SUBJECT: BASIC SCIENCE AND TECHNOLOGY **CLASS: JSS 2**

SCHEME OF WORK **3RD TERM LESSON NOTE**

WEEKS	TOPICS	Learning Objectives: By the end of the lessons, students should be able to:
1	Revision of last term's work / Welcome Test	Revise topics in different areas
2	Area of plane figures	Explain, Differentiate between enlarged and reduced plane figures
3	Wood machines, types	Demonstrate the uses of the metal work machines, portable power tools-belt sander, hand drill, jig saw-care, maintenance
4	Metal work machines, types-lathe/milling	Demonstrate the uses of the metal work, e.g. drilling machine power hacksaw, their uses, care and maintenance of metal
5	Friction – definition and causes	Explain, state causes, state the types of friction, differentiate the effect and application, state merits and demerits, define lubrication, types and demonstrate the uses of lubricants
6	Belt and chain drives	Explain drives in relation to belt and chain machines, differentiate various belt and chain drives, merit/demerit
7	Mid-term break	Continuous assessment / mid-term test / Open day
8	Gears – meaning, types	Explain, differentiate types of gear, demonstrate their uses, determine gear ratio, list functions of lubricants in gear
9	Hydraulic and Pneumatics-definition, examples	Explain the meaning of hydraulic and pneumatics, identify and differentiate between the two, components of machines, operation and uses of the machines
10	Building Construction	Explain site preparation, tools used during site preparation, uses of site preparation and setting out tools, define excavation and timbering
11	Practical	Practical
12	EXAMINATION	
12-13	EXAMINATION	

REFERENCES

UNIFIED SCHEME OF WORK

WEEK ONE- **TOPIC: Revision of Last Term's Work**

1. A plane figure bounded by four equal sides is called ___ (a) square (b) rectangle (c) trapezium(d) kite
2. Opposite sides of a parallelogram are ___ (a) diagonal (b) parallel (c) vertex (d) straight
3. ___ is a plane figure enclosed by three straight lines(a) Triangle (b) Quadrilateral (c) Pentagon (d) Heptagon
4. An octagon is a polygon with ___ sides ___ (a) 5 (b) 6 (c) 7(d) 8
5. The sum of angles in a quadrilateral is ___(a) 90 (b) 180 (b) 270 (d) 360
6. What is the center rule formula used to construct a polygon? (a) 360 – N (b) 360 x N (c) $^{360}/_{2}$(d) 360 + N
7. A regular polygon has ___ of its sides and angles equal (a) five (b) all (c) three (d) four
8. The opposite angles in a parallelogram are ___ (a) equal (b) unequal (c) positive (d)negative
9. Plane figures are identified by the number of ___ enclosing them(a) points (b) sides (c)values(d) circle
10. A line that joins two opposing corners of a quadrilateral is called ___(a) plane (b)diagonal(c) angle (d) vertex
11. Each angle in a regular pentagon is ___ (a) 60 (b) 72 (c) 82 (d) 92
12. A machine that is used to resaw or prepare timber into suitable sizes for articles of joinery and furniture is known as (a) Circular sawing machine (b) Surface planing machine (c) Milling machine (d) Thicknessing machine
13. A machine that is used exclusively for planing wood to a specific thickness after surface planing operation is called ___ (a) Circular sawing machine (b) Surface planing machine (c) Milling machine (d) Thicknessing
14. A wood working machine, which can also be used as machine tools, used for performing various operations such as boring, sanding and mortising is known as (a) Drill press (b) Surface planing machine (c) Milling machine (d) Thicknessing
15. Which of the following is not a type of scale drawing? (a) Reduced (b) Enlarged (c) Extended (d) Full
16. A quadrilateral with only two parallel sides is called ___ (a) square (b) rectangle (c) trapezium (d)kite
17. Which of the following is used to rotates the work and transmits movement to saddle of a lathe? (a) the bed (b) the headstock (c) the saddle cross slide (d) main spindle
18. The following are work holding methods except (a) catch and carrier (b) face plate (c) saddle (d) chuck
19. Which of the following provides a plane surface for mounting and moving accessories at a constant level on a lathe machine? (a) the bed (b) the headstock (c) the saddle cross slide (d) main spindle
20. Which of the following permits movement of tool at angle other than right angle? (e.g. for conical work) (a) the compound slide (b) the head stock (c) the slide cross slide (d) main spindle
21. The space occupied by a plane figure is called ___ (a) diagonal (b) area (c) volume (d) theorem
22. The lubricant commonly used in transmission system is (a) diesel(b) gear oil (c) grease (d) hydraulic
23. Constant lubrication of a machine is to prevent (a) corrosion (b) exhaustion (c) high speed (d) sulphation
24. Which of the following will not reduce friction? (a) lubrication (b) use of rollers (c) use of pulleys (d) drying
25. Which of the following is not a practical application of friction? (a) belt drive (b) cable drive (c) chain drive (d) clutches
26. MRO stands for (a) Machine, relevance and operations (b) Maintenance, repair and operations (c) Maintenance, relevance and organization (d) Machine, repair and organization
27. Which of the following is not a part of lathe machine? (a) head stock (b) main spindle (d) steadies (d) shaper
28. Which of the following triangles has none of its side equal A. Equilateral B. Scalene C. Isosceles D. Right-angled
29. The rougher the surfaces in contact, the …….. the frictional force (a) greater (b) lesser (b) partial (d) equal
30. Maintenance of metal work machines should include (a) periodic servicing (b) drying

(c) manufacturing (d) bending

WEEK: 2 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**

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

1. **Define plane figures / Area of plane figures**
2. Enlargement and reduction of plane figures
3. Triangle, rectangle, and square in a given ratio
4. Length of sides and radial line method

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards

CONTENT: AREA OF PLANE FIGURES

Plane figures

Any shape that can be drawn in the plane is called a plane figure. A shape with only straight sides as edges is called a polygon(POL-ee-gone). Polygons must have at least three sides, thus the polygons with the fewest number of sides are triangles. Circles and semicircles are not polygons because they have curved sides.

When all the sides of a polygon are equal, it is equilateral (ee-quee-LAH-teh-roll). When all the angles of a polygon are equal, it is equiangular (ee-quee-ANG-ger-lah). When a polygon is both equilateral and equiangular, it is a regular shape. When doing mathematics problems, it is very important that an equilateral shape may not be equiangular (such as a rhombus), and an equiangular shape may not be equilateral (such as a rectangle). However, an equilateral triangle is always both (see below).

When dealing with plane figures, there are two measurements that are important to find: the area and the perimeter. The perimeter is the length around the shape while the area is the size of the shape. They can be calculated with different formulae.

Enlargement and Reduction of Plane Figures

An object is enlarged when all of its dimensions are changed in the same ratio. Thus, enlargement is also called transformation. Each length of the objects is multiplied by the same number called scale factor to obtain the enlargement. When the scale factor is less than one, the original objects is reduced.
I.e. Scale Factor = length of enlargement/corresponding length.
Examples of enlargement/reduction of plane shapes include:

ENLARGEMENT OF PLANE FIGURES

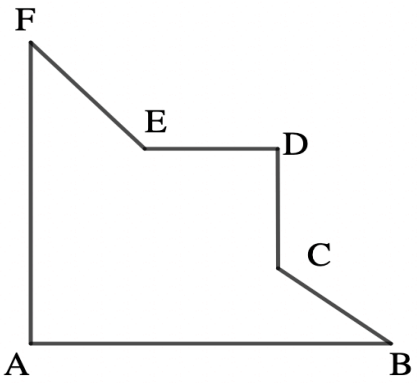
Drawing a Triangle Which is Twice the Size of the Original Triangle

Procedure:

1. Draw the given triangle ABC
2. Draw DB perpendicularly to AB, such that BD=AB
3. With center A, and radius AD, draw an arc to meet AB at E
4. From E, draw EF parallel to BC, with F on line AC
5. Draw lines to join AEF to give the triangle double in size.

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

For Example: To Construct a Figure Similar to the Given Figure ABCDEF shown below with sides in the Ratio of 7: 4.

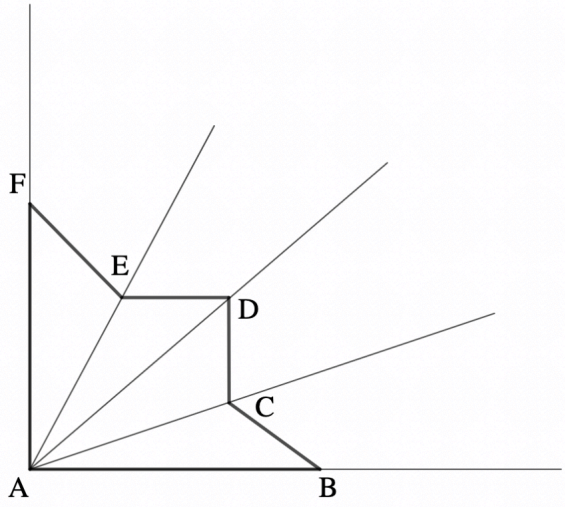


Steps:

i. Draw the given figure ABCDEF.

ii. Produce AB at B and AF at F.

iii. Radiate lines at AC, AD, and AE.

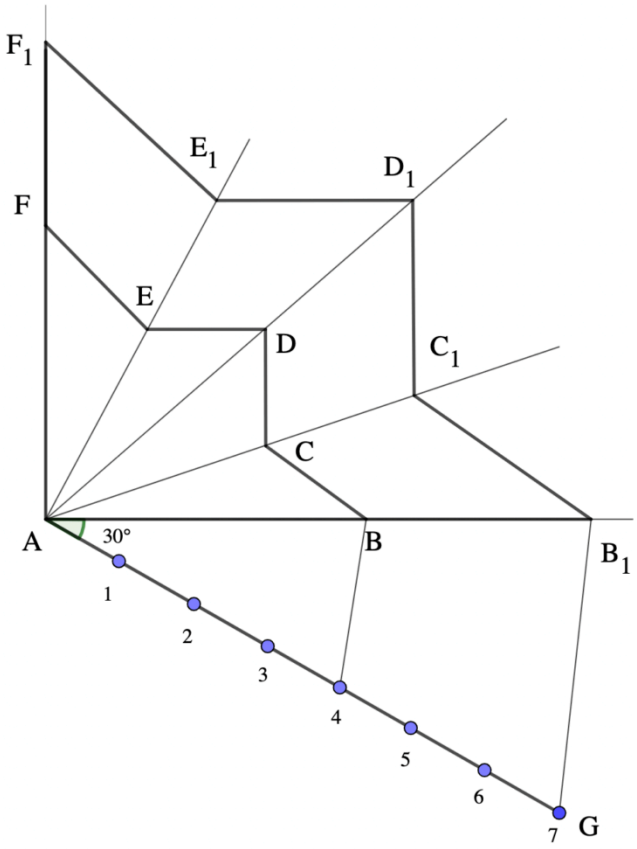


iv. Draw a convenient angle at AG (30° in this case) and divide it into 7 – equal parts.

v. Join, point 4 to point B, and draw $7B_1$ parallel to 4B.

vi. Draw B_1C_1, C_1D_1, D_1E_1, and E_1F_1 parallel to BC, CD and DE respectively to complete the required figure.

See the figure below:



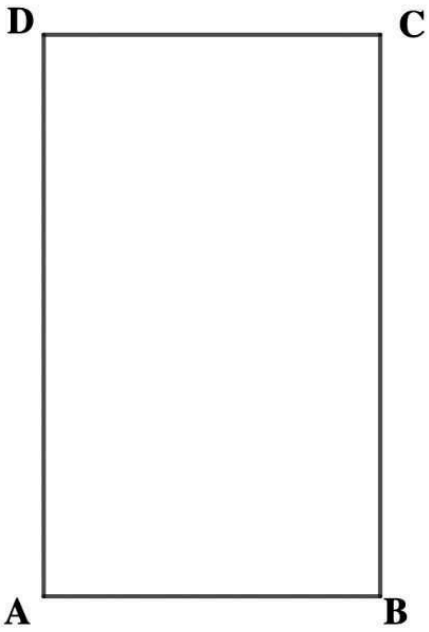
Definition of Reduction:

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.

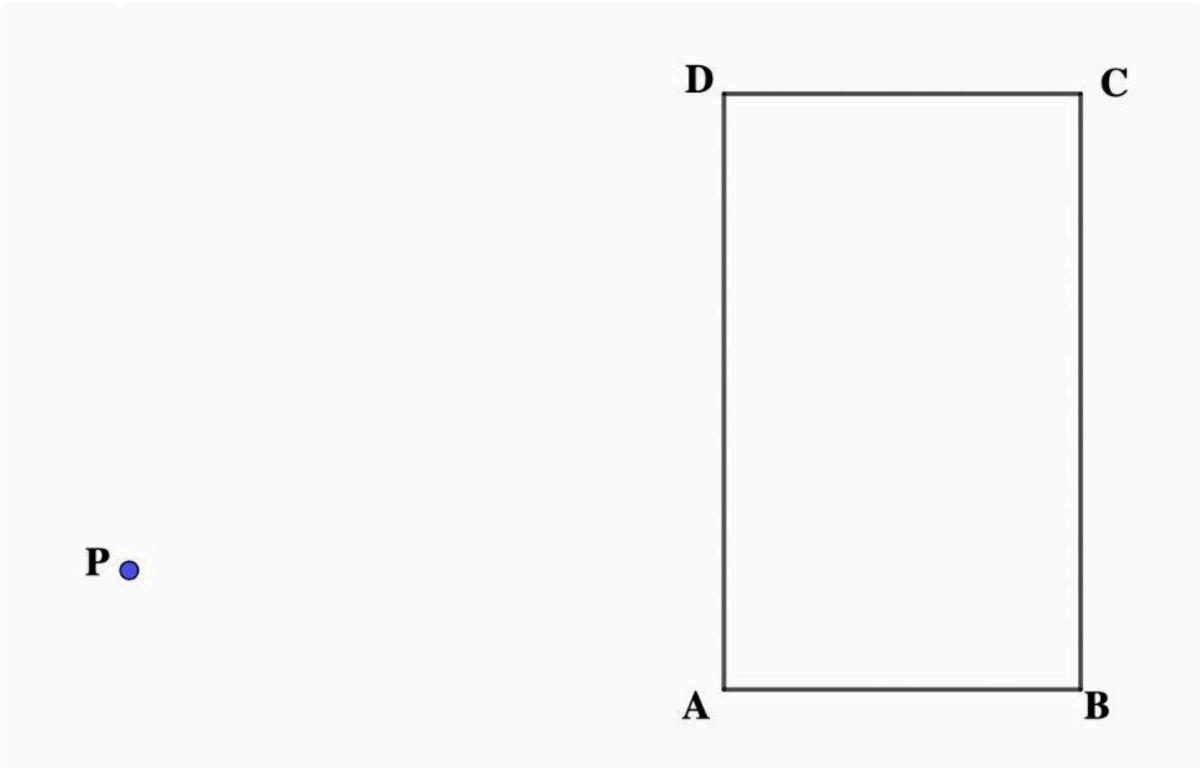
For Example: To reduce the size of a given rectangle ABCD shown below by a given proportion of 5:3.

Steps:

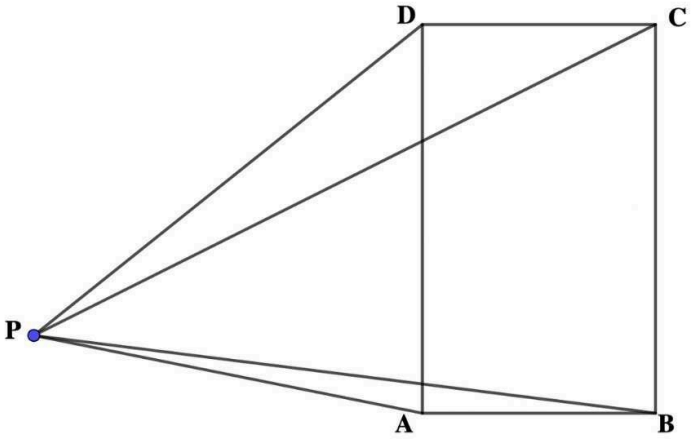
- Draw the given rectangle ABCD.



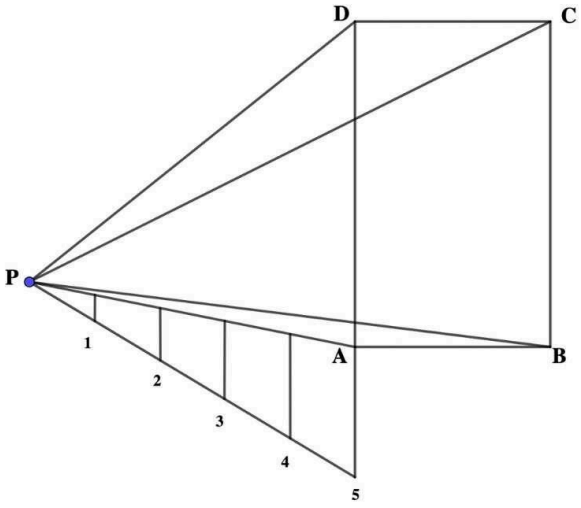
- Mark a point P at any convenient distance from the rectangle.



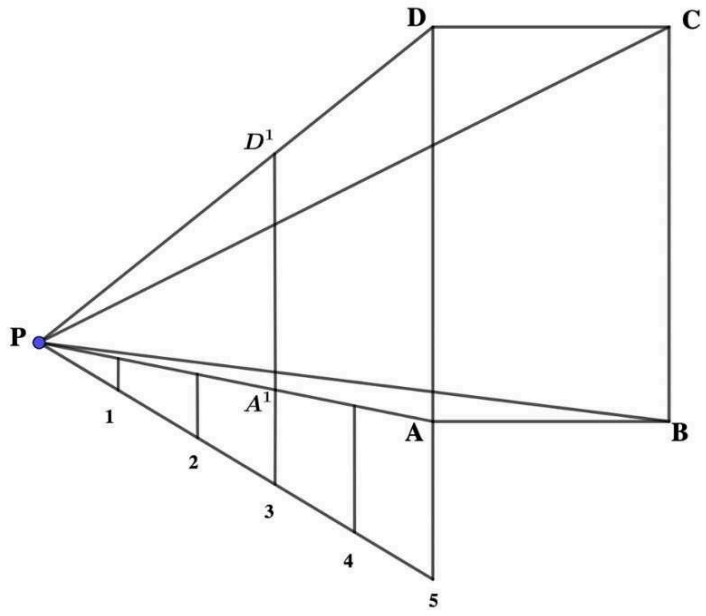
From P radiate lines to A, B, C, and D. (Draw lines from P to A, B, C, D)



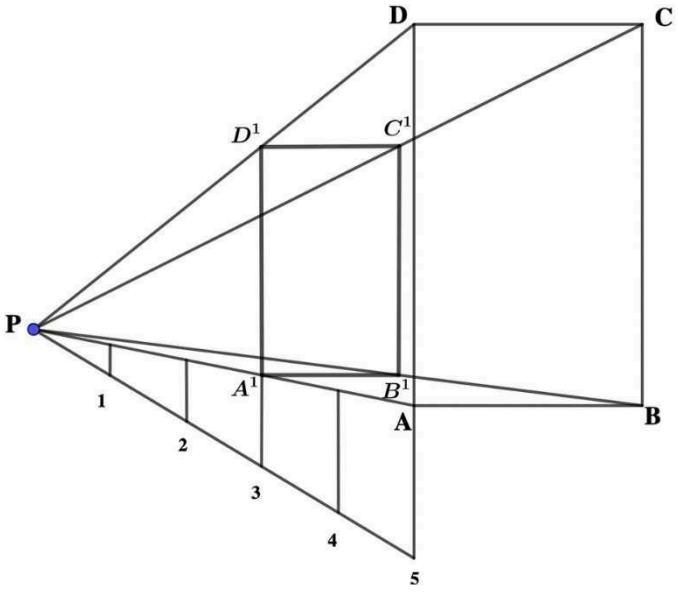
- Draw any convenient angle at PE and divide into 5-equal parts.



- Draw a line A^1D^1 from unit 3, parallel to AD



- Draw D^1C^1 parallel to DC
- Draw C^1B^1 parallel to CB
- Draw B^1A^1 parallel to BA to complete the reduced rectangle.



Triangles

A triangle is a shape with three sides. It can be classified according to its sides or angles, with three kinds each. Here they are:

- **Equilateral triangles**, which are also **equiangular triangles**, have three sides equal and three angles equal. Their angles are always 60°.
- **Isosceles triangles** are triangles in which two of the sides are equal. The non-included angles of the sides are also equal.
- **Scalene triangles** have no equivalence in any way.

- **Right triangles** are triangles with a right angle. The longest side of such triangles is called a hypotenuse.
- **Obtuse triangles** are triangles with an obtuse angle.
- **Acute triangles** are triangles with no right or obtuse angle.

It is interesting to note that the interior angles of triangles must add up to 180°. This is commonly used in proofs and other problems. Imagine a triangle whose points are marked A, B and C, angle A is 60 degrees, and angle B is 70 degrees:

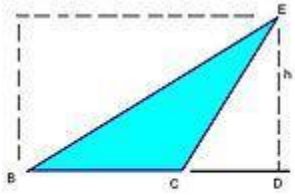
Usually, when drawing a triangle, we draw one side horizontally. This side is usually called the **base**. There is nothing special about the base. By turning your paper you can make any side into the base. There is no mathematical reason to call one side a base; we do it to make talking about the triangle easier. When you have a triangle and think of one of the sides as the base, then there is one corner of the triangle that is not on the base and this point is the furthest point on the triangle from the base. The **height** of the triangle is the line that is perpendicular to the base and goes through that furthest point. Sometimes instead of being called the **height** it is called the **altitude** of the triangle. (So if your teacher calls it an altitude, don't worry, it's really the same thing.) The length of the base and the height are the only two numbers you need to know when calculating the area of any triangle. Just multiply base and height and divide by two (or multiply it by a half if you like.) and you have the area of the triangle!

The perimeter of the triangle is easy: just add up all the sides and voilà, you have the perimeter. You can multiply one side of an equilateral triangle by three as well. As for isosceles triangles, simply multiply one of the equal sides by two and add the shorter one. There we go.

Quadrilaterals

A quadrilateral is a shape with four sides. You will spend a lot of time with these. They can be classified into many different categories:

- **Parallelograms** are shapes where opposite sides and angles are equal. The opposite sides are parallel, hence the name.
    - **Rectangles** are parallelograms where the angles are all 90°. Its width or breadth refers to the shorter sides, while its length refers to its longer ones.
    - **Rhombuses** are parallelograms where all the sides are equal, and opposite angles are equal.
    - **Squares** are parallelograms that are both rectangles and rhombuses, i.e. all angles are right and all sides are equal.
- **Trapeziums**, called **trapezoids** in American English, have two opposite sides that are parallel. The parallel sides are sometimes called the upper and lower bases.
    - **Right-angles trapeziums** are trapeziums with a right angle.
    - **Isosceles trapeziums** are trapeziums where the laterals sides are equal but not parallel.
    - **Scalene trapeziums** are trapeziums that fall into neither category.
- **Kites** are quadrilaterals where two pairs of adjacent sides are equal and one pair of opposite angles is equal.
- **Irregular quadrilaterals** are any quadrilaterals that do not fit into one of the groups above.



An example of how filling can be put to use.

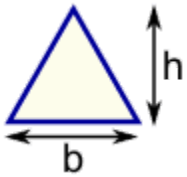
Calculating the area of these shapes can be very easy. For parallelograms, simply multiply the base with the height, the way with do with triangles, except we don't need to divide by two. The square is especially easy: just square one of the

sides, which would be the length. For the others, we can cut them up into bite-sized pieces before we calculate. For example, we can dissect the right-angled trapeziums into a right-angled triangle and a rectangle.

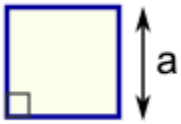
The perimeter of these shapes are just as easy. For rectangles, we simply add up the length and the width, then multiply by two. You can simply multiply the length of a square by four. The isosceles trapeziums are just as easy: multiply one of the lateral sides by two, then add it up with the other two. The kite is easy as well: Just add up the two different sides and multiply that by two. For the rest, you can just add up everything.

AREA OF PLANE SHAPES

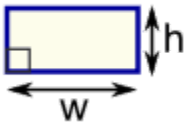
Area is the size of a surface!
Learn more about Area, or try the Area Calculator.



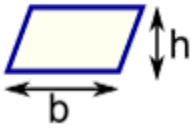
Triangle
Area = ½ × b × h
b = base
h = vertical height



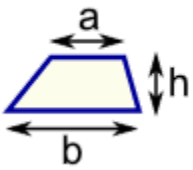
Square
Area = a^2
a = length of side



Rectangle
Area = w × h
w = width
h = height

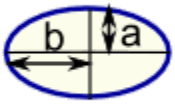


Parallelogram
Area = b × h
b = base
h = vertical height

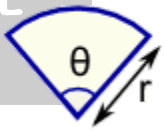


Trapezoid (US)
Trapezium (UK)
Area = ½(a+b) × h
h = vertical height

Circle
Area = π × r^2
Circumference = 2 × π × r
r = radius

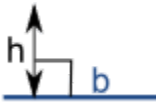


Ellipse
Area = πab

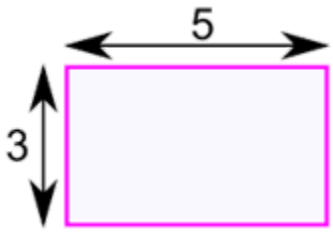


Sector
Area = ½ × r^2 × θ
r = radius
θ = angle in **radians**

Note: **h** is at right angles to **b:**



Example: What is the area of this rectangle?



The formula is:

Area = w × h
w = width
h = height

We know **w = 5** and **h = 3**, so:

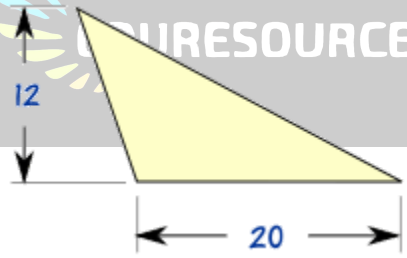
Area = 5 × 3 = **15**

Example: What is the area of this circle?

Radius = r = 3

Area $= \pi \times r^2$
$= \pi \times 3^2$
$= \pi \times (3 \times 3)$
$= 3.14159... \times 9$
= **28.27** (to 2 decimal places)

Example: What is the area of this triangle?



Height = h = 12

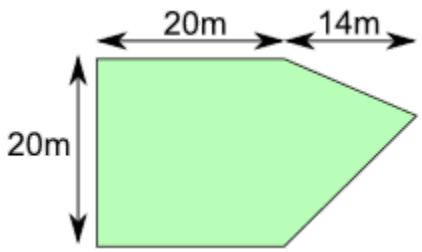
Base = b = 20

Area = ½ × b × h = ½ × 20 × 12 = **120**

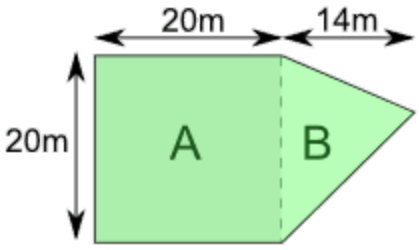
A harder example:

Example: Sam cuts grass at $0.10 per square meter

How much does Sam earn cutting this area:



Let's break the area into two parts:



Part A is a square:
Area of A = a^2 = 20m × 20m = 400m^2

Part B is a triangle. Viewed sideways it has a base of 20m and a height of 14m.
Area of B = ½b × h = ½ × 20m × 14m = 140m^2

So the total area is:
Area = Area of A + Area of B = 400m^2 + 140m^2 = 540m^2

Sam earns $0.10 per square meter
Sam earns = $0.10 × 540$m^2$ = $54

ASSIGNMENT

Construct a rectangle equal to the area of a given triangle

WEEK: 3 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**

Behavoiural Objectives : At the end of the lesson , pupils should be able to

- define wood machines
- say the two section of wood machines
- list simple machines that can be used as drills
- mention the necessary safety precautions that must be taken when using simple machines

Instructional Materials : Wall charts, Pictures, Related Online Video, Flash Cards

Methods of Teaching : Class Discussion, Group Discussion, Asking Questions, Explanation, Role Modelling

CONTENT

INTRODUCTION

Woodwork machines refer to the common equipment used in the workshop. Most of these machines are heavy and cannot be handled ordinarily. Some of them are fixed on the ground and are used with electric power. A few of these machines will be discussed.

Two sections exist here in this topic:

1. Portable power tools
2. Machines

Portable Power Tools

These are tools that are held in the hand and operated with electric current. The examples to be discussed here are:

1. Sanders
2. Hand drills
3. Fret-saw

Sanders

Sanding means smoothing of work with coated abrasives. The abrasives may be made of glass, garnet (a type of precious stone), silicon carbide, aluminium oxide (a brown African abrasive), etc.

Available portable sanders for wood-work smoothing including belt sanders and drum sanders.

Hand Drills

Holes in materials can be made by many methods, e.g. punching, flame cutting, boring and drilling. This section is concerned only with making cylindrical holes with the aid of drills. Drills and drilling machines are the commonest tools used for making holes. The operation is called drilling and the tool used is called a drill.

There are different types of drills used in a metal workshop:

1. Twist drill;
2. Flat drill;
3. Straight-fluted drill;
4. Counter-sink drill.

Sensitive Drilling Machine (Bench)

This type of drilling machine is also designed for light jobs. It is possible to drill holes from 1mm diameter to about 18mm.

The main difference between this machine and the electrical hand-drilling machine is that the bench type is to the work bench.

Fret-Saw

This saw is used for complex shapes and curves in plywood and veneers. The blade of this saw is finer than the coping saw blade. It has a high frame which allows it to be used over a wide area. Its blade is about 125mm long.

Machines

The other types of the equipment used in woodwork are those equipment which are not portable as the discussed earlier. These machines are heavy. They are fixed on a spot most of the times. Examples are circular saw, band saw, wood lathe, surface planner, thicknesser, sanders, drills, etc.

*In today's **Basic Technology** class, We will be discussing **Woodwork Machines.** We hope you enjoy the class!*

WOODWORK MACHINE

These are machines that are intended to be used to process wood. These machines are usually powered by electric motors and are used extensively in woodworking. Machines can be divided into the bigger stationary machines where the machines remain stationary while materials moved over the machine and handheld power tools where the tool is moved over the materials.

HANDHELD POWER TOOLS (PORTABLE POWER MACHINE)

1. Biscuit joiner
2. Domino jointer
3. Chain saw
4. Hand-held circular saw
5. Electric drill
6. Jigsaw
7. Miter saw
8. Nail saw
9. Hand-held electric plane
10. Reciprocating saw
11. Rotary tool
12. Router
13. Handheld sander, including belt sanders, orbital sander, random orbit sander.

STATIONARY MACHINES

1. Band saw.
2. Combination machine
3. Double side planner
4. Four side planner or timber sizer
5. Stationary sanders, including stroke sander, oscillating spindle sander, belt sander, disc sander (and combination disc – belt sander)
6. Table saw
7. Tenoner or tenoning machine.
8. Thicknesses or thickness planner
9. Round pole milling machine
10. Round pole sanding machine

CHAIN SAW

This is a portable mechanical saw which cuts with a set of teeth attached to a rotating chain that runs along a guide bar. It is used in activities such as tree felling, bucking and pruning, to fell snags and assist in cutting fire breaks in the forest.

JIGSAW

This is a tool used for cutting arbitrary curves, such as stencilled designs or other custom shapes, into a piece of wood or other material. It can be used in a more artistic fashion than other saws.

SANDER

This is a power tool used to smooth surfaces by abrasion with sandpaper. Sanders have a means of attaching the sandpaper and a mechanism to move it rapidly. The sandpaper is contained within a housing with a means which handhold it and fix it to a workbench. They are usually powered electrically.

BAND SAW

A bandsaw is a power tool which uses a blade consisting of a continuous band of metal with teeth along one edge to cut various workpieces. The band usually rides on two or more-wheel rotating in the same plane. It provides uniform cutting action as a result of an evenly distributed tooth.

CARE AND MAINTENANCE OF WOODWORK MACHINES

1. Remove loose-fitting clothing, rolling sleeves aprons and eye shield.
2. Remove scraps from saws, tables, and floor.
3. Regular oiling and greasing of bearings must be encouraged.
4. Use the correct saw for each job.
5. Saws should be properly set and should be sharp.
6. Before switching on, make sure the blade runs free
7. Stand to one side when switching on.
8. Switch off to make any adjustments on machine or checking measurements or changing belt speed
9. Do not overload the machine or force it to work beyond its capacity.
10. Make sure you know how to use the machine that you want to use.

Safety Hints in Using the Woodwork Machines

1. Remove loose fitting clothing, rolling sleeves aprons and eye shield.
2. Remove scraps from saws, tables and floor.
3. Regular oiling and greasing of bearing must be encouraged.
4. Use the correct saw for each job.
5. Saws should be properly set and should be sharp.
6. Before switching one, make sure the blade runs free.
7. Stand to one side when switching on.
8. Switching on to make adjustments on machine or checking measurements or changing belt speed.
9. Do not overload the machine or force it to work beyond its capacity.
10. Make sure you know how to use the machine that you want to use.

Presentation: The topic is presented step by step
Step 1: The class teacher revises the previous topics
Step 2. He introduces the new topic
Step 3: The class teacher allows the pupils to give their own examples and he corrects them when the needs arise
Conclusion

The class teacher wraps up or conclude the lesson by giving out short note to summarize the topic that he or she has just taught.
The class teacher also goes round to make sure that the notes are well copied or well written by the pupils.
He or she does the necessary corrections when and where the needs arise.

EVALUATION
State Safety Hints in Using the Woodwork Machines

WEEK: 4 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Define metal work machines**
2. State and explain types of metal work machines
3. Care and maintenance of metal work machines

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards
CONTENT: METAL WORK MACHINES

*In today's **Basic Technology** class, We will be discussing **Metal Work Machines.** I hope you enjoy the class!*

METALWORK MACHINES

Metalwork machines are tools used in working with metals to create individual parts, assemblies, or large-scale structures.

TYPES OF METALS WORK MACHINE AND THEIR FUNCTIONS

Metalworking has evolved from the discovery of smelting various ores, producing malleable and ductile metal useful for tools and machine makings. Modern metalworking processes specialize in forming, cutting or joining processes. Today's machine shop includes a number of machine tools capable of creating a precise, useful workpiece.

LATHE

A lathe is a machine tool which spins a block or cylinder of material so that when abrasive, cutting or deformation tools are applied to the workpiece, it can be shaped to produce an object which has rotational symmetry about an axis of rotation. It can as well be defined as a machine tool that revolves a piece of work on its axis at a suitable speed, and by the use of a suitable cutting tool on the revolving work, and a component of a circular cross-section is produced.

The main parts of a lathe

- Headstock
- Spindle
- Bed
- Carriage
- Apron
- Lead screw
- Tailstock
- Cross slide
- Compound slide
- Toolpost
- Feed shaft
- Chucks

Examples of objects that can be produced on a lathe

1. Candlestick holder
2. Table legs
3. Bow
4. Baseball bats
5. Crankshafts of engines
6. Camshaft
7. Bearing mounts

TURNING OPERATIONS ON THE LATHE MACHINE

1. **Facing or surfacing:** it is an operation of producing a flat surface on a metal bar and is carried out by moving the cutting tool perpendicular to the axis of the rotating workpiece.
2. **Sliding:** it is an operation of producing a cylinder surface and is carried out by moving the cutting tool parallel to the axis of the rotation.
3. **Parting off:** it is an operation of cutting off the finisher component from the remaining part of the bar length and is carried out by moving a parting – off tool perpendicular to the axis of rotation.
4. **Drilling on the lathe**: drilling operation is performed on the lathe machine by feeding the drill held in the tailstock into the rotating workpiece. Before the drilling operation can commence, the end of the workpiece must be faced and centre drilled with a combination centre drill.

5. **Boring:** it is an operation of enlarging the diameter of an already drilled hole with a single cutting tool held in the tool post.
6. **Thread cutting:** when the job is required to be screw cut on the lathe, the work is turned to the top or major diameter of the thread. After this, the correct gears selected with the screw cutting tool must be clamped in the tool post. The screw-cutting tool must now be set squarely and to centre by using the screw-cutting gauge to start the machine with low speed and engage the lead screw nut on the correct line of threading dial. Then, the carriage hence the tool moves along, making a fine spiral cut on the work.
7. **Taper turning:** There are four ways of producing a tapered surface in the centre lathe machine
    1. By swivelling the compound slide
    2. By offsetting the tailstock
    3. By using taper turning attachment
    4. By using a form tool.

DRILLING MACHINE

A drilling machine is a machine tool that holds the cutting tool (drill) perpendicular to the workpiece on the worktable and includes provision for rotating the cutting tool and feeding it into work and thereby originating a round hold.

TYPES OF DRILLING MACHINE

1. Sensitive drilling machine
2. Pillar drilling machine
3. Radial drilling machine

SENSITIVE DRILLING MACHINE

This is a light and high-speed machine used for drilling small holes up to 12mm diameter. The power is transmitted to the machine spindle by a vee-belt drive from the electric motor mounted on the machine.

PILLAR DRILLING MACHINE

This is similar in principle to the sensitive types but more robust than sensitive type. The machine is used for drilling holes up to about 40mm diameter. Its spindle has a tapered hole to accommodate taper shank drills. An all geared head is incorporated on the machine to provide a range of speeds.

RADIAL DRILLING MACHINE

This machine comprises a cast iron base with heavy steel column situated vertically at one end. The column supports an arm upon which a carriage carrying the drill spindle and feed arrangement is mounted.

Radial drilling machines are provided with several spindle speeds and automatic feeds. The machine can accommodate heavy-duty work.

CUTTING TOOLS

There are various tools required when performing drilling operation, among them are the drill and the holding tools. Others are clamp dog, parallel jaws, swivel base, taper shank adaptor, square head screw, headless (safety) screw, chuck key, drill chuck drift, chuck arbour, three-jaw chuck (for small drill) etc. the drills are twist drill, combination drill, reamer, countersunk, counterbore cutter, spot face cutter, trepanning tool, tap etc.

SAWING MACHINE

A power sawing machine is used to cut soft materials with coarse tooth ensures that the metal chips do not clog the teeth. There are many brands of the hacksawing machine, but a good one is a type incorporated with a relief of pressure on return stroke by oil pump or by adjustable oil dashpot in conjunction with the angular setting of the slide.

CUTTING FLUIDS

These are called coolants or cutting lubricants used to

1. Cool work and tools and to lessen distortion
2. Lubricant inured to reduce power consumption
3. Prevent welding of chips to tool
4. Wash away chips and swarf.
5. Improve surface finish
6. Protect tools against corrosion

Types of coolants

1. Soluble oil
2. Straight oil.

3. Water-based fluids

BOLTS AND NUTS

These are used for joining parts which may, at a later date have to be taken apart for the purpose of repair or replacement. They are also used where nut can be easily turned or held by a spanner.

SET SCREW

These are used for the same purpose as bolt and nut but mainly used where the nut is inaccessible. That is where the design of some component parts allows no room for a nut. Types of set-screw are countersunk, cheese, hexagonal, socket and round head screw.

STUDS

These are metal rods having threads on its both ends leaving an untreated small portion in between. The studs are mostly used for joining, parts to grey cast iron body or aluminium castings only.

PIN

It is a short thin piece of metal used for fastening two or more component parts together. Pins are made of cold drawn carbon steel and they are usually installed by pressing them into position. The most commonly used pins are dowel pins, straight pins, taper pins and spring pins.

CARE AND MAINTENANCE OF METALWORK MACHINES

1. Check the lubrication
2. Sharpen important component
3. Check alignment specifications
4. Inspect the cleanliness
5. Take good care of accessories and parts.

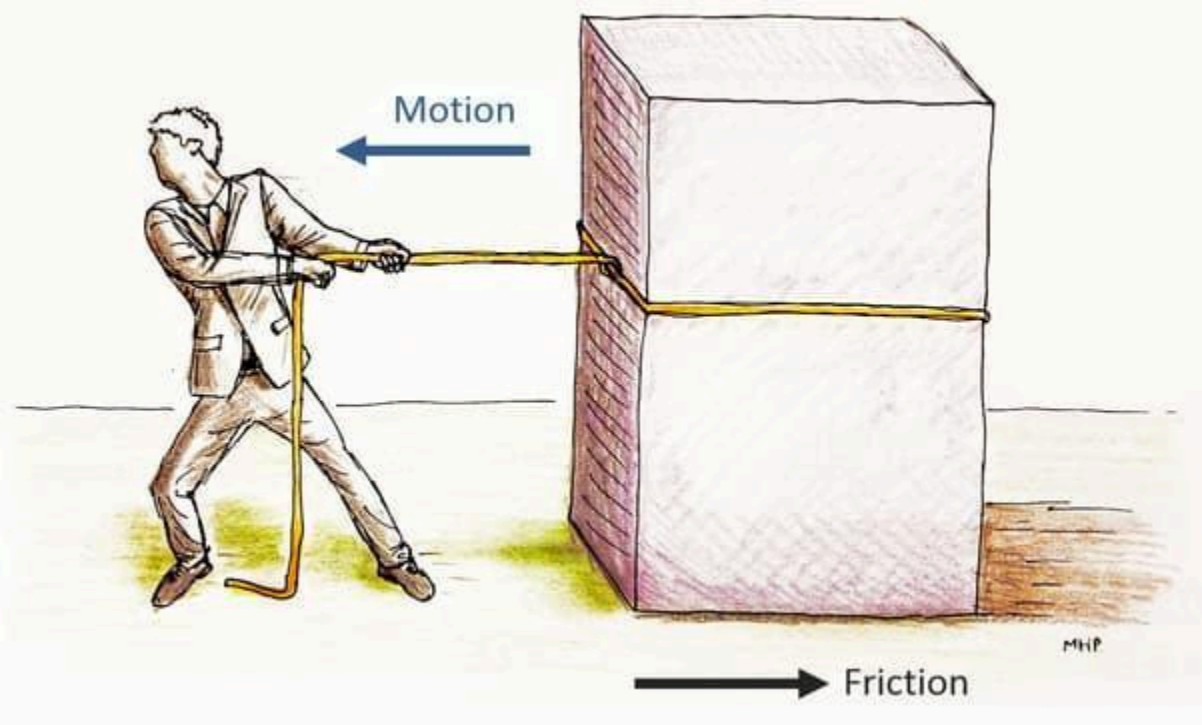
WEEK: 5 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Define friction**
2. Types of friction
3. Causes of friction
4. Advantages and disadvantages
5. Reduction of friction
6. Lubrication and types of lubricant

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards
CONTENT: FRICTION

In today's Basic Technology class, We will be discussing ***Friction.*** *We hope you enjoy the class!*



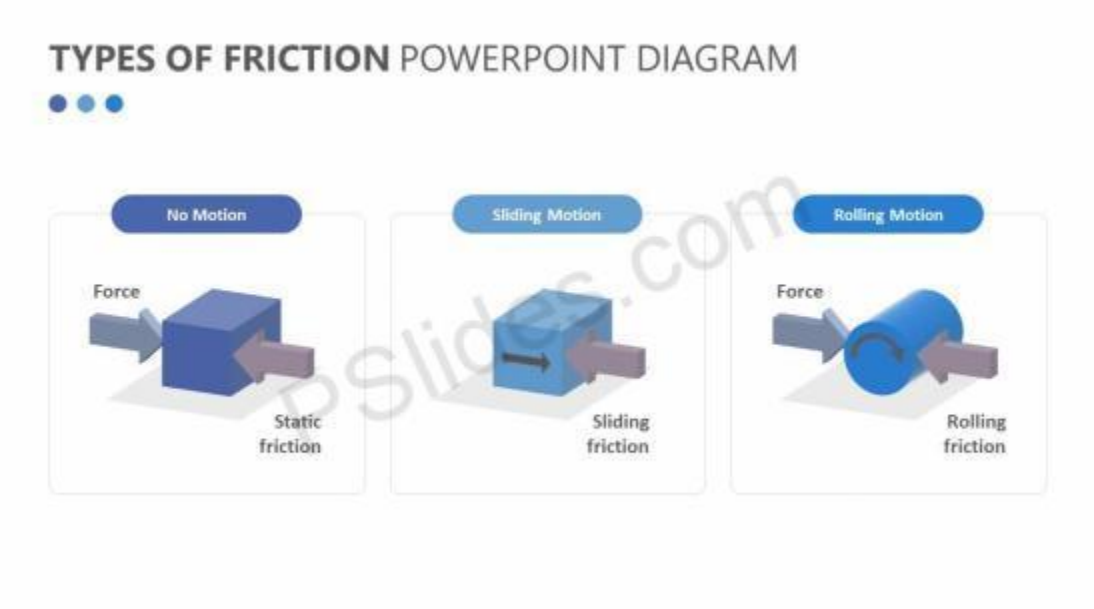
Friction is a force resisting motion of an object when in contact with another. This resistive force is caused by the surface roughness of the contact area of the materials, molecular attraction or adhesion between materials, and deformations in the materials. The cause of friction may be any or all of these items and this applies to sliding, rolling and fluid frictions.

Types of friction

'Rolling friction' is the force that resists motion when an object rolls on a surface. Technically it's not friction; its 'rolling resistance' since when a body rolls perfectly upon a surface, on paper, there is no sliding friction between that object and surface. But due to elastic properties in real life, both the bodies and the surface experience deformations due to contact between the bodies.

Sliding friction' is the frictional force between two surfaces that are rubbing against each other. It's a very easy and common concept. It's hard to find a perfectly smooth surface in the real-life, therefore when an object slides on any surface, it undergoes a backward force because of the relative motion between the two adjacent surfaces. It always acts against the motion.

Fluid friction when fluid layers are moving relative to each other, a type of friction occurs which is known as 'fluid friction'. The internal resistance to the flow of fluids is termed 'viscosity'; in simple terms, the viscosity is nothing but 'thickness' of a fluid.



Applications of friction

Friction plays an important part in many everyday processes. For instance, when two objects rub together, friction causes some of the energy of motion to be converted into heat. This is why rubbing two sticks together will eventually produce a fire.

Friction is also responsible for the wear and tear on bike gears and other mechanical parts. That's why lubricants, or liquids, are often used to reduce the friction — and wear and tear — between moving parts.

Advantages of friction:

1. Friction enables us to walk freely.
2. It helps to support a ladder against a wall.
3. It becomes possible to transfer one form of energy to another.
4. Objects can be piled up without slipping.
5. Breaks of vehicles work due to friction.

Disadvantages of friction:

1. It always resists the motion, so extra energy is required to overcome it.

2. It causes wear and tear of machines.

3. It decreases the life expectancy of moving parts of vehicles.

4. Since friction is very useful in some cases while harmful in some cases, friction is called a necessary evil.

Effects of Friction

- It produces heat, that helps in heating parts of any object or to warm ourselves.
- It also causes loss of power.
- It produces noise during any kind of operation.
- It's because of friction that we're able to walk, run, play, etc.

Reduction of friction

It is beneficial to reduce the friction between surfaces to make movement easier or reduce the wear and tear on a surface. There are a number of ways to reduce friction:

1. **Make the surfaces smoother:**Rough surfaces produce more friction and smooth surfaces reduce friction. Some swimmers wear suits to reduce underwater resistance. These suits mimic the smooth skin of sharks.
2. **Lubrication**is another way to make a surface smoother. A lubricant is a slippery substance designed to reduce the friction between surfaces. You might use oil to stop a door from squeaking – the oil reduces the friction in the hinge. Water can be used as a lubricant – think of how a floor becomes slippery after it has been mopped.
3. **Make the object more streamlined:**A streamline shape is one that allows air or water to flow around it easily, offering the least resistance. Compare a boxy old car with a new car that has a rounded shape, allowing it to move with less effort.
4. **Reduce the forces acting on the surfaces:**The stronger the forces acting on the surfaces, the higher the friction, so reducing the forces would reduce the friction. If you apply the handbrake when you try to drive a car, the car will have a lot of difficulty moving because of the force immobilising (stopping the movement of) the wheels. If you release the handbrake, the wheels will move more freely because there is no extra force acting on them.
5. **Reduce the contact between the surfaces:**Have you ever tried to roll a cube? Spheres are the best shape for reducing friction because very little of a spherical object is in contact with the other surface. Several types of wheels, such as skateboard wheels, contain small spheres called ball bearings to reduce the friction between the moving parts. You can witness the effect of ball bearings by comparing the friction between sliding a book on a table and then doing the same, but using marbles between the book and the surface of the table. Notice how the marbles act as ball bearings, reducing the friction.

LUBRICATION

Lubrication is simply the use of a material to improve the smoothness if movement of one surface over another; the material which is used in this way is called a lubricant. Lubricants are usually liquids or semi-liquids, but may be solids or gases or any combination of solids, liquids, and gases.

The smoothness of movement is improved by reducing friction. This is not, however, always the case, and there may be situations in which it is more important to maintain steady friction than to obtain the lowest possible friction.

In addition to reducing or controlling friction, lubricants are usually expected to reduce wear and often to prevent overheating and corrosion.

TYPES OF LUBRICANTS

Lubricants are usually divided into four basic classes.

(a) **Oils**: A general term used to cover all liquid lubricants, whether they are mineral oils, natural oils, synthetics, emulsions, or even process fluids.

(b) **Greases**: Technically these are oils, which contain a thickening agent to make them semi-solid. It is convenient, however, to include the anti-seize pastes and the semi-fluid greases under the same heading.

(c) **Dry lubricants**: These include any lubricants, which are used in solid form, and may be bulky solids, paint-like coatings, or loose powders.

(d) **Gases**: The gas usually used in gas bearings is air, but any gas can be used which will not attack the bearings, or itself decompose.

The advantages and disadvantages of oils stem from their ability to flow easily. Thus, on the credit side, it is very easy to pour them from a container, to feed them into a bearing by dripping, splashing or pumping, and to drain them out of a machine when no longer fir for use. Other advantages are the cooling of a bearing by carrying away heat, and cleaning it by removing debris.

The behavior of greases is very similar to that of oils, but the former are used where the advantages of easy flow are outweighed by the disadvantages. Thus grease do not easily leak out of a machine, or container, do not migrate away, and will form an effective seal against contaminants.

The advantages and disadvantages of solid lubricants are rather like the extremes for greases, where the lubricant will not flow at all. Similarly, the advantages and disadvantages of gas lubricants are like the extremes of oils, where the flow properties are almost too good.

ASSESSMENT

1. Which of the following actions will reduce friction?
   (a) Make the surfaces rougher
   (b) Make the surfaces smoother
   (c) Increasing the contact between the surfaces
   (d) Exerting more force on the surfaces
2. Lubrication is a way to make a surface
   (a) clean
   (b) smooth
   (c) rough
   (d) dirty
3. The stronger the forces acting on the surfaces…
   (a) the higher the friction
   (b) the lower the friction
   (c) the higher the smoothness
   (d) the lower the smoothness
4. One of these is not a class of lubricants
   (a) solid
   (b) liquid
   (c) gaseous
   (d) flat
5. Greases contain a thickening agent that makes them
   (a) solid
   (b) semi-solid
   (c) liquid
   (d) gas

WEEK: 6 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Define belt and chain drives**
2. State types
3. State uses

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards
CONTENT: BELT AND CHAIN DRIVES
BELT DRIVES

A belt is a looped strip of flexible material used to mechanically link two or more rotating shafts. A belt drive offers smooth transmission of power between shafts at a considerable distance.Belt drives are used as the source of motion to efficiently transmit power or to track relative movement. When the belt is used for speed reduction, the smaller sheave is mounted on the highspeed shaft, like the shaft of an electric motor. The larger sheave is then put on the driven machine.

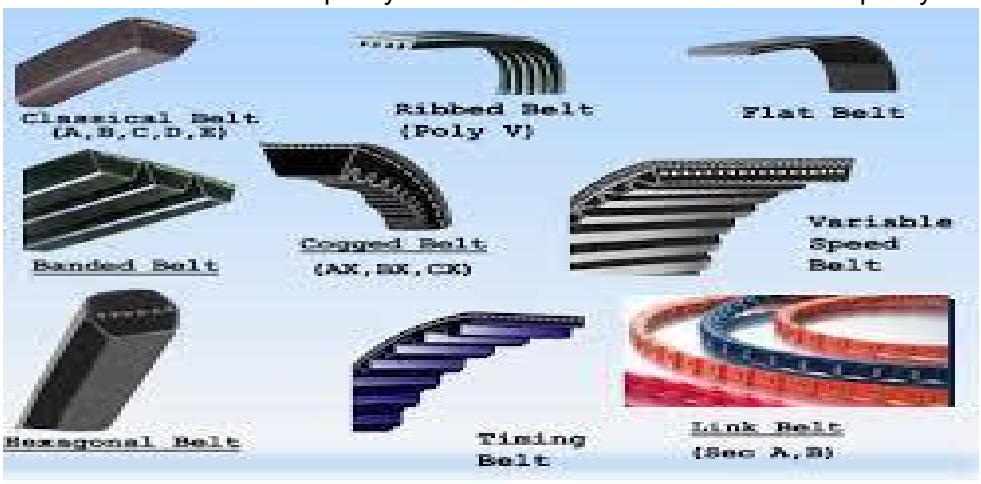
TYPES OF BELT DRIVES

The types of belt drives are diverse. The list of its kinds include the flat belts, synchronous timing belts, cog belts, vee-belts, round belts, multi-groove belts, ribbed belts, film belts, metal belts, endless round belts and speciality belts. Some of them are explained below:

1. **The Flat belt:** The simplest type is often made from leather or rubber-coated fabric. The sheave surface is also flat and smooth, limiting the driving force by the pure fiction between the belt and the sheave.
2. **Synchronous Belts, or Timing belts:** These ride onsprockets that have mating grooves that the teeth on the belt seat. It is a positive drive, limited only by the tensile strength of the belt and the shear strength of the teeth.
3. **Cog Belts:** These are applied to standard V-grooved sheaves. The cogs give the belt greater flexibility and higher efficiency compared with standard belts.
4. **Vee-Belts:** The V-shape causes the belt to wedge tightly into the groove, increasing friction and allowing high torques to be transmitted before slipping occurs.

BELT AND PULLEY ARRANGEMENT

There are various types of belt and pulley arrangement. These include:
1. Open belt: An open belt connecting two pulleys makes them run in the same direction
2. Crossed belt; this changes the direction of pulleys.
3. V-belt: V-belts run on V-pulleys. A common use of the V-belt and V-pulley is the fan belt of an automobile.



EVALUATION

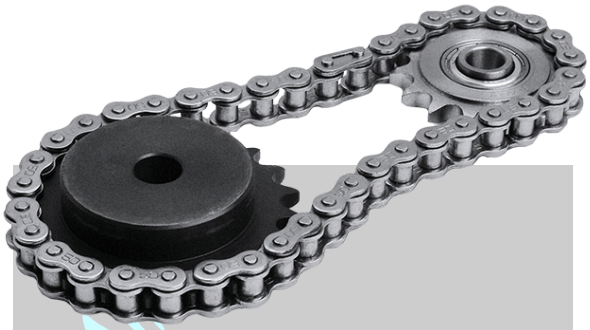
1. What is a belt drive?
2. State the types of belt drive
3. Explain each type of belt drive

CHAIN DRIVES

A chain is a power transmission element made as a series of pin-connected links.The design provides for flexibility while enabling the chain to transmit large tensile forces.Chain drive is a way of transmitting mechanical power from one place to another. When transmitting power between rotating shafts, the chain engages mating toothed wheels, called sprockets.

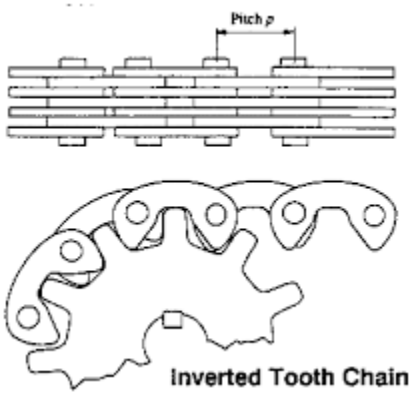
TYPES OF CHAIN DRIVES

1. **Roller Chain Drives:** The most common type of chain is the roller chain, in which the roller on each pin provides exceptionally low friction between the chain and the sprockets. Roller chain is classified by its pitch, the distance between corresponding parts of adjacent links. The pitch is usually illustrated as the distance between the centers of adjacent pins. Standard roller chain carries a size designation from 40 to 240.



2. **Conveyor Chain :** Rollers sit proud of links and can roll along supporting surface It can be used for transporting materials, as rollers can support weight. Can also be used just to support weight of chain if transmitting power over long distances

3. **Inverted Tooth (or silent) Chain:** Sprocket teeth mesh with shaped links instead of rollers on chain. Joints between links use rolling rather than sliding contact. Profiles of links are more like involute gear teeth. Overall effect is to reduce noise.



4. **Leaf (or lifting) Chain:**It is designed for lifting rather (than power transmission). Do not have to mesh with sprockets, hence no rollers. Therefore can narrower than roller chain with equivalent strength. Example: fork-lift truck.

EVALUATION

1. What is a chain drive?
2. State the types of chain drive
3. Explain each type of chain

GENERAL EVALUATION

1. Differentiate between a belt drive and a chain drive
2. State four(4) types each of belt and chain drives

READING ASSIGNMENT: Read more on belt and chain drives (NERDC Basic Tech. for JSS3 page 148-153)

WEEKEND ASSIGNMENT

1. The most common type of chain is the ……. chain. (a) inverted tooth (b) roller (c) leaf (d) conveyor
2. Which of these types of chains can be used for transporting materials?(a) roller chain (b) conveyor chain (c) inverted tooth chain (d) leaf chain
3. …….. is a power transmission element made as a series of pin-connected links. (a) Iron (b) Belt (c) Chain (d) magnet
4. Which of the following offers smooth transmission of power between shafts at a considerable distance(a) Belt drives (b) Chain drives (c) Magnetic drives (d) Electrical drives
5. Which of the following types of chain is used for lifting rather (than power transmission) (a) roller chain (b) conveyor chain (c) inverted tooth chain (d) leaf chain

THEORY

1. (a) What is a belt? (b) State the types of belt we have?
2. (a) State four (4) types of Chain drives (b) Explain any two

WEEK: 7- MID-TERM BREAK / CONTINUOUS ASSESSMENT / MID-TERM TEST / OPEN DAY

WEEK: 8 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Define Gear**

2. **State types of gears**
3. Lubrication of gears
4. Uses

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards

CONTENT: GEARS

GEARS

A gear is a wheel with teeth around its rim that mesh with the teeth of another wheel to transmit motion.

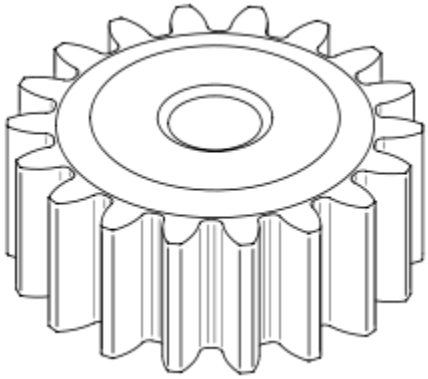
OPERATION

When two gears mesh, one is the driver and the other becomes the driven. A gear is a driver gear because the power to drive the system is generated by it, while the other is the driven because it is only being driven, and does not produce the power/energy.

TYPES OF GEAR

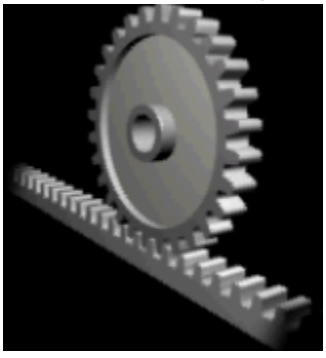
There are various types of gears, namely: Spur gear, Bevel gear, Rack and Pinion gear, Helical gear and Worm gears

1. **Spur gears:** They are used for transmitting drive between parallel shafts.



2**. Bevel gears:** These are used for transmitting power/drive between shafts at angles.

3. **Rack and pinion gears:** These gears are used for converting rotary motion of the pinion to linear motion of the rack.



4. **Helical gears**: These gears can transmit motion and power between either parallel or right angle shafts.

5. **Worm gears**: These gears operate silently and smoothly. They can be used for reducing speed and increasing torque.

LUBRICATION OF GEARS

Lubrication is the application of oily or greasy substance to machine parts in order to reduce friction. The substance applied (such as oil or grease) is called lubricant.

The purpose of lubricating gears is as follows:

1. To promote sliding between teeth to reduce the coefficient of friction
2. To limit the temperature rise caused by rolling and sliding friction.

Methods of Lubrication

There three gear lubrication in general use

1. Grease lubrication
2. Splash lubrication (oil bath method)
3. Forced oil circulation lubrication

There is no single best method or lubricant. Choice depends upon tangential speed and rotating speed. At low speed, grease lubrication is a good choice. For medium and high speeds, splash lubrication and forced oil circulation are more appropriate, but there are exceptions. Sometimes, for maintenance reasons, a grease lubricant is used even with high speed.

USES OF GEAR

1. Gears are used to transmit power from one shaft to another.
2. They are used to change the speed of shafts to either high or low speed.
3. They also change the running direction of a shaft.

EVALUATION

1. Define (a) Gear (b) List three types of gear and the uses
2. State the uses of gear
3. State the methods of gear lubrication

GENERAL EVALUATION

1. Mention three (3) types of gear and their applications.
2. Sketch a spur gear.

READING ASSIGNMENT

Read about gear ratio and gear speed (NERDC Basic Tech. for JSS3 page 157-159)

WEEKEND ASSIGNMENT

1. ……. are used for transmitting drive between parallel shafts (a) Bevel gears (b) Spur gears (c) Rack and pinion gears (d) Lift
2. Which of the following is used for transmitting power/drive between shafts at angles (a) Spur gears (b) Leaf gears (c) Rack and pinion gears (d) Bevel gears
3. In Rack and Pinion gears,…… generate rotary motion (a) rack (b) spur (c) lift (d) pinion
4. A wheel with teeth around its rim that mesh with the teeth of another wheel to transmit motion is called (a) Belt (b) Chain (c) Gear (d) Clutch
5. …… are used to change the speed of shafts to either high or low speed(a) Chain (b) Belt (c) Clutch (d) Gear

THEORY

1. What is a Gear? (b) State three uses of gears
2. State three types of gears (b)Briefly describe the operation of gears

GEAR RATIO

Gear ratio is defined as the ratio of number of teeth of output to input gear or input speed relative to output speed. It is calculated by dividing the number of teeth on the driven gear by the number of teeth on the driver gear.

Gear ratio= Number of teeth on the driven gear

Number of teeth on the driver gear

Example: Calculate the gear ratio if a gear with 15 teeth is used to drive a gear with 30 teeth.
Gear ratio= Number of teeth on the driven gear= 30/15= 2/1
Number of teeth on the driver gear

Gear ratio= 2:1

Ratio of a Series of Gears
When power flows through a series of gears, the ratio can be calculated in a similar manner. For example, if a 20-tooth driver gear drives a 24-tooth cluster gear, and the second speed cluster gear has 16 teeth driving a 20-tooth second speed driven gear, this could be calculated as follows:
Driven/Driver x Driven/Driver= 24/20 x 20/16= 1:5:1

GEAR SPEED
Gear speed is a measurement of how quickly a gear spins, often in a relation to the rotations of other gears. The speed of rotation of a gear is directly proportional to the number of teeth of the gear. For example, the speed of a 5-tooth gear will be twice the speed of a 10-tooth gear.

Example: A gear has 20 teeth. Its speed of rotation is 10 rpm. The gear drives another gear with 10 teeth. Determine the speed of the 10-tooth gear.

Solution
20 teeth x 10 rpm= 10 teeth x X rpm
X rpm= 20 teeth x 10 rpm/10 teeth
X rpm= 20 rpm

EVALUATION QUESTIONS
1. What is gear ratio?
2. Explain gear speed

GENERAL EVALUATION
1. Calculate the gear ratio if a gear with 20 teeth is used to drive a gear with 40 teeth.
2. A gear has 10 teeth. Its speed of rotation is 20rpm. The gear drives another gear with 15 teeth. Determine the speed of the 15-tooth gear.

READING ASSIGNMENT
Read about hydraulics and pneumatic machines (NERDC Basic Tech. for JSS3 page 170-180)

WEEKEND ASSIGNMENT
1. Calculate the gear ratio if a gear with 12 teeth is used to drive a gear with 16 teeth. (a) 4:3 (b) 3:4 (c) 2:1 (d) 1:2
2. A gear has 15 teeth. Its speed of rotation is 25rpm. The gear drives another gear with 25 teeth. Determine the speed of the 25-tooth gear. (a) 10rpm (b) 20rpm (c) 15rpm (d) 30rpm
3. The ratio of input speed relative to output speed is…… (a) gear speed (b) gear ratio (c) gear decimal (d) gear fraction
4. The speed of rotation of a gear is ……. to the number of teeth of the gear (a) equal (b) unequal (c) inversely proportional (d) directly proportional
5. ……. is a measurement of how quickly a gear spins (a) gear ratio (b) gear speed (c) gear decimal (d) gear fraction

THEORY
1. Explain (a) Gear Speed (b) Gear Ratio

(a) A gear has 32 teeth. Its speed of rotation is 4rpm. The gear drives another gear with 8 teeth. Determine the speed of the 8-tooth gear.

WEEK: 9 **`DAY:** **SUBJECT:**

DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Explain the meaning of hydraulic and pneumatics**
2. **Types Identify and differentiate hydraulic and pneumatic devices**
3. **Uses / components of the machines**
4. **Operation and uses of the machines**

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards
CONTENT: HYDRAULIC AND PNEUMATIC - MACHINES
DEFINITION - HYDRAULICS AND PNEUMATICS
Hydraulics is the branch of science and technology concerned with the conveyance of **liquids** through pipes and channels, especially as a source of mechanical force or control. When **compressed air (gas)** is the liquid, it is called Pneumatics. Hydraulic systems tend to be used at a much higher pressure than pneumatic systems. Consequently, the former can produce much larger forces and torque than the latter.

SIMPLE HYDRAULIC AND PNEUMATIC MACHINES
1. Simple Force Pump: Pumps are used to move gases and liquids by applying pressure greater than those of the gases or liquids. The simplest pump is the bicycle pump that moves air through the pump to the bicycle. Another simple pump is the suction pump. It is used for lifting liquids from a low level.
2. Centrifugal pump: This has a set of moving vanes which receive the the fluid (air or water) at a smaller radius
3. Hydraulic Jack: The discharge action in the hydraulic jack moves the liquid into a high pressure compartment. The piston is equipped to carry heavy loads such as cars.
4. Garden sprinkler: This consists of one or more water jets which can revolve about the center as it sprinkles water in a lawn or garden.
5. Reaction turbine
6. The waterwheel

USES/APPLICATION OF PNEUMATICS
1. Air brakes on buses, trucks and trains
2. Air compressors
3. Air engines for pneumatically powered vehicles
4. Pressure sensor
5. Pressure regulator and switch
6. Vacuum pump etc

USES/APPLICATION OF HYDRAULICS
1. Hydraulic Press
2. Breaks in cars, motorbikes and bicycles often use hydraulic systems to force to break pads
3. Office chairs
4. Boats and airplanes
5. Excavators and dump trucks use hydraulic pistons to control their equipment

EVALUATION
1. Define (a) Hydraulics (b) Pneumatics
2. State five (5) hydraulic and pneumatic machines
3. List five(5) applications of Hydraulics and Pneumatics

GENERAL EVALUATION
1. Differentiate between Hydraulic and Pneumatic Systems
2. State five (5) applications each of Hydraulics and Pneumatics
3. List five (5) Hydraulic and Pneumatic devices

READING ASSIGNMENT
Read about Site Preparation (NERDC Basic Tech. for JSS2 page121-123)

WEEKEND ASSIGNMENT

1. The branch of science and technology concerned with the conveyance of liquids through pipes and channels, especially as a source of mechanical force or control.
   (a) Pneumatics (b) Hydraulics (c) Gearing system (d) Mechanical system
2. Which of the following can be used to carry heavy loads such as car?
   (a) Centrifugal pump (b) Garden sprinkler (c) The waterwheel (d) Hydraulic Jack
3. Examples of application of pneumatic include the following except (a) Pressure sensor (b) Office chairs (c) vacuum pump (d) pressure regulator
4. The following are applications of hydraulics except (a) Hydraulic press (b) Air compressor (c) Boats (d) Excavators
5. Excavators and dump trucks use _____ to control their equipment
   (a) hydraulicjack (b)hydraulic press(c)hydraulic pistons (d) hydraulic fluid

THEORY

1. List five application each of hydraulic and pneumatics
2. State five types of hydraulic and pneumatics machine with their uses

WEEK: 10 **`DAY:** **SUBJECT:**
DATE: **TOPIC:**
SUBTOPIC: **PERIODS:** **DURATIONS:**
LEARNING OBJECTIVES: At the end of the lesson, students should be able to

1. **Define the meaning of site preparation**
2. Identify / state various tools in site preparation
3. State their uses
4. Define excavation and timbering

KEY VOCABULARY WORDS:

INSTRUCTIONAL MATERIALS: Wall charts, Pictures, Related Online Video, Flash Cards

CONTENT: BUILDING CONSTRUCTION – SITE PREPARATION

Site preparation involves the removal of trees, demolishing buildings, removing any and all old underground infrastructures, and any other things that might affect the construction process in the future or hinder the project to be done.

In various building projects, site preparation is very essential. The site may be a thick bush with big trees or a swampy and waterlogged area or a site with small hills and valley covered with stones and rock, or even a site with old and abandoned buildings.

TYPICAL HAND TOOLS IN SITE PREPARATION

Among the typical hand tools in site preparation operations are:

1. **Spade:** Used for digging relatively loose or soft earth
2. **Shovel:** Used for lifting and throwing loose materials (aggregates) or soft earth into another position and for spreading and leveling the earth.
3. **Matchet:** Used for cutting grasses or wood like tree branches and shrubs
4. **Hoe:** Used for digging usually about the surface level of the ground.
5. **Axle:** Used for cutting bigger branches.
6. **Chain saw:** Used for felling trees and for cutting the trunk into smaller lengths

MECHANICAL TOOLS USED IN SITE PREPARATION

Mechanical tools, which are also very valuable in speedy operations of site clearing, tackle the bulk of the heavy jobs on the site. Among these are following:

1. **Bulldozer:** This is a very powerful machine, which can push down almost any obstacle on its way and clear them from the site.
2. **Tractor shovel (pay loader):** This machine has a tipping bucket at the front. It is used for lifting large quantities of loose materials at a time and loading them into trucks or tippers.
3. **Grader** is used mainly for grading, that is, for trimming of bank or edges of roads and for cutting ditches

REMOVAL OF VEGETABLE SOIL SMALL TREES AND SHRUBS

The bulldozer is moved in to push down unwanted structures like old buildings and to uproot trees and shrubs. This debris is moved away to the site where parts of the trees are later salvaged for firewood. The bulldozer then scraps or excavates the topsoil to a depth of between 150mm and 300mm for the entire surface area of the site.

To prevent weed growth, an herbicide is applied. Herbicide is chemicals that are capable of preventing the growth of weeds when applied on a building site.

Herbicides

1. **Round up*:***This is a general-purpose herbicide
2. **Grammazon*:***This is another trade name for a type of herbicide used on building site.

Techniques for Grubbing out roots and stumps

It is better to first fell the trees, cut the trunk and transport to the sawmill for conversion into timber. The stump left is then tackled. Some digging is done around the tree stump to expose the roots, which are then cut either with an axe or the chain saw and the stump finally pulled out by the bulldozer.

LEVELING THE SITE

When all the tree stumps and roots have seen grubbed out and the top vegetable soil excavation to a depth of between 150mm and 300mm, a grader is moved in, to level the site. Here, earth is cut from the higher ground and moved down to fill valleys, holes and gullies.

EXTERMINATION OF TERMITES AND THEIR NESTS

When termite's nests and anthills are found on the construction site they should be destroyed. The anthill is knocked down and some poisonous chemicals like Gamaline or antitermite chemicals are mixed and poured into the nest to kill the termites.

GENERAL EVALUATION

1. Explain Site Preparation
2. State five (5)tools used in site preparation

READING ASSIGNMENT

Read about Setting out (NERDC Basic Tech. for JSS2 page123-126)

WEEKEND ASSIGNMENT

1. Which of the following is not a hand tools for site preparation? (a) spade (b) shovel (c) axle (d) grader
2. Which of the following is a mechanical tool used in site preparation? (a) matchet (b) bulldozer (c) chain saw (d) hoe
3. Which of the following is used for lifting large quantities of loose materials at a time and loading them into trucks or tippers? (a) grader (b) bulldozer (c) matchet (d) chain saw
4. One of the anti-termite chemicals used to exterminate termites from sites is (a) Marline (b) Gamaline (c) Benzene (d) Ester
5. Which of the following chemicals is used for general purpose prevention of the growth of weeds (a) Round up (b) Grammazon (c) Gamaline (d) Benzene

THEORY

1. Explain the following processes (a) Techniques for Grubbing out roots and stumps (b) Leveling the site.
2. State the uses of three (3) mechanical tools used in site preparation

TOPIC: SETTING OUT

Anybody wishing to construct a building usually first consult an architect on the need for a building and the type of building wanted. An architectural design is sent to the structural engineer, who determines and specifies the strength and type of building material to be used. The quantity surveyor studies the working drawing of the proposed building determines the cost of materials, labour and workmanship. Finally, a construction company wins the contract for the construction of the building.

SETTING OUT

Building construction start with setting out

Setting out is, therefore, a process of driving wooden pegs into the ground here and there, in a manner that agrees with the dimensions of the building specified on the architect's drawings.

Setting out is also the process of transferring with high degree of skill and accuracy, the detail of the foundation plan from the drawing sheet on the ground, with pegs, lines and tapes.

Working drawings include following drawings:

1. The floor plan
2. The elevations
3. The sections
4. The detailed drawing
5. The schedules
6. The electrical plan
7. The plumbing plan

The following tools are used for setting out

1. Steel rule
2. Builder's square
3. Theodolite

When the concrete footing for the foundation has been cast and cured lines for the thickness of the wall are run and plumbed down to the concrete footing and the first course of the concrete block wall is laid.

EVALUATION

1.What is setting out?

2. Mention the tools used for setting out

EXCAVATION

When foundation plan for a building has been transferred on to the site, by way of setting out, excavation begins. For very big structures like stadium or a multi-storey building, the trenches for the column foundation or wall foundation can be mechanically excavated. Holes are mechanically bored where bored *piled* foundation has been recommended.

TIMBERING

This is the process of supporting the walls of the excavated pit with timber, for the purpose of safety.

CONCRETE AND ITS MATERIALS

Concrete consists of a matrix or binding material (cement), fine aggregate (sand) and coarse aggregate (stone) mixed thoroughly with water. Concrete, therefore, is a composite material in which a binding material mixed with water o solidification binds the inert materials – the particles of well- graded fine and coarse aggregates. Green concrete is used in the construction of footings, foundations, slabs, columns, lintels, beams, steps, and walls. It resists decay moisture and corrosion from acids. *REINFORCED* concretes are concrete having steel rods or welding wire mesh.

A good concrete should be strong, durable, hard, dense, non-porous, fire resisting and economical.

EVALUATION QUESTIONS

1. Define (a) Excavation (b) Timbering
2. Mention the materials used for making cement.

GENERAL EVALUATION

1. Define the following a) excavation b)timbering (c) setting out
2. Mention things involve in working drawings.

READING ASSIGNMENT

Read more on setting out (NERDC Basic Tech. for JSS2 page123-126)

WEEKEND ASSIGNMENT

1. The process of supporting the walls of the excavated pit with timber (a) excavation

(b) timbering (c) concrete (d) coarse aggregates
2. Which of the following is not used for setting out right-angled triangles and squaring
(a) steel square (b) builder's square (c) concrete (d) Theodolite
3. Which of the following is not a required expectation of a good concrete (a) strong and hard (b) durable and fire resisting (c) non-porous and economical (d) weak and poor
4. The process of transferring with high degree of skill and accuracy, the details of the foundation plan from the drawing sheet on to the ground with pegs, lines and tape.
(a) Timbering (b) working drawing (c) setting out (d) site preparation
5. Which of the following professional plans and designs a building that satisfies the wishes and needs of the client? (a) Quantity surveyor (b) structural engineer (c) architect
(d) plumber

THEORY

1. Define (a) setting out (b) timbering (c) excavation
2. State and discuss six (6) working drawings used by building worker.

WEEK: 11- REVISION

WEEK: 12- EXAMINATION