

Motion

Chapter 1: Pages 14-31

Review Questions

3-8, 10, 22, 24, 26-28

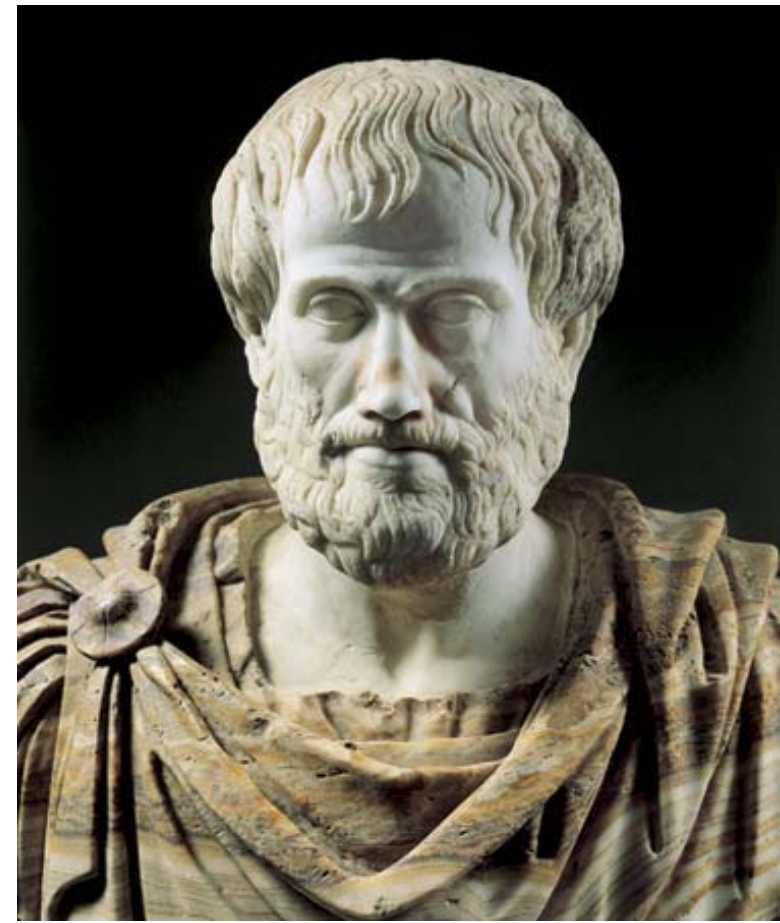
Peer Led Team Learning

- PLTL
- ES105x
- CRN 21433
- Monday or Wednesday 5:45-7:45
- Library room HL 101
- Teresa Trump

Study of Motion

Aristotle—4th century BC

- Student of Plato
- Tutor of Alexander
- Used logic to describe natural world: collected, classified
- Motion ceased when objects in their proper place
- Thought speed of falling objects depended on their weight
- Ignored friction, air resistance
- Influential for 2000 years



**Aristotle,
marble portrait bust,
Roman copy (2nd century
BC) of a Greek original (c.
325 BC); in the Museo
Nazionale Romano, Rome**

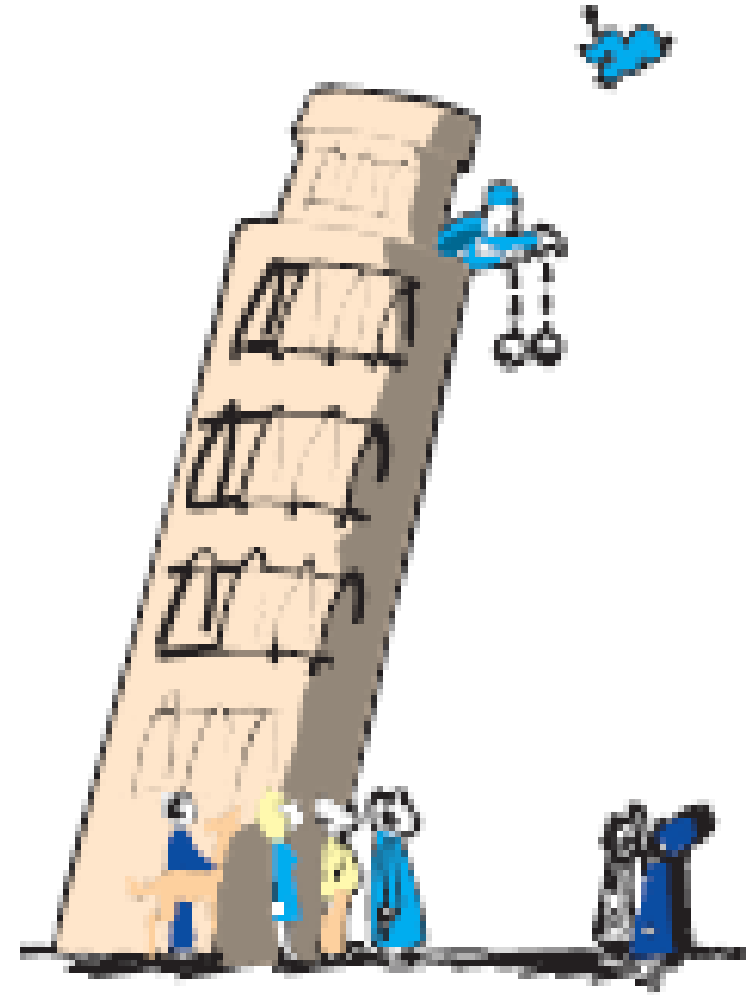


Galileo

- Studied Copernicus' work of 1543
- Use experiment to test logical ideas
- Discovered speed not dependent on weight, only on amount of time for falling

Study of Motion

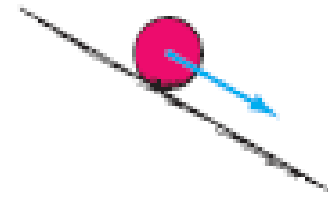
- Defined 'inertia': keep moving in same direction and speed without outside influences—resistance to change of motion
- Speed not dependent on weight, only on amount of time for falling
- Noted that gravity increased speed of falling objects, decrease speed of rising objects



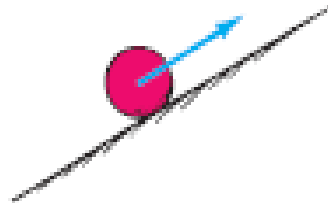
Galileo's inclined planes

- Balls roll down faster and faster
- Roll up slower and slower
- Weight not a factor

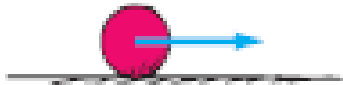
Slope downward-
Speed increases



Slope upward-
Speed decreases



No slope-
Does speed change?



Galileo's investigation of motion

- Used inclined planes to slow the descent of objects, because he didn't have a precise timer

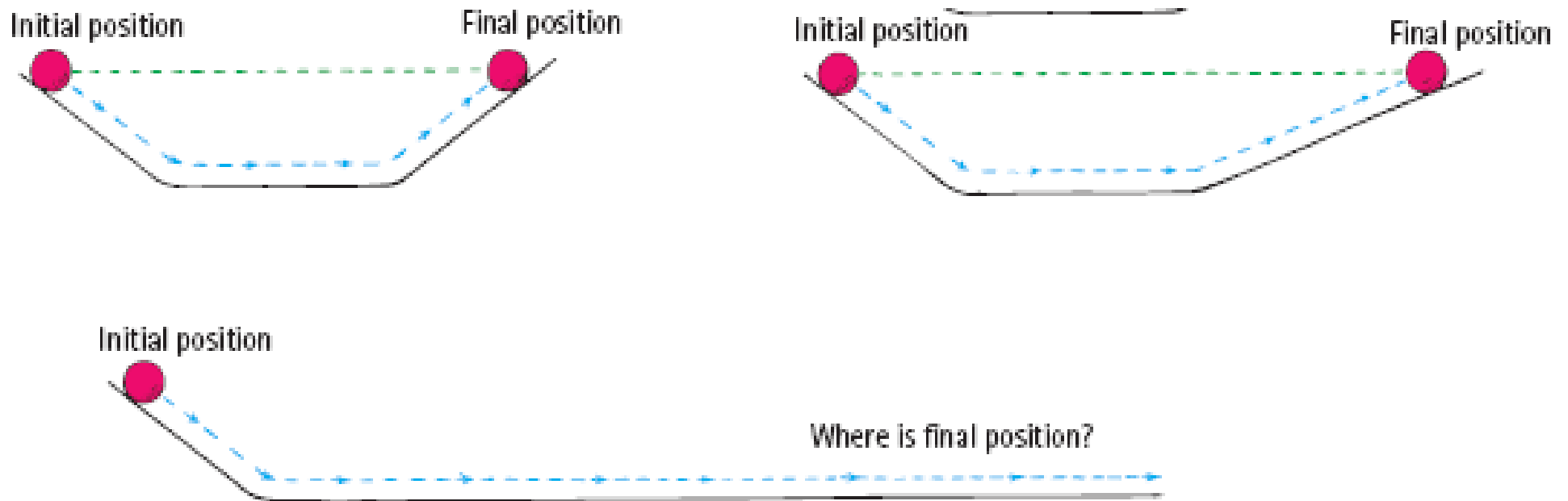
Initial position

Final position



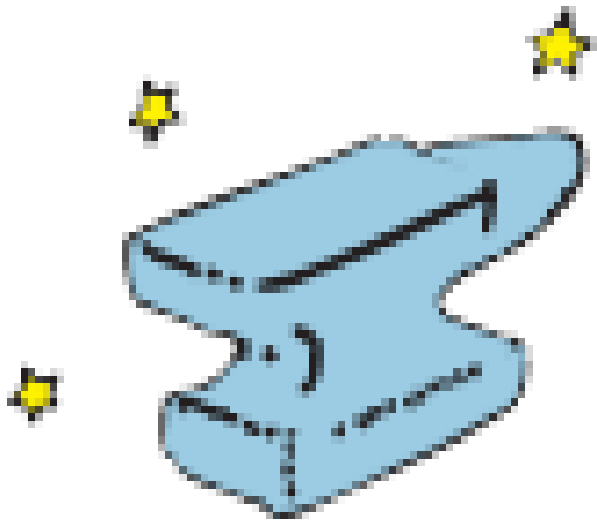
Galileo's inclined planes

- Rises to same height as it is released
- Height not dependent on incline



Mass

- Measure of inertia
- How much matter is there
- Corresponds to weight—the influence of the acceleration of gravity on the mass
- They are proportional



Mass

- Measured in kilograms
- Influence of gravity gives weight
 - Pounds lb.
 - Newtons N
- On Earth: $1 \text{ kg} = 9.8 \text{ N}$
- Not a measure of volume

Inertia vs. weight

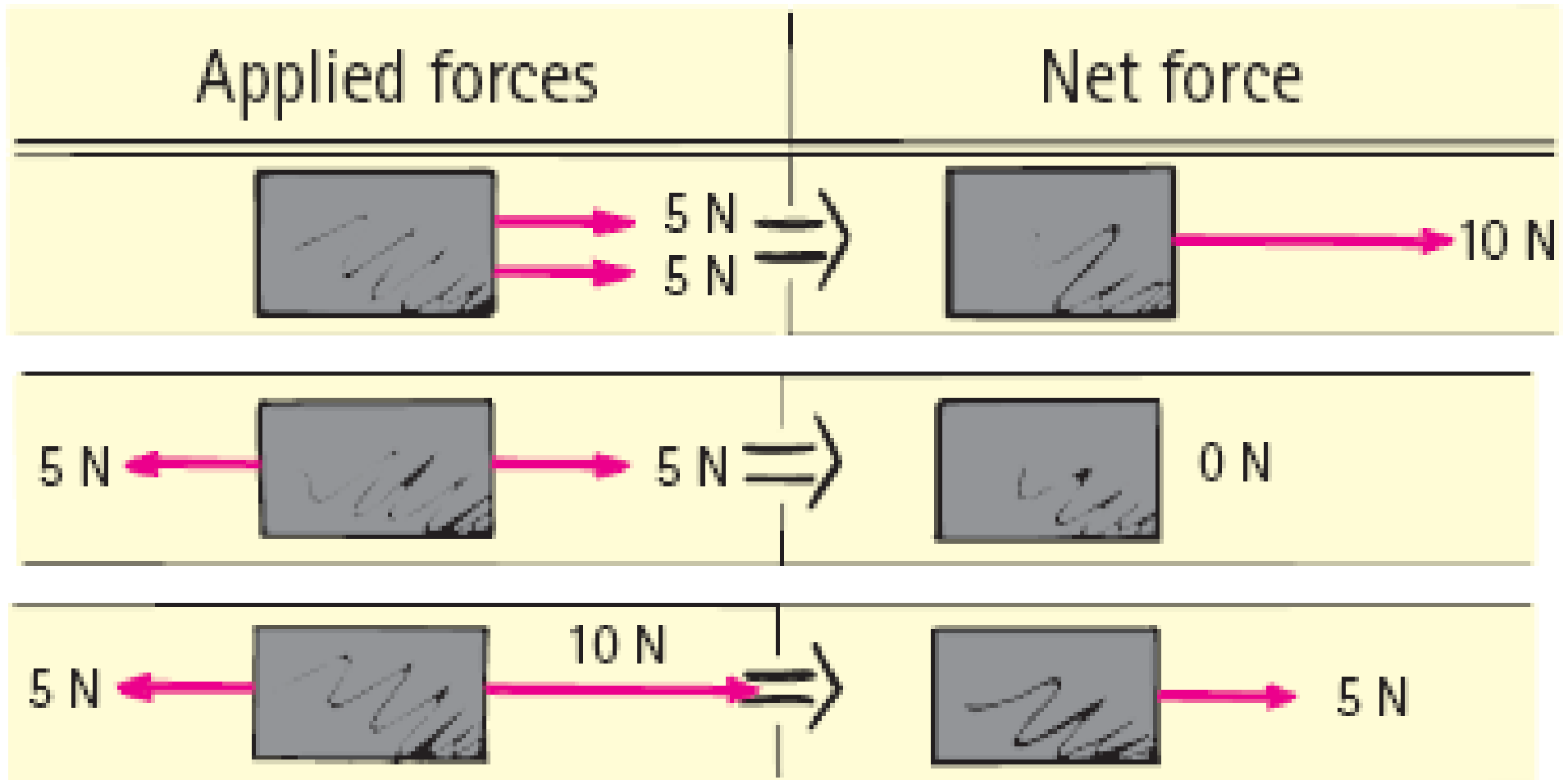
- Weight is the force, due to gravity—pulling iron ball down
- Inertia is resistance to change of movement—ball is not moving
- Pull slowly, you increase force and break string that is holding the ball up
- Rapid jerk will break string below ball, because it has large mass that is not moving—has inertia



Force

- Weight is a force due to gravity
- Force is *VECTOR QUANTITY*
- Vectors have magnitude and direction
- Multiple vectors add up

Applied forces

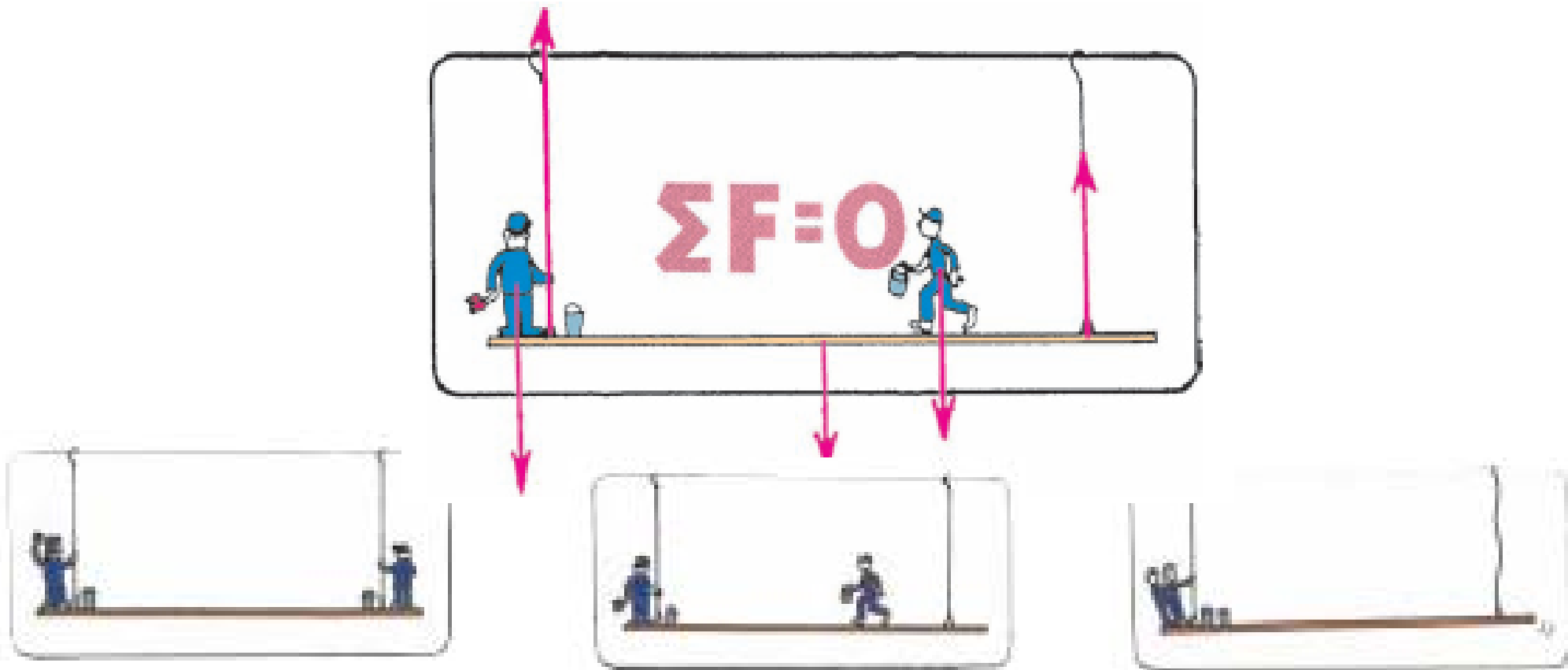


Objects not moving

- Force of weight is equal to force of string holding it up
- The sum of the forces is zero
- There is mechanical equilibrium

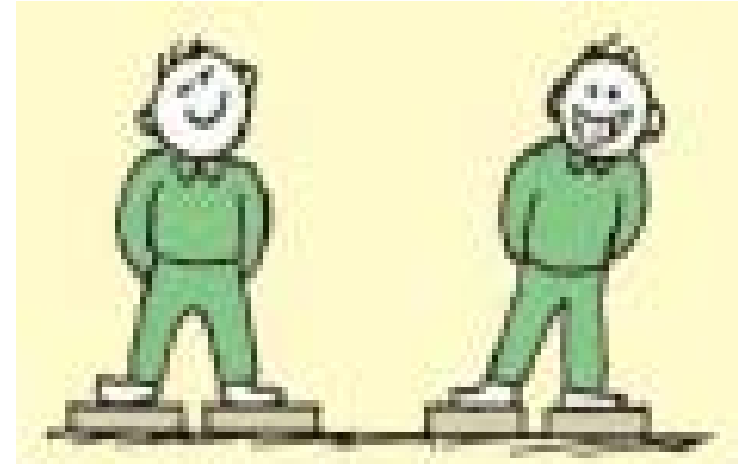
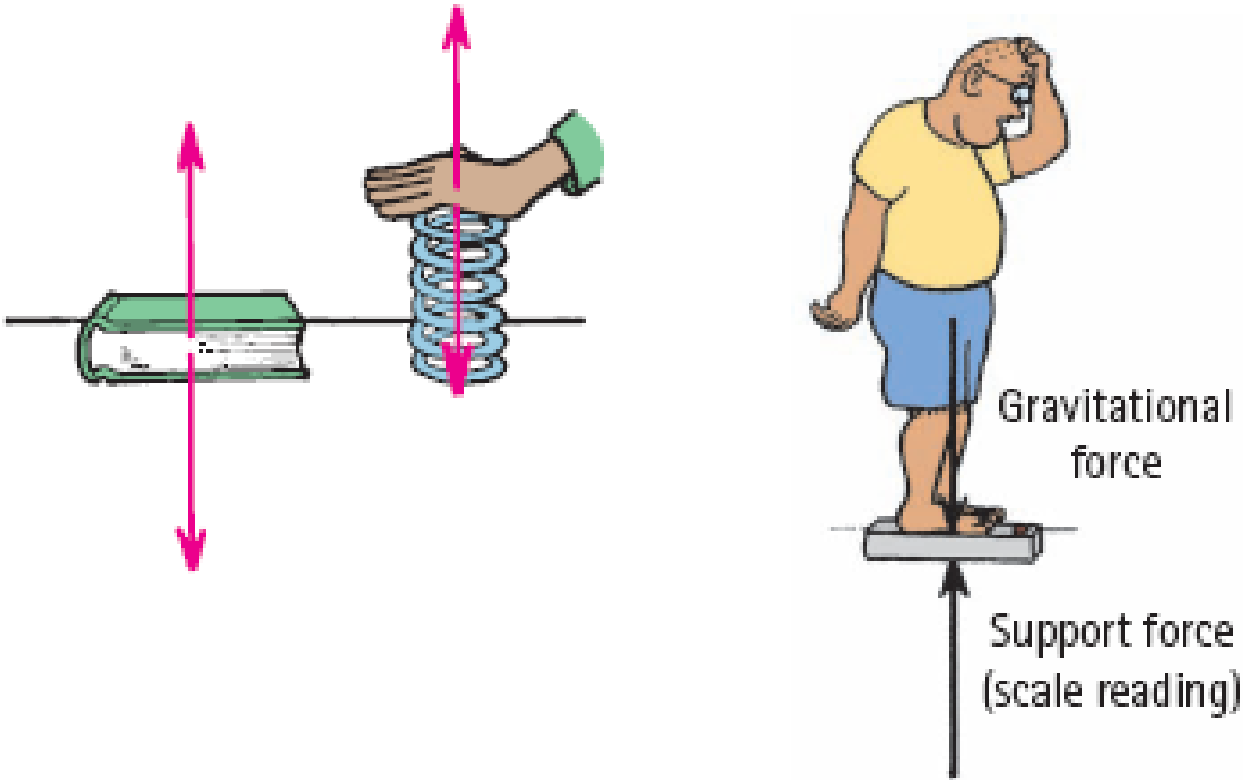


Objects not moving



- In equilibrium

Support Force



- Weight acts downward
- Atoms push back upward
- Forces equal—in equilibrium

Dynamic Equilibrium

- Can be moving
- At a constant speed in a straight line
- Net forces are zero

Friction

- Force that acts to resist motion
- Always in opposite direction to applied force
- When you are pushing something, and it moves at a constant speed, the frictional force is the same as the pushing force

Study of Motion

- Speed—how fast
- Velocity—how fast and what direction
- Acceleration—how fast it is changing how fast

Speed

$$\textit{speed} = \frac{\textit{distance}}{\textit{time}}$$



$$\frac{320\textit{km}}{4\textit{h}} =$$

$$\frac{80\textit{km}}{\textit{h}}$$

Common units of speed

- Miles per hour mph
 - Means ‘miles per hour’
 - Don’t use this abbreviation of the words
 - Use mi./h
- Kilometers per hour km/h
- Meters per second m/s

Speed of cheetah

$$\frac{100m}{4s} = \frac{25m}{s}$$

Distance equation

$$\text{Rate} \times \text{time} = \text{distance}$$

- Keep units with numbers, so you know you have set up the problems correctly

Example of $rt=d$ calculation

$$\frac{80km}{h} \bullet 4h = 320km$$

- Notice that hours cancels because it is above and below the fraction bar