knowledge will aid you on how you can be careful before and after using a metalwork machine or tool.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define maintenance of metalwork machines.

2. Carry out simple maintenance of metalwork machines.

3. Carry out cutting, drilling and facing operations.

Definition: Metalwork maintenance simply refers to the care of machines and machine tools so as to prolong their efficiency and ease of use.

Tips on How to Care for metalwork Machines

1. Always disconnect machines and tools from an electrical power source after use.
2. All metalwork machines and tools must be cleaned and lubricated regularly using metal brush, air jet or gas jet.
3. Do not carry portable power tools by the cables. Again, power cables should be kept away from heat, oil and sharp objects.
4. Blades and other cutting tools should be checked regularly for damage or any defects. If any defect is found, replacement should be done immediately. Cutting tools should be sharpened regularly.
5. The personnel operating the machine must be safety conscious, by wearing personal protective gears.
6. All machines must be operated according to the manufacturer's instruction manual.
7. When drilling or sanding, it is necessary to firmly secure the work piece. This gives you room to manipulate the machine.
8. Do not wear overflowing clothing or a necktie when operating a machine.

NOTE: It should be noted that apart from the tips enumerated above, the earlier lesson on woodwork hand tool maintenance applies inn this case also.

REVIEW QUESTIONS

1. Define maintenance of metalwork machines.

2. State five maintenance tips of metalwork machines.

LESSON 2.11

REVISION

LESSON 2.12

EXAMINATION

PART 3 NEXT.

Jss2 Third Term Scheme.

LESSON 3. 1

REVISION OF LAST TERM'S WORK

(THE TEACHER WILL USE HIS /HER DISCRETION).

Let Us Move Straight To Our Next Lesson.

LESSON 3. 2 & 3.3

BELT AND CHAIN DRIVES

Introduction

The first lesson for this term begins with belt and chain drives. In this lesson, you will learn about what belt and chain drives are, the machines that utilize belt and chain drives, applications, advantages and disadvantages of belt and chain drives.

OBJECTIVE(S): At the end of this lesson, the student should be able to:

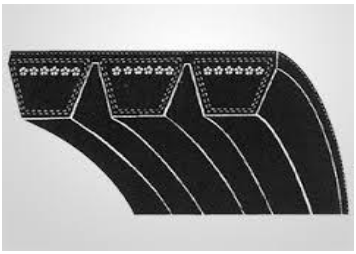
1. Define belt drive
2. List at least five machines that make use of belt
3. List at least two types of belts
4. State at least three advantages of belt drives
5. State at least five applications of chain drives
6. State at least four advantages of chain drives
7. State at least three disadvantages of chain drives

Definition of Belt Drives

Belt drives are simple mechanical devices used for transmitting motion from one pulley to the other. Belt drives are an arrangement of pulleys which are either connected to flat or vee-belts.

Types of Belt Drives

a. Vee Belt and Pulley e.g.



Vee belt and pulleys

b. Flat Belt Pulley e.g.

Flat belt and pulleys

c.Variable speed pulley with vee- belts. E.g.

Variable speed vee belt or toothed belt.

The three groups of belts above can be used to:

- Increase or reduce speed from driver to a driven shaft.
- Transmit power over a long distance between shafts.
- Change the direction of motion of both pulleys.

Application of Belt Drives

Belt drives can be used in the following areas:

i. Pepper grinders.
ii. Cassette and video or DVD tape players.
iii. Refrigerating and air-conditioning systems.
iv. Vehicle engines, where motion is transmitted to rotate radiator fan or drive the alternator.
v. In an alternating current generator, where motion is transmitted from the petrol engine to the alternator through a belt drive.
vi. The sewing machine-reciprocating rotary motion.

Advantages of Belt Drives

i. Belt drives need less or no maintenance since it requires no lubrication.
ii. Belt drives can be used to transmit motion over a long distance.
iii. Belt drives can be used to transmit power to shafts inclined at an angle different from the driven shaft.

Disadvantages of Belt Drives

i. Since energy is lost to friction, the transmission of power in belt drives is not too efficient, in fact no machine is 100% efficient due to heat.
ii. In belt drives, the belt can get worn-out with time and can break suddenly.

Definition of Chain Drive

This is an arrangement of a chain connected across two sprocket gears. You can see the application of a chain drive in:

i. A bicycle
ii. Motorcycle
iii. Forklift, etc.

Chain and gear

Advantages of Chain Drives

i. Chain drives can be used between shafts that are at a great distance apart.
ii. Chain drives transmit power more efficiently because it has less friction.
iii. Chain drives do not break so easily like belts.
iv. Chain drives, once greased takes time to dry up. This means less maintenance .

Disadvantages of Chain Drives

i. Chain drives are limited in their use for distances less than one metre.
ii. Chain drives are not easily reversible.

REVIEW QUESTIONS

1.Define belt drive
2. List at least five machines that make use of belt
3. List at least two types of belts
4. State at least three advantages of belt drives
5. State at least five applications of chain drives
6. State at least four advantages of chain drives
7. State at least three disadvantages of chain drives.

LESSON 3. 4

HYDRAULIC AND PNEUMATIC MACHINES (I)-Examples

Introduction
In the last lesson, you learned about belt and chain drives. In this lesson, you are going to be learning about hydraulic and pneumatic machines. You will be exposed to some examples of these machines and how they function.

OBJECTIVES: At the end of this lesson, the student should be able to:
1. Define hydraulic
2. Identify four hydraulic devices
3. Define pneumatic
4. Identify at least two pneumatic devices.

Definition of Hydraulic
Hydraulic can be defined as the flow of fluid through pipes under pressure in machines to be able to do work.

Hydraulic fluid:
The liquid or fluid used in any hydraulic system is referred to as hydraulic fluid. Examples are water and oil.

Hydraulics:
Hydraulics are machines that work on the principle of hydraulic. E.g. Forklift.

It is important to note that both hydraulic and pneumatic devices are used for the following purposes:

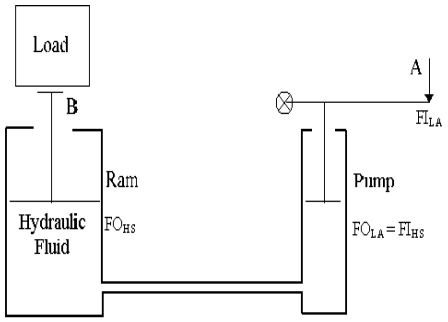
- For pushing
- For pulling and
- For lifting.

Hydraulic Components: Some of the components that make use of hydraulic include the following:
i. Hydraulic brake
ii. Lifting and crushing mechanisms

iii. Hydraulic pallet
iv. pump driven hydraulics
v. Truck mounted trains
vi. Hydraulic jack.

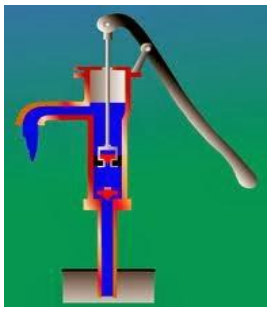
Hydraulic Devices

Bottle Jack: This is the simplest form of an hydraulic jack. It has two main parts – the handle and the lever which is connected by two pistons which raises the lever that raises the load (car). E.g.



External and Internal Structure of a Bottle Jack

Suction and Double Acting Pump: These are manually operated pumps used for lifting liquids and gases from reservoirs. E.g.

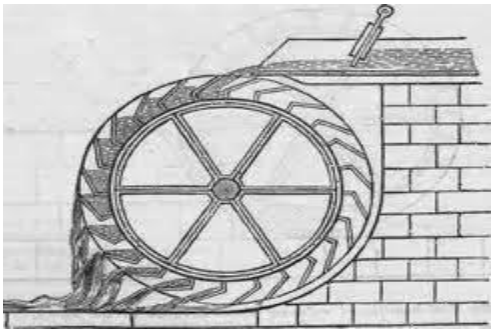


Double Acting pump

Garden Sprinkler: The sprinkler is used in water gardens. It has jets which issues out water at a given speed about an axis. E.g.

Water sprinklers.

Water wheel: This wheel can be used to create mechanical energy in grinding, milling and electric power machines. E.g.



Water wheel

Others: Other devices that make use of hydraulic system include-(a) Reaction turbine (at dams) and (b) Brakes – used in cars to control motion, etc.

Definition of Pneumatic

The use of compressed air in machines to do work is called pneumatic.

Compressed Air:

When ordinary air is forced under pressure into a small space it is called compressed air. As such, when air is under pressure it possesses energy which can be released to do important work for man's enjoyment.

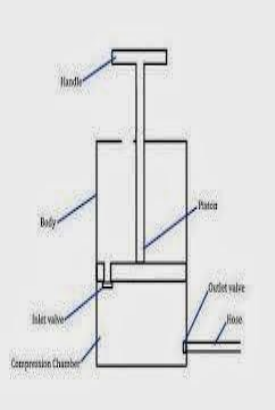
Pneumatic Components: Pneumatic components include the following:

i. The single acting cylinder
ii. The shuttle valve
iii. A double-acting cylinder
iv. A three-port valve
v. The five-port valve
vi. A flow regulator

Some of these components will be discussed in the next lesson.

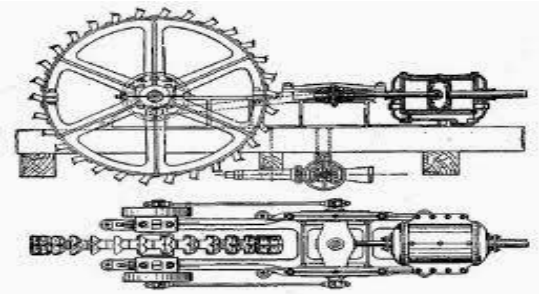
Pneumatic devices include the following:

Hand Pump: These are of different types, they are used to inflate tyres, balloons, balls etc. the hand pump has a plunger which sucks in and pushes out air at the barrel cylinder.



Hand pump

Compressor Machine: This machine is used by vulcanizers. The modified one is used as a spray machine on several products. E.g.



Compressor machine

REVIEW QUESTIONS

1. Define hydraulic
2. Identify four hydraulic devices
3. Define pneumatic
4. Identify at least two pneumatic devices.

LESSON 3.5

HYDRAULIC AND PNEUMATIC MACHINES(II)-Operations

Introduction

In the last lesson, examples of hydraulic and pneumatic machines were mentioned. However, in this lesson, you going to learn about the principles of operation behind these machines and why they function the way they do.

You are also going to see videos that will demonstrate first hand how these principles work in real life. You are advised to download and see how these machines work personally. Your teacher may assist you and see these videos with you also.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Identify both hydraulic machines.

2. State at least two components in both hydraulic machines.

3. State at least one principle of operation in any of the machines that will be identified above.

4. State at least one use each of the machines that will be identified during the lesson.

1. Hydraulic Jacks

Hydraulic jacks are used to lift heavy loads like cars, heavy-duty trucks, etc. Hydraulic jacks work on the principle of hydraulic press. In an hydraulic press there are two cylindrical drums, one with smaller area (A_1) and the other with a larger area (A_2).

The surface area of a piston in A_2 supports the load why the surface area of a piston in A_1 forms where an effort is applied.

In the hydraulic press, as force is applied at the smaller cylinder drum (A_1), force is transmitted throughout the body of the liquid contained in the cylinder drum to the opposite larger cylinder drum (A_2), which lifts any load resting on it. E.g.

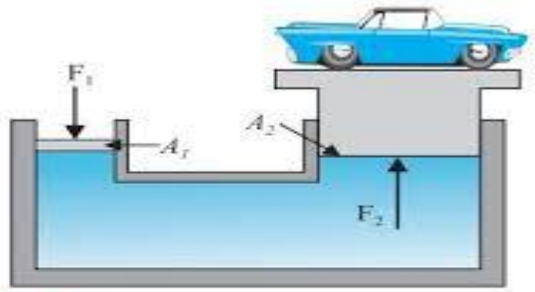


Fig 10.6 Schematic diagram illustrating the principle behind the hydraulic lift, a device used to lift heavy loads.

(See Downloaded Video on "Hydraulic Jack.")

2. **Bottle Jack:** This is the simplest form of hydraulic jacks. It contains a lever arm, vertical inner cylinder containing mineral oil and a bearing pad which is in direct contact with the load.
   When pressure is applied through the lever arm to lift any heavy load, the bearing pad reciprocates by lifting the load attaché to it. This type of jack is best suited for vehicles with a good clearance above the ground. For cars with a low base, the bottle jack is not an ideal jack for them. E.g.

Bottle jack.

(See Downloaded Video on Hydraulic Jack)

3. **Turbines:** There are different types of turbines namely:

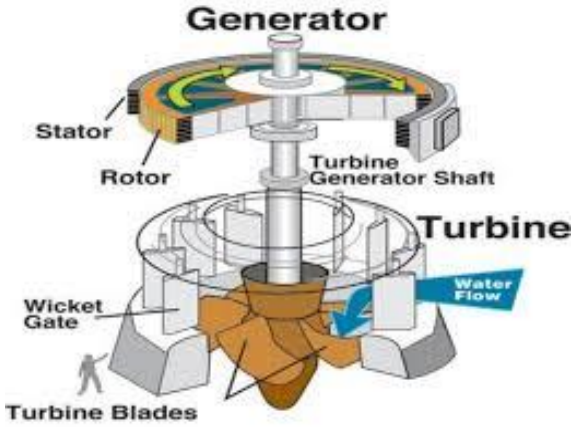
i. Water turbine
ii. Gas turbine and
iii. Steam turbine

Water turbine for instance is also referred to as reaction turbine. Usually water turbines are located at the base of dams where river or lagoon water can be controlled through a gate and channeled towards the turbine.

A water turbine is made up of a rotor shaft with an adjoining blades called buckets. All these are arranged in an enclosed casing.

Mechanical energy from the flowing water pushes against the buckets or blades to turn the rotor shaft. In turn, this energy drives an hydropower generator to generate electricity. It

should be noted that the pressure in a water turbine changes as the water flows in and out of the turbine. E.g.



Water Turbine

4. **Hydraulic Brakes:** Brakes rely on the human body to provide the force to create pressure in the hydraulic system. By the time the brake pedal is pressed, a small piston in the master cylinder creates pressure in the brake fluid which is transmitted to the wheel cylinder.
   The piston in the wheel cylinders exerts a force on the brake pad which rubs against the rotating disc. Therefore this slows down and finally stops the vehicle.
   In cars with drum brakes, the arrangement is a little different but the same principles, especially on cars where all four wheels have either a disc or drum brake. E.g.

Disc Brake

(See Downloaded Video on How Brakes Work)

REVIEW QUESTIONS

1. Identify both three hydraulic machines you learned about in this lesson.
2. State at least two components in the hydraulic machines identified above.
3. State one principle of operation in a hydraulic jack machine.
4. State at least one use each of the machines that identified during this lesson.

LESSON 3.6

HYDRAULIC AND PNEUMATIC MACHINES(III)-Uses And Working Principles

Introduction

A close look at the last lesson shows that emphasis was generally on hydraulic machines and their principles of operation.

In this lesson the shift is on pneumatic machines and the principles of operation. You are also going to learn about the uses of these pneumatic machines.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. **Identify pneumatic machines.**
2. **State at least one component of pneumatic machines.**
3. **State at least one principle of operation in an identified pneumatic machine.**
4. **State at least one outstanding use of an identified pneumatic machine.**

Generally speaking, pneumatic machines are mostly pumps for moving air to inflate a container, to move water or waste from one point to another through changes in air pressure within a cylinder or system.

1. **The Hand Pump:** This is the one generally known as the bicycle pump. It is often referred to as a positive displacement pump. Positive displacement pumps have a plunger and a cylinder.
   The plunger is enclosed within the cylindrical barrel and at one end of the barrel, there is a nozzle.
   In using the pump, all you need do is to pull and push the plunger. The displacement of the piston (plunger) results is massive suction of air into the designed cylindrical container.
   At the forward stroke, air is pushed out through the nozzle thereby inflating any material it was attached to such as football, balloon or tyres. E.g.

2. **Compressed Air Pumps:** Compressed air pumps, centrifugal pumps and vacuum cleaners belong to the group of pumps known as rotary pumps. Their principle of operation is quite different.
   The compressed air machine has two parts. There is the petrol or diesel engine part and

the rotary pump section. Internally, the compressed pump contains a rotary device in the form of a fan which draws in air from the immediate surrounding and directs it through a nozzle.

The air compressor machine is used by most tyre repairers (vulcanizers) to inflate automobile and vehicle tyres.

In some other cases, some compressed air pumps have a cylindrical metal tank, called the receiver, into which sucked air is directed by passing through a regulator. This device makes it possible to build up air at constant pressure.

Such stored air can also be used to direct a jet of spray of polish or paint on furniture and bodies of metallic materials. E.g.

(See Downloaded Video on "How Double Acting Pump Works.")

REVIEW QUESTIONS

1. **Identify two pneumatic machines you just learned about.**
2. **State at least one component of the pneumatic machines.**
3. **State at least one principle of operation in an identified pneumatic machine.**
4. **State at least one outstanding use of an identified pneumatic machine.**

LESSON 3.7 & 3.8

GEARS(I)-

Definition, Types and Uses

Introduction

In the last lesson, you learned about the uses and the working principles of hydraulic and pneumatic machines.

In this lesson, you will learn about what gears are, the different types of gears, what gears are used for and the application of gears in a some machines.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Define a gear.

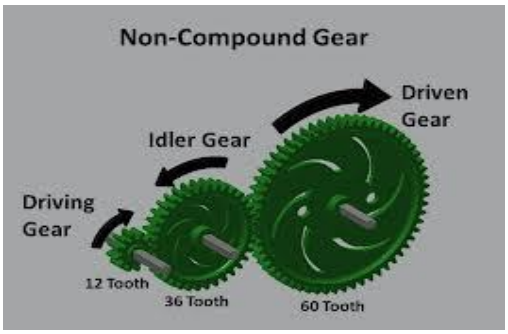
2. State at least four types of gears.

3. State at least five uses of gears.

4. State at least four applications of gears in a machine.

Definition of a Gear

Gear is a toothed wheel used to transmit motion from one shaft to another, to change speed and direction in machines. They can be made of plastics or metals. E.g.



Meshing gears

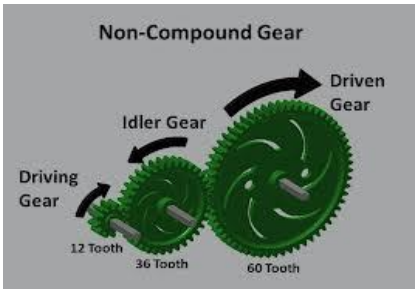
Classification of Gears

i. Internal gear: This is a type of gear that is toothed internally.

ii. External gear: As the name implies, this class of gear is externally toothed.

Types of Gears

i. **Wheel gears:** These are gears that are used when shafts are arranged in parallel. E.g.

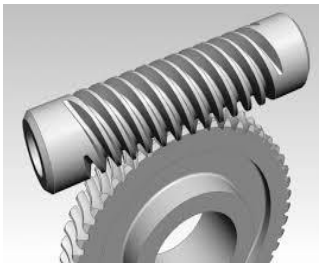


Meshed Wheel gears

ii. **Bevel gears:** These are gears used where shafts are inclined at 90^0 to each other and for speed reduction. E.g.

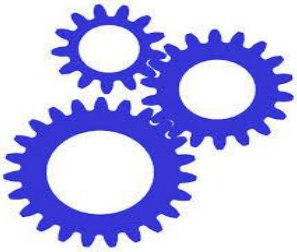
Bevel gear

iii. **Worm gears:** Where axis of rotation is inclined at 90^0 the worm gear is used. E.g.



Worm gear

iv. **Sprocket gears:** These are the types of gears used on bicycles and motorcycles. E.g.



Sprocket gears

Applications of Gear

Can be applied in the following mechanical devices:

i. Wood and metal work machines-lathes.
ii. Used on cranes.
iii. Mechanical clocks.
iv. Bicycle and motorcycles.

v. Hoists.
vi. Cars and automobiles –gear box, rear axle.

Uses of Gears

a. Gear is used for transmitting power.
b. Gear can be used to change the direction of travel by transmitting force of speed at 90^0 with the use of bevel gear.
c. Gear can be used to change speed, either to increase or decrease the speed.
d. Back movement with the selection of bevel gear is possible in most engines with the use of gears.

REVIEW QUESTIONS

1. Define a gear.
2. State at least four types of gears.
3. State at least five uses of gears.
4. State at least four applications of gears in a machine.

LESSON 3. 9

GEARS(II)-

Gear Ratio and Speed of Rotation

Introduction

In working with gears in engineering, one must understand how to calculate gear ratios and the speed of rotation. This is what this lesson will be exposing to you. You are also going to learn the relationship between gear ratio and the speed of rotation in a gear system.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Carry out simple calculations involving gear ratios
2. Describe the relationship between gear ratio and the speed of rotation
3. State at least three functions of lubricants on gears.

Gear Speed and Ratio

When two or more gears are in a mesh, one will drive the other. As such, one of the gears will be referred to as a driving gear and a driven gear.

Driving gear: This is the gear that transmits power, force or speed to the other gear.

Driven gear: This is the gear that receives the force, power or speed transmitted to it.

Gear ratio (G_R): Gear ratio is the relationship between two gears in which one gear has larger speed than the other.
For instance, a gear A has 120 teeth and another gear B has 40 teeth. The gear ratio will be 3:1, which means that there is enlargement of speed.
If the ratio were 1:3, it means there is speed reduction of ratio 1:3.

Simple Calculations Involving Gear Ratios

To carry out calculations involving gears, let use appropriate parameters to refer to them.

Number of Teeth in Driver Gear = N_d
Speed of Rotation for Driver Gear = S_d (revolution/sec)

Number of Teeth in Driven Gear = N_D
Speed of Rotation for Driven Gear = S_D (rev/sec)

But **Gear Ratio (G_R) = $\frac{N_d}{N_D}$** i.e. $\frac{\text{Number of Teeth in Driver Gear}}{\text{Number of Teeth in Driven Gear}}$

NOTE: It is the gear ratio (G_R), that determines the speed of the Driven Gear.
As such, **Speed of the Driven Gear is $S_D = G_R \times S_d$ ……(1)**
This implies that SD = $\frac{N_d}{N_D} \times S_d$ ……(2)

This implies that Speed Ratio, $G_R = \frac{S_D}{S_d}$ (I only cross multiplied 1 above)

This means that **Speed Ratio (S_R)** = **Gear ratio(G_R)**. (The two means the same thing).

Now, let us use an example to drive home the point more clearly:

EXAMPLE

A bicycle has 40 teeth in its driver gear at the pedal of the bicycle which turns at a speed of 1000rev/min. If the driven gear at the rear of the bicycle has 80 teeth, calculate the speed of the driven gear.

SOLUTON

Speed of Driver Gear, S_d = 1000rev/min
Number of teeth in Driver Gear, N_d = 40
Number of teeth in Driven Gear, ND = 80
Speed of revolution of Driven Gear = ?

Recall that $S_D = G_R \times S_d$

But $G_R = \frac{N_d}{N_D}$
= 40 / 80
= 0.5 or 1:2.

Since S_d = 1000rev/min
$S_D = G_R \times S_d$

Therefore, S_D = 0.5 x 1000
= **500rev/min.**

Example 2.

A forklift consisting of two gears in a mesh have a speed ratio of 4. If the driven gear rotates at 600 rev/min and has 60 teeth, determine:

i. **The gear ratio**
ii. **The speed of the driver gear**
iii. **The number of teeth in the driver gear.**

SOLUTION

Given that: G_R (speed ratio) = 4

S_D = 600 rev/min.

N_D = 60 teeth

S_d = ?

N_d = ?

Recall that, Speed Ratio = Gear Ratio,
therefore, (i). **The gear ratio** = 4:1

(ii). **The speed of the driver gear**

$G_R = S_D/S_d$

Therefore, $S_d = S_D/G_R$

= 600/4

= **150 rev/min.**

(iii). **The number of teeth in the driver gear**

$G_R = N_d/ N_D$

Therefore, $N_d = G_R \times N_D$

N_d = 4 x 60

N_d = **240 teeth.**

Functions of Lubricants in Gears

Definition: Lubrication is the process of applying grease or oil on sliding surfaces in contact. A good lubricant must possess viscosity. Viscosity is the resistance to flow of a fluid. It shows how thick the lubricant is and its readiness to flow.

Properties of Good Lubricant

i. A lubricant with proper viscosity must not be corrosive.
ii. It must be chemically stable.
iii. The lubricant must wet the surfaces being lubricated.
iv. A lubricant with proper viscosity must not evaporate easily.

Lubrication and Gears

Whenever two or more gears are in a mesh, friction results. This force of friction can be reduced with the use of correct grade of gear oil. The gear wheels of motor vehicles do swim in gear oil inside the gear box so as to overcome frictional force.

The effects of lubrication of gears can achieve the following:
i. Reduce friction;

ii. Reduce heat;
iii. Reduce corrosion;
iv. Reduce wear and tear.
v. Serves as a cushion for proper movement of the teeth.

REVIEW QUESTIONS

1. Differentiate between driver and driven gear.

2. In two meshing gears, the driver gear has 30 teeth and rotates at 150 r.p.m. What is the speed of the driven gear with 18 teeth?

3. In a gear box, if the driver gear has 24 teeth and rotates at 120 revolution/minute, what is the speed of the driven gear with 160 teeth?

LESSON 3. 10

GEARS(III)-

Construction and Uses

Introduction

This lesson is going to be a practical lesson. All hands must be on deck on this one. I will strongly recommend the video attached to this lesson be seen first either as a group or as an individual, preferably in the classroom or workshop.

Take notes and ask questions from your instructor. Obtain the necessary materials and set to good work.

OBJECTIVES: At the end of this lesson, the student should be able to:

1. Construct gears made of either plywood, fibre board or modeling board.

2. State at least four uses the gear constructed.

By making a wooden or modeling board gears, you can investigate the speed ratio/gear ratio of a simple gear train.

For the purpose of this lesson, a simple 5mm thick plywood or modeling board card may be used. In addition, the following tools will be required:

i. Marker

ii. Ruler

iii. Scissors or cutting knife

iv. Gear template (one can obtain a template online like the one shown below).

Gear template

Project Procedure

i. After printing out and cutting out the pattern of the template shown above, you ca use the template to draw out on the plywood outlines of the pair of gears

ii. Use your cutting knife or fret saw in the case of a plywood, to cut out the marked outline.

iii. Nail the pair of plywood or modeling board gears on a flat wooden board. Ensure they are arranged in mesh as shown above.

iv. Turn one of the gears to see (a) what direction the other is turning (b) and how faster or slower it does.

(See Downloaded Video on Wooden Gear Construction)

BONUS TOPICS-

Energy, Work, , Magnetism

Electric Circuits and Power

Concept of Energy

Definition: Energy can be defined as the ability to do work.

Work: Work is defined as the application of force to an object or body such that the object or body moves through a distance.

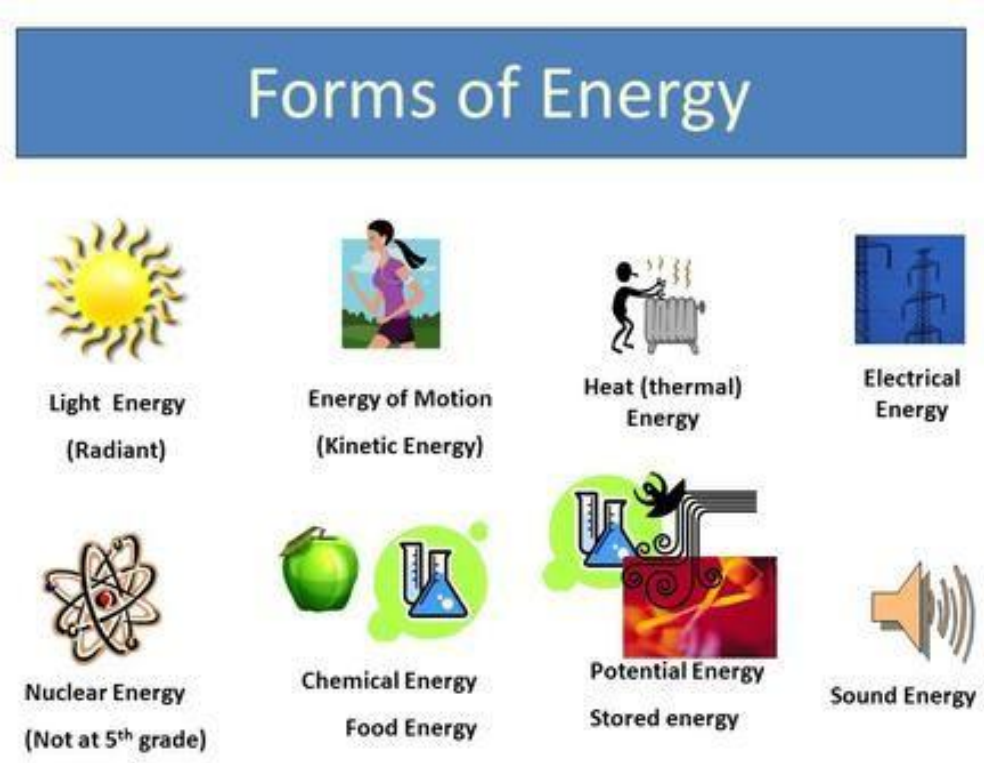
The unit of energy and work is known as Joules (j).

Sources of Energy

The two sources of energy at this level to be considered are renewable and renewable energy.

1. **Renewable Source of Energy:** Renewable energy is derived from power sources that do not run out, such as wind, water, and solar power.
2. **Non-renewable Source of Energy**: Non-renewable energy on the other hand, is finite. The three main non-renewable sources of energy are coal, oil, and natural gas.

Forms of Energy



1. **Mechanical Energy:** Mechanical energy is energy that results from movement or the location of an object. Mechanical energy is the sum of kinetic energy and potential energy.

   Examples: An object possessing mechanical energy has both kinetic and potential energy, although the energy of one of the forms may be equal to zero. A moving car has kinetic energy. If you move the car up a mountain, it has kinetic and potential energy. A book sitting on a table has potential energy.

2. **Thermal Energy:** Thermal energy or heat energy reflects the temperature difference between two systems.

   Example: A cup of hot coffee has thermal energy. You generate heat and have thermal energy with respect to your environment.

3. **Nuclear Energy:** Nuclear energy is energy resulting from changes in the atomic nuclei or from nuclear reactions.

   Example: Nuclear fission, nuclear fusion, and nuclear decay are examples of nuclear

energy. An atomic detonation or power from a nuclear plant are specific examples of this type of energy.

4. **Chemical Energy:** Chemical energy results from chemical reactions between atoms or molecules. There are different types of chemical energy, such as electrochemical energy and chemiluminescence.
   Example: A good example of chemical energy is an electrochemical cell or battery.

5. **Electromagnetic Energy:** Electromagnetic energy (or radiant energy) is energy from light or electromagnetic waves.
   Example: Any form of light has electromagnetic energy, including parts of the spectrum we cannot see. Radio, gamma rays, x-rays, microwaves, and ultraviolet light are some examples of electromagnetic energy.

6. **Sonic Energy:** Sonic energy is the energy of sound waves. Sound waves travel through the air or another medium.
   Example: A sonic boom, a song played on a stereo, your voice.

7. **Gravitational Energy:** Energy associated with gravity involves the attraction between two objects based on their mass. It can serve as a basis for mechanical energy, such as the potential energy of an object placed on a shelf or the kinetic energy of the Moon in orbit around the Earth.
   Example: Gravitational energy holds the atmosphere to the Earth.

8. **Kinetic Energy:** Kinetic energy is the energy of motion of a body. It ranges from 0 to a positive value.
   Example: An example is a child swinging on a swing. No matter whether the swing is moving forward or backward, the value of the kinetic energy is never negative.

9. **Potential Energy:** Potential energy is the energy of an object's position.
   Example: When a child swinging on a swing reaches the top of the arc, she has maximum potential energy. When she is closest to the ground, her potential energy is at

its minimum (0). Another example is throwing a ball into the air. At the highest point, the potential energy is greatest. As the ball rises or falls it has a combination of potential and kinetic energy.

10. **Ionization Energy:** Ionization energy is the form of energy that binds electrons to the nucleus of its atom, ion, or molecule.
    Example: The first ionization energy of an atom is the energy needed to remove one electron completely. The second ionization energy is energy to remove a second electron and is greater than that required to remove the first electron.

Law of Conservation of Energy

The law of conservation of energy states that the total energy of an isolated system remains constant; it is said to be conserved over time. This law means that energy can neither be created nor destroyed rather, it can only be transformed or transferred from one form to another.

Calculations Involving Work and Energy

In calculating work done, we say energy transformed = work done = applied force x distance.

As such, we write this equation as:

W = F x d

Example 1:

A crate of mass 50kg is pushed along a floor with a force of 20N for a distance of 5m. Calculate the work done.

Solution:

Use WD = F x d = 20N x 5m

WD = 100Nm

Note that energy transformed = work done. Energy is measured in Joules (J) so Nm must be the same unit as J.

This means we can say that WD = **100J**

Example 2:

How far must a 5N force pull a 50g toy car if 30J of energy are transferred?**Solution:**

Use W = F x d

Rearrange the form above to get!

$$d = \frac{W}{F}$$

$$= \frac{30}{5}$$

$\therefore d =$ **6m**

Example 3:

A man exerts a force of 2000N on a wall but fails to move it. Calculate the work done.

Solution:

Use us use W = F x d

d = 0, because the wall does not move

= 2000 x 0

W = **0**

NOTE: If an object does not move when the force is applied then no work is done. Work is only done if the object moves.

Gravitational Potential Energy

Whenever we lift up an object we are providing a force to act against gravity. By lifting the object we are storing energy in it.

We can calculate the energy stored in an object when it is raised up by looking at the work done in lifting it.

Imagine that a box of mass **m** is lifted up to a height **h** above the ground. The force that must be overcome to move the box is the weight due to gravity. The weight (**W**) is given by:

W = mass x gravitational field

So W = mg (= Force to lift the box).

Now we can use W = F x d to calculate the stored energy.

W = F x d = (mg) x d = (mg) x h so

W = mgh

This tells us that the energy needed to lift something (E) is given by:

E = mass x gravitational field strength x height

In other words, the potential energy stored in the object by raising it up is given by

Ep = mgh

Where Ep = potential energy
m = mass
g = gravity
h = height.

Worked Example

A football of mass 2.5kg is lifted up to the top of a cliff that is 180m high. How much potential energy does the football gain?

Solution:

Using **Ep = mgh**

Ep = 2.5 x 10 x 180

So **Ep = <u>4500J</u>**

Kinetic Energy

Any moving object has Kinetic Energy (E_k). The kinetic energy of an object will increase if mass increases. The kinetic energy will increase if speed increases.

We can calculate kinetic energy using the equation !

$$Ek = \frac{1}{2}mv^2$$

where **m** is the mass of the object and **v** is the speed.

Notice that the speed is squared in the equation. This means that if speed is doubled, energy x 4 if speed is tripled, energy x 9

Worked Example

1. How much kinetic energy has a 160g cricket ball when it is thrown at a speed of 22m/s?

Solution:

We use ! $Ek = \frac{1}{2}mv^2$

$=0.5 \times 0.16 \times (22)^2$

$= 0.5 \times 0.16 \times 484$

So Ek = **38.72J**

Example 2:

How fast is a trolley moving if it has 180.5J of kinetic energy?

Solution:

Rearranging

$$Ek = \frac{1}{2}mv^2$$

We get !

$$\mathbf{2Ek = mv^2}$$

So !

$$v^2 = \frac{2Ek}{m}$$

$$v = \sqrt{\frac{2Ek}{m}}$$

$$v = \sqrt{\frac{2x180.5}{4}}$$

$$v = \sqrt{\frac{391}{4}}$$

$$v = \sqrt{90.25}$$

So **v = 9.5m/s**

Where Potential and Kinetic Energy Appear in a Problem

Potential and Kinetic Energy often appear in the same problems. Imagine a brick falling from a wall. The brick originally has only potential energy. As the brick falls, it loses potential energy but gains kinetic energy as it accelerates towards the ground. The total energy of the brick at any point in time is given by the sum of the potential and kinetic energies and is always equal to the initial potential energy.

This is due to the conservation of energy.

Example:

A ball rolls off a table and hits the floor at 5m/s. What is the height of the table?

Solution:

Recall that--Initial energy = Ep and

Final energy = Ek

But conservation of energy tells us:

Ep = Ek.

So mgh = $\frac{1}{2}mv^2$

In the equation above the m will cancel out

So, **$2gh = v^2$**

$\therefore \quad h = \frac{v^2}{2g} = \frac{25}{20}$

So h = **<u>1.25m</u>**

Power (Mechanical)

Power is the way we measure how quickly energy is being changed. In simple terms we can say that power is the rate at which work is done.

When we look at the power of a moving object, we are really looking at how fast work is happening.

We define power as:

$$\text{Power} = \frac{\text{work done}}{\text{time taken}}$$

and using symbols, we write this as:

$$P = \frac{(F \times d)}{t}$$

Power is measured in **Watts (W).**

Example 1:

A person of mass 70kg runs up a flight of stairs with a vertical height of 5m. If the trip takes 7s to complete, calculate the person's power.

Solution:

W = Ep = mgh

= 70 x 10 x 5

= 3500J !

$$\text{Power} = \frac{\text{work done}}{\text{time taken}}$$

$$= \frac{3500}{7}$$

So **Power = 500W**

Example 2:

A lift motor has to move a fully laden lift 4m between floors in 1.5s. The lift has a mass of 1850kg (ignore friction).

a) Calculate the weight of the fully laden lift.

Solution:

W(F) = mg

= 1850 x 10

Weight (F) = <u>18500N</u>

b) What is the upward force in the cable when the lift is moving at a constant speed?

Solution:

At constant speed, forces must be balanced.

Upward force = downward force (weight)

Upward force = **<u>18500N</u>**

c) What is the work done by the motor?

Solution:

W = F x d

= 18500 x 4

So **<u>W = 74000J</u>**

d) What is the minimum power of the motor to raise the lift at a steady speed?

Solution:

At steady speed forces are balanced.

$$\textbf{Power} = \frac{\textbf{work done}}{\textbf{time}}$$

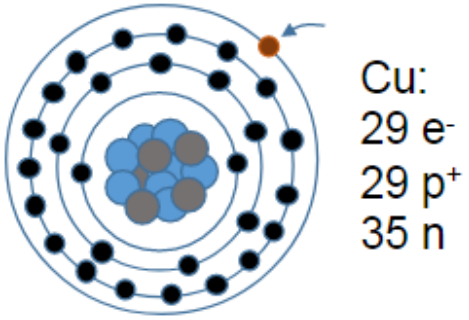
$$= \frac{7400}{1.5}$$

So **<u>Power = 4933.3W</u>**

PowerBasic Ideas of Electricity

Definition:

Electricity is defined as the flow of electrons or electric current. It is an invisible form of energy that can be transformed into other forms of energy like heat, light and mechanical energy.



Atomic Structure and Electricity

Electricity is created from the flow of free electrons **(e)** in some materials known as conductors. The main quantity responsible for this flow is the electron found in the atoms of such conductors.

Atom: Atom is the basic component of matter. It composes of a nucleus which is the central part, the protons and electrons.

Electron: Electron is the negatively charged component of an atom. It has the ability to flow.

Proton: Proton is the positively charged component of an atom. It has the ability to attract electrons.

Neutron: This is a component in an atom that carries no charge.

Matter: Matter is anything that occupies space and has mass. It can be a solid, liquid or gas in state.

Current: Current is the same as electricity or flow of electrons. The amount of current flowing in a circuit can be measured in ampere (I).

Conductors: Conductors are the materials or substances which allow electricity to flow through them. They are able to conduct electricity because they allow electrons to flow inside them very easily. Conductors have this property of allowing the transition of heat or light from one source to another.

Examples of conductors include metals, humans, earth, and animal bodies. This is the reason we get electric shocks! The main reason is that being a good conductor, our human body allows a resistance-free path for the current to flow from wire to our body.

Conductors have free electrons on their surfaces which allows current to pass through. This is the reason why conductors are able to conduct electricity.

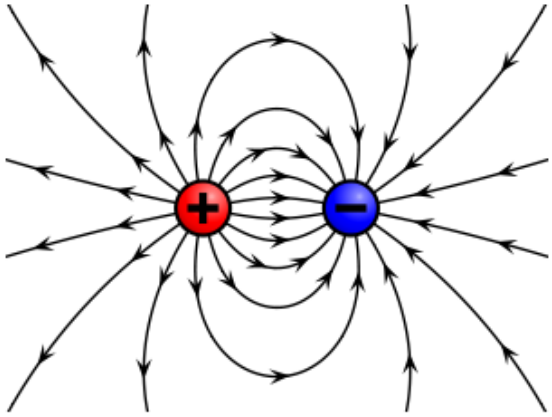
Insulators: Insulators are the materials or substances which resist or don't allow the current to flow through them.

Wood, dry wood, cloth, glass, mica, and quartz are some good examples of insulators. Insulators are also protectors as they give protection against heat, sound and of course passage of electricity. Insulators don't have any free electrons and it is the main reason why they do not conduct electricity.

Electric Charges

If you analyze a battery, there are two symbols, '+' and '-'. This is because these two ends are responsible for the transmission of positive & negative charges.

In the atomic structure shown above, the electrons are negatively charged while the protons are positively charged.

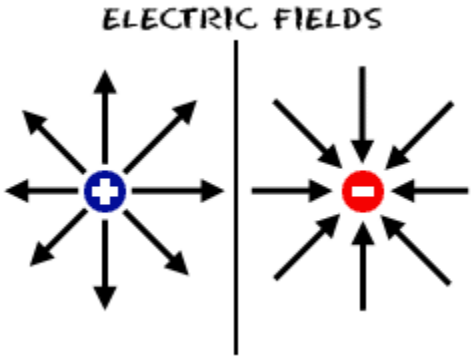


Effect of Electric charges in an atom

Protons and electrons are responsible for the development of electric fields, which apply a force termed as Coulomb force. This force is known to be outward radiating in all directions. Since protons are usually limited to the nuclei implanted inside atoms, their movement is not that free as compared to electrons.

Electric Field

Electric field is defined as a space or area or vacuum where forces of attraction or repulsion can be experienced between two or more charges. E. g.



Assume there are point charges (sizes <<< r) P and Q placed r distance apart in a vacuum. Both charges create an electric field around them which ultimately is responsible for the force applied by the two on each other. The Electric Field around Q at position r is:

$E = kQ / r^2$

Where **r** is a unit vector of the distance **r** with respect to the origin. This value E(r) [SI unit N/C] amounts to an electric field of each charge based on its position vector **r**.

Types of Electricity

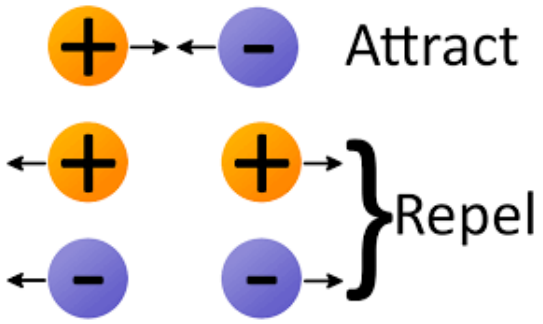
There are two types of Electricity namely, static electricity and current electricity.

i. Static Electricity is made by rubbing together two or more objects and making friction.

ii. Current electricity is the flow of electric charge across an electrical field.

Law of Charges

Things that are negatively charged and things that are positively charged pull on (attract) each other. This makes electrons and protons stick together to form atoms. Things that have the same charge push each other away (they repel each other). This is called the Law of Charges. E.g.



Magnets

Magnets are solid objects that attract iron or steel. Magnets do this by a phenomenon called magnetism, in which they generate a force that extends into a (magnetic) field (i.e., the area around the magnet).

A magnet may have the ability to do this naturally, such as lodestone, or it may *acquire* the ability when combined with other elements

Types of Magnets

There are three types of magnets, namely temporary, permanent, and electromagnets. Magnets are categorized by their source of magnetism.

i. **Temporary magnets** become magnetized in the presence of a magnetic field. They lose their magnetism gradually, when the magnetic field is removed. Some irons and iron alloys, as well as paper clips and nails, function as temporary magnets.

Screwdrivers can be temporarily magnetized

ii. **Permanent magnets** do not easily lose their magnetism. These magnets may be naturally-occurring ("rare-earth") elements, or chemical compounds.
Permanent magnet examples include Alnico (an alloy of aluminum, nickel, and cobalt) and ferrites (ceramic-like material made from a mix of iron oxides with nickel, strontium, or cobalt).

iii. **Electromagnets** are created by running an electrical current through a coil with a metal core. The energized coil creates a magnetic field. When the current is shut off, the magnetic field disappears.

Electromagnets are preferred for applications that require strength including rail road tracks, motor engines, MRI machines, and cranes. They're also used in computer and television hardware.

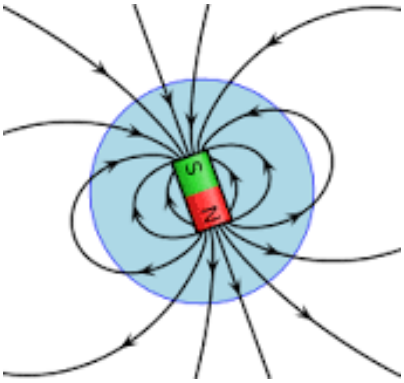
Cranes use electromagnets

Magnetism

In physics, magnetism is a force that can attract (pull closer) or repel (push away) objects that have a magnetic material like iron inside them (magnetic objects). In simpler words, it is a property of certain substances which pull closer or repel other objects.

Magnetic Field

The magnetic field is the area around a magnet in which there is magnetic force. Moving electric charges can make magnetic fields. In physics, the magnetic field is a field that passes through space and which makes a magnetic force move electric charges and magnetic dipoles. E.g.

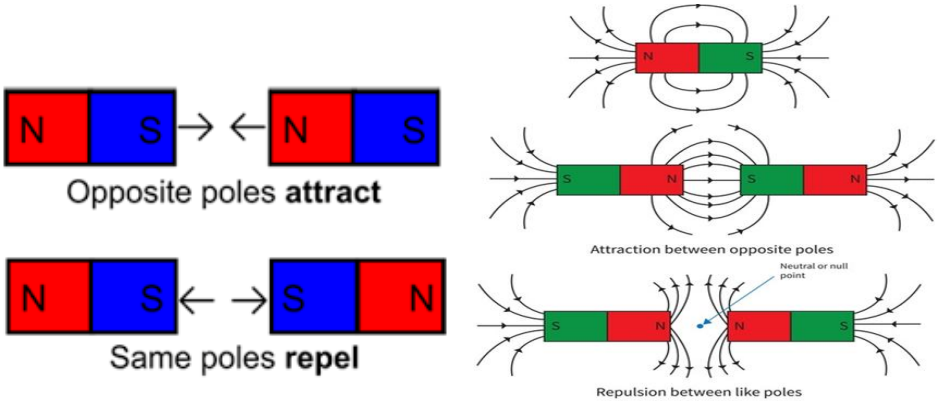


Magnetic Flux

These are the lines of force between the North and South poles of a magnet. For instance, in the figure shown above, the black lines running between the poles is what is referred to as magnetic flux. They cannot be seen with the naked eyes.

Laws of Magnetism

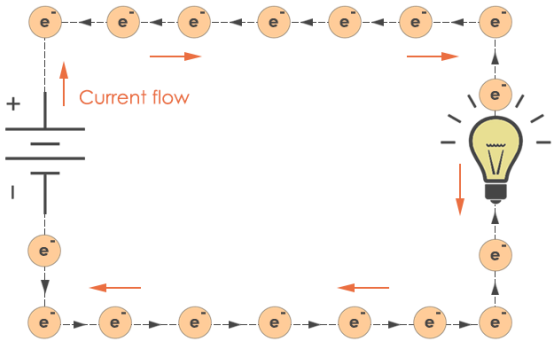
The law of magnetism states that like poles of a magnetic property attracts while unlike poles attract. (see illustration below).



PoweBasic Components of Electric Circuits

Definition:

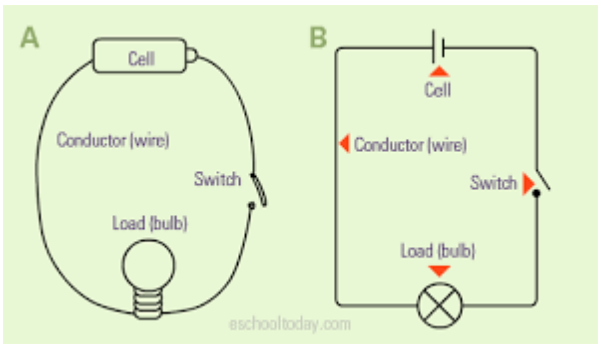
A circuit is a closed path where electrons flow in a wire. An electric circuit is a path in which electrons from a voltage or current source flows. E.g.

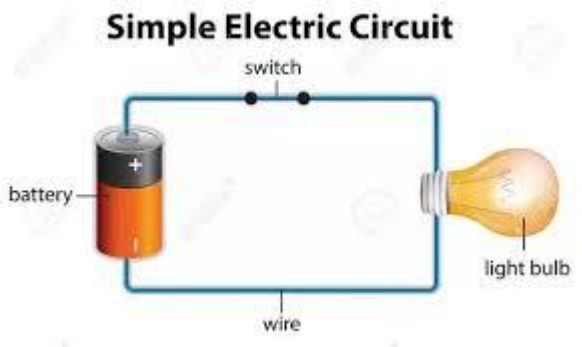


Circuit diagram

Components of an Electric Circuit

An electrical circuit consists of batteries, resistors, inductors, capacitors, switches, ammeter or transistors.





Simple electric circuits

Power source: This is an electrical source that provides voltage to the circuit. It may be a direct current source from a battery or alternation current source like a transmission station. They are the source of electrons.

Switch: This component makes and breaks the circuit.

Resistor: The resistor to control the rapid flow of current in an electric circuit.

Conductor cable: These are wires which are conducting path to carry electric current from one point to another in a circuit.

Load: Loads in the circuit can be motor, LED, lamp, fan, refrigerator, etc. that utilizes voltage in the circuit.

Properties of electrical circuits

i. The circuit is always a closed path.

ii. A circuit always consists of an energy source,

iii. Direction of flow of current is from positive terminal to negative terminal of the source.

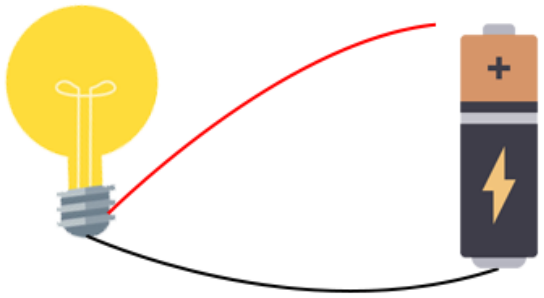
iv. Direction of flow of electrons is from negative terminal to positive terminal of the source.

Types of Circuits

There are basically three types of circuits:

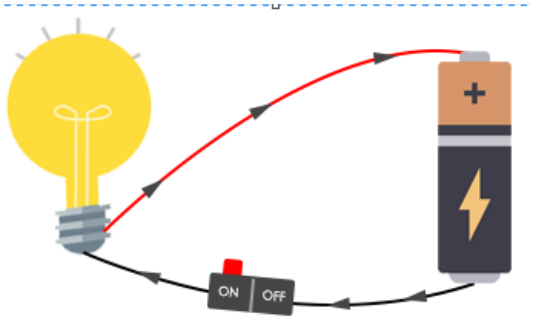
i. Open circuit:

If in a simple circuit one terminal is disconnected, then there is no flow of current through that circuit. This is said to be an open circuit or no load condition.



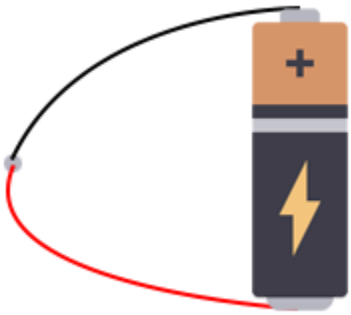
ii. Closed circuit

An electric circuit has a source of Electromotive force and a load. This load acts as a conductor path. If the current flows through the load it is considered as a closed circuit. If in a simple circuit, current can flow from one terminal of the battery to another without any discontinuation is said to be closed circuit. E.g.



iii. Short circuit

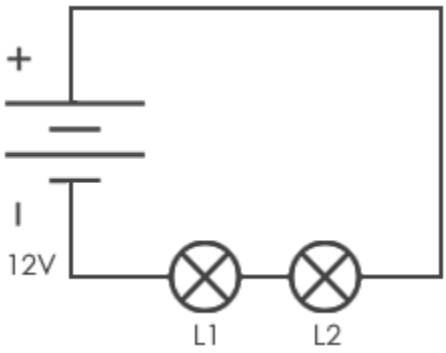
If the positive terminal of the battery is directly connected to the negative terminal without any resistance between them it is said to be a short circuit. E.g.



Series Circuit

If in a circuit, components are connected in series then the circuit is known as a series circuit. In a series circuit, current through each component is the same and voltage supplied is the sum of the voltage across each component.

If a wire joins the battery to one lamp, to the next lamp and then back to the battery, the lamps are said to be connected in series. E.g.



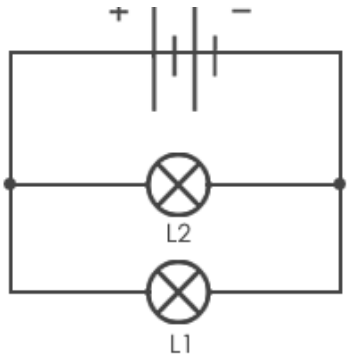
Series circuit

Parallel Circuit

If in a circuit, components are connected in parallel then the circuit is known as parallel circuit. In a parallel circuit, the voltage across each component will be same and total current applied is the sum of current through each component. If a lamp is connected to the battery and another lamp is connected in a separate loop with first lamp, then lamp is connected in parallel connection.

Here, the voltage across each bulb would be the same as the voltage applied by the battery. Current across each lamp would be divided by each bulb. If we apply 5A to the circuit, 5A will be the current flowing through each lamp.

Thus this is how series and parallel circuits work and they have their own current and voltage dividing properties. E.g.



Parallel circuit

Calculations Involving Electric Circuits

To understand how components work in an electric circuit, there is the important need for Ohm's law.

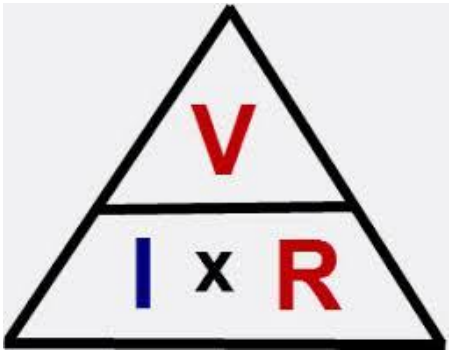
Georg Ohm, in full **Georg Simon Ohm**, (born March 16, 1789, Erlangen, Bavaria [Germany]—died July 6, 1854, Munich), German physicist who discovered the law, named after him, which states that the current flow through a conductor is directly proportional to the potential difference (voltage) and inversely proportional to the resistance.

In other words, Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points. The formula for Ohm's law is V=IR.

Georg Simon Ohm(1789-1854)

Ohm's Magic Triangle

To understand Ohm's law and the quantities involved, there is a simple principle based on a triangle termed **'Ohm's Magic Triangle'** shown below:

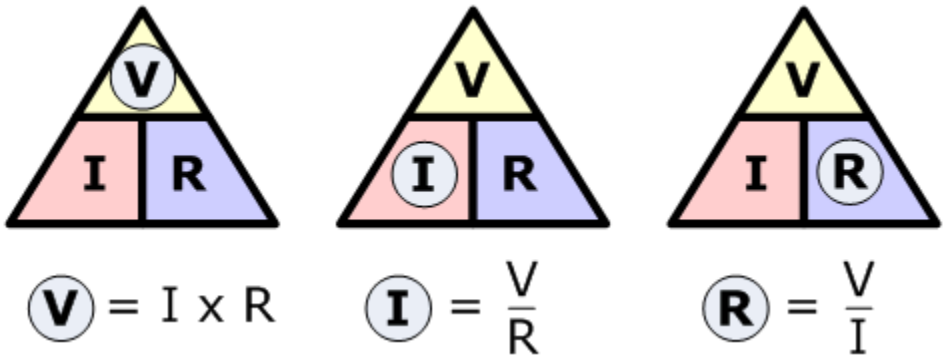


From the magic triangle above,

V = voltage. **(This can also be written as E)**

I = current

R = resistance. And that:



Calculations Involving Ohm's Law Application in Electricity

Solved Examples

Example 1:

A potential difference of 18 volts is applied to a lamp of 45 ohms resistance. What current will flow in the circuit?

Solution:

Potential difference, p.d. = 18 volts

Resistance, R = 45 ohms.

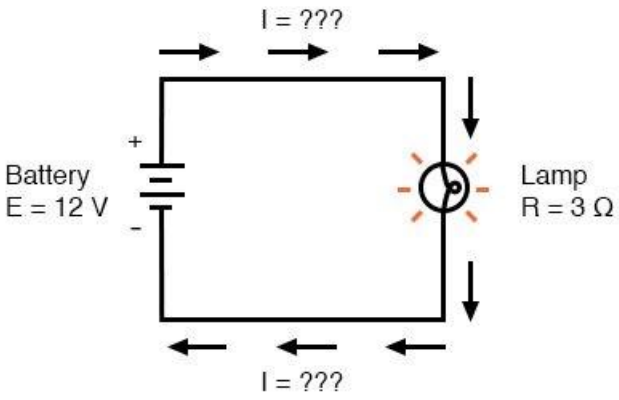
Using $\mathbf{I = \frac{V}{R}}$

$\mathbf{I = \frac{18}{45}}$

$\mathbf{I = 0.4A}$

Example 2:

In this second example, we will calculate the amount of current (I) in a circuit, given values of voltage (V) or (E) and resistance (R):

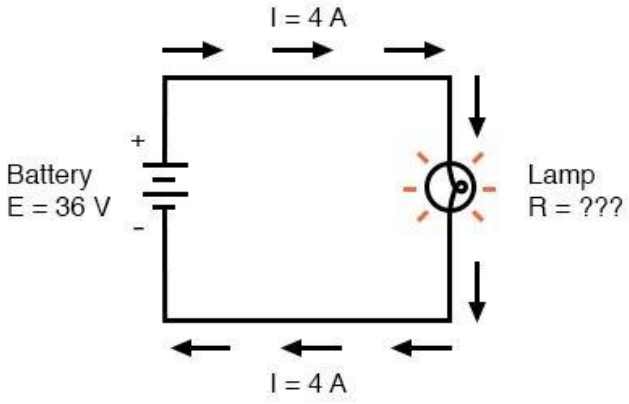


What is the amount of current (I) in this circuit?

$$I = \frac{E}{R} = \frac{12\ V}{3\ \Omega} = 4\ A$$

Example 3:

In this third example, we will calculate the amount of resistance (R) in a circuit, given values of voltage (E) or (V) and current (I):

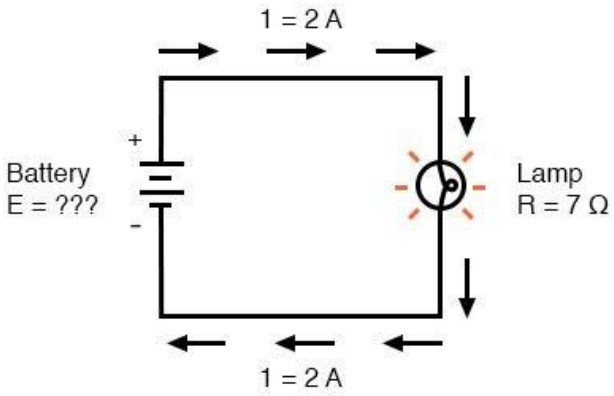


What is the amount of resistance (R) offered by the lamp?

$$R = \frac{E}{I} = \frac{36\ V}{4\ A} = 9\ \Omega$$

Example 4:

In the last example, we will calculate the amount of voltage supplied by a battery, given values of current (I) and resistance (R):



What is the amount of voltage provided by the battery?

$$E = IR = (2\ A)(7\ \Omega) = 14\ V$$

Electric Power Formula

Generally speaking, power is defined as the rate at which work is done. At this level, we will be exposed to mechanical and electrical power.

Mechanical power tells us the rate at which a machine is working while electric power is the rate at which energy is transferred to or from a part of an electric circuit. A battery can deliver energy, or a circuit element like a resistor can release energy as heat. For any circuit element, the power is equal to the voltage difference across the element multiplied by the current.

By Ohm's Law, V = IR, and so there are additional forms of the electric power formula for resistors. Power is measured in units of Watts (W), where a Watt is equal to a Joule per second (1 W = 1 J/s).

General form:

electric power = voltage difference x current

P = VI

Resistors:

$$electric\ power = (current)^2 \times resistance = \frac{(voltage\ difference)^2}{resistance}$$

$$P = I^2R = \frac{V^2}{R}$$

We also have that:

P = VI.

Where:

P = electric power (W)

V = voltage difference (V = J/C)

I = electric current (A = C/s)

R = resistance (Ω = V/A)

Worked Examples

Example 1:

If the battery of a cell phone operates at 12.0 V, and it has to deliver a current of 0.9 A while playing music, what is the power required?

Solution:

The power required from the battery can be found using the electric power formula:

P = VI

P = (12.0 V)(0.9 A)

P = (12.0 J/C)(0.9 C/s)

P = 10.8 J/s

P = 10.8 W

The power required from the battery of the phone is **10.8 W.**

Example 2.

A resistor with a 24.0 V potential difference across it is radiating heat. The thermal energy is being generated at a rate of 16.0 W. What is the resistance value?

Solution:

The resistance value can be found by rearranging one of the forms of the electric power formula. The form that is applicable relates power, voltage, and resistance:

$$P = \frac{V^2}{R} \rightarrow R = \frac{V^2}{P}$$

$$R = \frac{V^2}{P}$$

$$R = \frac{(24.0\ \mathrm{V})^2}{16.0\ \mathrm{W}}$$

$$R = \frac{576\ \mathrm{V}^2}{16.0\ \mathrm{W}}$$

$$R = 36.0\ \frac{\mathrm{V}^2}{\mathrm{W}}$$

$$R = 36.0\ \frac{\mathrm{V}^2}{\mathrm{J}/s}$$

$$R = 36.0\ \frac{\mathrm{V}^2}{(\mathrm{J}/\mathrm{C})(\mathrm{C}/s)}$$

$$R = 36.0\ \frac{\mathrm{V}^2}{(\mathrm{V})(\mathrm{A})}$$

R=36.0 V/A

R=36.0 Ω

The resistance value is 36.0 Ω.

Example 3

A radio transistor is operated by a source voltage of 12 volts. If the resistance of the component in the circuit is 4 Ω , calculate the power rating of the transistor radio.

Solution:

We have that;

V = 12 volts

R = 4 Ω

Therefore, using $P = \frac{V^2}{R}$

$P = \frac{12^2}{4}$

$P = \frac{144}{4}$

P = 36watts

Example Involving Mechanical Power

A train is so designed to carry passengers of up to 80kg through a distance of 20m. If the time the train will use to complete this work is is 40 seconds, calculate the power used by the train. (Let acceleration due to gravity be $10m/s^2$).

Solution:

We have that;

mass m = 80kg

distance d = 20m

time t = 40 seconds

Given mechanical power $P = \frac{f \times d}{t}$

Where f = m x g

f = 80 x 10

f = 800N

Using $P = \frac{f \times d}{t}$

$P = \frac{800N \times 20m}{40}$

P = **400watts**

Basic Technology General Revision Questions

Basic 8

DISCLAIMER: THE QUESTIONS BELOW ARE STRICTLY FOR REVISION PURPOSES ONLY..

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PART A

GENERAL REVISION QUESTIONS JSS 2

1. In which type of triangle is no scale equal to another side?
   (a) Quadrilateral triangle (b) Rhombus (c) Isosceles triangle (d) Trapezium (e) Scalene
2. All of the following are the parts of a circle **except**
   (a) Diameter (b) Radius (c) Segment (d) Chord (e) Vertex
3. An angle which is less than a right angle is called
   (a) Obtuse angle (b) Reflex angle (c) Straight angle (d) Acute angle (e) Right angle
4. A quadrilateral with all sides equal but has no right angle is a
   (a) Cube (b) Square (c) Rectangle (d) Trapezium (d) Rhombus
5. The line use for centre lines is called
   (a) Thin long chain (b) Thin continuous line (c) Thin long chain (d) Thin short dashes
6. An angle which is greater than 180 but less than 360 is called?
   (a) Acute angle (b) Obtuse angle (c) Reflex angle (d) A Revolution
7. A triangle having only two sides equal is called
   (a) Equilateral triangle (b) Isosceles triangle (c) Scalene triangle (d) Rhomboid
8. The external angle of a regular polygon is 45 using the rule 360N determine the sides of the polygon (a) 7 sides (b) 8 sides (c) 6 sides (d) 10 sides (e) 9 sides
9. A square that has its opposite sides equal and parallel but no angle is right angled is called (a) Square (b) Rectangle (c) Rhomboid (d) Rhombus
10. A plane figure bounded by eight straight lines is called
    (a) Hexagon (b) Heptagon (c) Octagon (d) Nonagon
11. A perpendicular from the top or apex of an object to its base is called
    (a) Base (b) Altitude (c) Vertex (d) Oblique
12. A figure whose opposite sides are equal and parallel is called
    (a) Equilateral triangle (b) Isosceles triangle (c) Rectangle (d) Parallelogram
13. An electrical appliance is using 200 volts and 0.5 amps. Calculate the power consumption?

(a) 200 watts (b) 100 watts (c) 12 watts (d) 140 watts

14. The line used for cutting and viewing plane is called
(a) Thick continuous line (b) Thick long chain (c) Thin continuous line (d) Thin short dashes

15. The line used for hidden outlines and edges is called
(a) Arrowed line (b) Thin continuous line (c) Thin long chain (d) Thin short dashes.

16. An angle which is greater than 90 but less than 180 is called
(a) Acute angle (b Obtuse angle (c) Reflex angle (d) Right angle

17. A triangle which has one of its angle greater than a right angle is called?
(a) Obtuse angle (b) Right angle (c) Acute angle (d) Reflex angle

18. A plane figure bounded by ten straight lines is a
(a) Hexagon (b) Heptagon (c) Octagon (d) nonagon (e) Decagon

19. In equilateral triangle all the three angles are equal each being
(a) 90 (b) 30 (c) 60 (d) 45 (e) 180

20. A plane figure bounded by more than four straight lines is called
(a) Trapezium (b) Quadrilateral (c) Polygon (d) Square (e) Rhombus

21. All the following are examples of quadrilateral EXCEPT
(a) Square (b) Rectangle (c) Rhombus (d) Rhomboid (e) Eclipse

22. The external angle of a regular polygon is 72 using the rule 360N determine the, side of the polygon
(a) 10 sides (b) 9 sides (c) 5 sides (d) 6 sides (e) 7 sides

23. The flow of current in one direction is called
(a) Alternating current (b) Potential difference (c) Impedance (d) Direct current (e) Resistance

24. A bulb 100 watts is connected to a supply of 2 amps. Calculate the resistance
(a) 30 Ohms (b) 45 Ohms (c) 25 Ohms (d) 40 Ohms

25. For climbing hill motorist need a/an
(a) Lower gear (b) High gear (c) Medium gear (d) Equilibrium gear

26. The combustion of the petro inside the cylinder of the engine is caused by the
(a) Piston movement (b) Carburetor (c) Spark (d) Cylinder

27. Ohms is the unit of
(a) Voltage (b) Resistance (c) Current (d) Potential difference (e) Electromotive force

28. A boy pushes a load of mass 20kg to a distance of 30 meters in 20 second, calculate the body power
(a) 300 watts (b) 200 watts (c) 40 watts (d) 50 watts

29. In comparing the water flow system to an electric circuit the control value represent the
(a) Ammeter (b) Switch (c) Voltmeter (d) Variable resistor

30. Which of the following electrical instrument is capable of measuring voltage, current and resistance?
(a) Voltmeter (b) Ammeter (c) Multi-meter (d) Ohmmeter (e) Wattmeter

31. A potential difference of 80 volts applied to a lamp 10 ohms resistance. What current will flow in the circuit
(a) 8A (b) 0.4A (c) 0.8A (d) 0.8A (e) 1.0A
32. What is the resistance in a current of 2 amperes current flow and 24 volts voltage supply?
(a) 12 ohms resistance (b) 18 ohms (c) 240 ohms (d) 360 ohms (e) 480 ohms
33. A bulb rated 100 watts is connected to a supply of 200 volts calculate the amount of current flowing through the bulb
(a) 2.50 Amps (b) 2.00 Amps (c) 1.50 Amps (d) 1.00 Amps (e) 0.50 Amps
34. The primary voltage of a transformer is 10 volts and the primary winding is 20 turns. If the secondary winding is 20 turns. What is the secondary voltage
(a) 500 volts (b) 50 volts (c) 20 volts (d) 10 volts
35. The following are application of electromagnetic EXCEPT
(a) Electric bulb (b) Relay circuit (c) Electric bells (d) Alarm circuits (e) Telephone
36. Which of the appliance do NOT have an electric motor?
(a) Electric drilling machine (b) Television (c) Blender (d) Electric grinder (e) Electric fan
37. The meter installed in N.E.P.A to determine the amount of electrical power consumed is known as
(a) Ammeter (b) Watt-hour meter (c) Ohmmeter (d) Multimeter (e) Watt- meter
38. The battery charging equipment is used on
(a) Dry cell batteries (b) Electric motors (c) Lead-acid accumulators (d) Generators in motors vehicle (e) Alternators motor vehicle
39. The following are appliances used in converting electrical energy to heat Except
(a) Electric Cooker (b) Electric iron (c) Electric Cookers (d) Gas cooker (e) Electric water heater
40. What is the instrument used for the detecting of the same of charge battery?
(a) Thermometer (b) Ammeter (c) Voltmeter (d) Hydrometer (e) Thermocouple
41. Which of these devices converts heat energy into electrical energy
(a) Electric iron (b) Electric-Heater (c) Solar cell (b) Thermocouple (e) Photocell
42. Fuel is a source of
(a) Light energy (b) Chemical energy (c) Nuclear energy (d) Heat energy (e) Solar energy
43. Mechanical energy can be converted directly to electrical energy using the
(a) Windmill (b) Thermocouple (c) Water heater (d) Electric iron (e) Daniel cell
44. Solar energy can be converted directly to electrical energy using the
(a) Voltaic cell (b) Daniel cell (c) Photo Voltaic (d) Mercury Cell (e) Leclanche cell
45. A boy pulled a block steadily of 2 meters against a frictional force of 10 Newtons. Calculate the work done by the boy in joules
(a) 20 (b) 8 (c) 5 (d) 0.2
46. If an electric kettle has a rating of 1000 watts and a resistance of its element is 40 Ohms, the current in the circuit then is
(a) 44,000 amperes (b) 25 amperes (c) 5 amperes (d) 0.04 amperes

47. If an electric kettle pressing iron develops a total failure the first thing to check is the
(a) Thermostat (b) Fuse (c) Sole plate (d) Element

48. Calculate the word done when a force of 50N moves a load through distance of 10mm
(a) 600KJ (b) 96KJ (c) 10.4KJ (d) 0.60KJ (e) 5000

49. If an electric fan motor is humming but refuses to rotate. The likely cause is
(a) Faulty capacitor (b) Faulty blades (c) Wrong electrical connection (d) Low current
(e) Burnt motor

50. What is the value of a kinetic energy of a ball of mass 5kg moving of a velocity of $120m/s^2$
(a) 0.3K/J (b) 0.6K/J (c) 6K/J (d) 345K/J (e) 360K/J

ANSWERS FOR PART A QUESTIONS

BASIC 8			
1.	E	26	B
2.	E	27.	B
3.	D	28.	A
4.	E	29.	B
5.	A	30.	C
6.	C	31.	A
7.	B	32.	A
8.	B	33.	E
9.	D	34.	D
10.	C	35.	A
11.	B	36.	B
12.	D	37.	B
13.	B	38.	C
14.	B	39.	D
15.	D	40.	D
16.	B	41.	C
17.	A	42.	B

18.	E	43.	A
19.	C	44.	A
20.	C	45.	A
21.	E	46.	B
22.	C	47.	E
23.	D	48.	D
24.	C	49.	D
25.	A	50.	E

PART B

TERMINAL OBJECTIVE QUESTIONS

(QUESTION SOURCE: NATION BUILDING BASIC TECHNOLOGY 2, By Ajayi E.K.)

1. If the piston inside the cylinder of a vehicle got stuck and repair work is carried out, what type of maintenance is it?
   (a) preventive (b) predictive (c) corrective (d) overhaul
2. If the scale chosen for a technical drawing assignment is 10mm to 20, 25m will be represented by (a) 50mm (b) 55mm (c) 100mm (d) 125mm
3. An electrical instrument that can be used for measuring voltage, resistance and current is known as (a) Ohm meter (b) ammeter (c) multimeter (d) watt meter
4. The ability of a soil to carry load is called _____ capacity
   (a) power (b) load (c) strength (d) bearing
5. An electronic device used for changing alternating current to direct current is called _____ (a) rectifier (b) amplifier (c) oscillator (d) modulator
6. The sides of an excavated trench in a water logged area are prevented from collapsing by the process known as (a) bonding (b) planking (c) timbering (d) walling
7. The process of hammering and forming of hot and cold metal into a certain shape is known as
   (a) brazing (b) forging (c) swaging (d) soldering

8. We can take care of our drawing board by (a) keeping it inside the locker (b) keeping it on the floor (c) washing with soap and water when dirty (d) avoiding scratches on the surface
9. The process of storing and measuring out components of concrete during building is called (a) batching (b) bulking (c) bonding (d) storage
10. Any substance capable of holding or bonding two pieces of wooden material together is (a) abrasive (b) latex (c) adhesive (d) sap
11. The mathematical representation of ohm's law is (a) V = I/R (b) V = T/R (c) V = R/I (d) V = IR
12. The device which allows motion in one direction or intermittent motion is known as (a) link (b) ratchet (c) gear (d) worm wheel
13. The form of energy released when fuels are burnt is called
(a) solar energy (b) electric energy (c) heat energy (d) mechanical energy
14. How many head pans of sand is needed to make sandcrete blocks using one bag (50kg) of Portland cement in ratio 1:10?
(a) 5 headpans (b) 10 headpans (c) 20 headpans (d) 40 headpans
15. Scale rules are used to produce (a) reduced or enlarged sizes of drowning (b) equal and normal size of drowning (c) enlarged sizes of drawing only (d) a good linear drawing
16. The following are methods of processing plastics EXCEPT
(a) compression molding (b) vacuum forming (c) thermosetting molding (d) injection molding
17. The following are application of electromagnet EXCEPT
(a) electric bulb (b) relay circuits (c) electric bells (d) alarm circuits
18. Which of the following is NOT an application used for the conversion of chemical energy to heat energy? (a) charcoal pressing iron (b) gas lamp (c) kerosene lamp (d) immersion heater
19. The purpose of hydraulic fluid in a clutch system is to
(a) increase and transmit the pedal force (b) decrease and transmit the pedal force (c) neutralize the pedal force in the transmission (d) maintain a constant transmission system.
20. A bulb rated 100watts is connected to a supply of 200volts . calculate the amount of current flowing through the bulb.

(a) 2.50amps (b) 2.00amps (c) 1.50amps (d) 0.50amps

21. What is the value of the kinetic energy of a ball of mass 5kg moving at a velocity of 120m/s? (a) 0.3K/J (b) 0.6k/J (c) 6K/J (d) 36K/j

22. A regular polygon with nine sides is called
(a) hexagon (b) heptagon (c) decagon (d) nonagon

23. The gauging of oil in the oil pump of a machine is a type of maintenance that is (a) corrective (b) preventive (c) predictive (d) diagnostic

24. In technical drawing hidden details are shown with
(a) dotted lines (b) thin continuous line (c) short dashes (d) wavy line

25. The type of maintenance carried out by a man who often sends his car for servicing is known as (a) corrective (b) predictive (c) preventive (d) detective

26. In forge work the device used in producing heat is (a) blast furnace (b) kiln (c) oven (d) hearth forge

27. The following are disadvantages of friction EXCEPT
(a) wear and tear (b) slippery (c) heat (d) power loss

28. Which of the following is NOT a quadrilaterals? (a) prism (b) rhomboid (c) rhombus (d) parrallelogram

29. The type of meter installed in our homes by NEPA is called
(a) multimeter (b) voltmeter (c) wattmeter (d) watt-hour meter

30. Which of the following serves as binding agent in concrete? (a) cement (b) sand (c) stone (d) water

31. Water flow are classified into (a) vertical and horizontal flow (b) turbulent and random flow (c) laminar and turbulent flow (d) higher and lower flow

32. Which of the following appliances does NOT convert chemical energy to heat energy?
(a) gas cooker (b) kerosene cooker (c) charcoal pressing iron (d) immersion heater

33. Which of the following operations is NOT a forging process?
(a) bending (b) riveting (c) twisting (d) drawing down

34. In a gearing system, if the driving gear has more teeth than the driven gear, the driven gear will revolve. (a) slower than the driving gear (b) at the same speed as the driving gear (c) faster than the driving gear (d) the same direction as the driving gear

35. Which of the following items is NOT a tool used on site preparation?
(a) matchet (b) hoe (c) hacksaw (d) axe

36. The following items are used in soft soldering EXCEPT
(a) tong (b) solder and bite (c) flux (d) blow lamp

37. What type of maintenance is involved when burnt fuse is replaced in an electric plug?
(a) predictive maintenance (b) detective maintenance (c) overhauling maintenance
(d) corrective maintenance

38. The purpose of maintenance in engineering equipment is to (a) keep it in good working condition always (b) prevent it from making loud noise (c) stop it from working too long (d) enable it to last for ever

39. The primary voltage of a transformer is 20 volts and the primary winding is 40 turns. If the secondary winding is 40 turns, what is the secondary voltage? (a) 80.volts (b) 60 volts (c) 40 volts (d) 20 volts

40. The main function of a beam in a building is to (a) support the structure above the floor (b) transmit the load from above to the column (c) distribute the load of the building (d) join two columns

41. In engineering systems, gear, belts and chain drives are used for (a) energy conversion (b) energy transmission (c) power conversion (d) power transmission

42. The following operational cycle of a four stroke internal combination (IC) engineer includes the following strokes EXCEPT. (a) compression (b) conversion (c) power (d) exhaust

43. Which of the following procedures comes first in constructing a building? (a) concreting (b) excavation (c) leveling (d) site clearance

44. The best reason for keeping household water tanks on a high position is to (a) enable fresh air to reach the water (b) enable the water to flow to all parts of the house (c) keep the water out of the reach of rodents (d) keep the water from disease

45. The workshop equipment on which all metals to be beaten are placed is (a) swage (b) vice (c) table (d) anvil

46. The following are some of the basic electrical power transmission equipment EXCEPT
(a) control panel (b) emitters (c) generator (d) line supports

47. What is the main function of the Damp Proof Course (D.P.C) layer in the wall of a building? (a) to keep the building damp (b) to provide good base for the floor slab (b) to mark an important stage in the construction (d) to prevent water from rising up the wall.

48. In an electrical connection, 25 voltage releases 5 amperes current. Calculate the resistant of the cable
(a) 125 ohms (b) 30 ohms (c) 20 ohms (d) 5 ohms

49. A trowel is a hand tool used for (a) rendering (b) packing (c) mixing (d) digging

50. Calculate the power expended when a current of 6 amperes flows through a resistance of 2 ohms. (a) 18W (b) 120W (c) 72W (d) 720W

51. Which of the following is NOT an appliance based on conversion of electrical energy to mechanical energy? (a) electric fan (b) electric grinding machine (c) electric heater (d) tape recorder

52. When two gears mesh one is called the driver, while the other is called the (a) rotor (b) driven (c) idler (d) shaft

53. Ohm is the unit used for measuring (a) resistance (b) voltage (c) current (d) frequency

54. The process of increasing the length of a metal bar at the expense of its thickness is called (a) bending (b) drawing down (c) normalizing (d) twisting

55. Which of the following minerals CANNOT be sued for an abrasive coating?
(a) aluminium coating (b) asphalt (c) silicon carbide (d) glass

56. What is the value of the electrical power of a bulb with 12 voltages which allows a current of 5 amperes to flow through it?
(a) 17 watts (b) 24 watts (c) 27 watts (d) 60 watts

57. A plane figure which has its opposite sides equal and parallel but with not right angle is called. (a) parallelogram (b) rhomboid (c) rectangle (d) square

58. All the following are methods of joining metals EXCEPT (a) fastening (b) glueing (c) riveting (d) soldering

59. Which of the following CANNOT reduce the effect of friction? (a) ball bearings between rotating shafts (b) oiling of gear box (c) streamlining racing cars (d) trading of tyre

60. The instrument which controls the flow of current in an electric circuit is the _____ (a) ammeter (b) cell (c) resistor (d) switch

61. To measure and draw various angles you need a (a) template (b) set-square (c) protractor (d) French curve

62. The application of the gear and chain drive arrangement can be seen in the movement of the (a) bicycle (b) bar (c) crane (d) clock

63. The function of clutch in a vehicle is to (a) enable vehicle stop instantly (b) act as a release to change gears easily (c) help the gears to run faster (d) make it possible to negotiate a bend

64. The following are mechanical plants used in site clearance EXCEPT (a) dumpy level (b) bulldozer (c) pay loader (d) grader

65. The unit of energy is (a) watts (b) ohms (c) joules (d) Newton

66. A freshly mixed concrete is called (a) reinforce concrete (b) wet concrete (c) damp concrete (d) green concrete

67. Current flow through a path when all electrical parameters are connected in a closed (a) panel (b) channel (c) circuit (d) shell

68. The blender is an appliance that can covert
(a) mechanical energy into electrical energy (b) the blender is an appliance that can convert (c) electrical energy into mechanical energy (d) electrical energy into sound energy

69. The pair of compasses is used for drawing (a) vertical and inclined lines (b) irregular curves and angles (c) horizontal and parallele lines (d) arcs and circular lines

70. A force of 5 Newton was applied to a car which moves through a distance of 100m. Calculate the work done by the car.
(a) 105J (b) 150J (c) 250J (d) 500J

71. Which of the following is NOT a wood joint? (a) built (b) bridle (c) contact (d) dovetail

72. A trapezium is also a (a) triangle (b) parallelogram (c) pentagon (d) polygon

73. Laminar flow of water is produced at (a) alternating velocity (b) high velocity (c) normal velocity (d) low velocity

74. The following are Damp Proof Course (D. P. C) materials EXCEPT (a) adhesive (b) varnish (c) mortar (d) plank

75. Chain-driven machines are better than belt-driven machines because (a) chain-driven machines are chapter (b) chain-driven machines can drive for a longer period of time than belt-driven machines (c) chain-driven machines are faster than belt-driven machines (d) chain-driven machines are more durable

76. When the dry cells of a wall clock is week, the best thing to do is to

(a) recharge the cells (b) discharge the cells (c) replace the cells with new ones (d) put ht cells under the sun

77. In two meshing gears, the driver gear has 30 teeth and rotates at 150 r.p.m. what is the speed of the driven gear with 18 teeth? (a) 30 r.p.m (b) 50 r.p.m (c) 80 r.p.m (d) 90 r.p.m

78. Drawing paper is placed squarely on the drawing board with the aid of (a) tee-square (b) scale rule (c) ruler (d) hands

79. Which of these devices is used to convert mechanical energy into electrical energy (a) table fan (b) electric motor (c) electric lamp (d) generator

80. Which of the following is used in the transmission of power in a bicycle? (a) chain (b) pedal (c) spoke (d) gear

81. The following tools are used for setting out building EXCEPT
(a) pegs (b) nails (c) lines (d) tapes

82. What takes places when a force moves through a distance?
(a) potential energy is released (b) power is expended (c) work is done (d) kinetic energy is released

83. Which of the following is NOT used for good board practice?
(a) dividers (b) try square (c) scale (d) compass

84. A closed path which current flows is known as (a) electric field (b) electric circuit (c) north and south pole (d) magnetic field

85. Which of these devices is used for connecting and disconnecting two revolving shafts?
(a) ratchet (b) brake (c) gear (d) clutch

86. Centre lines are drawn in (a) long thin chain lines (b) zigzag chain lines (c) thin continuous lines (d) thick continuous lines

87. The preliminary work carried out to get a site ready for the erection of a building is called
(a) foundation (b) site preparation (c) bonding (d) pegging

88. A process of enlarging or reducing the size of drawing is known as
(a) freehand sketching (b) isometric drawing (c) orthographic drawing (d) scale drawing

89. The type of current which reverses it direction periodically is called (a) high tension current (b) alternating current (c) variable current (d) low tension current

90. Hydro-electric power generation station make use of (a) wave (b) petrol (c) diesel (d) water

91. The process of increasing the length of a metal by hammering is known as
(a) upsetting (b) lengthening (c) drawing down (d) jumping up

92. The type of gear introduced when gears need to move in the same direction is known as
(a) driver (b) pulley (c) sprocket (d) idler

93. Concrete is made up of (a) cement + sand + water (b) cement + stone + water (c) cement + sand + stone (d) cement + sand + stone + water

94. Which of the following statement is NOT true of a secondary cell? (a) it is rechargeable (b) it produces current (c) its chemical action can be reversed (d) it is not rechargeable

95. The pressure of water in an overhead tank in a building increases with (a) volume (b) height (c) usage (d) the type of building

96. Preventive maintenance include the following EXCEPT (a) lubrication (b) inspection (c) adjustment (d) repair

97. What is the power consumed by an electric iron which has a resistance of 5Ω and current of 4 Amps? (a) 80 watts (b) 60 watts (c) 40 watts (d) 20 watts

98. Voltage is measured with an instrument called.
(a) voltmeter (b) ohmmeter (c) ammeter (d) galvanometer

99. In a gear box, if the driver gear has 12 teeth and revolves at 60 revolution/minute, what is the speed of the driven gear with 80 teeth?
(a) 160 revolution/minute (b) 90 revolution/minute (c) 60 revolution/minute (d) 400 revolution/minute

100. Which of the following can be used for drawing vertical and inclined lines?
(a) protractor (b) scale rule (c) compass (d) set-squares

101. The type of gear introduced when gears need to move in the same direction is known as
(a) drive (b) pulley (c) sprocket (d) idler

102. Energy can be define as the …….
(a) rate of doing power (b) ability or capacity of doing work (c) rate of doing power (d) power to do work

103. The drawing instrument used for drawing irregular curves is called.
(a) bow compass (b) protractor (c) French curve (d) set-square

104. Which of the following devices is used to limit the flow of current in a circuit?

(a) insulator (b) inductor (c) resistor (d) switch

105. Soldering bit is made of …… (a) bronze (b) mild still (c) brass (d) copper

106. Which of the following instruments is used for free-hand sketching?
(a) pencil and eraser (b) set-square and pencil (c) tee-square and pencil (d) comapss and pencil

107. The following are made during site preparation EXCEPT…..
(a) molding of blocks (b) leveling (c) uprooting (d) cutting

108. The purpose of earthen a house is to prevent ……. (a) leakage of current (b) power loss (c) excessive voltage (d) shock

FIRST AID TREATMENT AND RESCUE OPERATIONS

109. The simple medical treatment given to somebody before the arrival of the medical practical is called…. (a) treatment (b) second aid (c) first treatment (d) first aid

110. Where the materials needed for first aid care are stored is called……
(a) carton box (b) metal box (c) first aid box (d) plastic box

111. The facts listed below are the objectives of first aid treatment except…….. (a) relieving (reducing) pains (b) purely for blood donation (c) preventing injuries from becoming worse (d) arresting bleeding

112. First aid can be used to care for the following EXCEPT
(a) accident (b) injury (c) headache (d) blood donation

113. ……. can be defined as unpleasant occurrence that occurs unexpectedly and causes injury. (a) first aid (b) first treatment (c) first aider (d) accident

114. A cut in the leg that results to escape of blood may be referred to as ……..
(a) first aid (b) first aiding (c) sore (d) injury

115. Workshop accident includes the following except. (a) fracture (b) bleeding (c) plastering (d) wound

116. The losing of blood from the body is known as (a) wound (b) fracture (c) strain (d) hemorrhage

117. A break in bone is referred to as…. (a) fracture (b) hemorrhage (c) dislocation (d) wound

118. Factors responsible for workshop accident include the following except.
(a) faulty tools (b) fatigue (c) carelessness (d) seriousness

119. To avoid accident in the workshop, you must do the following EXCEPT
(a) lacking of manufacture's or personnel's instructions (b) always use right tool for each job (b) avoid using worn-out faulty tools (d) do not welcome distractions while working

120. When a bone is out of its normal position in a joint, such is referred to as ---------
(a) wound (b) dislocation (c) fracture (d) breaking

121. The first aid materials includes the following EXCEPT.
(a) cotton-wool (b) forceps (c) pincers (d) scissors

122. …….. can be referred to as first aid materials (a) analgesics (b) pincers (c) temperature metre (d) antibiotics

123. ……. Is used to cover wound so as to prevent it from being infected with harmful bacteria (a) iodine (b) plaster (c) cotton wool (d) sterile gauze

124. When a victim takes……., it makes him to recover from weakness and loss of energy
(a) glucose (b) distilled water (c) soda water (d) pure water

125. …….. can be used to massage a swollen, strained aching muscles (a) analgesics (b) embrocation (c) antiseptics (d) methylated spirit

126. Identify the tool below……. (a) scissors (b) safety pin (c) forceps (d) pincer

127. Giving first aid to a wound, your hand must be cover with …….. (a) disposable hand glove (b) cloth (c) nylon (d) plaster

128. A first aid personnel must possess all the following EXCEPT
(a) must lack confidence (b) must be knowledgeable (c) must be cheerful and gentle (d) must be sympathetic

129. Which of the following can be used to take care of snake bit?
(a) potassium permanganate (b) embrocation (c) antiseptics (d) methlated spirit

130. Which of the following is the correct interpretation of ABC in first aid?
(a) airway, breathing, circulation (b) airflow, breeding, circulation (c) airway, breeding, circulation (d) airflow, breathing, circulation

131. …….. can be defined as an operation organized to free from danger or save life during dangerous situation. (a) first aid operation (b) rescue operation (c) responsive operation (d) caring operation

132. Which of the following can be regarded as a rescue operation

(a) vehicle-extrication rescue operation (b) surface water rescue operation (c) air-sea rescue operation (d) first aiding

133. The following must be bore in mind while carrying out rescue operation except. (a) eye protection (b) hearing and respiratory protection (c) protective blankets (d) sleeping dose

134. Highway operations and vehicle rescues includes the following except (a) positioning of C-caution on the road (b) use of double trafigator light (c) directing traffic by calling the attention of other drives to the incidence (d) by shouting on the road.

135. The following hazards must be guided against on the road during rescue operation except. (a) fire and fuel (b) sharp object (c) electric power (d) eye protection

136. One of the following cannot be used to fight large fire accident (a) pure water (b) ifre extinguisher (c) sand bucket (d) fire blanket

137. Accident in a confined space includes the following except……. (a) storage silo (b) hoppers (c) pits (d) ground

138. Confined space hazards include the following except…..
(a) hygienic space (b) oxygen-deficient atmosphere (c) toxic or explosive (d) entrapment by machinery

139. one of the following is NOT among the rescuers safety measures (a) face cap (b) safety boot (c) hand gloves (d) helmets

140. hazard control during rescue operation includes the following except (a) poisonous substance (b) swift-moving current (c) hygienic air (d) biological agents

ANSWERS TO PART B QUESTIONS

TERMINAL OBJECTIVE

1	C	25	A	49	A	73	D	97	A	121	C
2	D	26	D	50	C	74	D	98	A	122	D
3	C	27	B	51	C	75	B	99	D	123	D
4	D	28	A	52	B	76	C	100	D	124	A
5	A	29	D	53	A	77	D	101	D	125	B
6	C	30	A	54	B	78	A	102	B	126	C
7	B	31	C	55	B	79	D	103	C	127	A
8	D	32	D	56	D	80	A	104	C	128	A
9	A	3	B	57	B	81	B	105	D	129	A
10	C	34	A	58	B	82	C	106	A	130	A
11	D	35	C	59	D	83	B	107	A	131	B
12	B	36	D	60	D	84	B	108	A	132	A
13	C	37	D	61	C	85	D	109	D	133	D
14	A	38	A	62	A	86	A	110	C	134	D
15	A	39	D	63	B	87	B	111	B	135	D
16	C	40	B	64	A	88	D	112	D	136	A
17	A	41	D	65	C	89	B	113	D	137	D
18	D	42	B	66	D	90	D	114	D	138	A
19	D	43	D	67	C	91	C	115	C	139	A
20	D	44	B	68	C	92	D	116	D	140	C
21	D	45	D	69	D	93	D	117	B		
22	D	46	B	70	D	94	D	118	D		
23	B	47	D	71	C	95	B	119	A		
24	C	48	D	72	B	96	D	120	B		