FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI

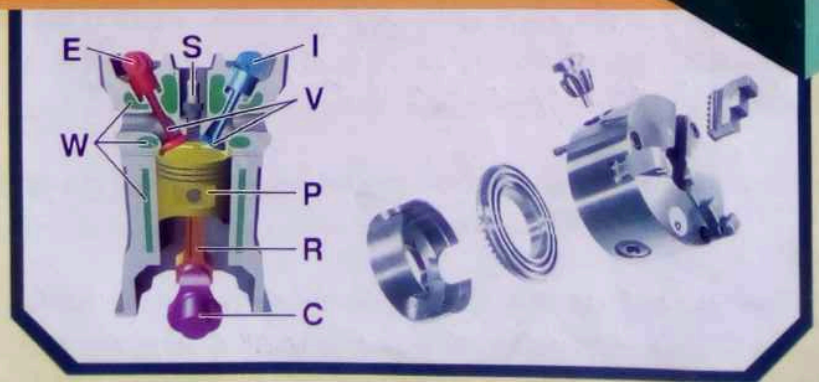
DEPARTMENT OF MATERIALS & METALLURGICAL ENGINEERING

LABORATORY MANUAL & EXERCISES

For

(ENGINEERING WORKSHOP PRACTICE II)

ENG 102



job cannot be done safely; then it should not be done at all. We know that when a [illegible] makes a mistake, someone else may die; but when an engineer makes a mistake, he is likely to be the first victim. Every engineer must take his safety and the safety of other workers around him very seriously.

Many countries have enacted their own version of ***safety legislation*** in compliance with ILO Convention. In Nigeria, it is currently the **Factories Act of 1990** (Cap. 126). The purpose is to among others,

- Secure the health, safety and welfare of persons at work.
- Protect persons other than those at work, against risks to health or safety arising out of or in connection with the activities of persons at work.
- Involve everyone, both management and employees, and make them all aware of the importance of safety and health.

Problem 2.1:

Enumerate two safety measures you would employ to combat **dust and fumes** in industrial atmospheres:

a. Totally enclose the process concerned to prevent the escape of dust and fumes

b. Using a properly designed tool or exhaust system.

Problem 2.2:

State two safety strategies you would use in the event of **noise pollution**:

a. If it is not possible to reduce the noise level, screen the operator from the noise by means of walls or acoustic panel.

b. Locate the source and reduce the noise level.

Problem 2.3:

What three safety precautions would you use to prevent the condition known as industrial **dermatitis**?

a. Wear protective clothing which should always be cleaned and isolated from other clothing.

b. Use mechanical aids such as tongs, scrappers etc.

c. Bath always with water and use clean towels.

Problem 2.4:

Give the appropriate name for the disease condition resulting from inhalation of the fumes or dust of the following toxic substances:

a. Aluminium: Aluminosis in the lungs

b. Silicon: Silicosis.

Problem 2.5:

a. The part of files and rasps where handles are fitted is called Tang.

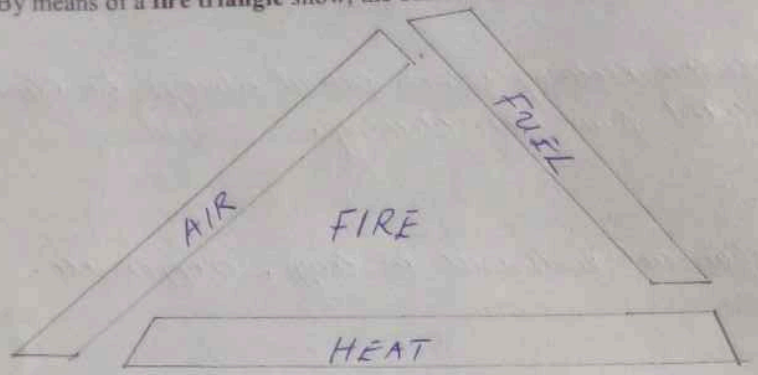
b. The moving parts of machine tools are usually protected to prevent accidental access. This protection is done by means of

Problem 2.6:

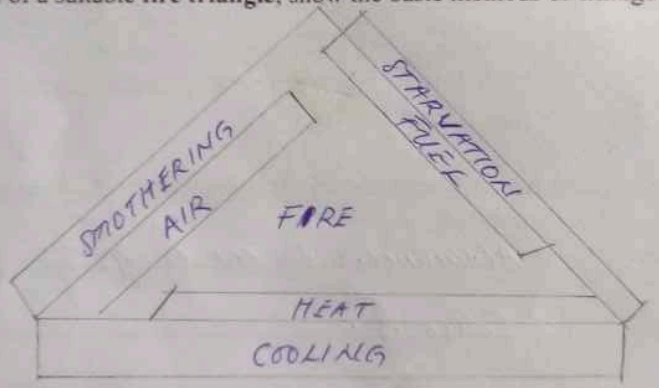
A safety device that is aimed at stopping electrically powered equipment in an emergency is called Isolator Switch.

Problem 2.7:

a. By means of a **fire triangle** show, the basic elements required to initiate and sustain fire.



b. By means of a suitable **fire triangle**, show the basic methods of extinguishing fire.



Problem 2.8:

Identify the following safety equipment (PPE) by writing the correct name beneath the corresponding equipment.

SPECTACLES (WITH SIDE SHIELD)

EYESHIELDS

GOGGLES

FACE SCREEN

FACE SHIELD

Problem 3.1:

a. A manufacturing process that involves material removal in order to shape useful products is generally referred to as: Machining

b. Four major property requirements of cutting-tool materials are:

i. Resistance to abrasion, diffusion, spalling and plastic deformation.

ii. High hardness for easy penetration into the workpiece

iii. Resistance to high temperatures which would otherwise diminish the aforementioned qualities

iv. Toughness and high mechanical resistance to bending, and to compression so that it can withstand cutting forces.

c. Name any three cutting-tool materials:

i. Sintered ceramics (oxides)

ii. Cast alloys

iii. Cubic Boron Nitride (CBN)

d. Two functions of **cutting fluids** include:

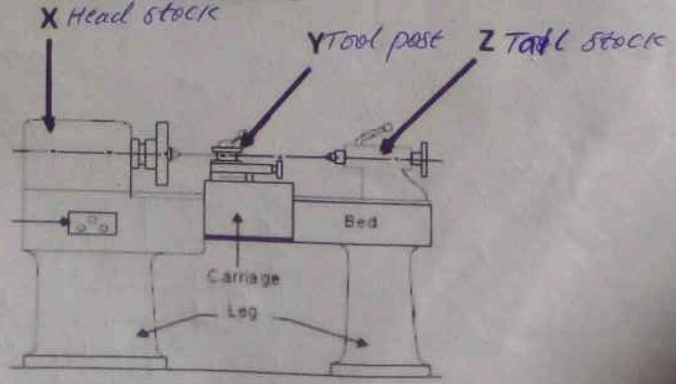
i. Improved machine ability and reduced power consumption.

ii. Improved control of dimensional accuracy.

Problem 3.2:

a) Identify the parts/components labeled X, Y and Z in the figure below by writing their names above the letters as appropriate. Which machine tool is shown in the figure?

CENTRE LATHE MACHINE.



Problem 3.3:
A cylindrical job 120 mm diameter is to be turned at a cutting speed of 30 m/min, the feed being 1.8 mm/rev. if the length of the job is 200 mm find the time required for 1 cut. (Use the space below for your calculations)

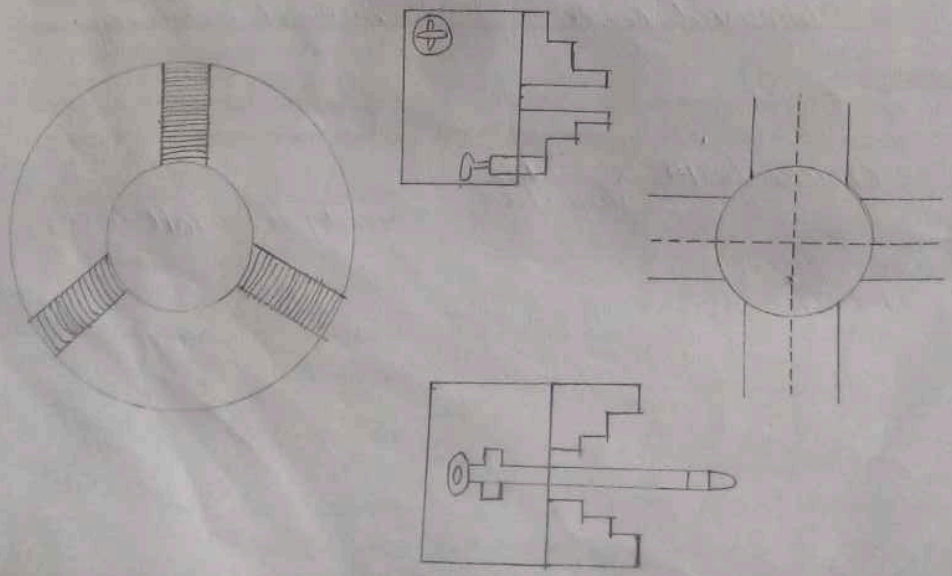
$$\text{Speed} = \frac{1000(S)}{\pi d} = \frac{1000 \times 30}{3.142 \times 120} = 80 \text{ rev/min}$$

$$\text{Number of revolution required} = \frac{\text{length of work}}{\text{Feed per revolution}} = \frac{200}{1.8} = 111.11 \text{ rev}$$

$$\Rightarrow \text{Time for one cut} = \frac{\text{Revolution required}}{\text{Rev/min or work pieces}} = \frac{111.11}{80} = 1.39 \text{ min}$$

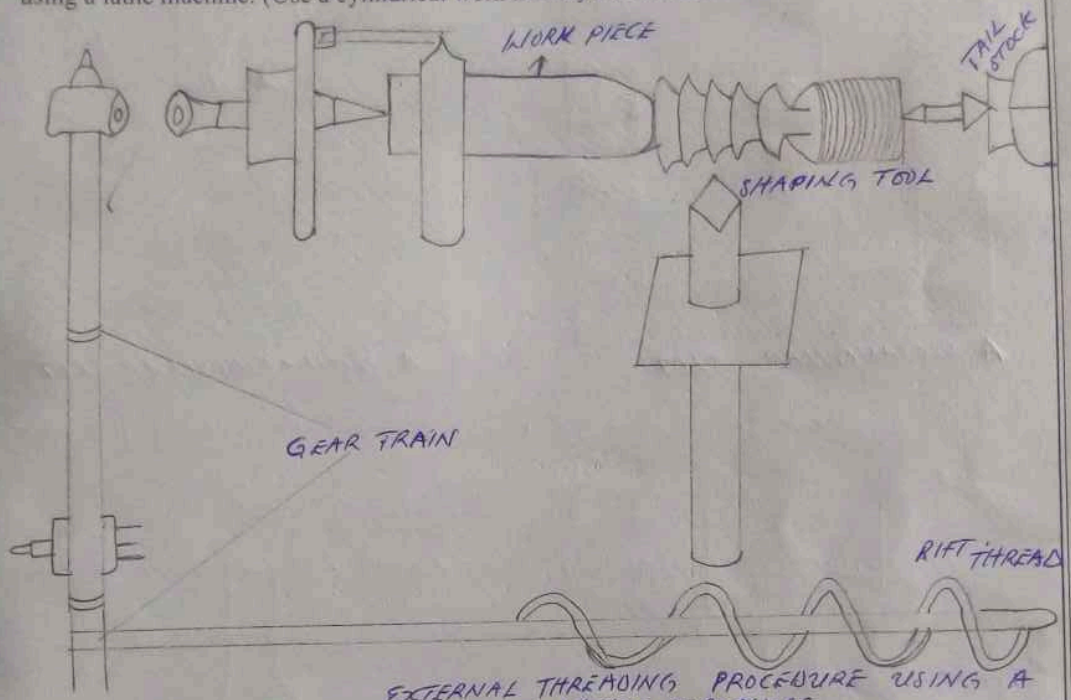
Problem 3.4 (LATHE):
In the space below, sketch:

(i) A four-jaw independent chuck and
(ii) A three-jaw self-centered chuck of a lathe machine.



Problem 3.5 (USING A LATHE):

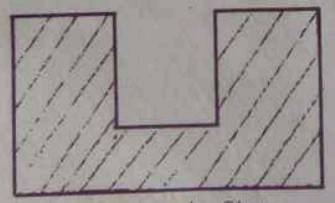
In the space below, draw a schematic sketch to illustrate the external threading procedure using a lathe machine. (Use a cylindrical work held by the chuck for this sketch.)



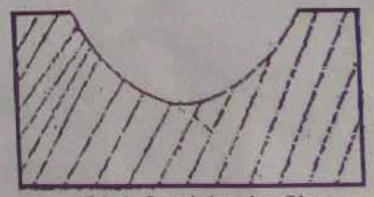
EXTERNAL THREADING PROCEDURE USING A LATHE MACHINE

Problem 3.6 (MILLING):

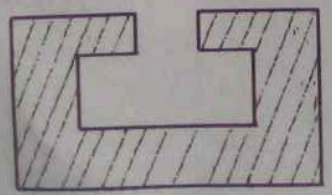
Use the blank space on page 10 to draw the appropriate milling cutters that will produce the following shapes on work pieces. Show the directions of motion of work pieces and the direction of rotation of the cutters.



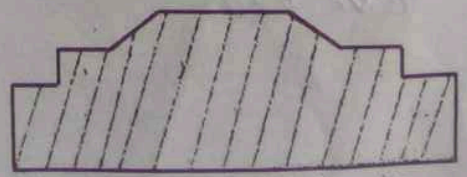
(a) Rectangular Slot



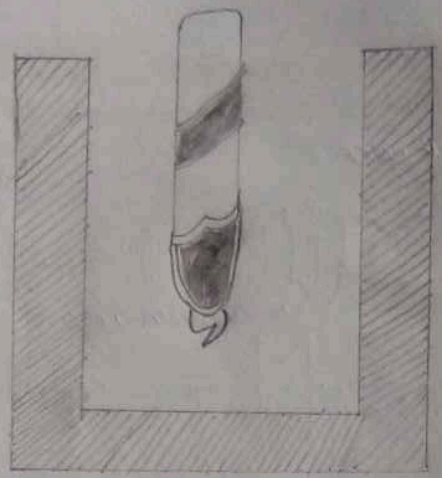
(b) A Semicircular Slot



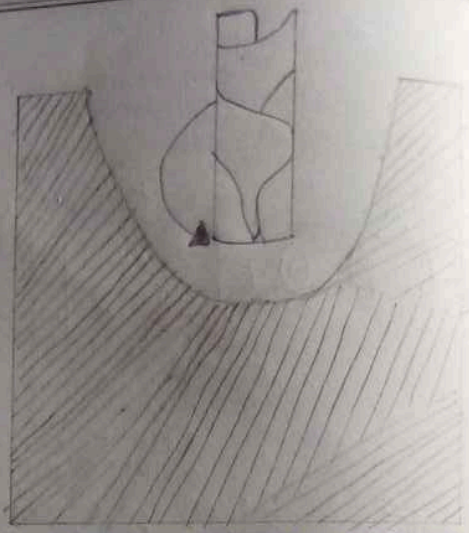
(c) Dovetail Slot



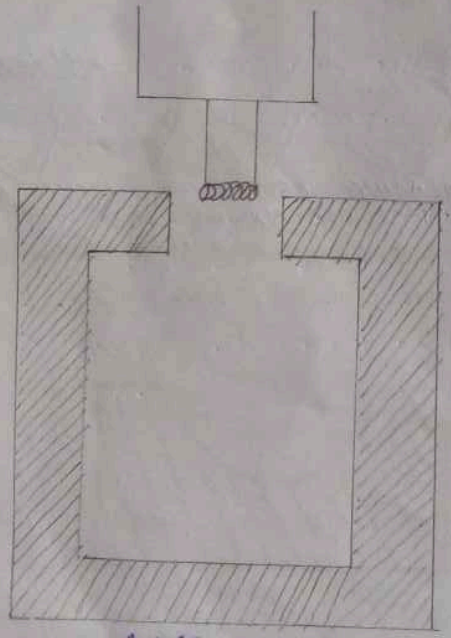
(d) A Complex Surface Configuration



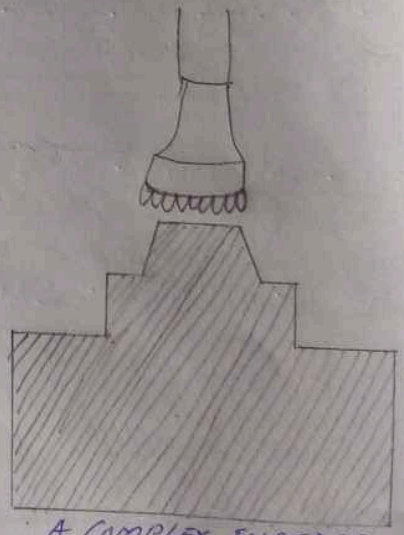
A RECTANGULAR SLOT



A SEMI-CIRCULAR SLOT



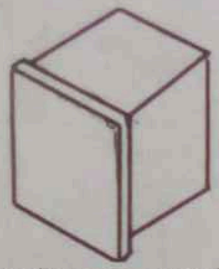
DOVE TAIL



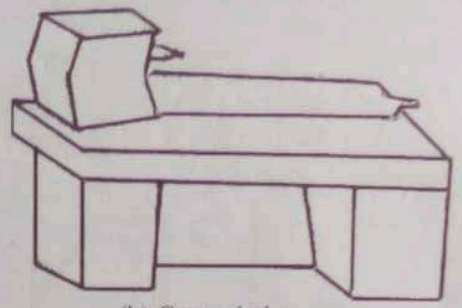
A COMPLEX SURFACE CONFIGURATION

Problem 3.7 (SAFETY DEVICES IN MACHINE TOOLS):

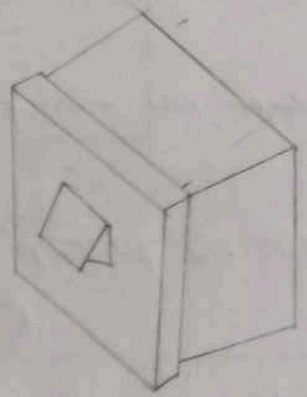
Re-sketch the following in the space below and include the missing precautionary safety devices.

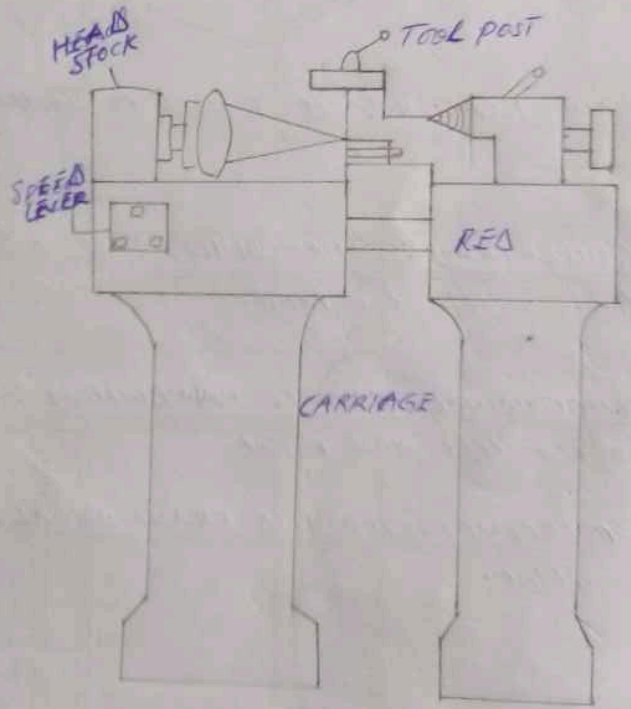


(a) Stop button on a machine



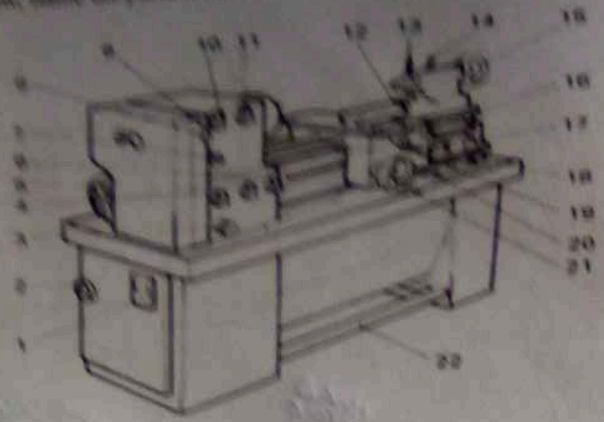
(b) Centre lathe





A CENTRE LATHE MACHINE

Problem 3A (IDENTIFICATION OF PARTS IN MACHINE TOOLS):
In the figure below, name the parts labelled 2, 15, 21 and 22 and state their functions



(2) MAIN MOTOR :- It is used to transform the main electric section

(15) CROSS-TRAVERSE HANDWHEEL :- It moves the table up and down towards the head

(21) LONGITUDINAL-TRAVERSE HANDWHEEL :- It moves the workpiece to the left and right

(22) EMERGENCY-STOP AND BRAKE PEDAL :- It is used to stop the machine.

F. Starter Unable to Crank Engine	
Possible Cause	
i. Dead battery	Charge or replace battery
ii. Loose or dirty battery connections	Clean and tighten connections
iii. Defective starter switch or solenoid	Replace switch or solenoid
iv. Defective starter	Replace starter
v. Engine bearings too tight	Install correct bearing
vi. Piston to cylinder wall clearance too small	Fit pistons correctly

Problem 4.1:

1. All the systems of the automobile can be grouped into four basic assemblies, namely:

a. Engine

b. Drive train

c. Chassis or support and control system

d. Body

Problem 4.2:

Explain the following terms as used in automobile diagnosis and repairs:

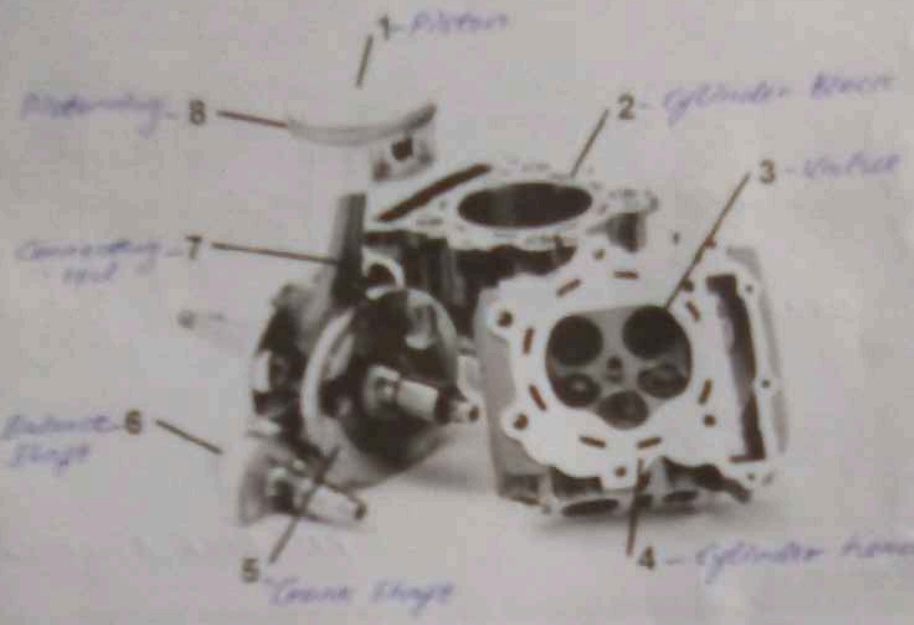
a. **Redlining:**

Redlining refers to the maximum engine speed at which an internal combustion engine or tractor motor and its components are designed to operate without causing damage to the components themselves or other parts of the engine.

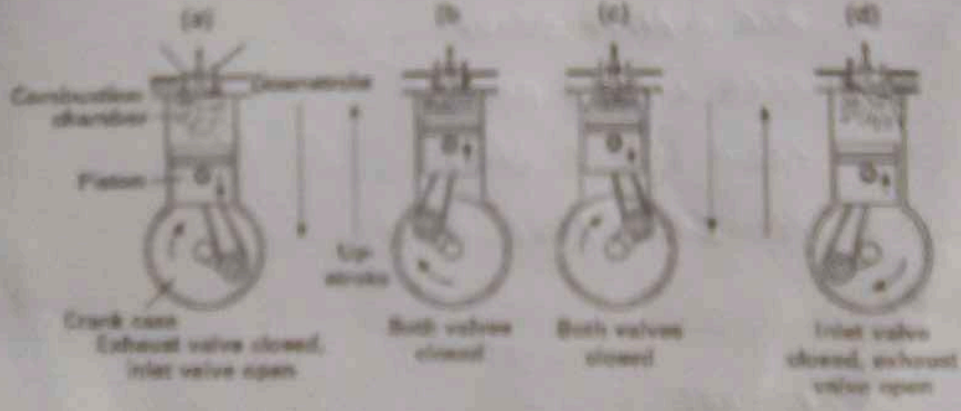
b. **Tune-up:**

A set of adjustment made to an engine to make it more efficient is known as tune-up. In Nigeria today, the car owner goes to the mechanic to change the plugs, drain the oil change the filter and contact set.

Problem 4.3:
Eight parts of a four-stroke cycle engine are indicated in the figure below. Identify them.



Problem 4.4:
Identify the various stages of the engine operations shown below



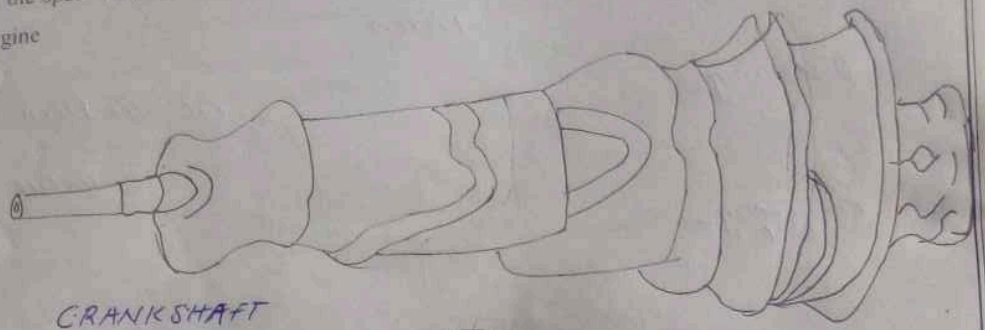
(a) Admission of fuel mixture

(b) Compression

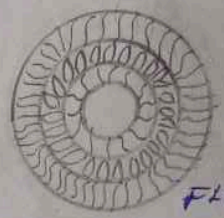
(c) Power

(d) Exhaust

Problem 4.5:
In the space below sketch the crankshaft and the flywheel assembly for a 4 cylinder in-line engine



CRANKSHAFT



FLYWHEEL ASSEMBLY

Problem 4.6:
Provide the full meanings of the following abbreviations as encountered in automobile work:

(a) TDC: TOP DEAD CENTRE

(b) BDC: BOTTOM DEAD CENTRE

(c) AWD: ALL WHEEL DRIVE

(d) RWD: REAR WHEEL DRIVE

(e) FWD: FRONT WHEEL DRIVE

(f) 4WD: FOUR [4] WHEEL DRIVE

Problem 4.7:
The automobile ignition switch has four positions, name them:

i. ACCESSORIES

ii. OFF

iii. ON

iv. START

Problem 4.8:
Use the space below to answer the following questions:

a) An eight cylinder engine has bore of 90mm and stroke of 73mm. Determine the approximate engine capacity in (i) cubic centimeters (cc), and (ii) litres.

b) A six cylinder engine has bore of 80mm and stroke of 70mm. Calculate the engine capacity approximately in (i) cubic centimeters (cc), and (ii) litres.

DO YOUR CALCULATIONS ON THIS PAGE

4.8(a)

(i) Engine capacity $= \frac{\pi d^2 b \times 9}{4}$

$= \frac{3.142 \times (9)^2 \times 7.3 \times 8}{4}$

$= 3715.7cc$

(ii) In litres

$1cc = 0.001L$

$3715.7cc = 3.7157$ litres

4.8(b)

(i) Engine capacity $= \frac{\pi d^2 b \times 9}{4}$

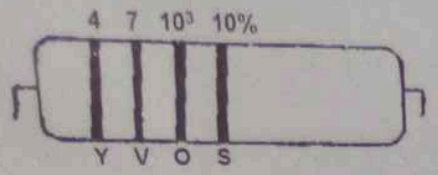
$= \frac{3.142 \times (8)^2 \times 7 \times 6}{4}$

$= 2111.4cc$

(ii) In litres

$1cc = 0.001L$

$\Rightarrow 2111.4cc = 2.1114$ litres



- Y = 4, V = 7, O = 000, G = 10%

$\Rightarrow 47000\Omega \pm 10\%$

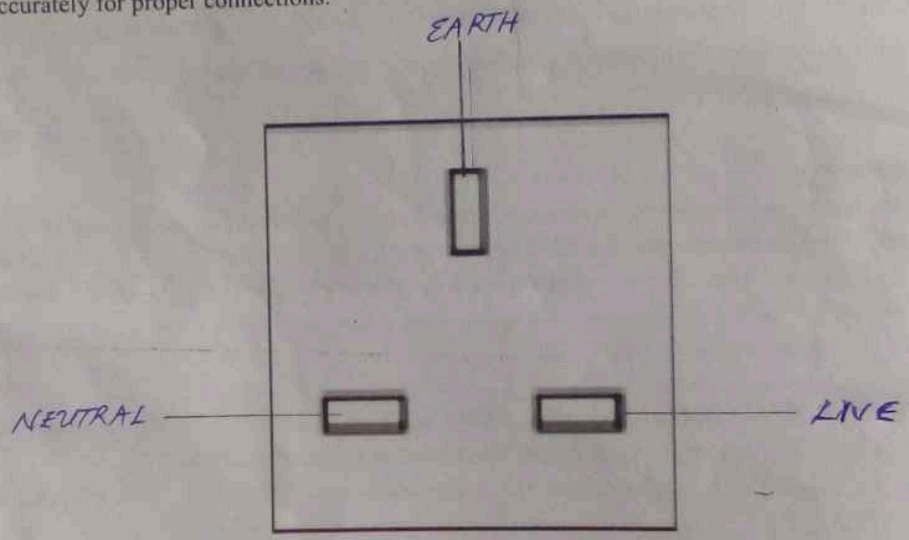
$\Rightarrow 47000 - 0.1 \times 47000 = \mathbf{42,300\Omega}$

to

$\Rightarrow 47000 + 0.1 \times 47000 = \mathbf{51,700\Omega}$

NOTE: When the band rate reaches 4 and above, there should be a tolerance. When you pick a resistor to read, observe that the area bearing the tolerance is smaller than the colour bands.

Problem 5.1:
The figure below shows a socket-outlet viewed from the front. Label the rectangular holes accurately for proper connections.



Problem 5.2:

a) When is an electrical circuit said to be complete?

b) Explain the terms wire and cable

c) What does the law of cable say?

(a) A complete electrical circuit is a never ending loop of electrons. If we take a wire and loop it around, it forms a continous path in which electrons can flow forever.

(b) A wire is a single, usually cylindrical, flexible stand or rod of metal used to bear mechanical loads or electricity.

A cable is an assembly of one or more wires running side by side or bundled.

(c) The law of cable says that the bigger the cable, the lesser the current it consumes.

Problem 5.3:

a) Given a resistor with the colour bands Black, Red, and Yellow. What is the value of the resistor?

b) Represent this resistor diagrammatically.

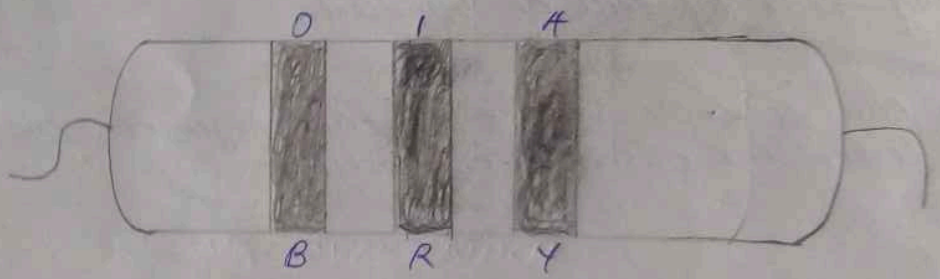
(A) (i) Band [A] – Black has a value of 0

(ii) Band [B] – Red has a value of 1

(iii) Band [C] – Yellow has a value of 4

∴ The resistor has a value of 200,000Ω

(B)



Problem 5.4:

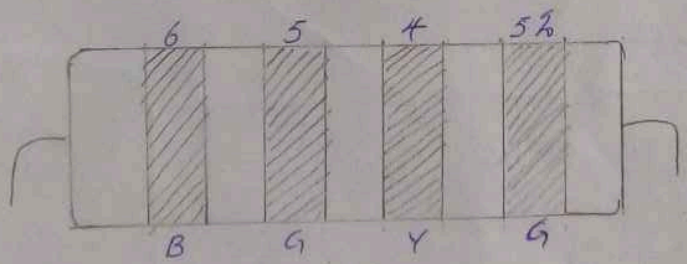
a) What do you understand by the term resistance of a resistor?

b) Given a resistor with the colour blue, green, yellow, and gold painted on its body. What is the value of the resistor?

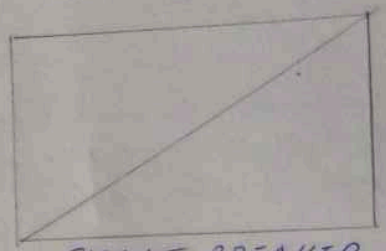
c) Represent this resistor diagrammatically.

(a) The resistance of a resistor is a measure of the opposition of the flow of current through a circuit.

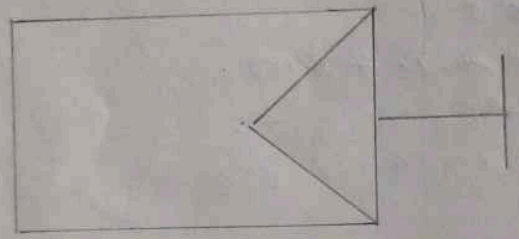
(b) By using the resistor table
Blue has value of 6
Green has value of 5
Yellow has value of 4. Ie 4 zeros.
Gold indicates a tolerance of 5%
∴ The value of the resistor is 650,000 Ω 5%



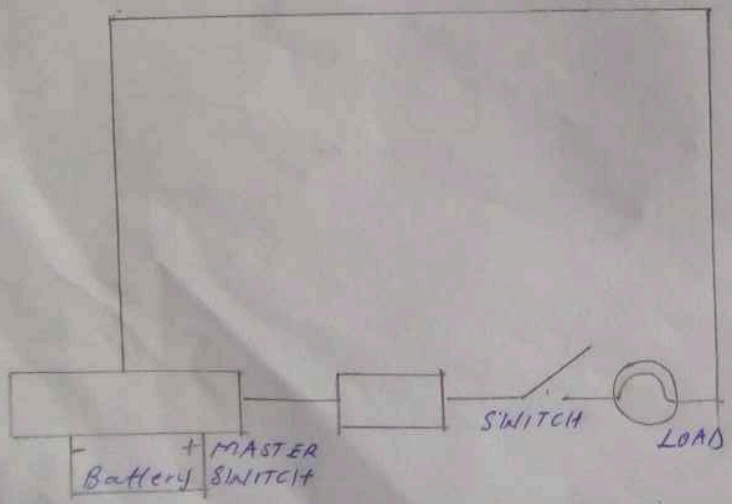
Problem 5.5:
Draw the symbols for: (i.) A circuit breaker, (ii.) A change-over switch, and (iii.) A circuit with a lamp showing a two-way switch.



CIRCUIT BREAKER



CHANGE OVER SWITCH



A LAMP CONTROLLED BY TWO WAY SWITCH