CREAMHILL SCHOOLS – MULAGO

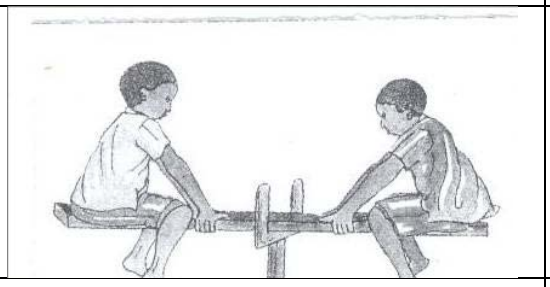
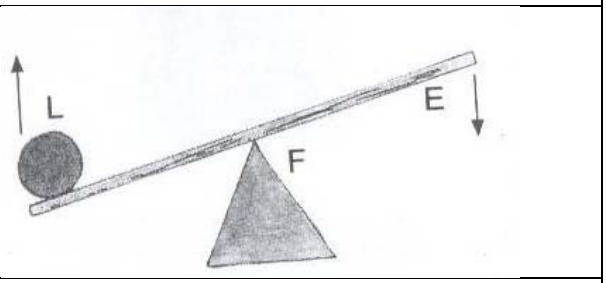
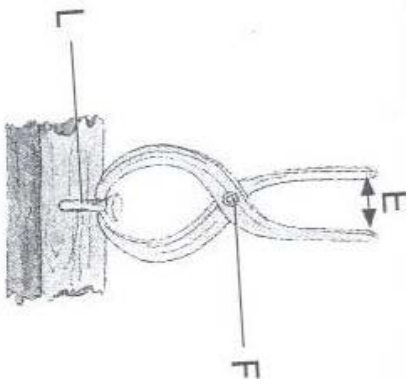
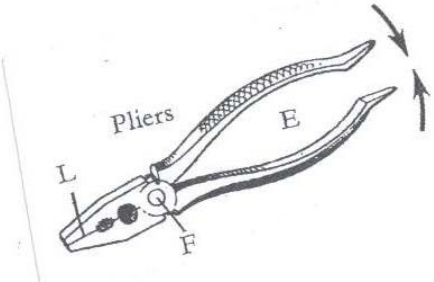
SCIENCE P.7

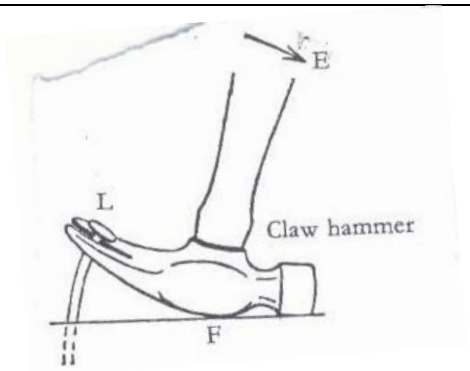
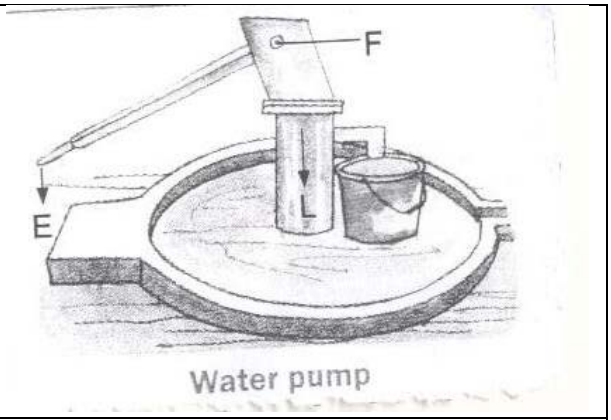
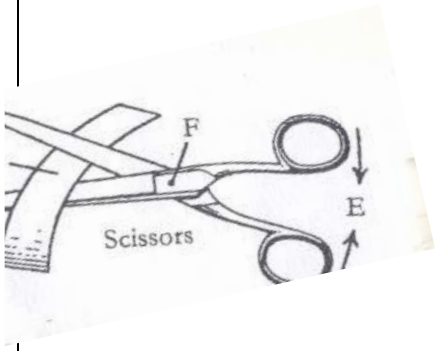
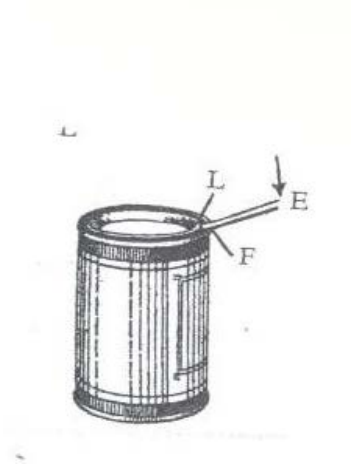
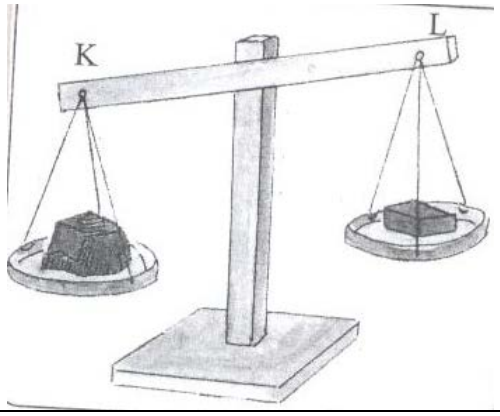
First class levers (copy this in your class work books and answer the questions that follow accordingly)

Fulcrum/pivot is between the load and effort

In this class, the effort arm is longer than the load arm.
The longer the effort arm, the smaller the effort applied.
The advantage of the first class lever is that less effort is used.

Examples of first class levers.

1	See saw	5	Crow bar
			
2	pincers	6	pliers
			
3	Claw hammer	7	Water pump

			
4	scissors	8	Lid opener
			
9	scales		
			

<u>Second class lever</u>

Load is between the **fulcrum** and **effort.**

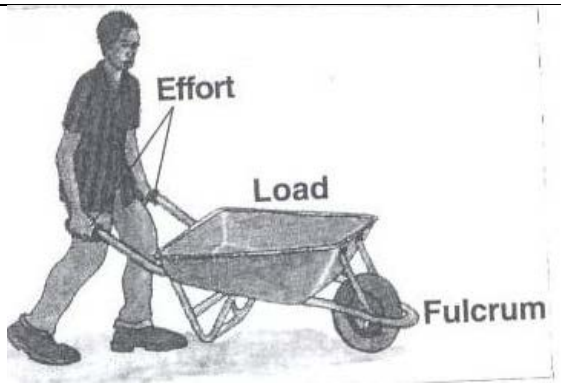
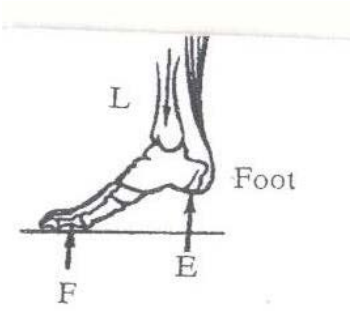
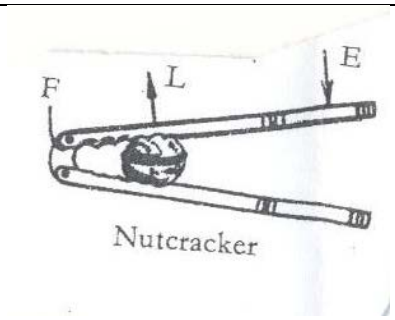
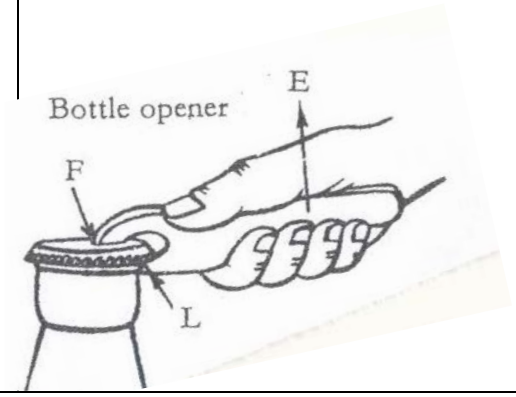
The fulcrum and the effort are on either side. (FLE OR ELF)

The load is closer to the fulcrum than the effort

The effort applied is smaller compared to the load.

First and second class levers are referred to as force multipliers

Examples of second class levers.

1	Wheel barrow	3	Human Foot
			
2	Nut cracker	4	Bottle opener
			

Questions.

1. Write down any two examples of each of the following.
   a) 1st class lever b) second class lever
2. State any one advantage of using first class lever?
3. Draw one any two items in 1st class lever.
4. How are machines important in life?
5. State any two ways in which machines are able to improve on the efficiency of a machine

LESSON TWO

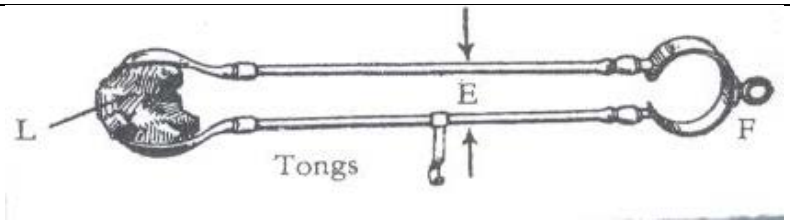
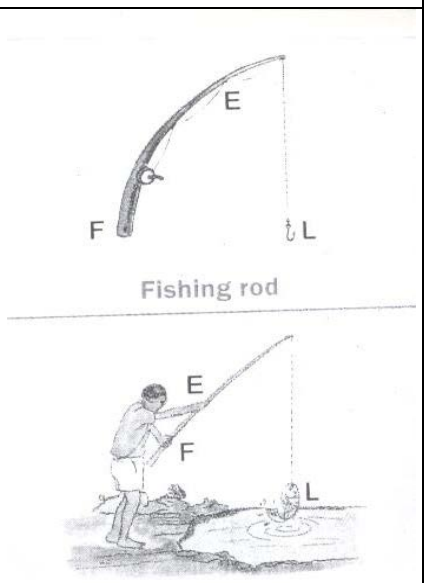
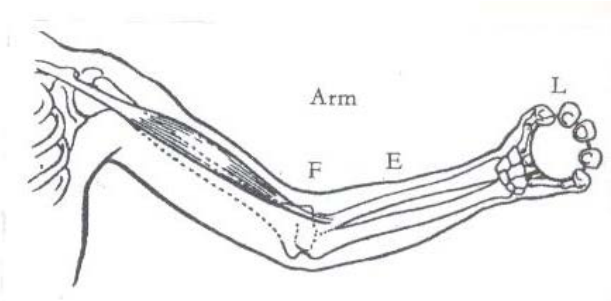
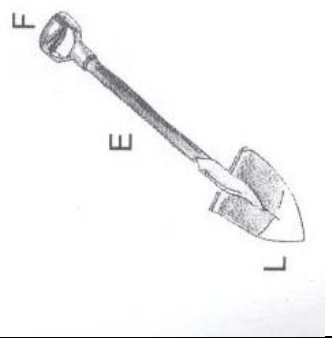
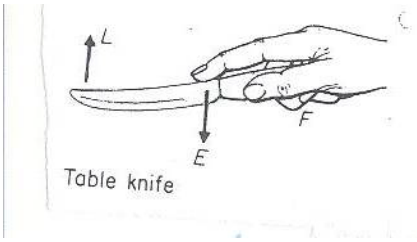
Third class levers

Effort is between fulcrum and load
The fulcrum and the load are on the either side. (FEL)

The effort is closer to the pivot than the load
The effort used is greater than the load.
Third class levers are referred to distance multipliers.

The advantage of using this class is that the effort moves through a shorter distance

Examples of third class levers

1	Sugar tongs	3	Fishing rod.
			
2	Human arm.	4	Spade.
			
5	Table knife	6. Tweezers	
	 		

N.B

The formula PLE or FLE can help to determine the class of lever

SUMMARY EXERCISE;

1. Name any two examples of the following classes of levers;
   a) Second class levers
   b) First class levers
   c) Third class levers

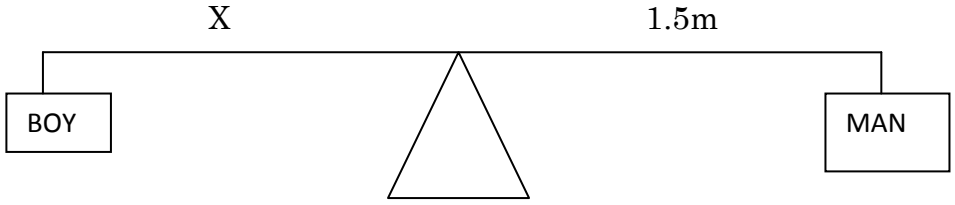
2. Why is a pair of scissors grouped under first class levers?
3. Give one advantage of using first class levers.
4. Give reason why less effort is used to lift the load using first class levers.
5. Why is the first and second class levers called force multipliers?
6. Why is the third class of levers called a distance multiplier?

The principle of moments. (The law of the lever)

The load force multiplied by the load arm is equal to the effort force multiplied by the effort arm.// it states that clock wise moments are always equal to anti-clock wise moments

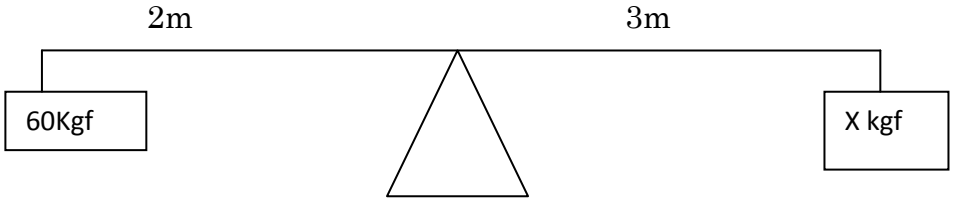
Examples

1. A man weighs 60 kgf. He sits 1.5 metres from the fulcrum of the see saw. How far from the fulcrum will the boy whose weight is 30 kgf sit in order to balance the man.
   Let the man be the effort and the boy be the load.
   Let the load be x metres.



   Load x Load arm = Effort x effort arm.
   30Kgf x X =60kgf x 1.5m
   $\frac{30x}{30} = \frac{90}{30}$
   x =3 metres

   2. A boy weighing 60kgf sits 2 metres away from the fulcrum of the see saw. A girl sits on the other side at a distance of 3 metres from the fulcrum in order to balance the see saw. Find the weight of the girl.



Let the boy be the effort and the girl the load.
Let the girl's weight be y
Then, Load x Load arm= Effort x Effort arm

y x 3m = 60Kgf x 2 metres.

$\frac{3y}{3} = \frac{120}{3}$

y = 40kgf

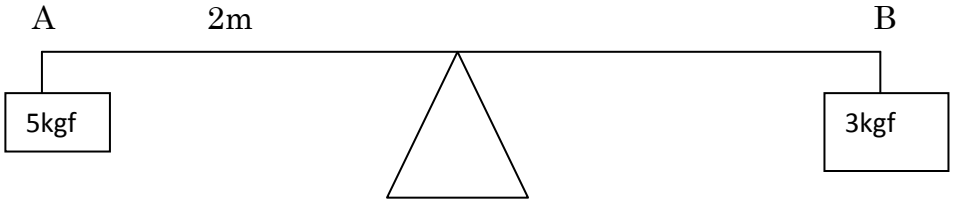
3. A weight of 120 grams at a distance 3cm from the fulcrum is balanced by a weight of 30g on the other side. Find the distance from the 30kg weight to the fulcrum.
Take 120kgf as the effort and 30kg as the load.
Let y be the distance of the load from the fulcrum.
Then Load x load arm = Effort x Effort arm.

30 x y = 120gf x 3cm

$\frac{30y}{30} = \frac{360}{30}$

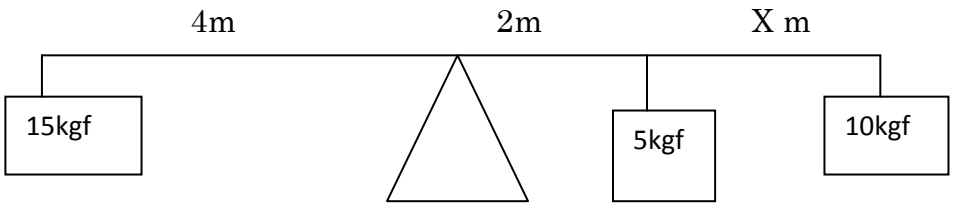
y =12cm

4.Using a see-saw shown below, find the length of the wooden plank AB.

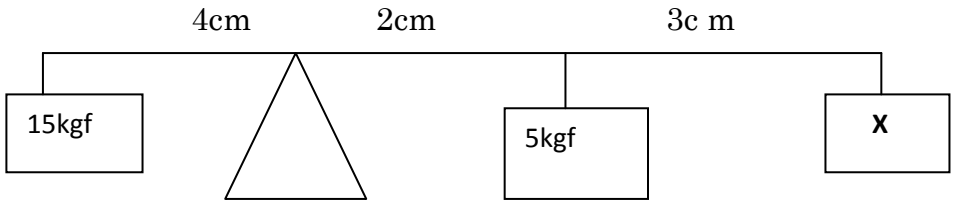


LESSON THREE.

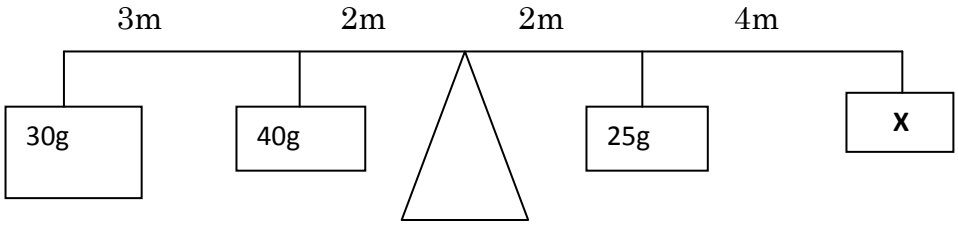
1.Find the value of X



2. **Find the weight at X**



3. Find the weight at X



LESSON FOUR.

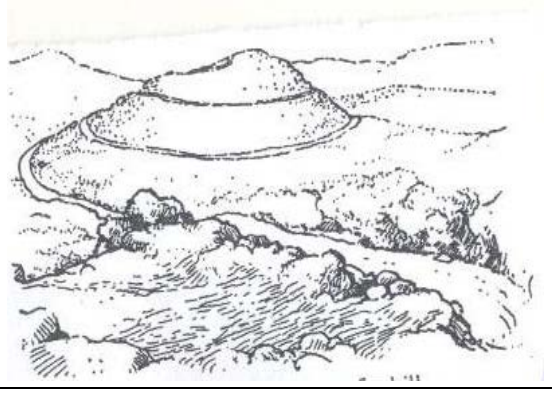
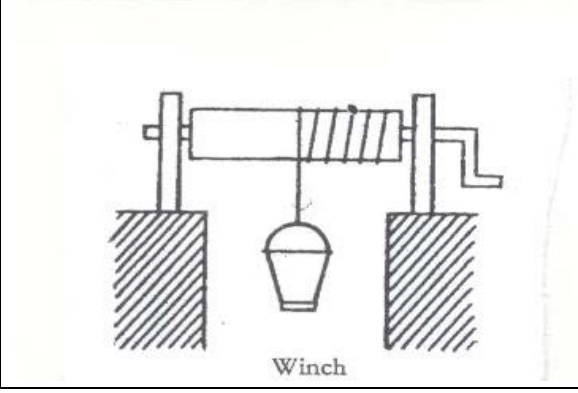
The inclined plane (slope)

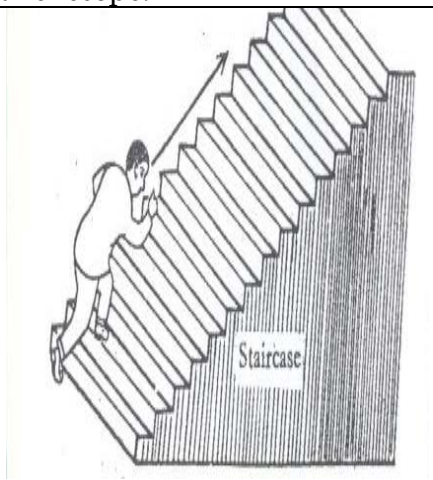
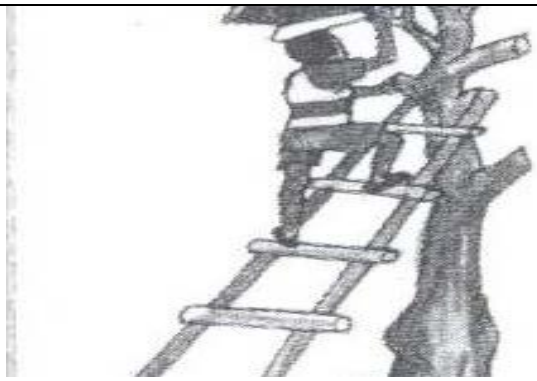
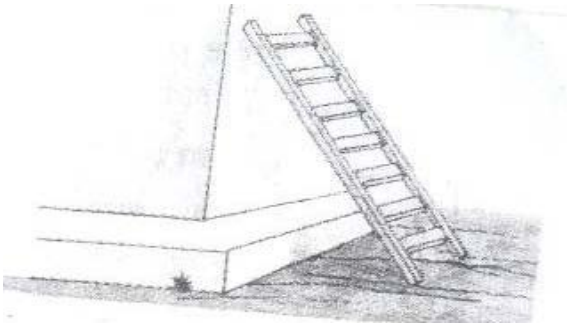
An inclined plane is a slanting surface.

Importance of an inclined plane.

- It enables heavy loads to be raised using a lesser effort.

examples of inclined plane

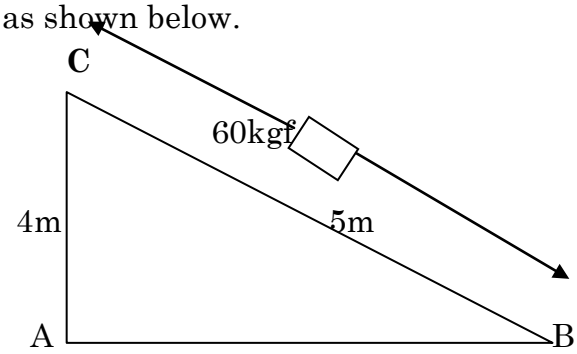
1	Winding road	3	Winch
			

2	Stairs/ steps.	4	Ladders
			 

<u>Mechanical Advantage of machines.</u>

Mechanical Advantage is the ratio of the load to effort. i.e. M.A = Load/effort.
M.A is the number of times a machine simplifies work.
M.A has no units since it is a ratio.
Friction lowers M.A.

Example;
John used a slope to raise a load of 60kgf from the ground to the higher level as shown below.



Work out the following
The effort distance
=5m
The load distance
=4m
Work done
W=FXD

M.A= $\frac{\text{Load}}{\text{Effort}}$

= $\frac{\text{Distance effort moves}}{\text{Distance load moves}}$

= $\frac{\mathbf{5}}{\mathbf{4}}$

Work

Work is a product of force and the distance moved.
Work=Force x Distance moved.
Work done by the effort=effort x effort arm.
Work done by the load= load x load arm.
The unit of work is a joule.
The unit of force is the Newton.
The standard unit of distance is the metre.
1 kgf = 10N

1 joule(of work) is done when one newton (of force) moves through one metre(of distance)
1 joule=1 N x 1 m
1 joule=1 Nm

Questions

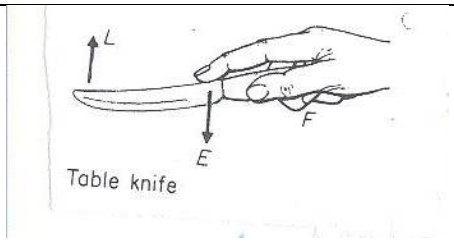
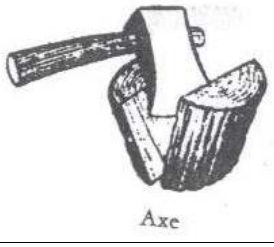
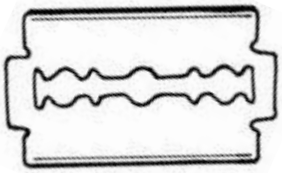
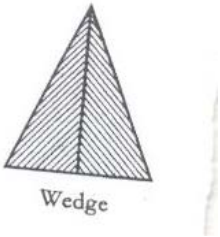
From comprehensive science book seven.

LESSON FIVE.

WEDGES

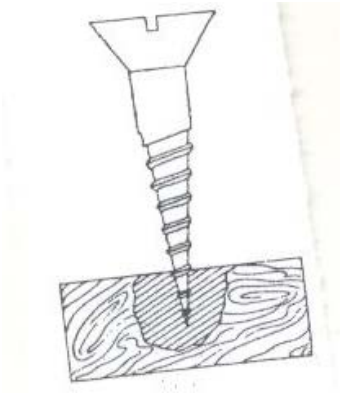
A wedge is a cutting tool. It is double inclined plane/slope.

Examples of wedges

1	Knife edge.	**5**	Axe blader
			
2	Hoe	**6**	Razor blade
			
3	Nail.	**7**	Needle.
			
4	A wedge 		

SCREWS

DIAGRAM SHOWING A SCREW.

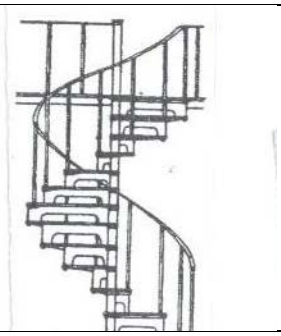
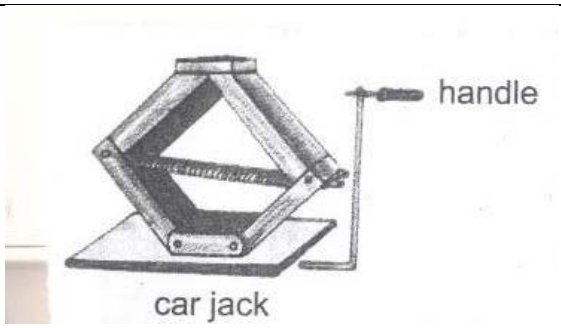
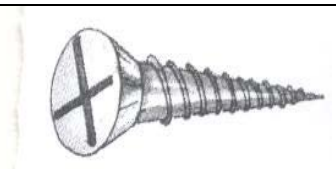


A screw is an inclined plane wound round
We use it to make our work easier.

USES OF SCREWS

1.Lifting very heavy things e.g. screw jack.
2. It makes movement upstairs easier e.g. using a spiral staircase

3. Used to fasten things together.
EXAMPLES OF SCREWS

1	Spiral staircase	**3**	Screw jack
			
2	Screw nails		
			

EXERCISE;

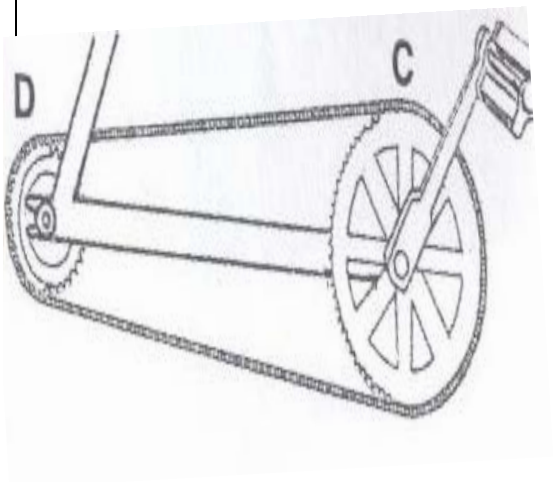
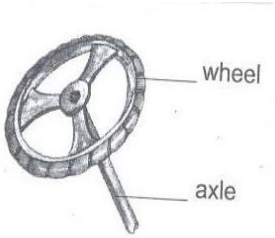
1. Name two examples of wedges used in the kitchen.
2. Why a knife grouped under wedges?
3. Give two uses of an axe used as wedge.
4. State two uses of screws to carpenter.
5. How is a car jack useful to a truck driver?
6. Suggest two applications of wedges in our daily life especially at home

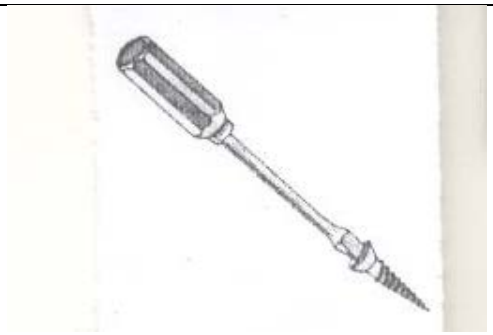
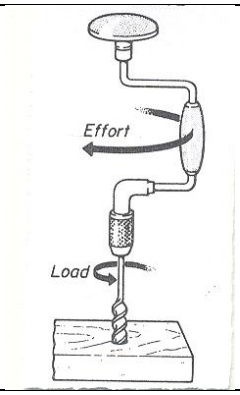
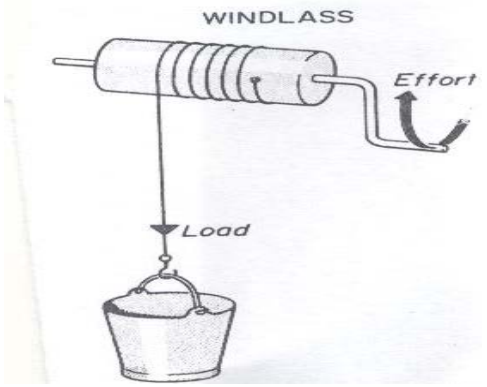
LESSON SEVEN

Wheel and axle

An axle is a rod passed through a wheel.
The wheel rotates on an axle.

Examples of devices that use wheels and axles.

1	Door Knobs	**5**	Pedal wheels
			
2	steering wheel	**6**	Egg beaters
			
3	Screw drivers	**7**	Brace

			
4	Windlass 		Handles of a bicycle. 

USES OF WHEEL AND AXLE

1. Drawing water from underground tanks using windlass/winch.
2. Drilling holes in wooden materials using the brace
3. Turning screws to fix things together using a screw jack.
4. It helps in loosening the screws.
5. Preparing eggs for frying using egg beaters.

Questions

1. Give any two examples of each of the following:
   a) Wheels and axles
   b) screws
2. How are screws important to people?
3. How is an inclined plane important to a farmer?
4. Give any two examples of screws.
5. How are inclined planes important to human beings**?**

WEEK SEVEN LESSON FOUR AND FIVE

PULLEYS

A pulley is a wheel with grooved rim that rotates freely about an axle through a centre.

A rope or chain passes over the pulley and is prevented from slipping by the grooved

The frame which holds the pulley is called block.

IMPORTANCE OF PULLEYS.

1. They help in lifting objects from the lower level to higher level.
2. They help in lifting heavy loads during building.
3. They help in offloading heavy vehicles.
4. They help in towing vehicles.
5. They are used to raise flags on the poles.
6. Help to move window curtains.

TYPES OF PULLEYS.

1. Single fixed pulley
2. Single movable pulley.
3. Block and Tackle system.

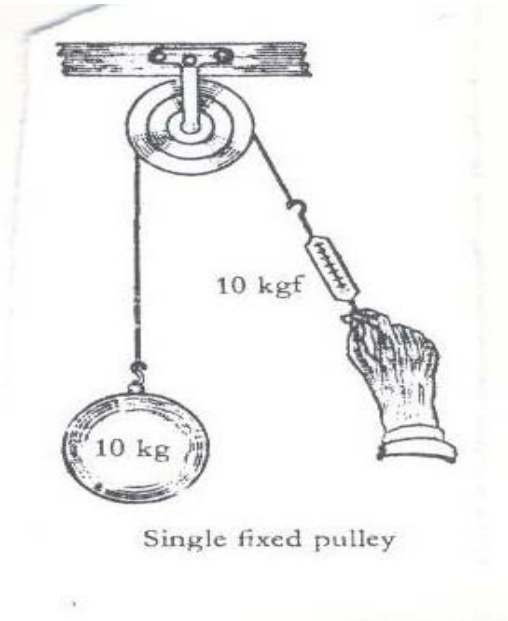
SINGLE FIXED PULLEY.

The effort applied is equal to the load.

It changes the direction of force

Boy applying the down ward force, work becomes easier.

The M.A of a single fixed pulley is one (1).



Single fixed pulley

Example;

If a load of 30kgf is to be raised using a single fixed pulley, find the effort needed

M.A =1

L=30kgf

E=??

M.A = load/Effort

1 = 30/E

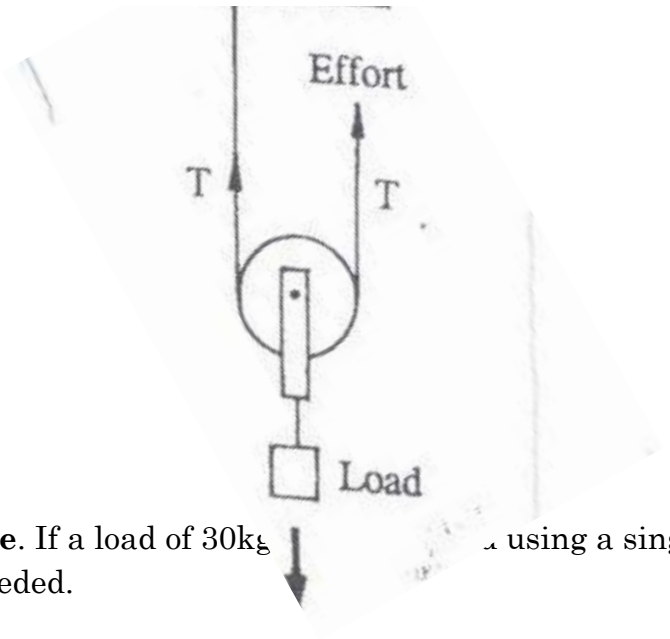
E x 1 = 30

E = 30kgf.

SINGLE MOVABLE PULLEY

It is supported on two ropes.
The rope is pulled up wards.
The pulley moves with the load.
Each of the ropes share a half of the effort needed.
The rope moves twice as far as the load.
The M.A advantage of single movable pulley is 2 (two)

Effort applied is half the load force. (It reduces the effort needed)



Example. If a load of 30kg is lifted using a single movable pulley, Find the effort needed.

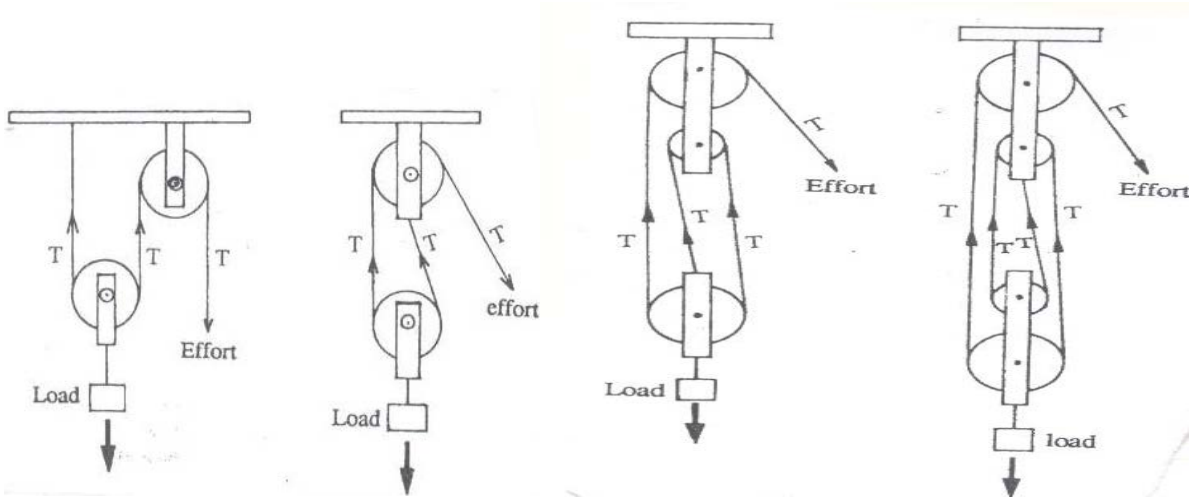
M.A = 2
L = 30kgf
E =??
M.A = L/E
2 = 30/E
2 x E = 30
$\frac{2E}{2} = \frac{30}{2}$
E =15kgf.

DIFFERENCES BETWEEN FIXED AND MOVABLE PULLEY

Fixed pulley	Movable pulley
Work is done faster	Work is slower
Change direction of force	No change of in direction of force
Force used is equal to the load.	Effort applied is half the load force.

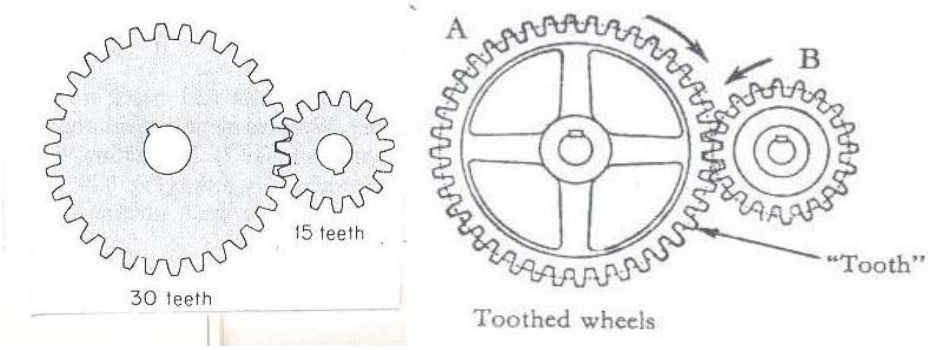
BLOCK AND TACKLE SYSTEM.

It does work more easily because it is a combination of both fixed and movable pulleys.
It changes direction of force.
It reduces effort needed.
The ratio of load to Effort is determined by the number of pulleys.



GEARWHEELS/COG WHEELS OR TOOTHED WHEELS

A gearwheel is a special form of the wheel
It has teeth around its edge.
These teeth interlock with the teeth of another gear wheel.
When one turns it causes the other one to turn.



If A has 30teeth and B has 15 teeth, how many rotations does B make in one revolution?
30divided by 15 =2 turns.

Questions.

1. Give any two types of pulleys.
2. How are pulleys important at school?
3. Calculate the Mechanical Advantage of a machine that needs an effort of 20kg to overcome a load of 60 kg.
4. State one difference between a single fixed pulley and a single movable pulley.
5. Cite any two importance of the rope on a pulley.