 **Levers: How They Work**

**Introduction**

* You are using a lever when you swing a baseball bat or use a shovel;
* Lever is a rigid bar that pivots at a point called a fulcrum;
* Can multiply a small force (input effort) into a larger force (output load).

**Types of Levers**

* Found in all sorts of tools and in complex machines such as cranes and robots;
* Three types of levers: class 1, class 2, and class 3;
* Classification is based on the relative positions of the effort, fulcrum, and load.

**Class 1 Lever**

* Fulcrum is between the load force and the effort force;
* Example is a screwdriver being used to pry off the lid of a paint can.

**Class 2 Lever**

* The fulcrum is at one end and the load force acts between the effort and the fulcrum;
* Example is a wheelbarrow.

**Class 3 Lever**

* Always makes things harder to lift or move instead of easier;
* Fulcrum is at one end and the effort force is exerted between the fulcrum and the load force;
* Example is a fishing rod.

**Mechanical Advantage**

* When designing machines it is helpful to know what benefit one mechanism provides to another;
* Mechanical advantage is the number of times by which a machine can increase or decrease the effort force;
* MA = Load Force (N) / Effort Force (N)

**Mechanical Advantage and Levers**

* MA = Length of load force / Length of load arm;
* E.g., MA = 80N ÷ 4N
* MA = 20

**Velocity Ratio**

* VR = distance effort force moves ÷ distance load force moves;
* For class 3 levers, the velocity ratio is always less than 1, but class 1 and 2 levers, the velocity ratio is larger than 1.

**Conclusion**

* Many machines and other devices use a combination of levers called a linkage to transmit force and motion;
* Linkage is two or more levers connected together;
* The choice of where each fulcrum is placed affects the movement of the connecting levers.