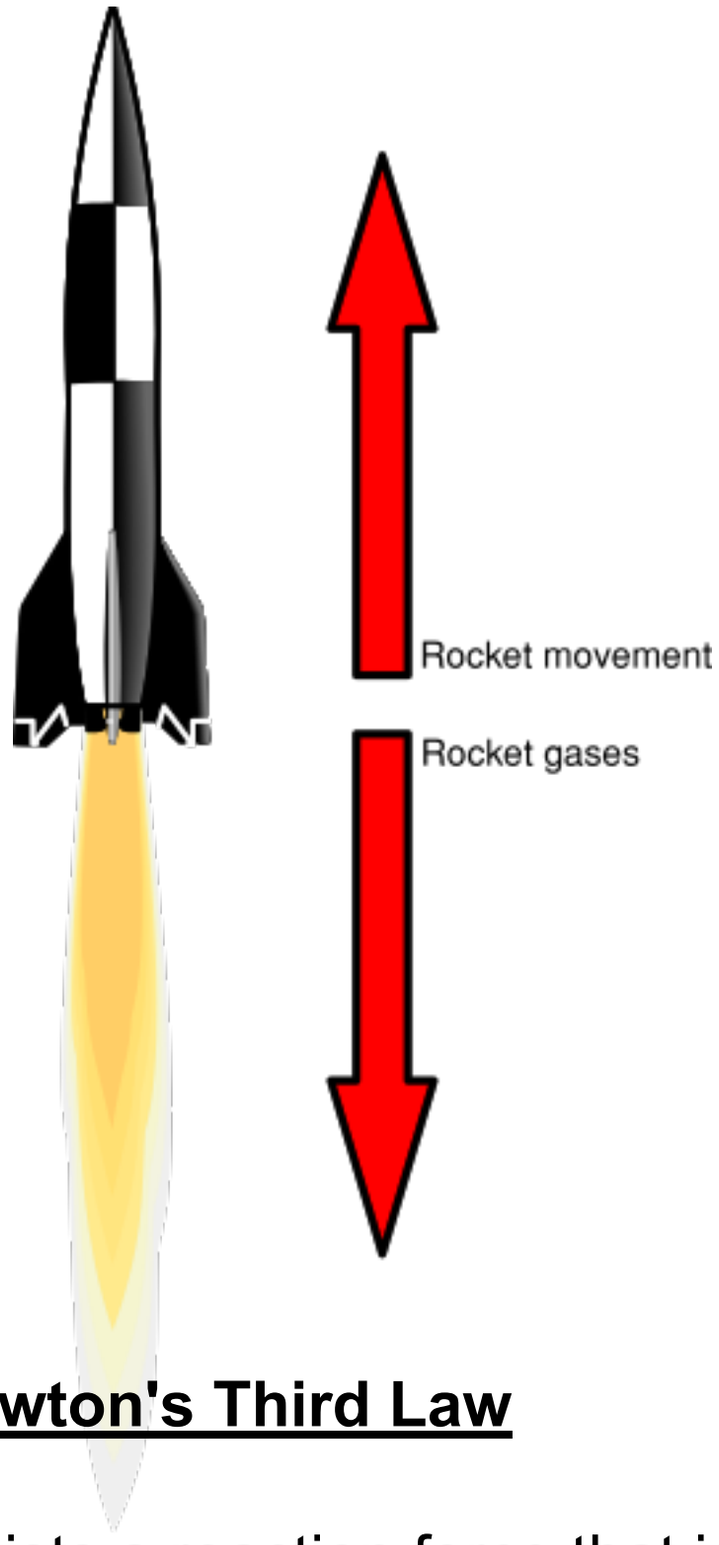
Newton's Third Law ~ Why you should never punch a wall!

Have you ever stubbed your toe? You apply the force but also feel the pain.

When an asteroid hits the earth, the earth stops the asteroid but the asteroid creates a crater.

Whenever object A exerts a force on object B, object B resists or pushes back on object A with a force that is equal in magnitude but opposite in direction to the force object A exert on B.

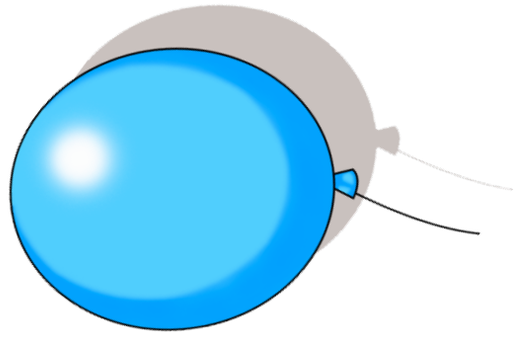


Newton's Third Law

For every force, there exists a reaction force that is equal in magnitude but opposite in direction.

Examples:

~ release an inflated balloon

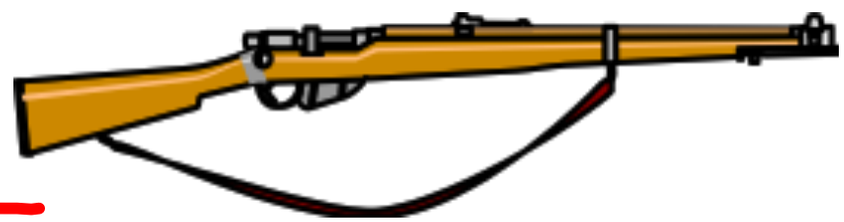


$$F_{air} = -F_{balloon}$$

~ skater pushing off from the boards

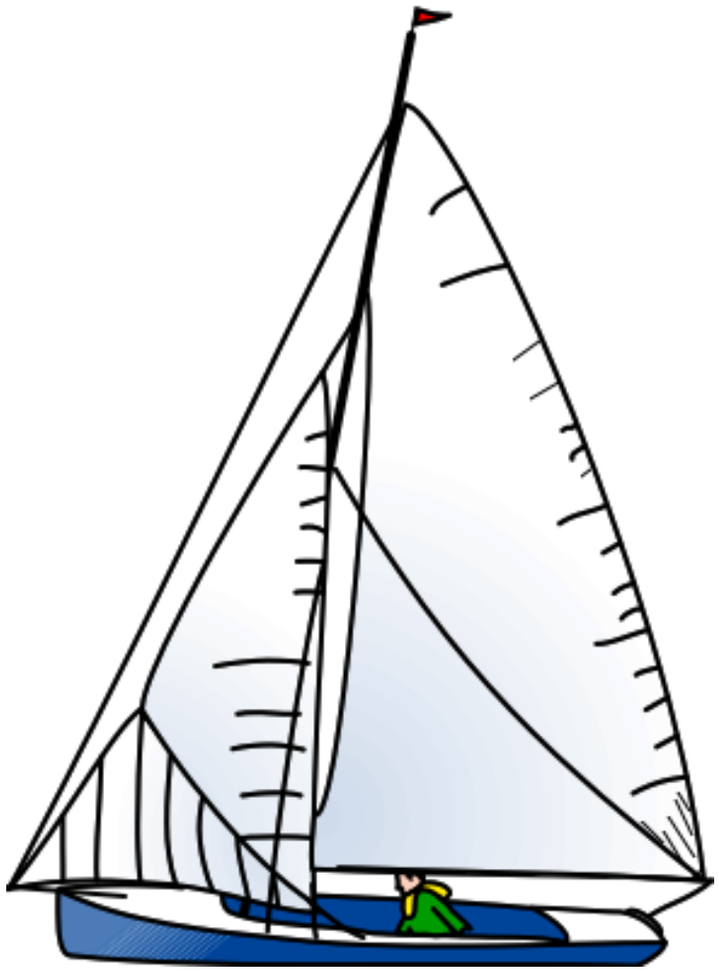
$$F_{skater} = -F_{boards}$$

~ recoil from a gun



$$F_{Bullett} = -F_{gun}$$

~ sail and wind



~ canoe and paddle

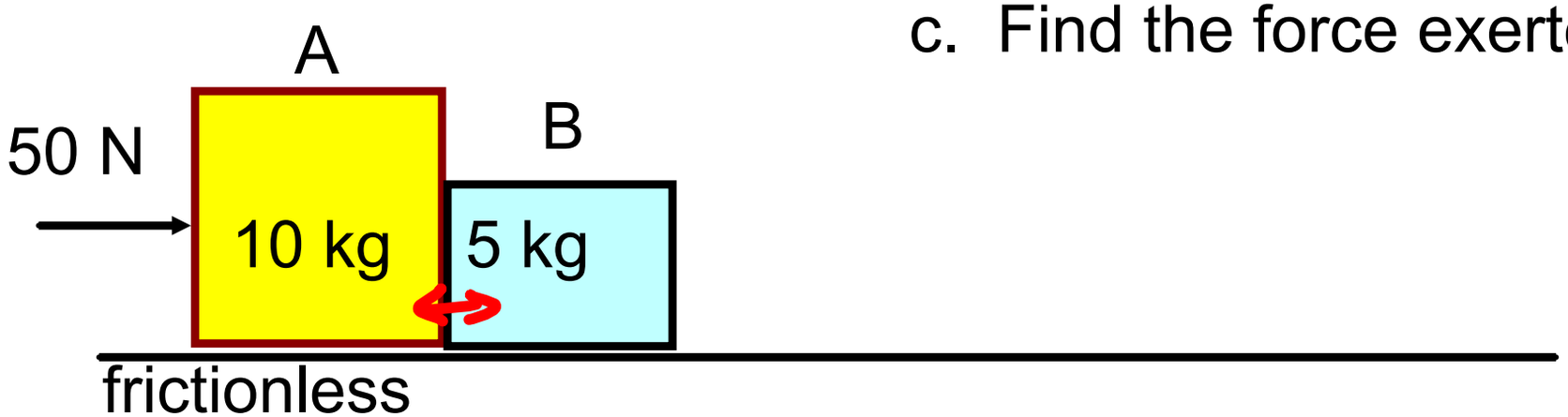
~ walking

~ swimming

$F_{\text{swimmer on water}} = -F_{\text{water on swimmer}}$

An Action-Reaction Problem

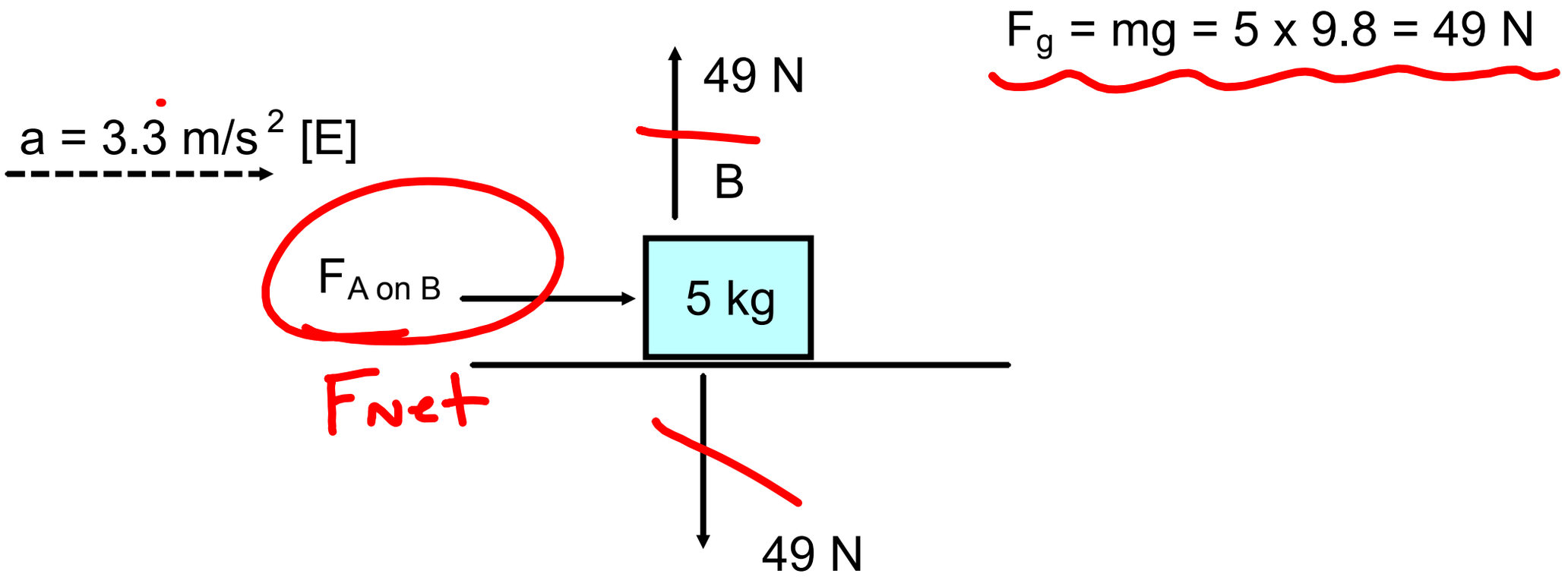
a. Find the acceleration of the boxes.
b. Find the force exerted by A on B.
c. Find the force exerted by B on A.



a. To find the acceleration assume both boxes are together as one box with mass 15 kg.

$F_{net} = ma$
$a = F_{net}/m$
$a = 50/15$
$a = 3.3\ m/s^2\ [E]$ $\therefore$ The boxes are accelerating at $3.3\ m/s^2\ [E]$

b. To find the force exerted by A on B, construct a FBD for B.

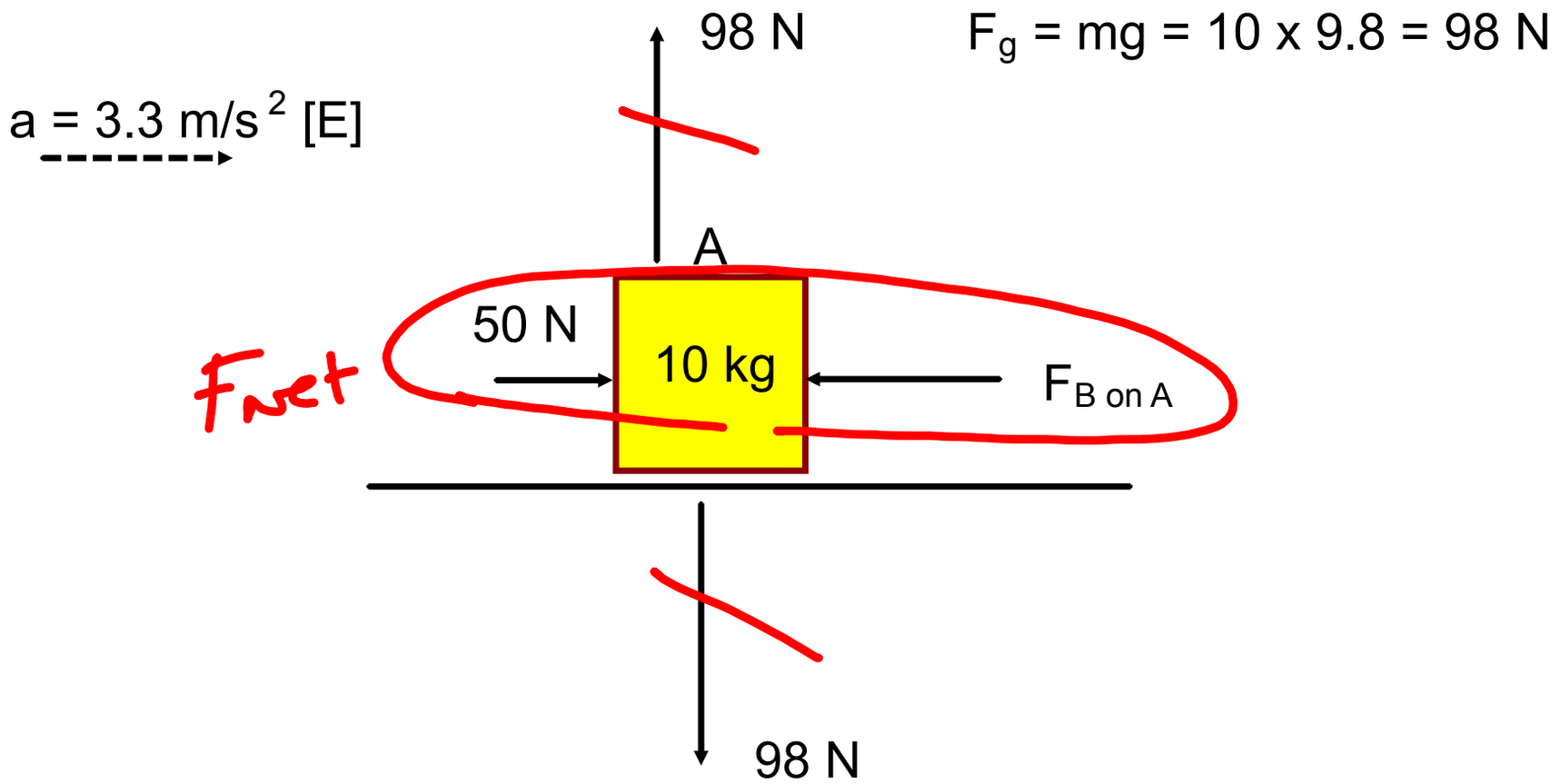


Since the force exerted by A on B is the only force acting in the horizontal direction it must be the unbalanced force.

$F_{A \text{ on } B} = F_{net} = ma = 5 \times 3.3 = 16.7$ N [E]

$\therefore$ The force exerted by A on B is 16.7 N [E]

c. To find the force exerted by B on A construct a FBD for A.



F_{net} = ma = 10 x 3.3 = 33.3 N [E]

Now since F_{net} = 33.3 N [E] and you are pushing with 50 N [E] B must push on A with 50 - 33.3 = 16.7 N [W]

$\therefore\ F_{A\ on\ B} = -F_{B\ on\ A}$

http://www.youtube.com/watch?v=mNM5tHou4IQ&feature=fvw

pg 144 # 26, 27, 29, 30, 31, 33, 35