Motion

Chapter 1: Pages 14-31

Review Questions

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

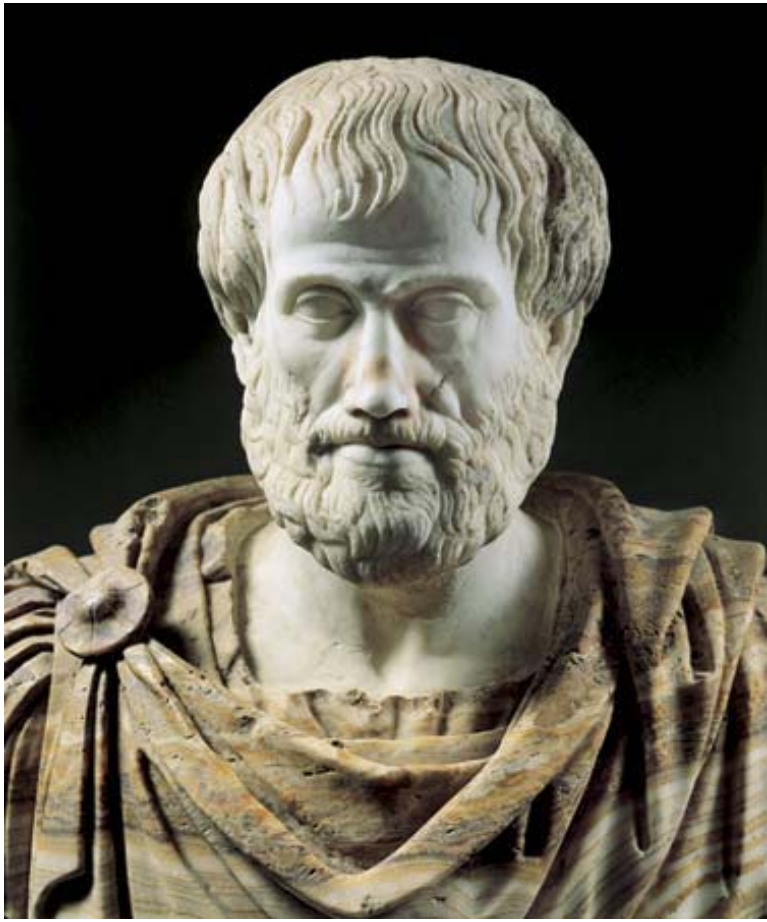
Peer Led Team Learning

- PLTL
- ES105x
- CRN 21823
- Looking like evening class: some have requested it to start at 6:30 or 7, so they can have dinner and then go to it?
- Day of the week still to be determined
- Please put your name on the sign-up list if you are interested

Study of Motion

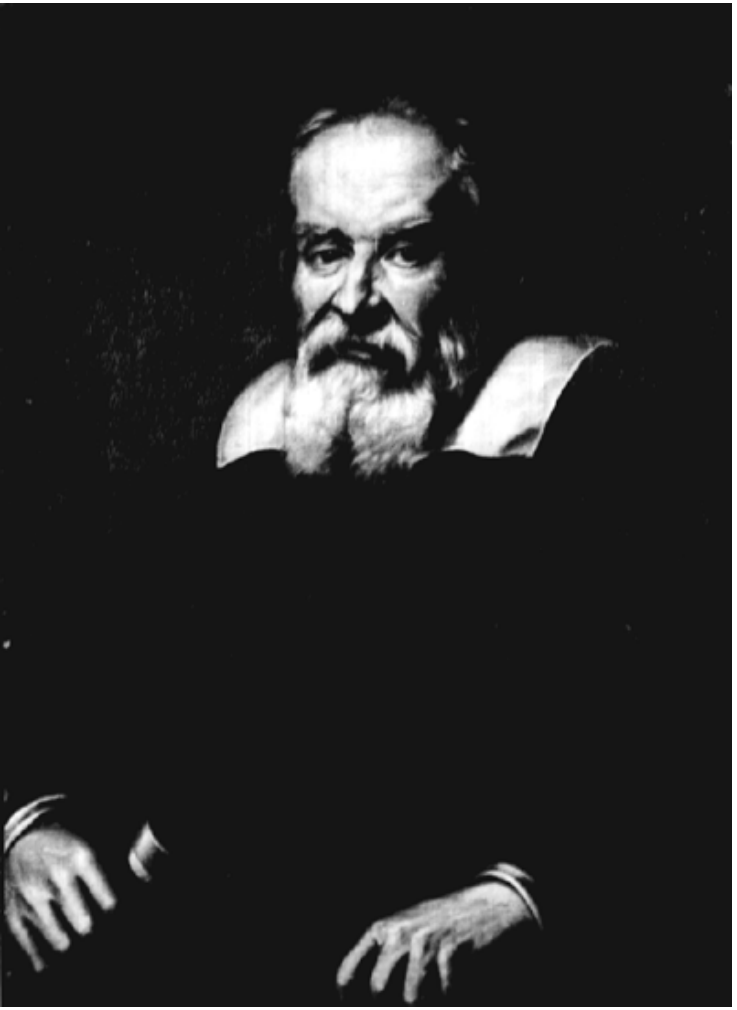
Aristotle—4th century BC

- 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

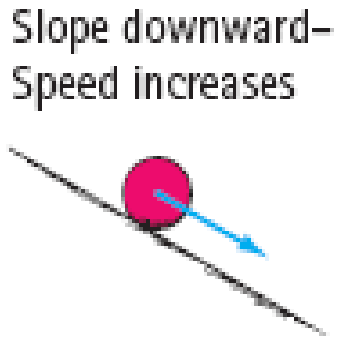
http://airandspace.si.edu/etp/discovery/disc_galileo.html

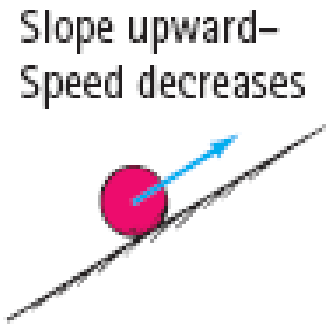
Galileo's Study of Motion

- 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

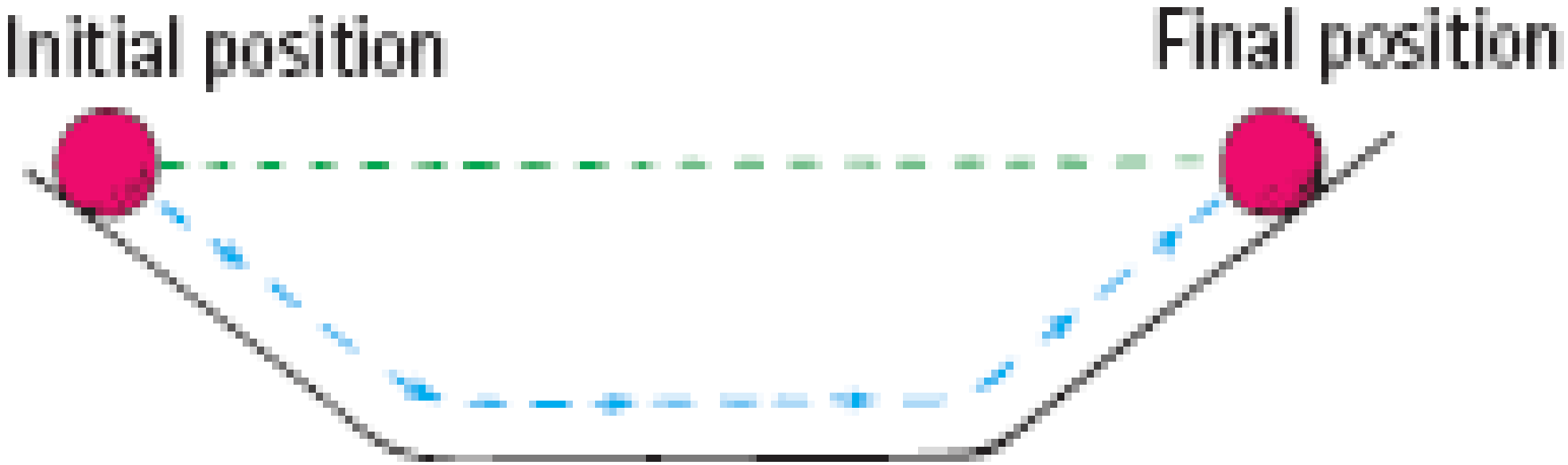
- Balls roll down faster and faster
- Roll up slower and slower
- Weight not a factor





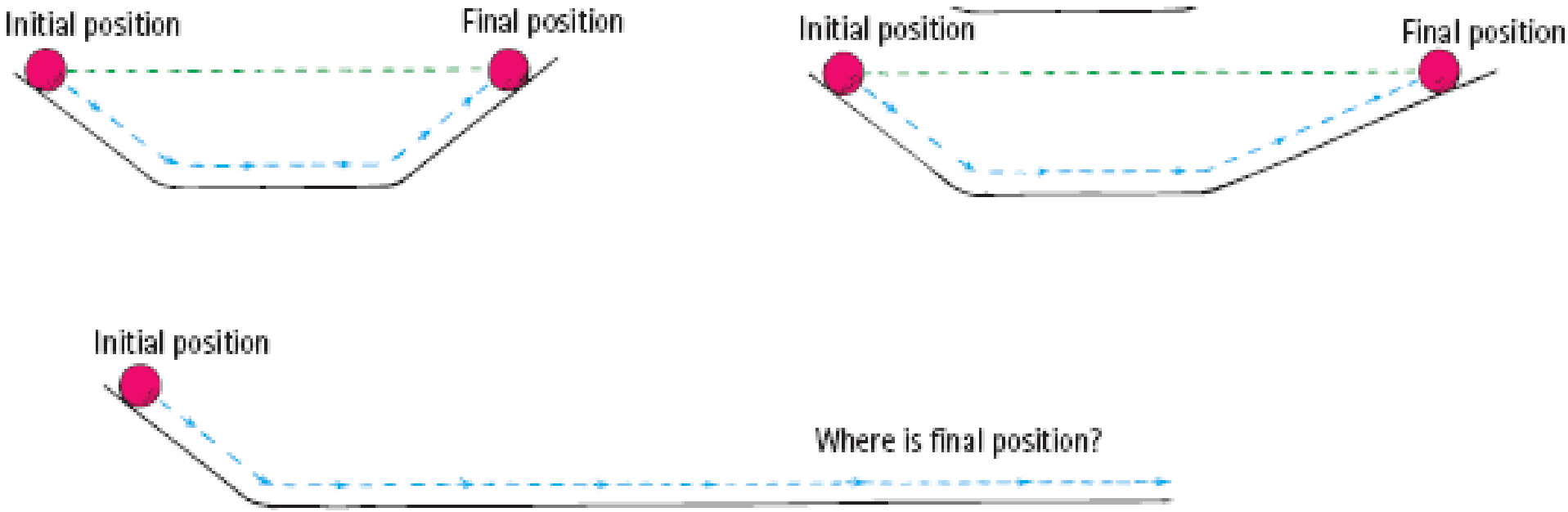
Galileo's investigation of motion

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



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 kg = 9.8 N
- Not a measure of volume

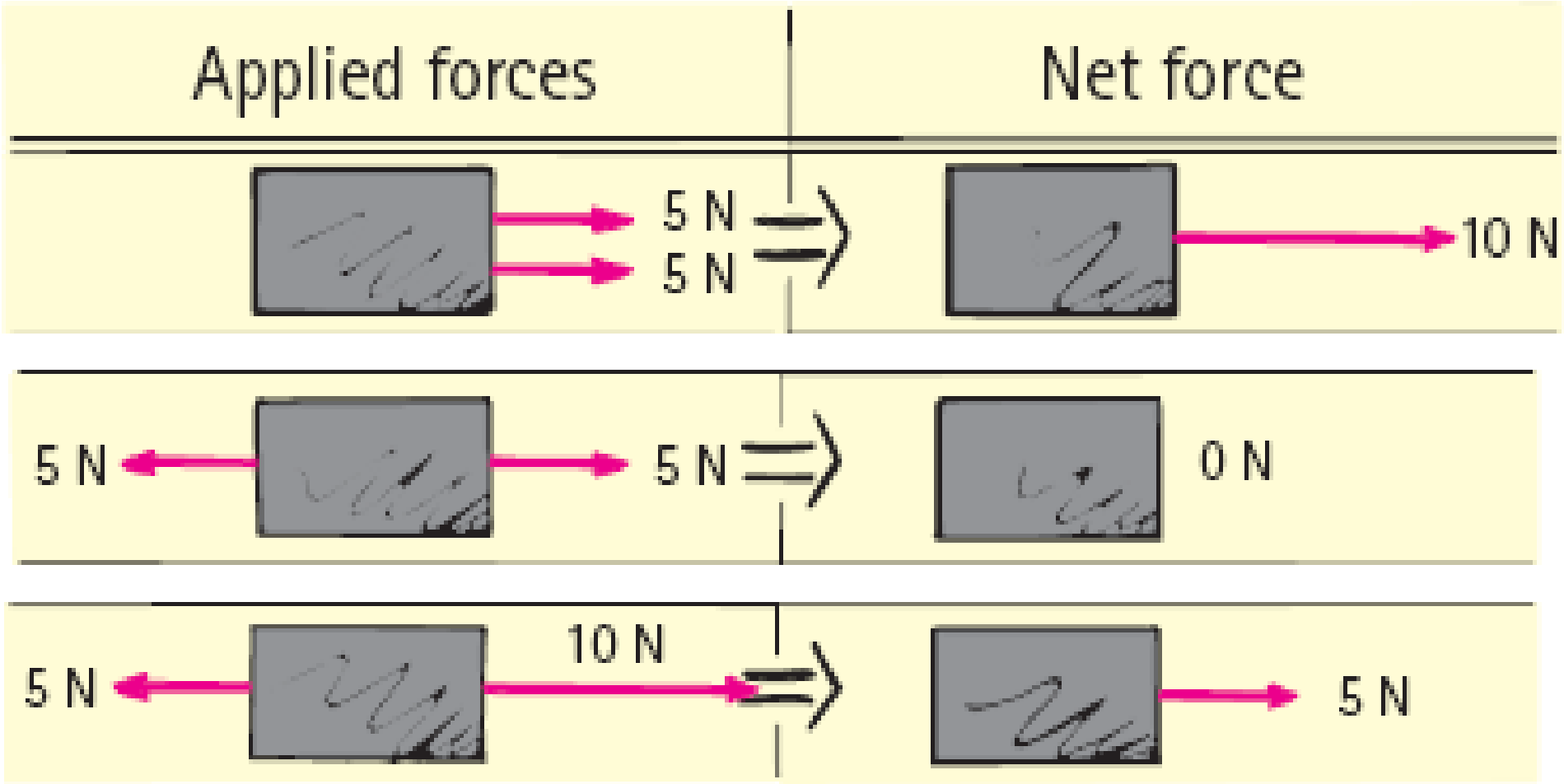
Inertia vs. weight

- 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

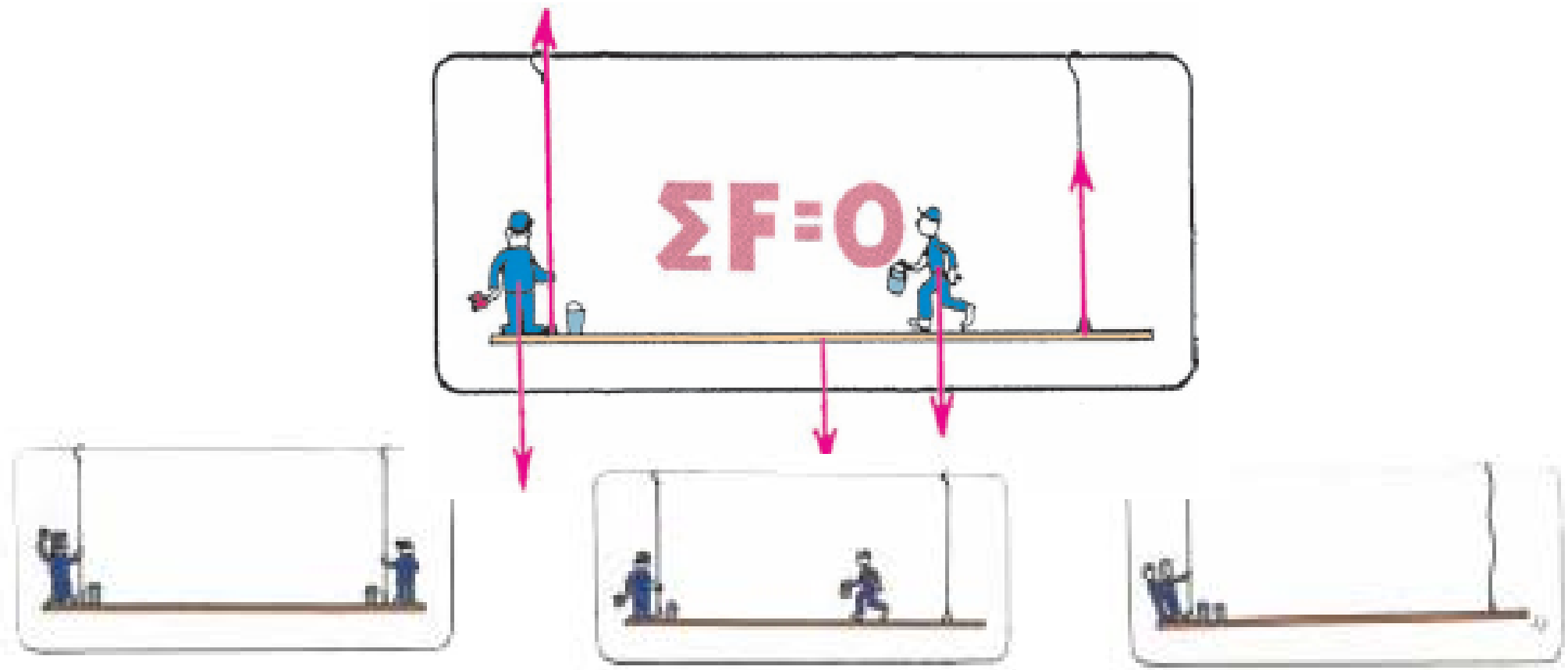
Applied forces



Objects not moving

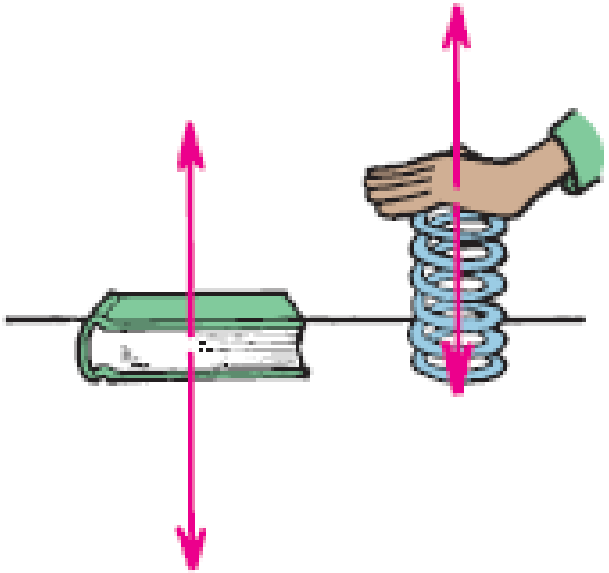
- Force of weight is equal to force of string holding it up
- The sum of the forces is zero
- There is mechanical equilibrium

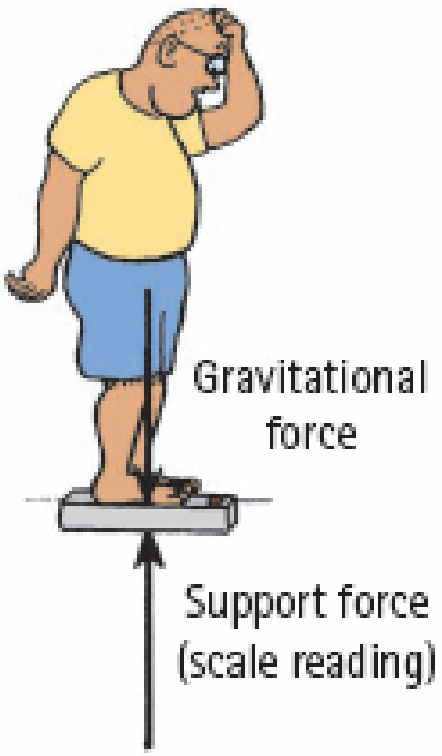
Objects not moving

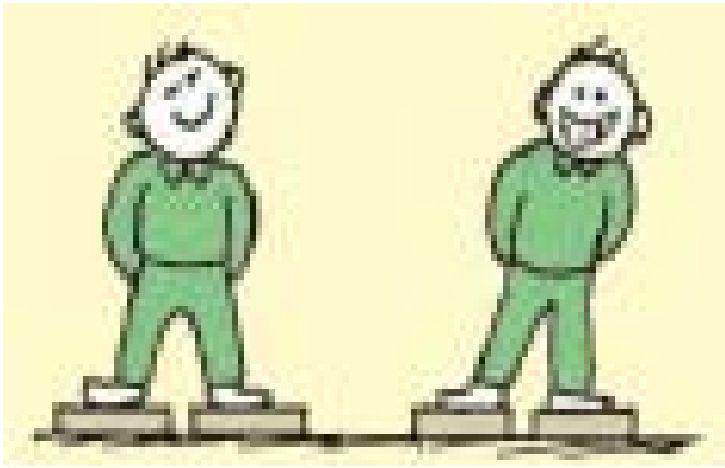


- In equilibrium

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

A pair of parallel forces of 8 N and 12 N can have a resultant of

1. 4 N.
2. 20 N.
3. Both of the above.
4. Neither of the above.

- *Explanation*:

When parallel, 12 N + 8 N = 20 N,
or 12 N – 8 N = 4 N.

Study of Motion

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

Speed

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

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

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