# Basic Machines

Levers and Inclined Planes

# Outcomes

analyze a mechanical device, by:

– describing the overall function of the device

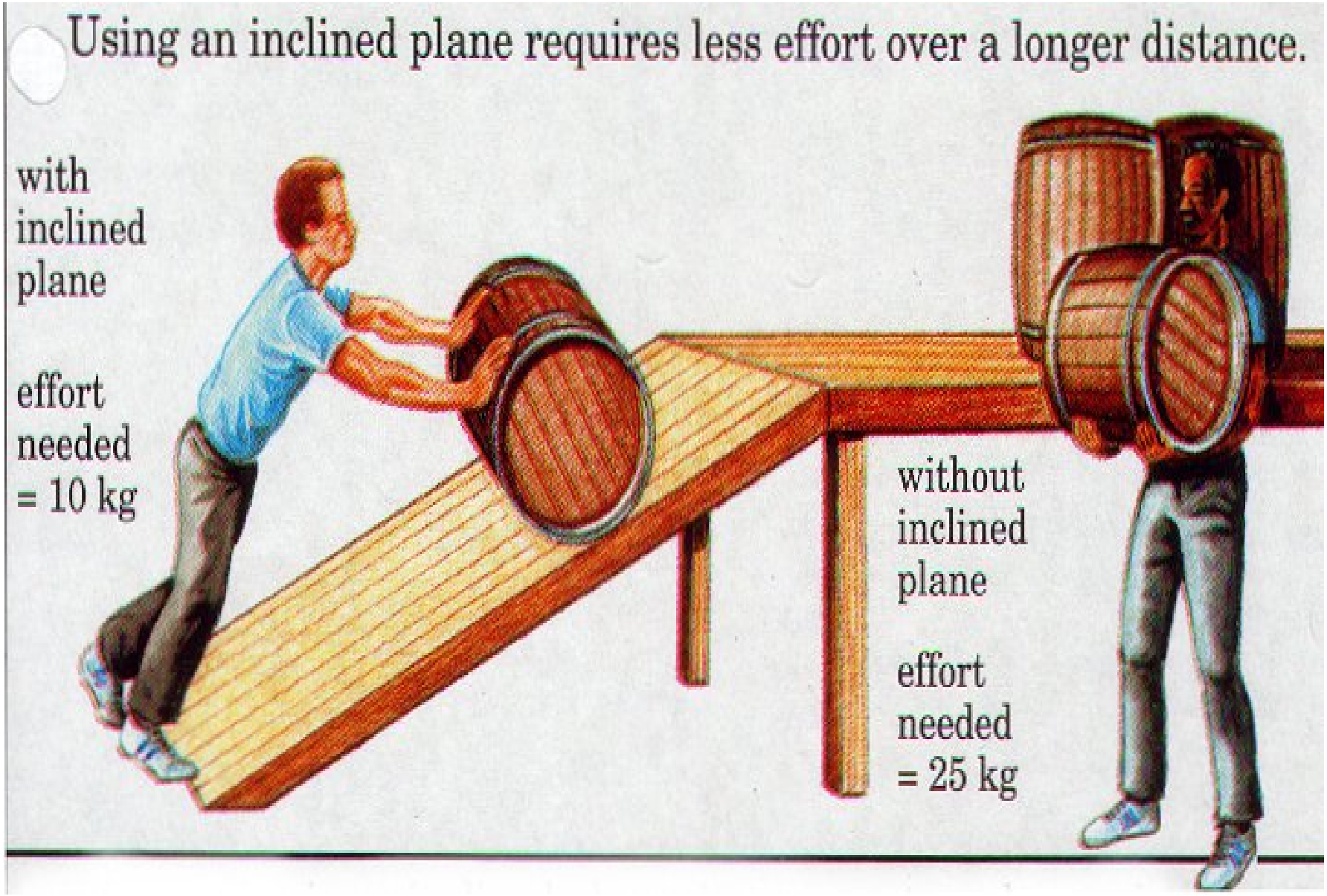
– describing the contribution of individual components or subsystems to the overall function of the device

– identifying components that operate as simple machines

# Eureka! Inclined Planes

- https://www.youtube.com/watch?v=s5DkwLBpGRQ&index=1&list=PLRIO78Em2glZfv0w_ai6vHVurf6CbLRD_
- https://www.youtube.com/watch?v=sTOWiDDgTIk

# Incline Plane



# Inclined Planes

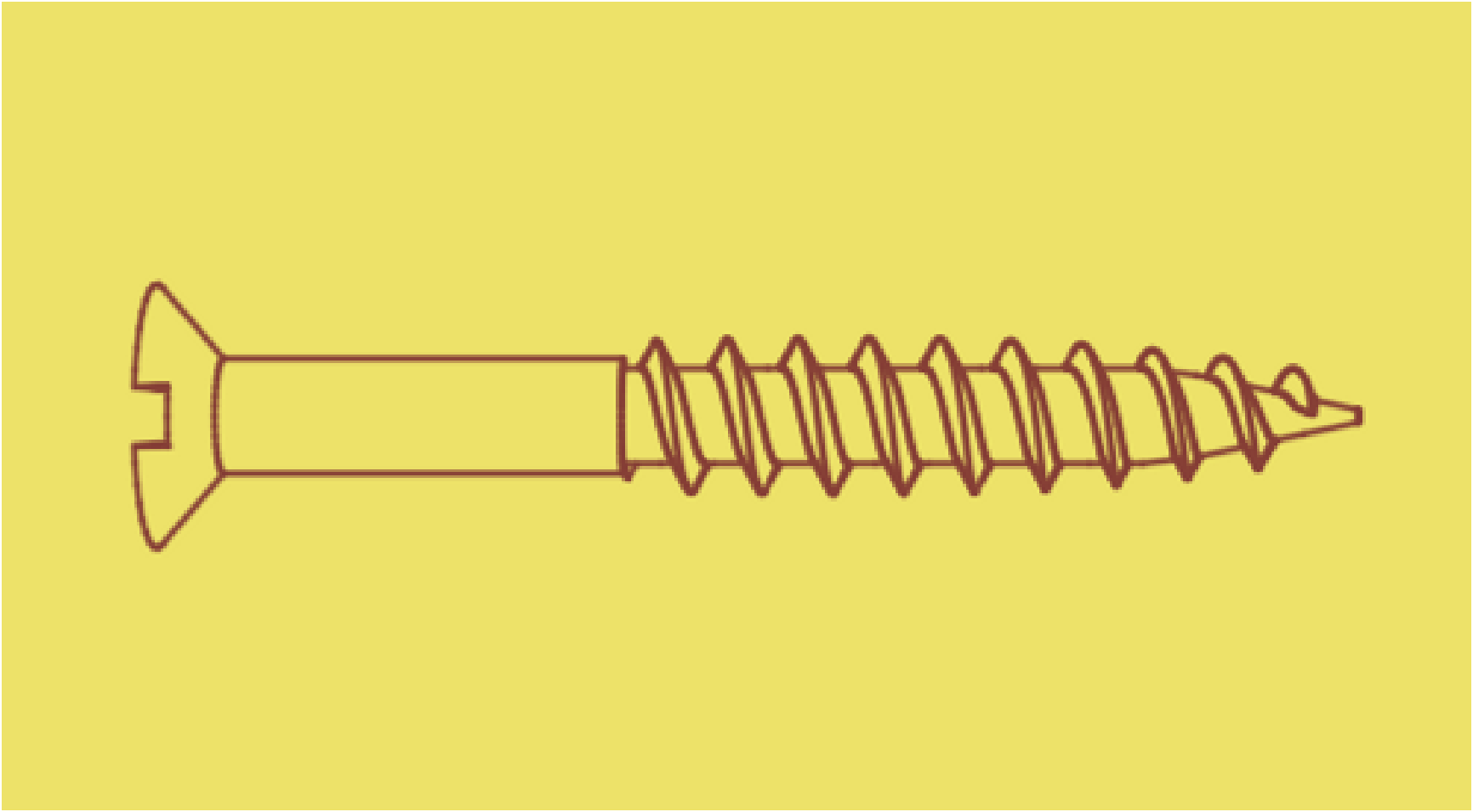
An inclined plane is a ramp or slope that reduces the force you need to lift something.

Examples of inclined planes are: wheelchair ramps, loading ramps in factories, etc.

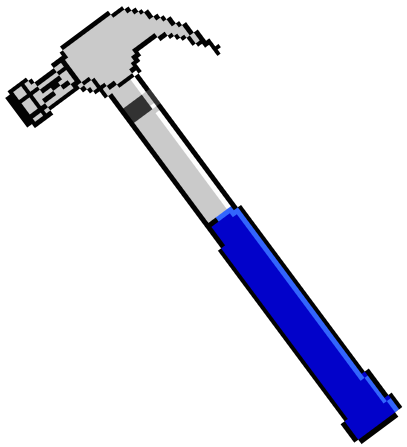
# Eureka! Levers

- https://www.youtube.com/watch?v=vvIGuMZFfyA&index=2&list=PLRIO78Em2glZfv0w_ai6vHVurf6CbLRD_

# A Screw or an Inclined Plane?



# Lever

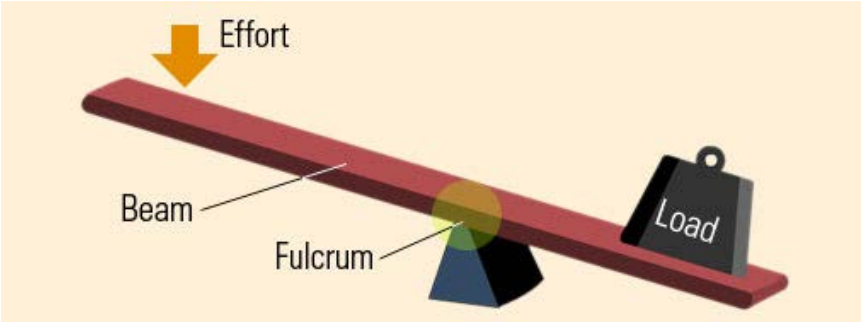


**A lever is a simple machine that changes the amount of force you must exert to move an object.**

It consists of a bar that is free to rotate around a fixed point called the **fulcrum**

Examples:

- screwdrivers,
- bottle openers
- hockey sticks
- scissors
- wheelbarrows
- teeter-totter

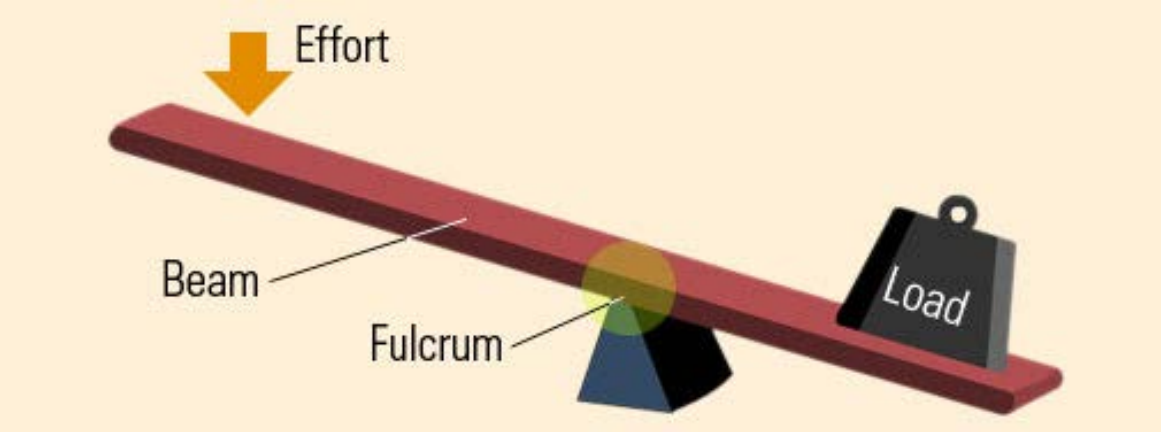


**Effort force** is the force you exert on a lever to make it move.

(Remember: force is measured in Newtons (N))

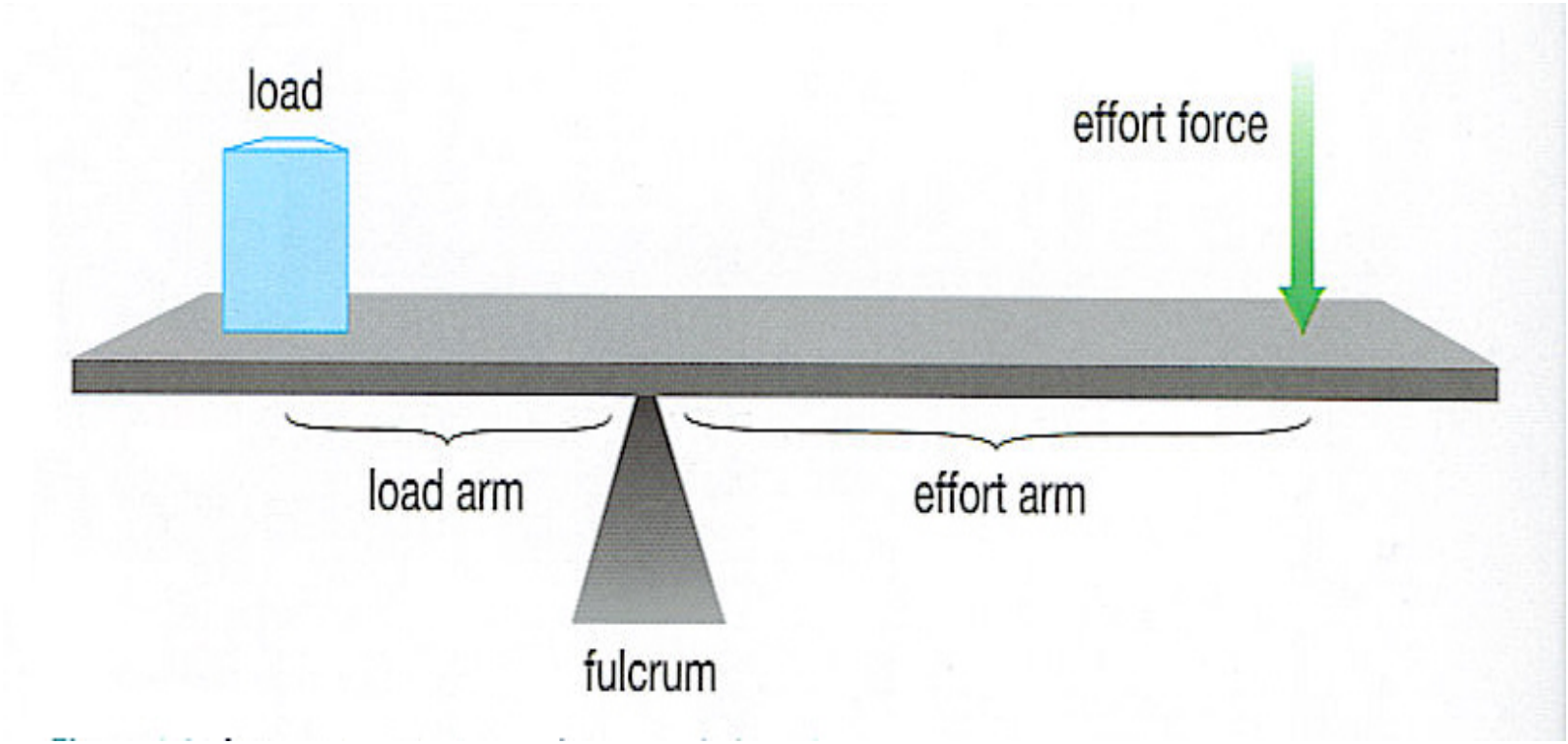
The **Load** is the mass of an object that is moved or lifted.

In other words, the load is the **Resistance** that a machine must overcome.



The **Effort Arm** is the distance between the fulcrum and the effort force.

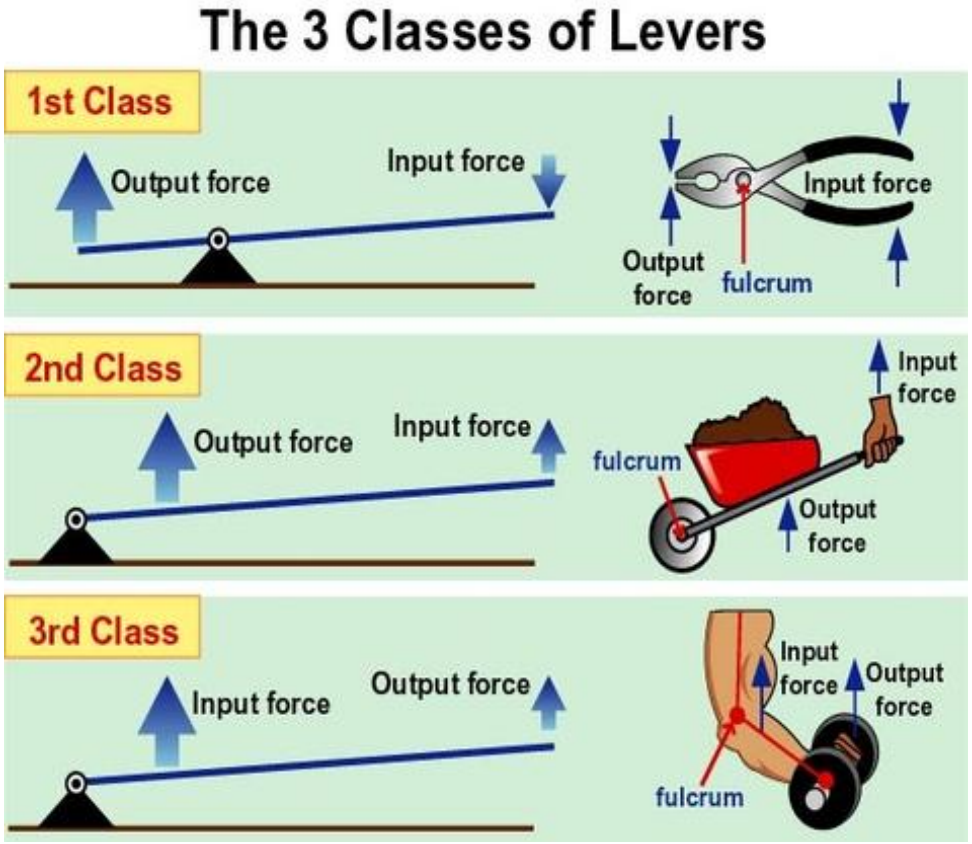
The **Load arm** is the distance between the fulcrum and the load.



# Levers With Class!

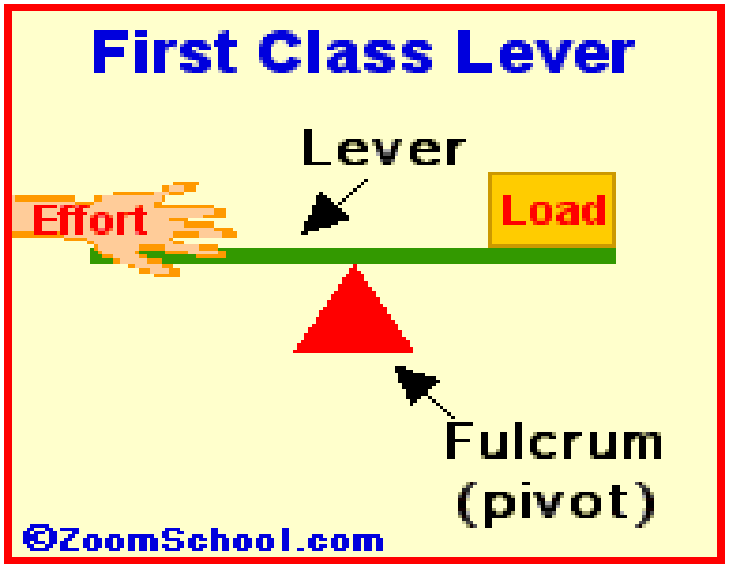
There are 3 classes of levers, depending on the location of the

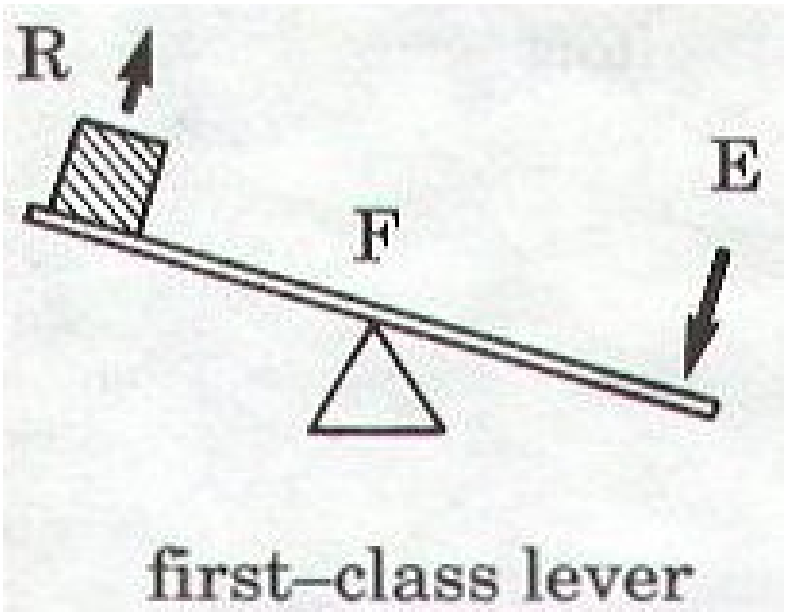
i. Fulcrum
ii. Effort &
iii. Load



# Class 1 Lever (think See-Saw)

The fulcrum is in the middle.
**Effort** and **Load** are on opposite sides.



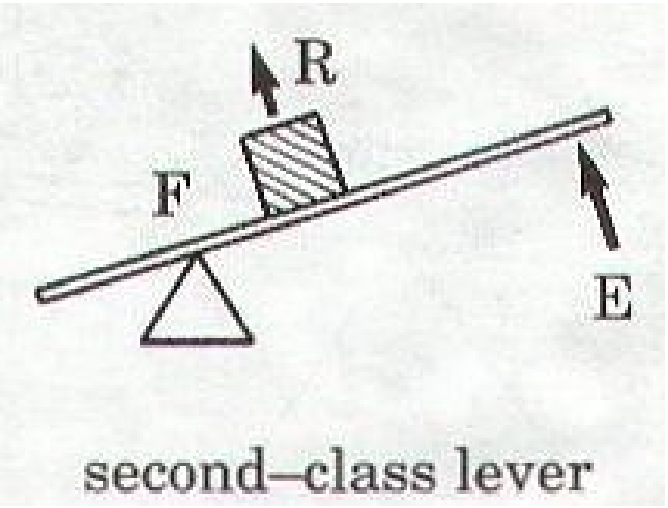



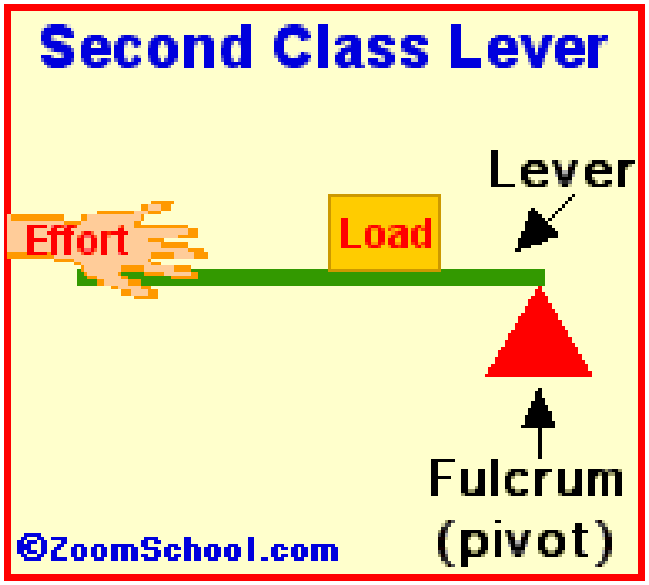

**Effort is exerted to move the load**
**Ex: Seesaw, Crowbars, Scissors,**

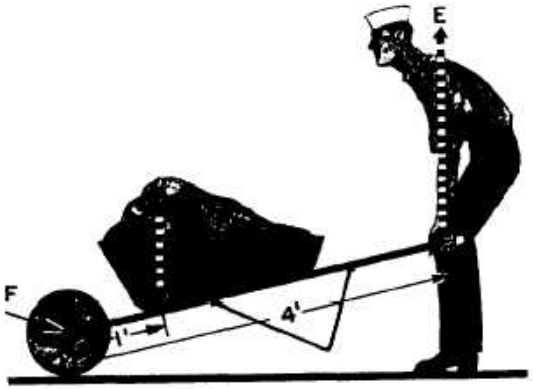
# Class 2 Lever (think Wheelbarrow)

The **Load** is in the middle.

- Exerts great force on the load. It magnifies your effort so that you can lift heavy objects easily.



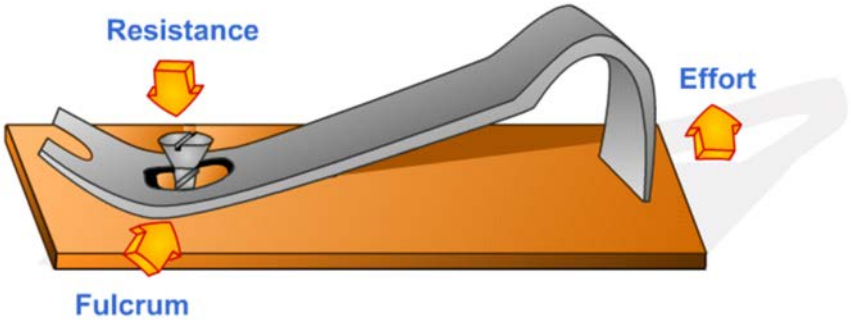



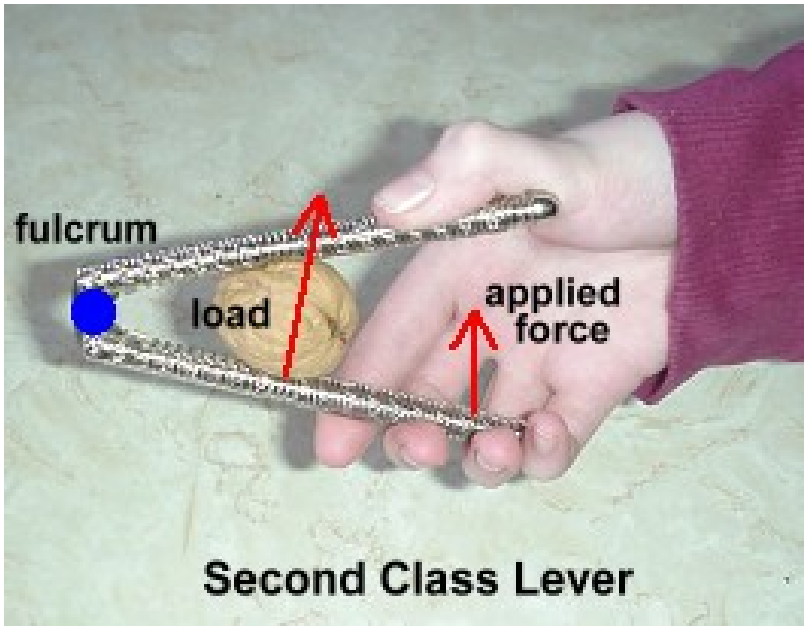



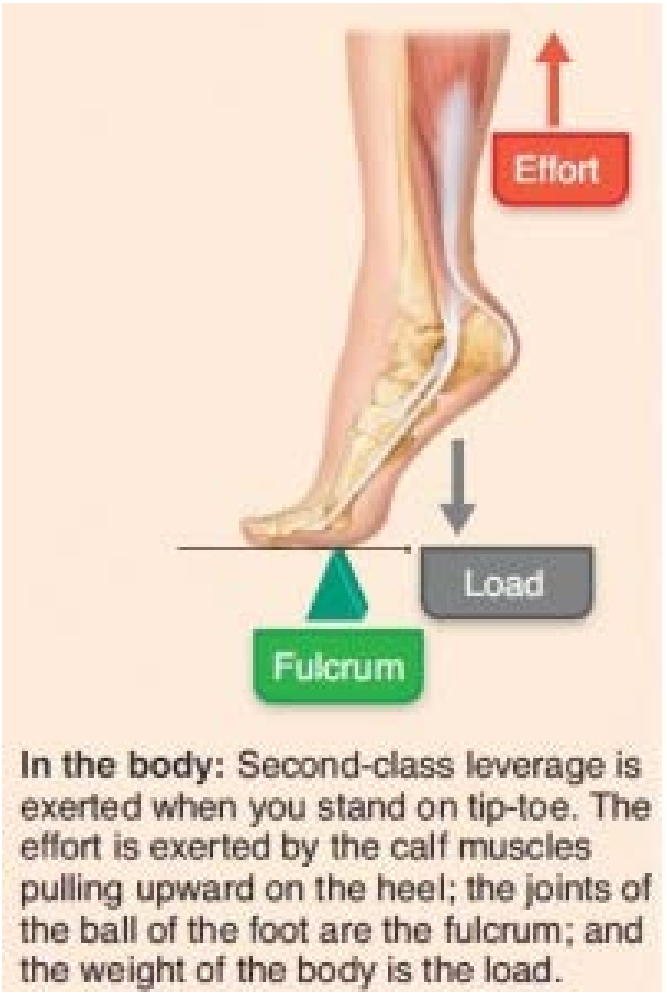

Examples : Wheelbarrow, Bottle Openers, and Nut Crackers.

# More Examples of Class 2 Levers

- Remember, the load/resistance has to be in the middle



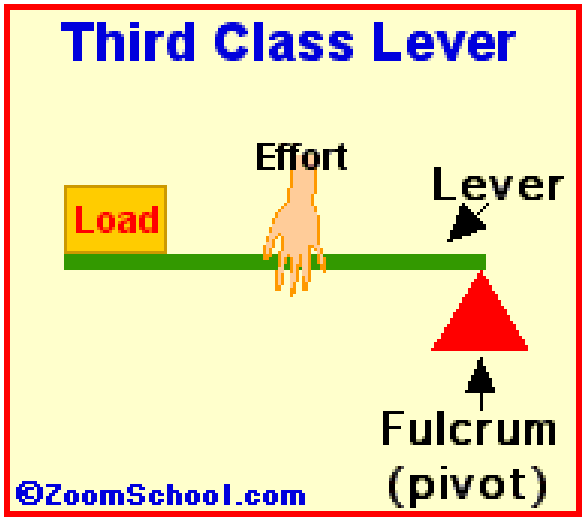



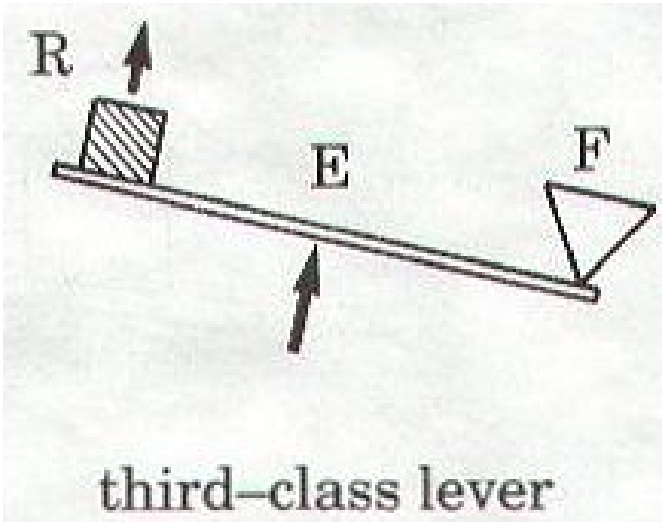

**In the body:** Second-class leverage is exerted when you stand on tip-toe. The effort is exerted by the calf muscles pulling upward on the heel; the joints of the ball of the foot are the fulcrum; and the weight of the body is the load.

# Class 3 Lever (think athletics)

The **effort** is in the middle.

- You apply way more effort force than the lever gives back. In return, the lever rewards you with speed.

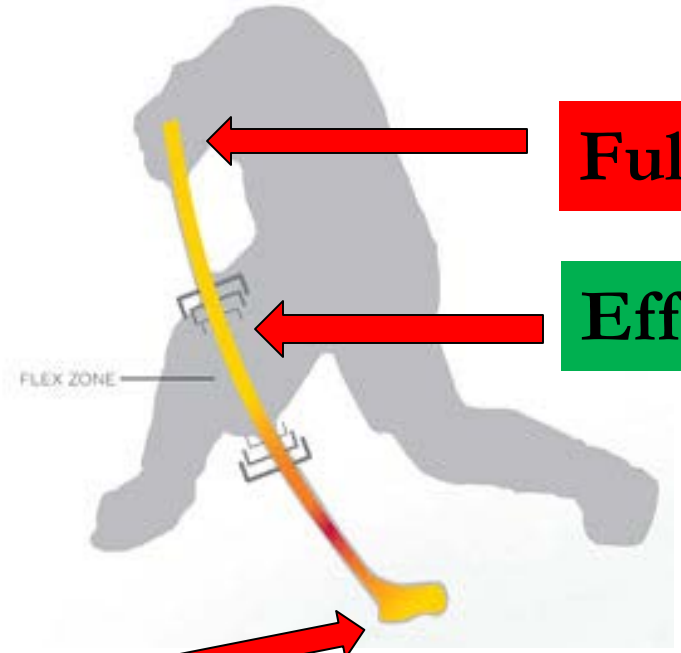



Broom, Shovel, Fishing Pole, Baseball Bat, and Tongs.

# More Examples of Class 3 Levers

- Remember that **Effort** has to be in the middle.
- It takes a lot of strength, but speed is your reward.


Fulcrum

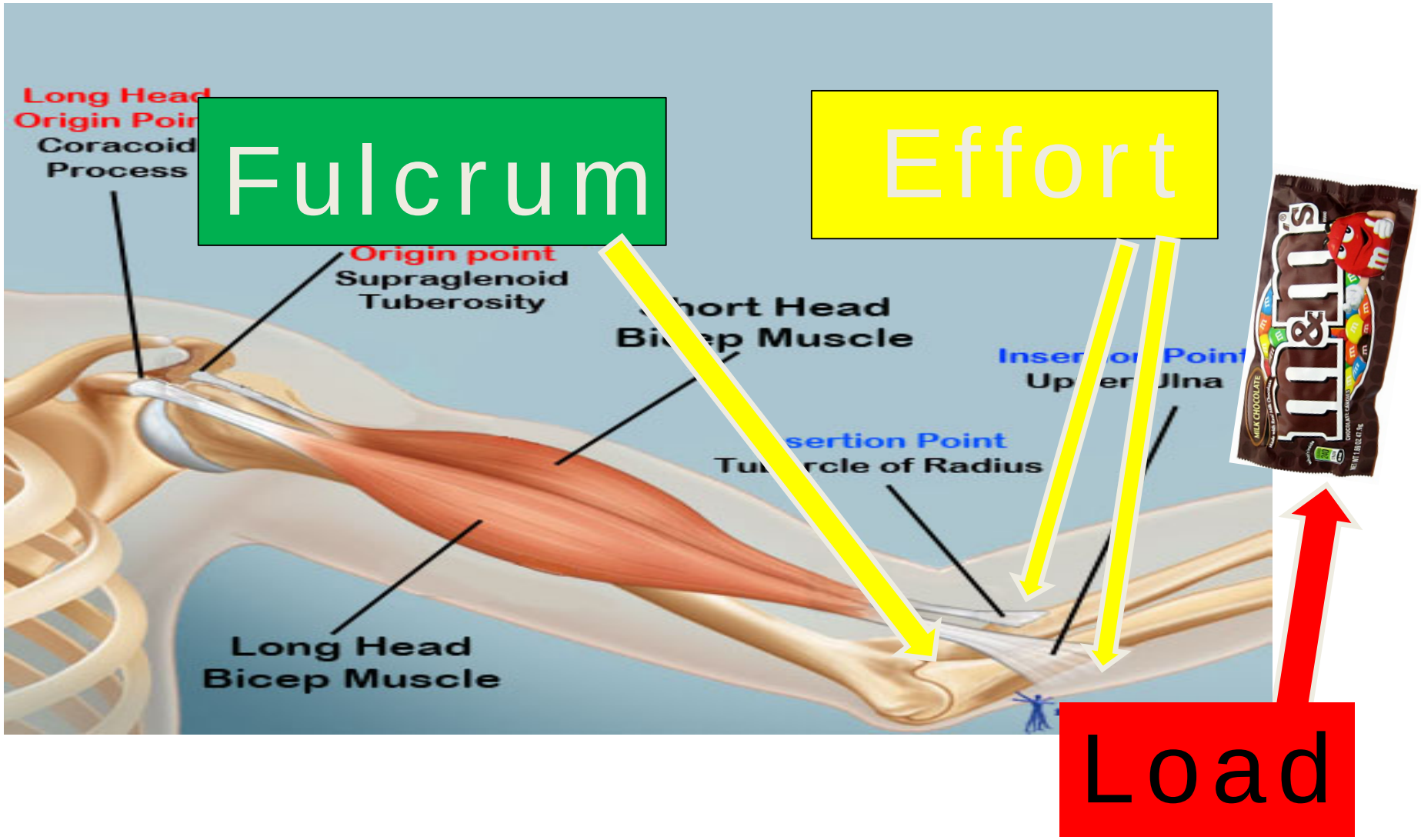
Effort

Load/ Resistance

# More Examples of Class 3 Levers

- Remember that **Effort** has to be in the middle.
- It takes a lot of strength, but speed is your reward.

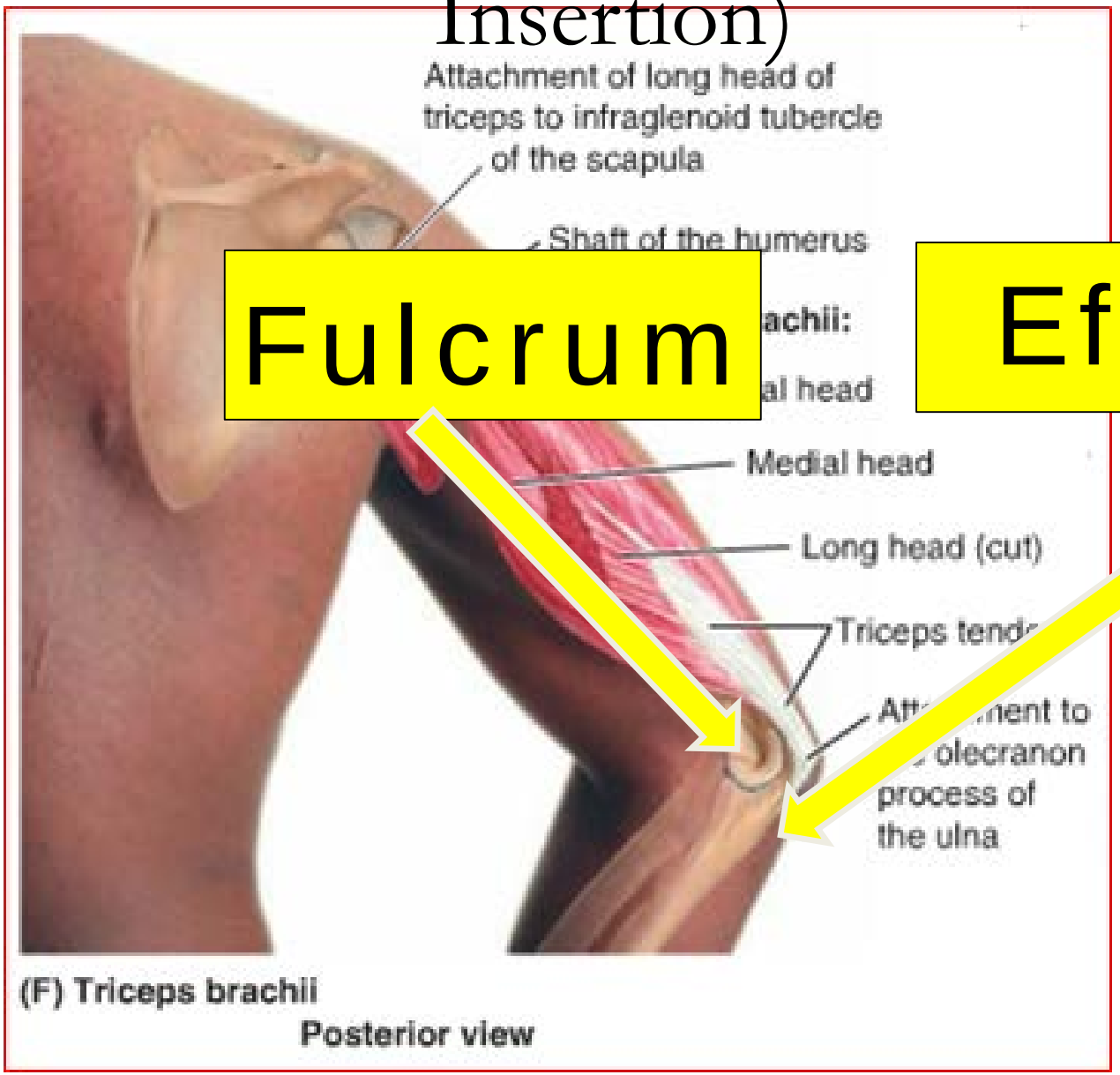

# Class 3 Lever (Human Arm..Bicep Insertion)



# Check This Out!

http://www.fearofphysics.com/Seesaw/seesaw.html

# Class 3 Lever (Human Arm..Tricep Insertion)



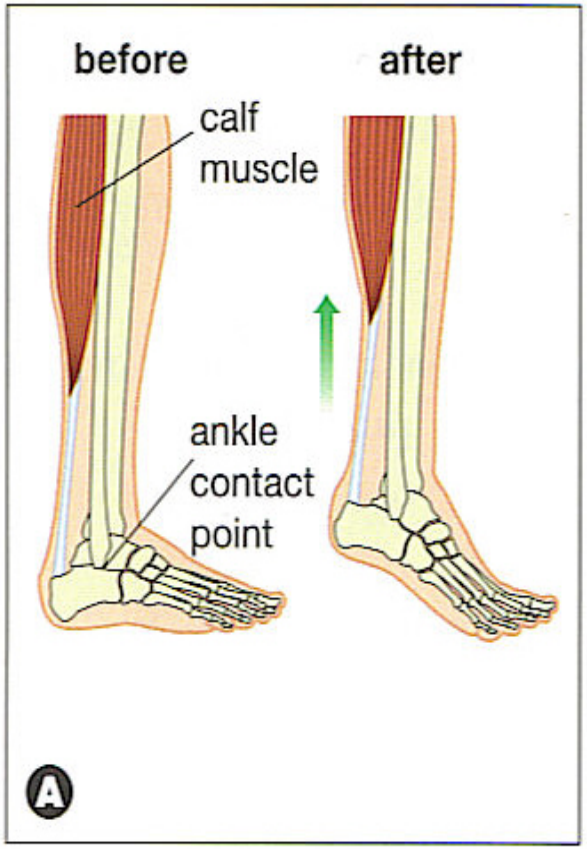



**Figure 4.5A** The calf muscle provides the effort force. Assume that a body weight of 600 N is the load.

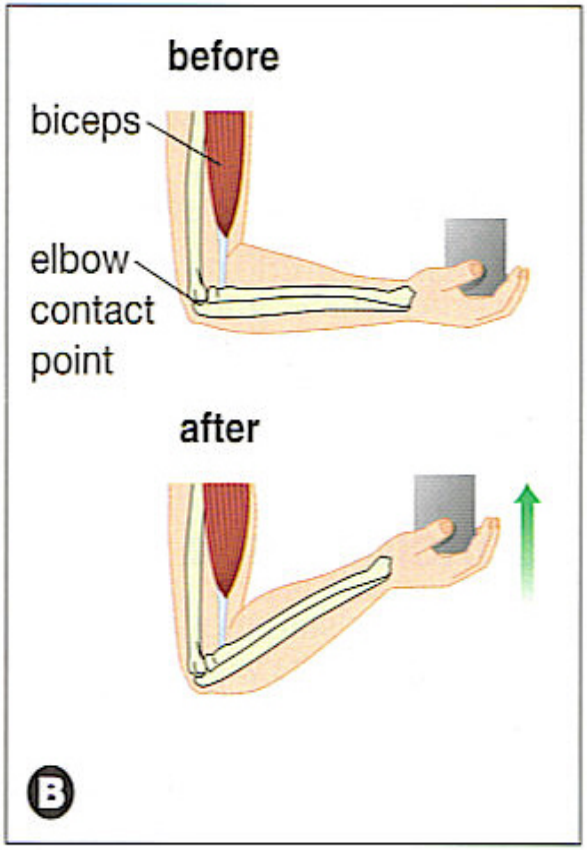



**Figure 4.5B** The biceps muscle provides the effort force. The hand is lifting a 15 N object.

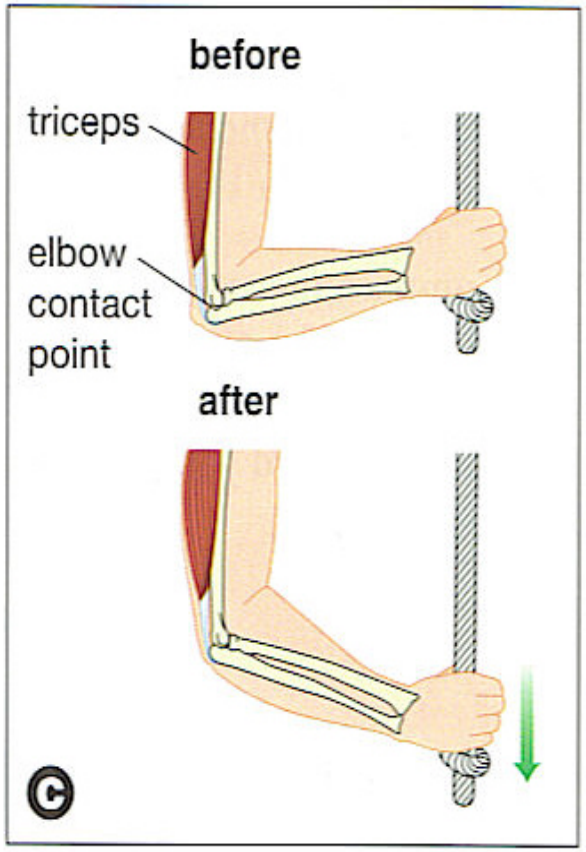



**Figure 4.5C** The triceps muscle provides the effort force. The hand is pulling the rope down with a force of 30 N.

# Label the Parts of the lever