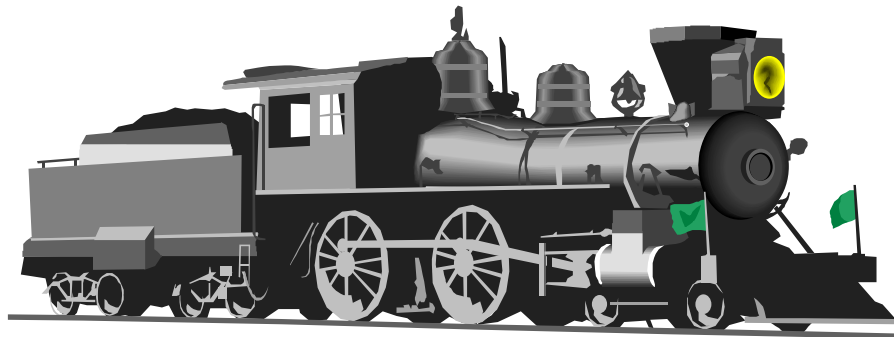


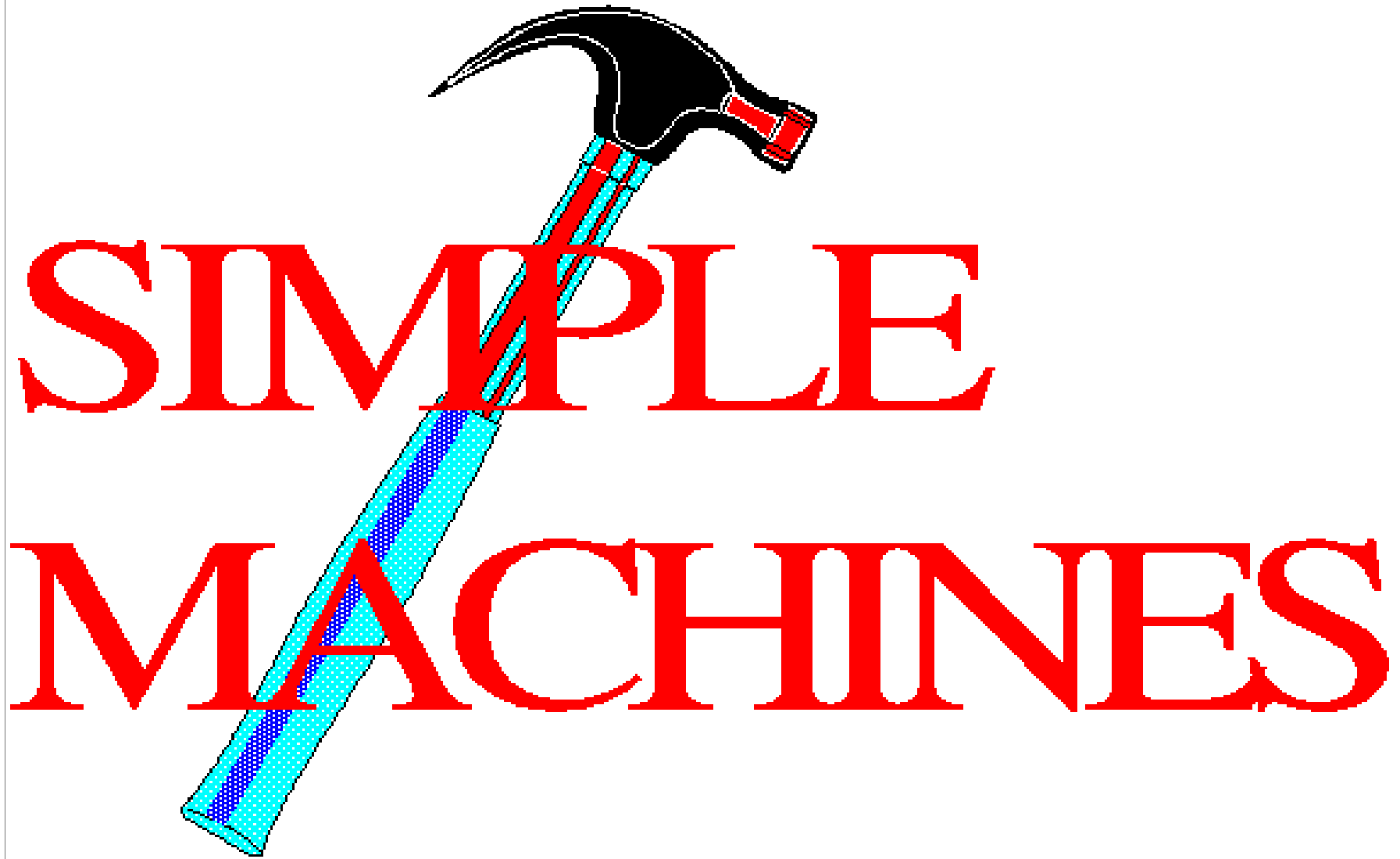
# MAKING MACHINES WORK



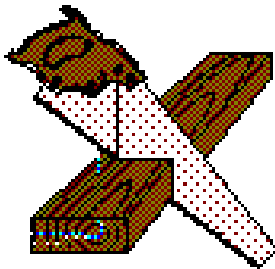
# ***CREATING ENERGY TO MAKE MACHINES DO EFFICIENT WORK***

***remember the four interactions***





# ***INCLINED PLANE***



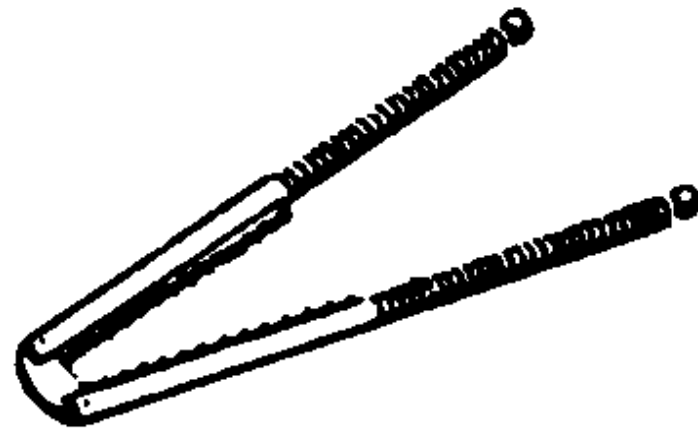
**to transfer the movement  
of energy efficiently**

**engineering of waterways and railroads in early  
Europe and China**

# **LEVER**

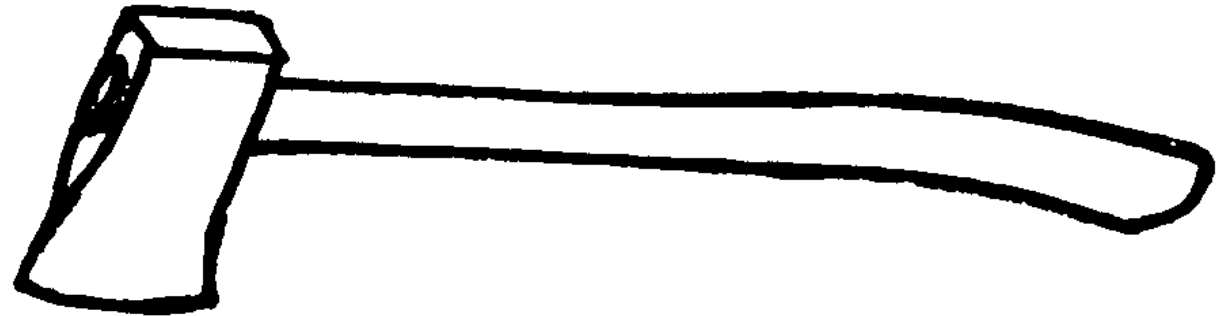
to make work easier,  
(lifting, moving, or breaking)

a rigid body pivoted on a  
fixed fulcrum



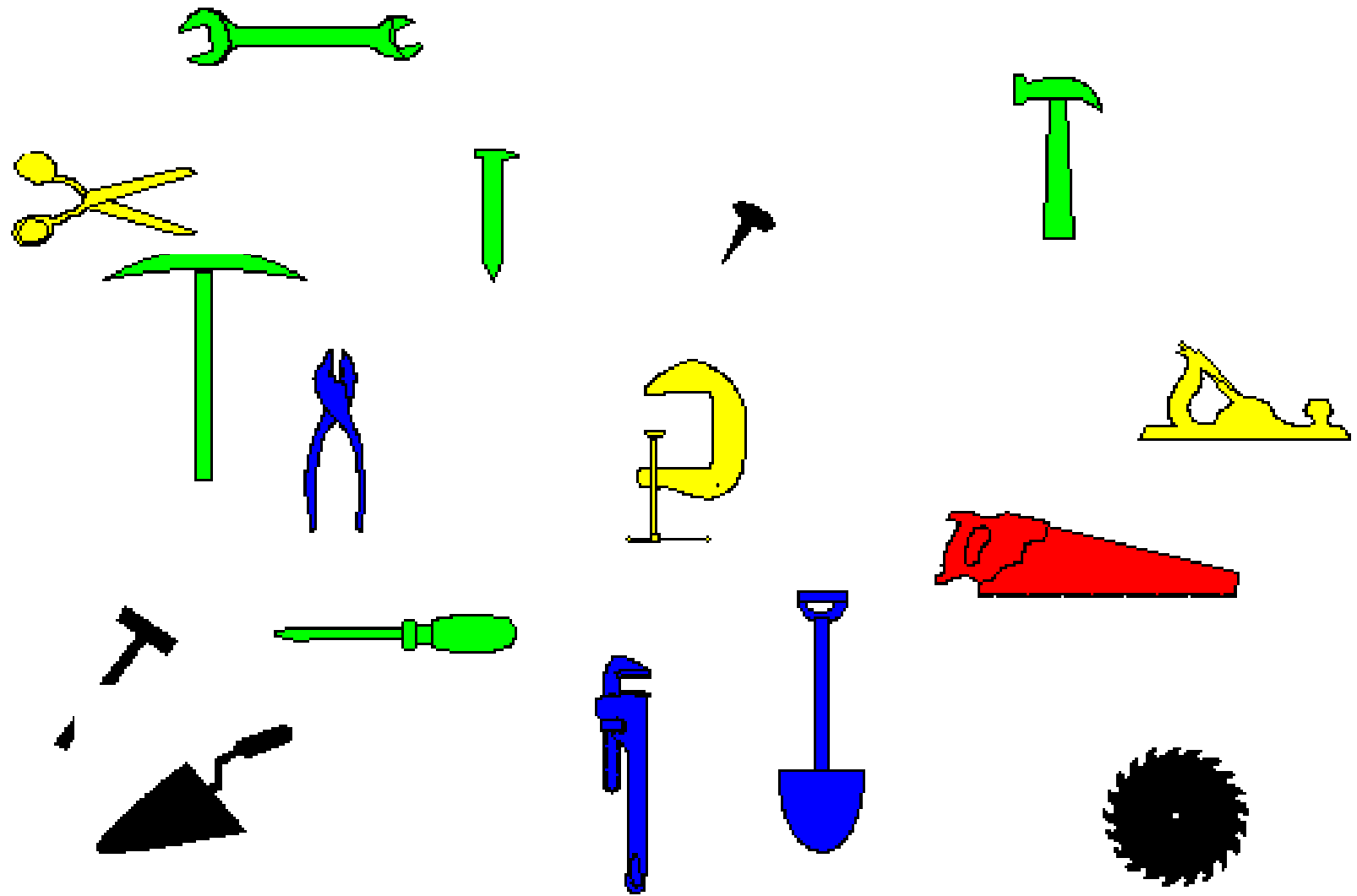
***" Give me a fulcrum on which to rest and I will  
move the Earth." Archimedes***

# **WEDGE**

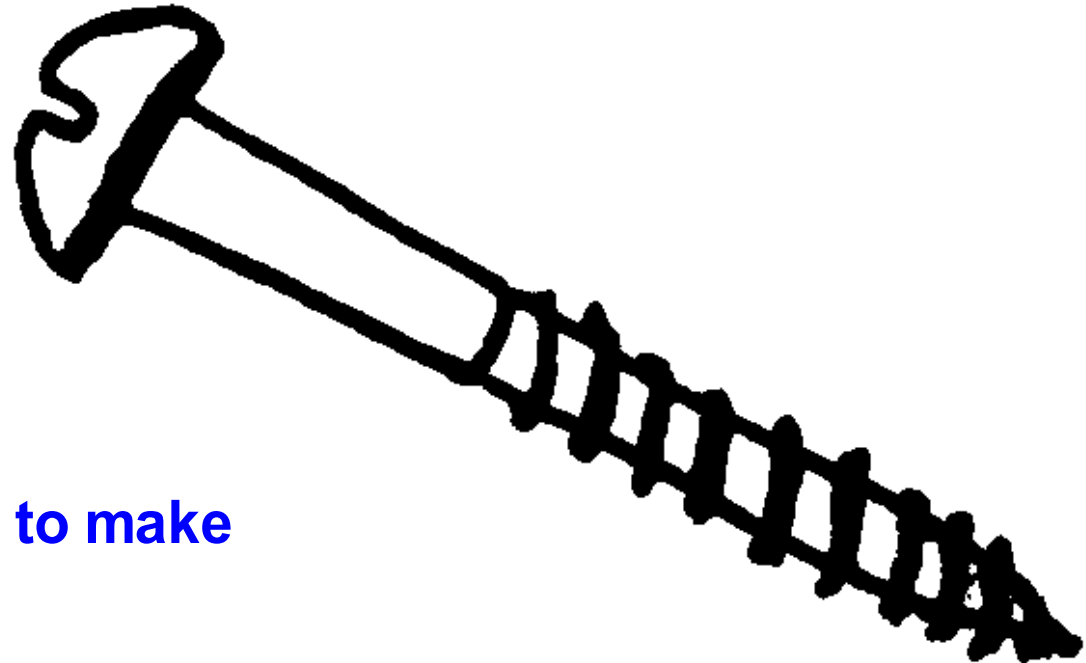


**to help direct energy to be more efficient**

**Lever**      **Wedge**      **Inclined plane**



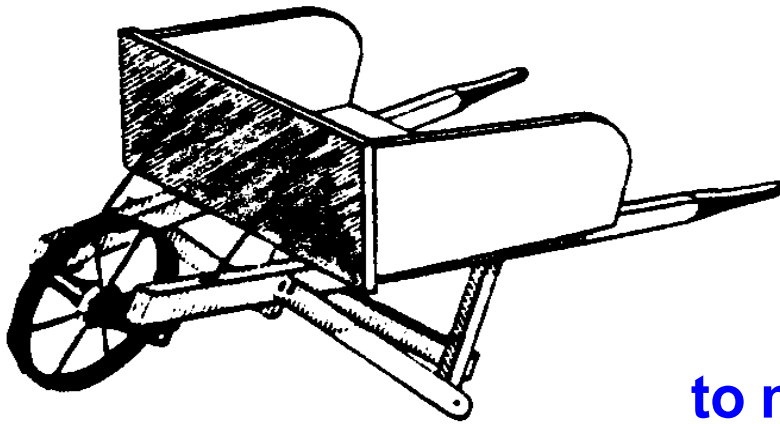
# **SCREW**



**force travels farther to make  
the task easier  
(modified inclined plane)**



# ***WHEEL AND AXLE***



**to make things move**

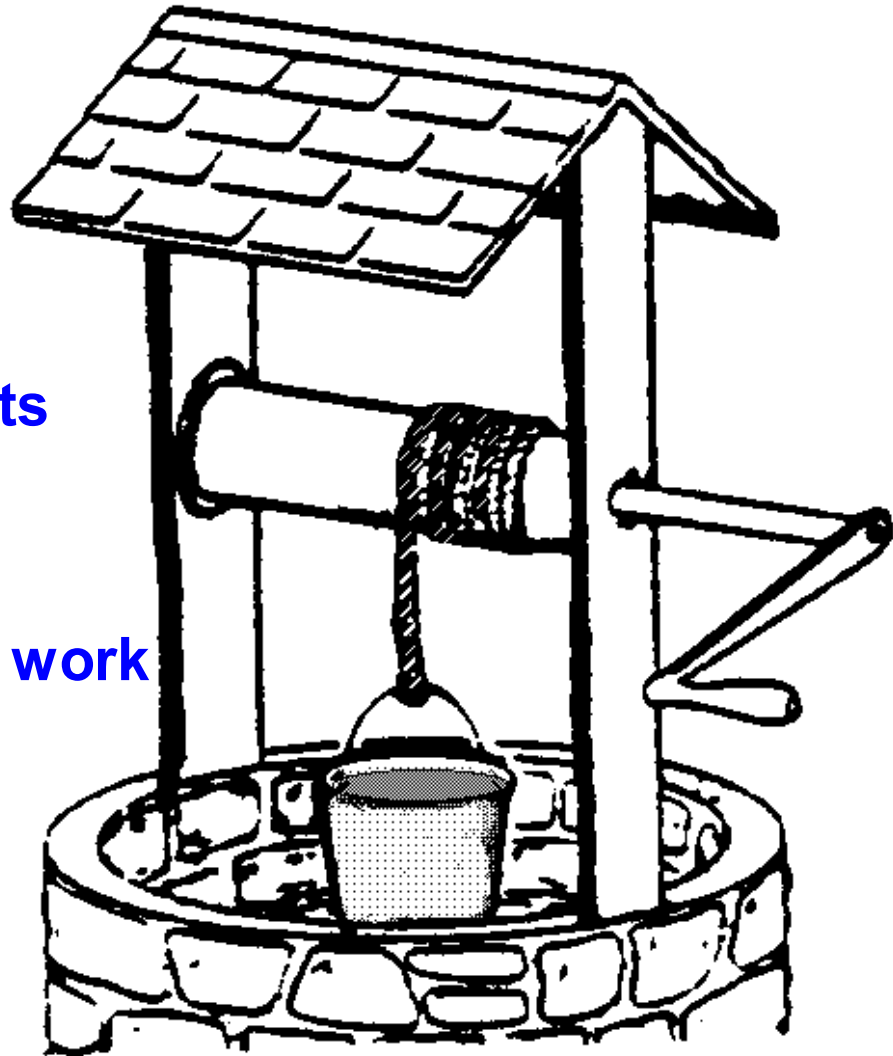
**invention 4000 BC from potter's wheel in  
Mesopotamia, spoked wheel about 2000 BC**

# ***PULLEY***

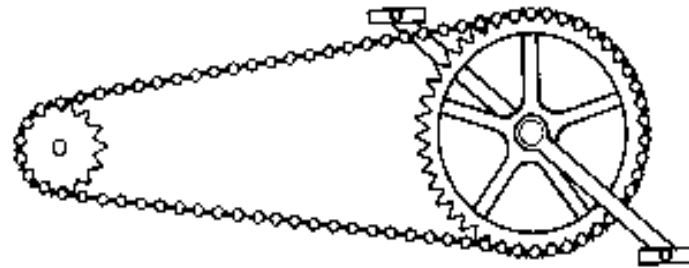
requires a belt

Helps to lift heavy objects  
easily

transfer of energy to  
create different types of work

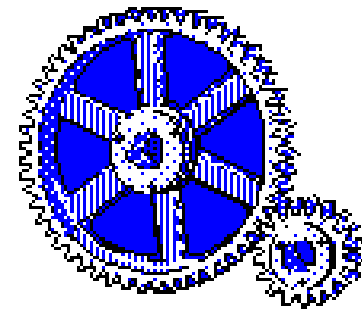


# GEARS



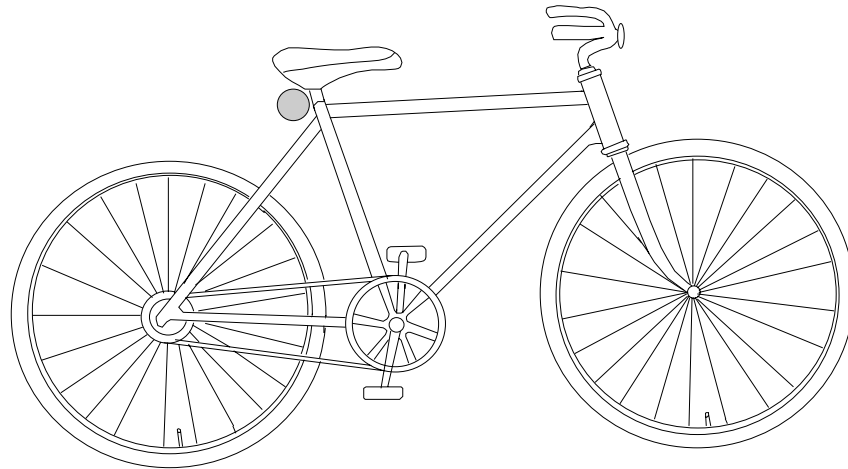
**Transfers motion and force  
from one rotating shaft to another, controls**

**grooves of gear = teeth  
smaller gear = pinon; larger = gear**



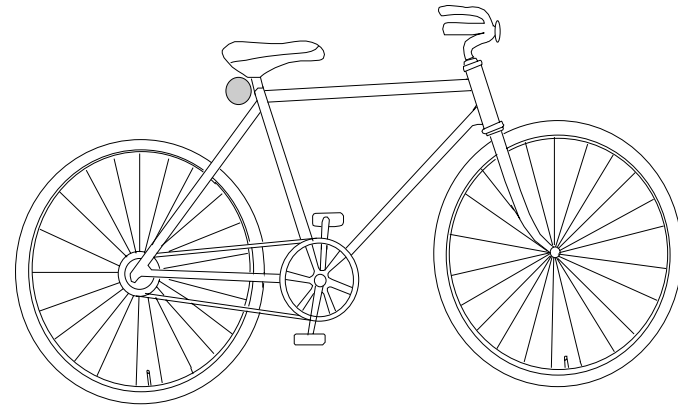
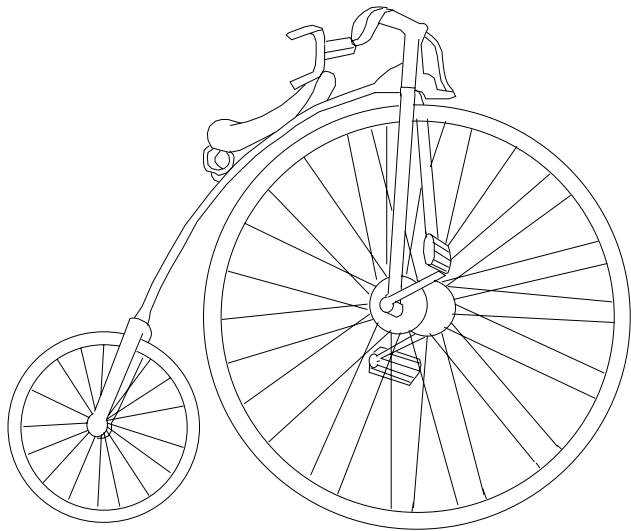
# ***Gear Ratio***

***transfer of energy efficiently***

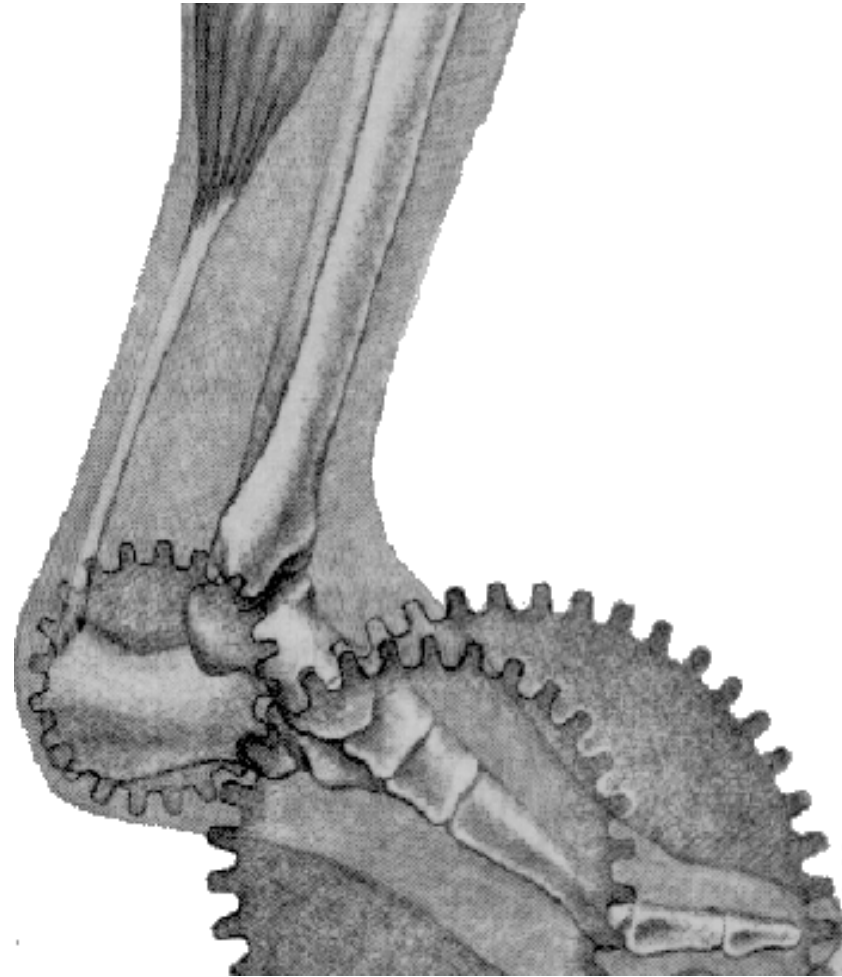


$$\frac{\text{teeth gear}}{\text{teeth pion}} = \text{gear ratio}$$

# ***WHICH BIKE IS MORE EFFICIENT? WHY?***

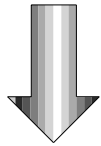


# ***The Human Machine***

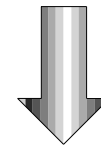


# ***MECHANICS***

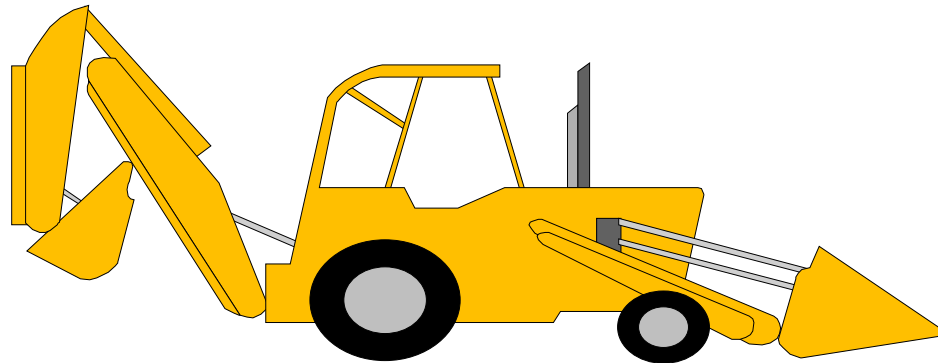
***STUDY OF MOTION OF OBJECTS***



***KINEMATICS (describe)***



***DYNAMICS (forces related)***



***in other words, the physics of understanding and designing machines that create work***

# VOCABULARY OF MACHINES

*mass*

*potential*

*kinetic*

*efficiency*

*momentum*

*acceleration*

*distance*

*force*

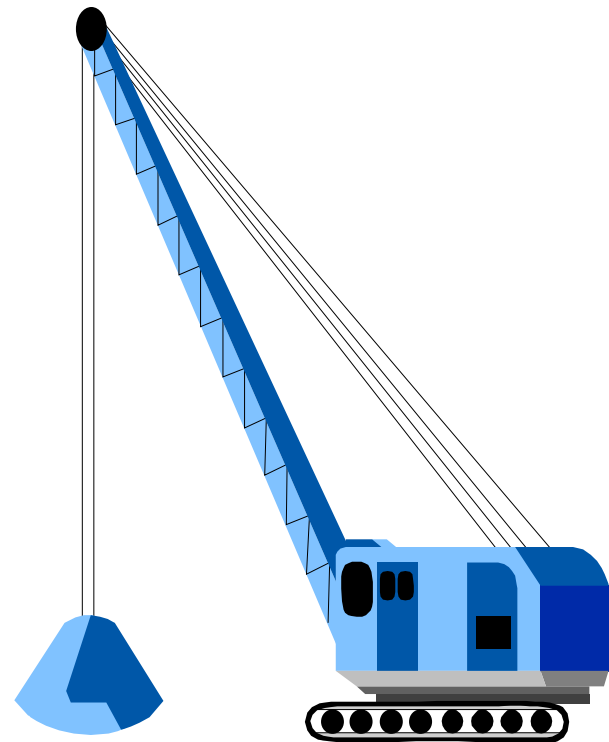




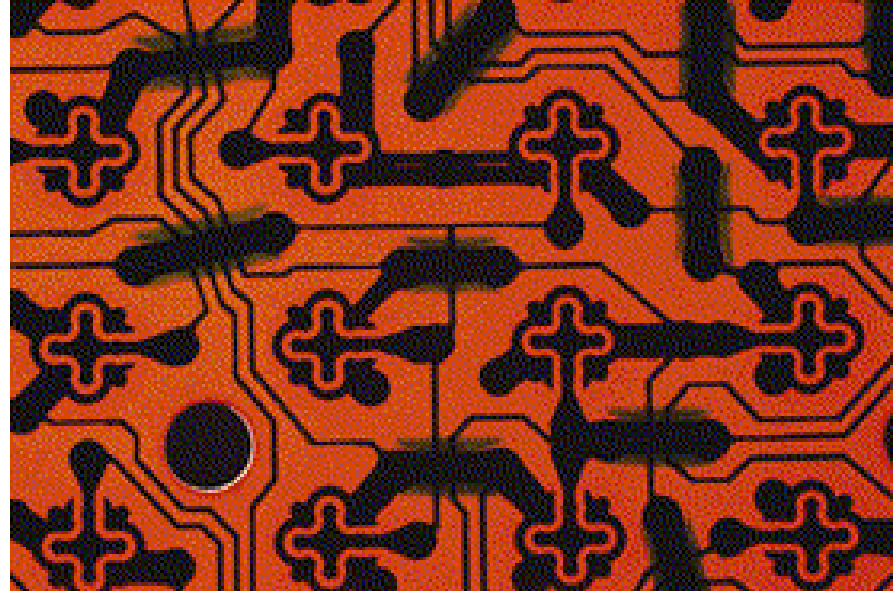
***WORK IN = WORK OUT***

$$W = FD$$

$$F = MA$$



## ***Are machines being redefined?***



***after mechanics - atomic physics,  
quantum mechanics, thermodynamics,  
and who knows where physics will lead  
us***