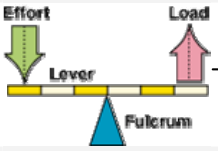
Grade 8 - Unit 4 – **Mechanical Systems** Concepts

Simple Machines

- change direction
- multiply force
- change speed
- transfer force

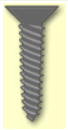
Levers



Inclined Plane (Ramp)

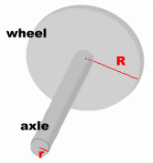
Wedge

Screw



Pulley

Wheel and Axle

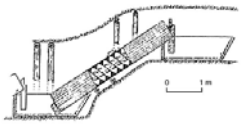


Machines from the Past

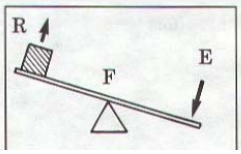
Aqueduct

Sakia

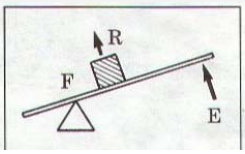
Archimedes Screw



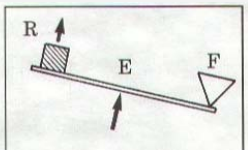
1st Class Lever



2nd Class Lever



3rd Class Lever



Work = Force x distance

Mechanical Advantage

$$\textbf{MA} = \frac{\text{Output force}}{\text{Input force}}$$

Speed Ratio

$$\textbf{SR} = \frac{\text{Input distance}}{\text{Output distance}}$$

$$\textbf{Efficiency} = \frac{\text{MA}}{\text{SR}} \times 100$$

Machine Efficiency

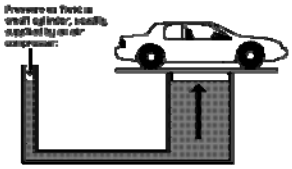
$$\textbf{Efficiency} = \frac{\text{Work}_{output}}{\text{Work}_{input}} \times 100$$

Pascal's Law

Pressure is transmitted equally in all directions throughout an enclosed fluid.

Pressure = **F**orce / **A**rea

Hydraulics



Pneumatics

$$\frac{\text{Force of the small piston}}{\text{Area of the small piston}} = \frac{\text{Force of the large piston}}{\text{Area of the large piston}}$$

Complex Machines

System

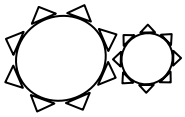
↓

Subsystems

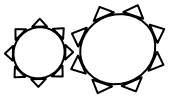
↓

Gears

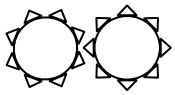
Multiplying



Reducing



Parallel



Linkage

Transmission

Mousetrap Vehicle

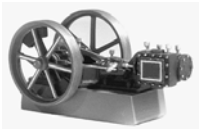
Evaluation Criteria

Efficiency	Effectiveness	Function	Design	Cost	Improvement
Safety	Convenience	Esthetics	Packaging	Environmental Impact	

Societal and Technological Impact of Machines

Block and Tackle

Steam Engine



Bicycles

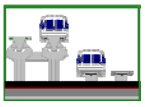
Early

Modern

Egg Beater

Pop Can Tab

MagLev Trains



Robots