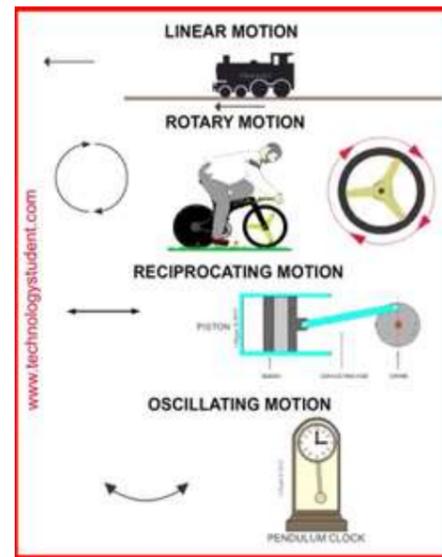


1.5 Mechanical Devices – Year 10 Product Design

Key Terminology	Definition
Mechanism	A device that changes an input motion into a different output motion.
Lever	A mechanism that moves around a fixed point (a pivot)
Linkages	Mechanisms that transfer force and can change the direction of movement.
Cam	A mechanism with a cam, slide and follower. When the cam rotates the follower moves up and down.
Gear train	A mechanism for transmitting rotary motion and torque.
Torque	The turning force that causes rotation.
Friction	Resistance to motion when one object rubs against another.
Co-efficient of friction	The amount of friction a material has.

Types of motion



Linear motion – movement in a straight line.

Rotary motion – movement around in a circle.

Reciprocating motion – movement backwards and forwards in a straight line.

Oscillating motion – movement swinging from side to side.

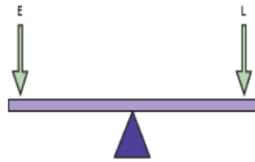
Key points

- There are four basic types of movement: linear, reciprocating, rotary and oscillating.
- Lever and linkages are mechanisms used to transfer and alter force, and can change the direction of movement.
- There are three different orders of lever.
- Types of motion can be converted from one type to another by a mechanism.
- Diagrams and symbols are used to represent mechanisms.
- Mechanisms can change the magnitude and direction of forces.

A **lever** changes an input movement and force into an output movement and force.



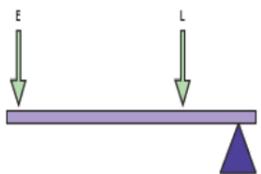
A **first-order lever** has the fulcrum between the effort and the load.



If the fulcrum is moved closer to the load less effort is needed to move it (although the load does not move as far).



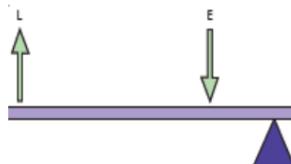
A **second-order lever** has the load and effort on the same side of the fulcrum.



The load is nearer to the fulcrum, so less effort is required to move it. To make the effort smaller, the distance the lever moves is greater.



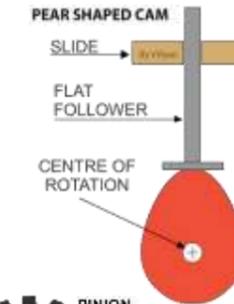
A **third-order lever** has the load and effort on the same side of the fulcrum.



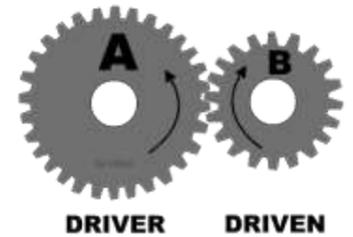
The load is further from the fulcrum, so the effort required is greater than the load.



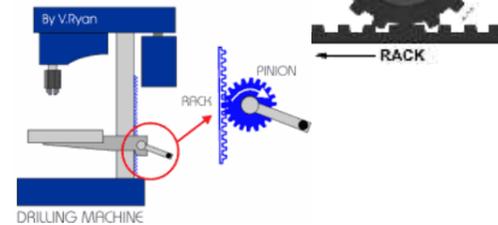
A cam mechanism has three parts – a **cam**, a **slide (guide)** and a **follower**. When the cam rotates, the follower moves up and down in a reciprocating motion.



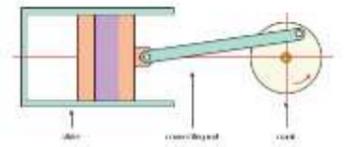
A **gear train** is a mechanism for transmitting rotary motion and **torque** (the turning force that causes rotation).



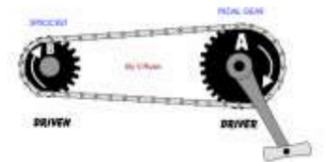
A **rack and pinion** mechanism can turn rotary motion to linear motion or vice versa.



A **crank and slider** mechanism can turn linear motion to rotary motion or vice versa.



A **chain and sprocket** mechanism transfers rotary motion to rotary motion elsewhere in a machine, such as in bicycles and motorcycles.



Pulley systems transmit rotary motion to rotary motion in machines. A pulley is a wheel with a groove in its rim. Two pulleys connected together by a flexible belt will transmit rotary motion and torque.



$$\text{velocity ratio} = \frac{\text{number of teeth on the driven gear}}{\text{number of teeth on the driver gear}}$$

$$\text{velocity ratio} = \frac{48}{24} = \frac{1}{2} = 1:2$$

(The driven gear will rotate two times slower, or at half the speed of the driver gear.)

