# 7<sup>th</sup> grade science for Nov. 27 to Dec. 1: Simple Machines!

# Review of Nov. 21 worksheet

- Mathematical definition of WORK?

- Definition of MACHINE?

- Change in FORCE vs. change in DISTANCE?



**Input force**

A nutcracker *increases* the force but applies it over a *shorter* distance.

**Output force**

A hammer *decreases* the force, but applies it over a *greater* distance.

**Output force**

**Input force**

A simple pulley changes the *direction* of the input force, but the size of the output force is the same as the input force.

**Input force**

**Output force**

When a screwdriver is used as a lever, it *increases* the force and *decreases* the distance over which the force is applied.

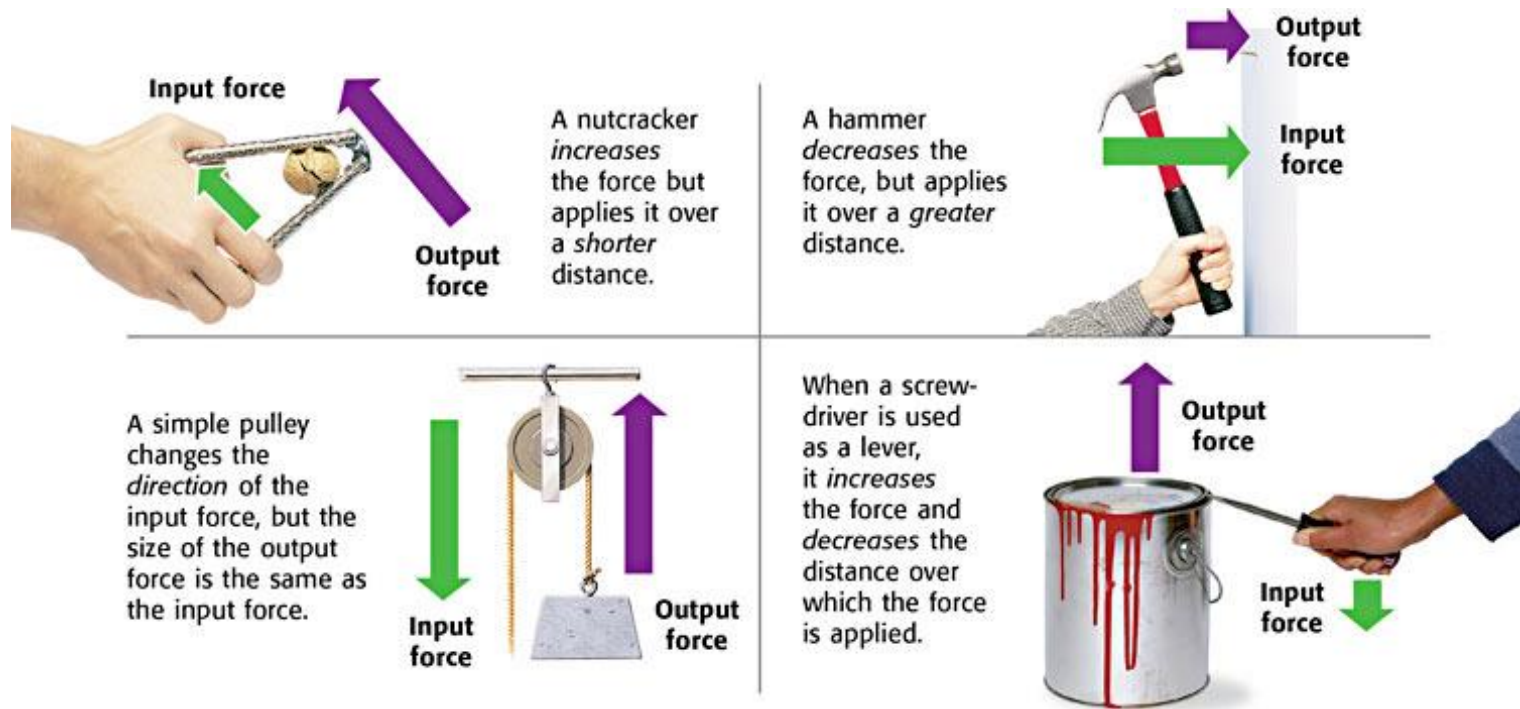**Output force**

**Input force**

Figure 4 on page 103 of your textbook

# Review of Nov. 21 worksheet

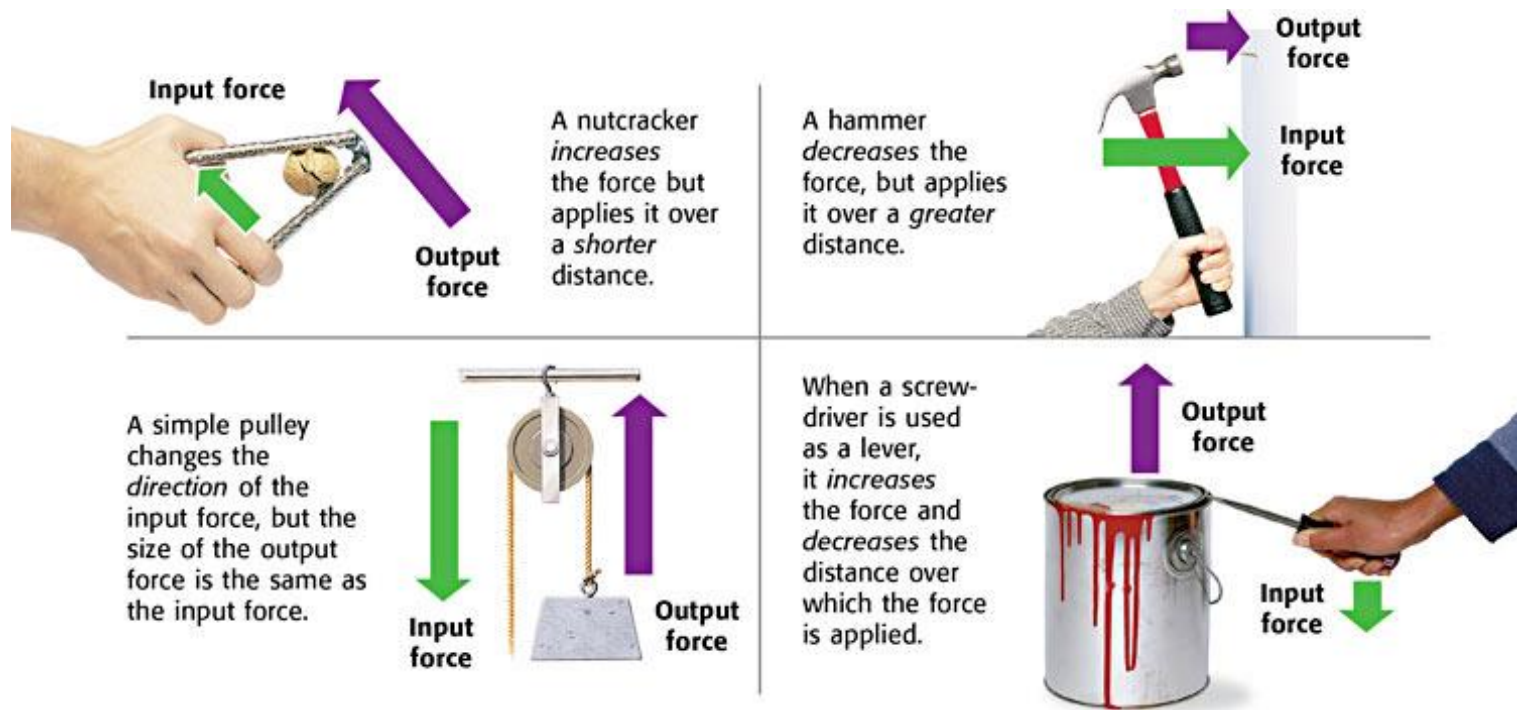- Mathematical definition of MECHANICAL ADVANTAGE?
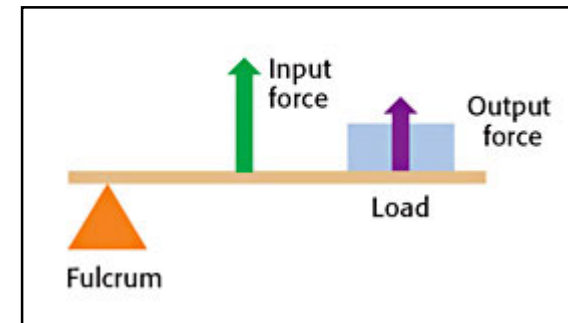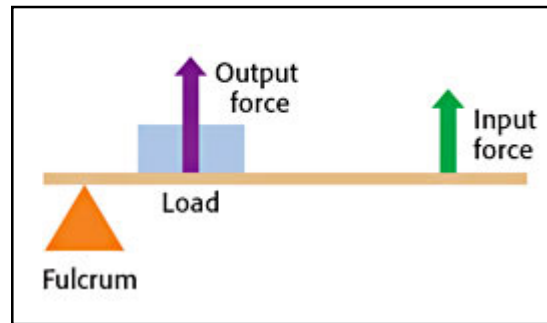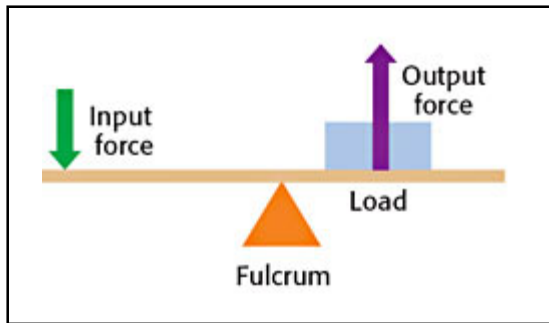
- Range of possible values?



Figure 4 on page 103 of your textbook

# Types of simple machines: LEVERS

- Terms

  - Input force (effort)

  - Output force

  - Load

  - Fulcrum

# Types of simple machines: LEVERS

- Class (1$^{st}$, 2$^{nd}$, or 3$^{rd}$) depends on arrangement of input force, output force, and fulcrum



- Mnemonics
  - F-L-E 1-2-3
  - Easy examples

# LO:  Investigate the mechanical advantage of levers.
# SLE: Work collaboratively.

**Problem:** Does mechanical advantage depend on fulcrum position?

**Hypothesis (with reason):**

**Independent variable/dependent variable/3 controls:**

**Procedure:**

1. Make a first-class lever (lever "A") with the fulcrum in the middle.  Measure the distances to the "load end" and the "effort end."

2. Place a 5-N weight (the load) at one end of the lever.

3. Using a spring scale, measure the amount of "effort" force needed (at the other end of the lever) to lift the weight.

4. Move the fulcrum away from the middle of the lever. Measure distances.

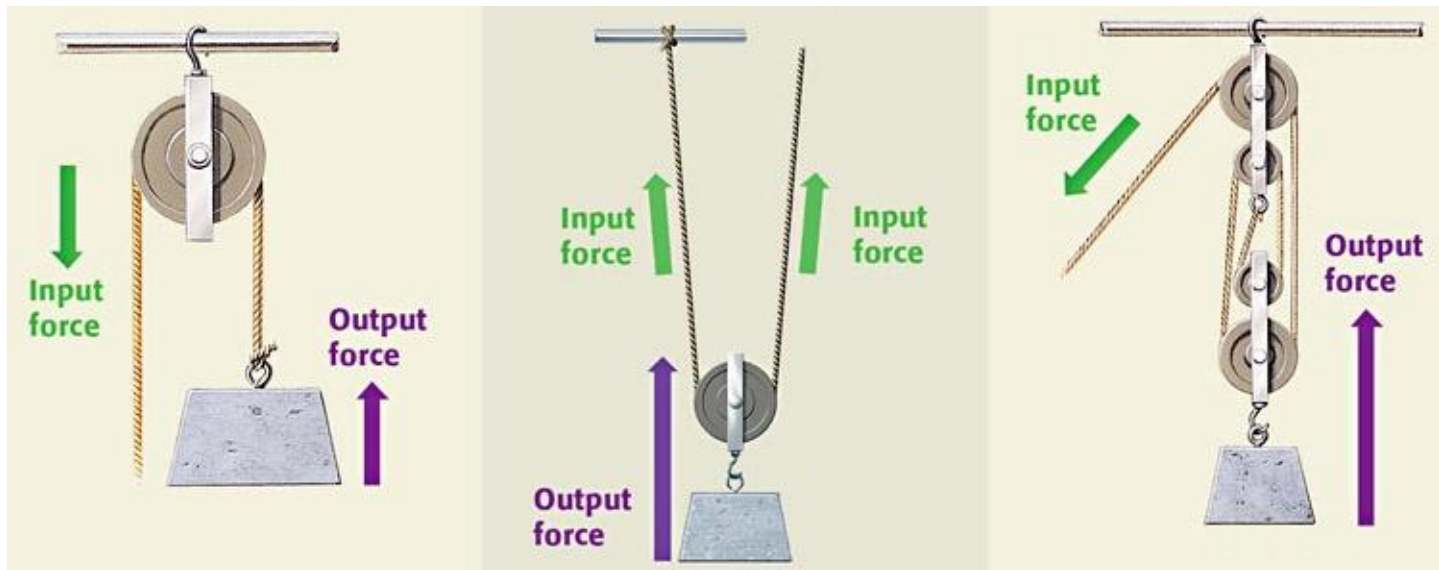5. Repeat steps 2 & 3.

**Data:**

| Type of lever | Fulcrum to effort (cm) | Fulcrum to load (cm) | Input force (N) | Output force (N) | Mechanical advantage |
|---|---|---|---|---|---|
| A | | | | | |
| B | | | | | |

**Conclusion:**

# Types of simple machines: PULLEYS

- Definition

- 3 types



Figures from pages 106-107 of your textbook

LO: Compare the mechanical advantage of fixed & movable pulleys.
SLE: Work collaboratively.

**Problem:** Does a movable pulley have a greater mechanical advantage than a fixed pulley?

Hypothesis:

Independent variable:

Dependent variable:

3 controlled variables:

Procedure:

1. Make a fixed pulley.

2. Use the pulley to lift a 5N weight.

3. Observe how much force you need to put into the pulley to lift the weight.

4. Repeat Steps 1-3 with a movable pulley.

# Data:

| Type of Pulley | Input Force (N) | Output Force (N) | Mechanical Advantage |
|---|---|---|---|
| Fixed | | | |
| Movable | | | |

# Conclusion:

# Review for Friday quiz

- How is work calculated?

- Define machine.
    - Do machines change the work done?
    - What DO they change?

- What are the 6 types of simple machines?

- Define lever.
    - Be able to classify a lever as 1st-class, 2nd-class, or 3rd-class.

- Define pulley.
    - What are the 3 types of pulleys?

- How is mechanical advantage calculated?
    - What is the range of possible values?

# The 6 simple machines (again)
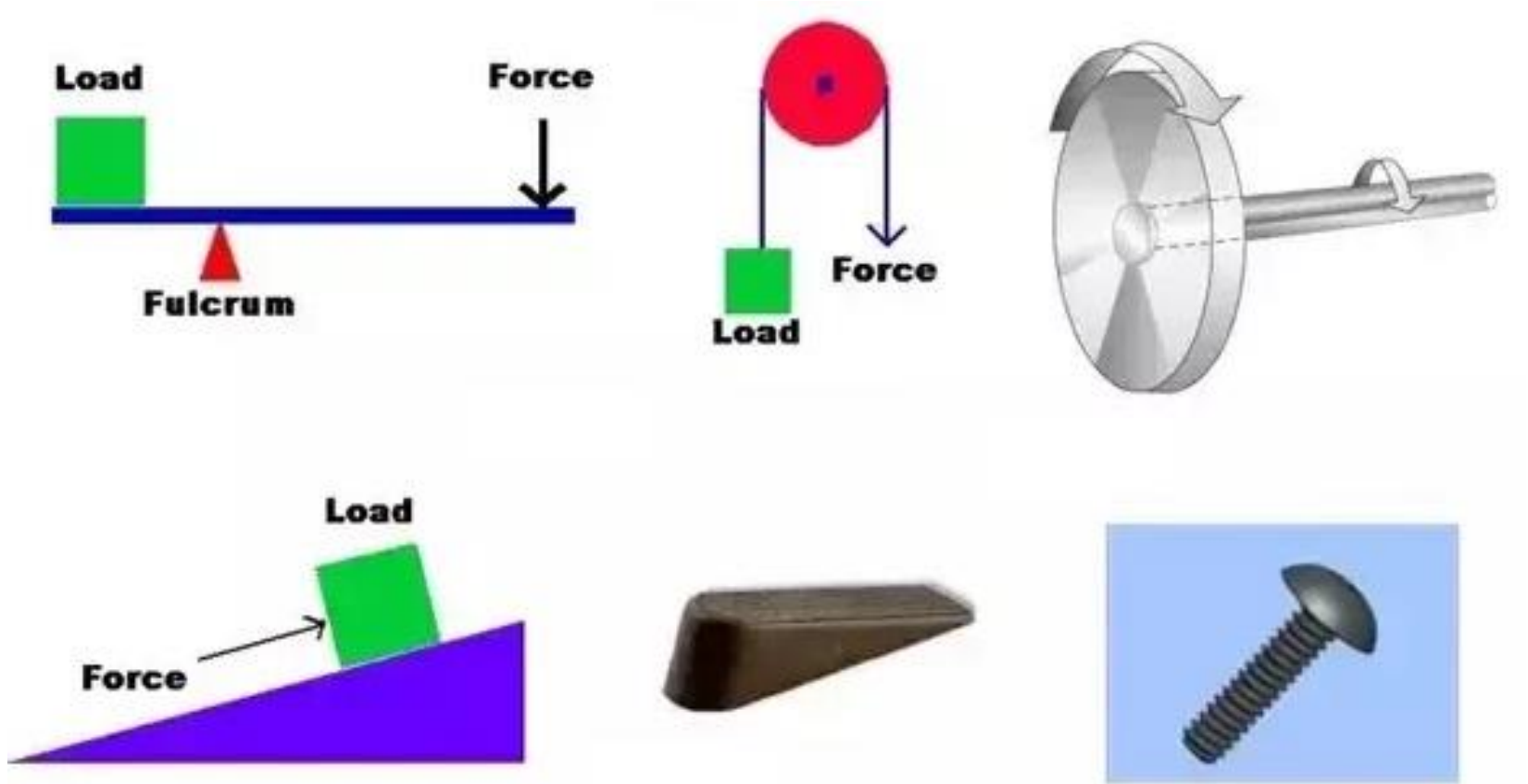
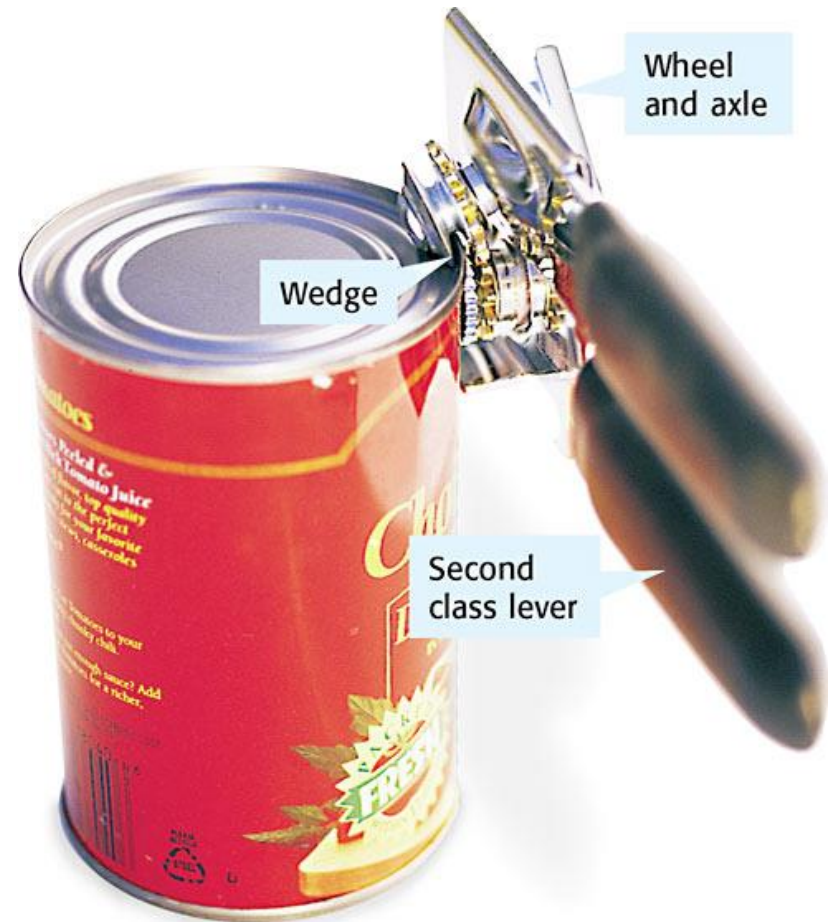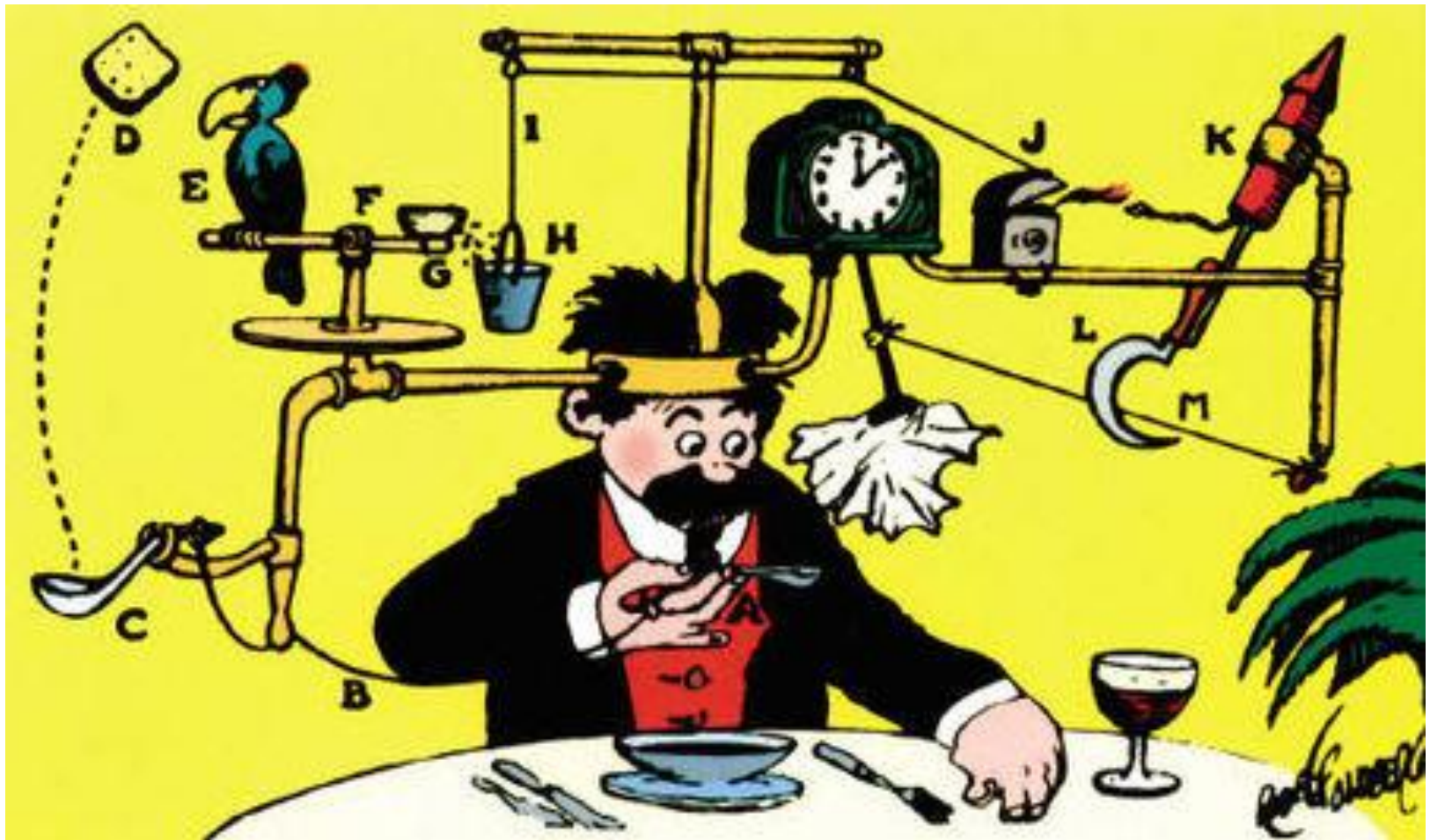# Compound machines: combinations of simple machines!



Wheel and axle

Wedge

Second class lever

# Rube Goldberg devices are compound machines