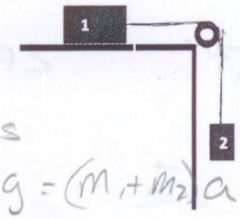
Quiz #5

Name: Solution

1. What is the acceleration of mass 2 if there is no friction on Mass 1?



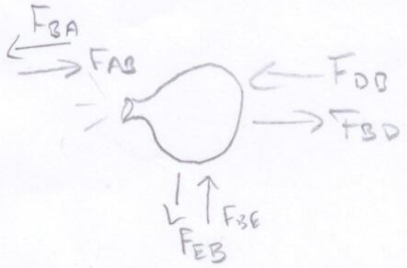
   a. Less than 9.8 m/s^2
   b. 9.8 m/s^2
   c. More than 9.8 m/s^2

Force of gravity only on mass 2 but both masses must be accelerated $m_2 g = (m_1 + m_2) a$

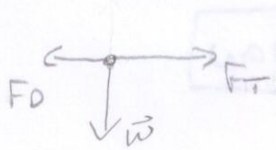
2. If a big truck hits a small car, which exerts the larger force on the other?
   a. The big truck exerts the larger force on the car.
   b. The small car exerts the larger force on the truck.
   c. Neither, they exert equal force on each other. Force pair
   d. Depends on the speed and direction of each vehicle.

3. You blow up a balloon but don't tie off the end. Then you let it go.
   a. Draw a diagram showing all the action reaction pairs of forces on the balloon.
   b. Draw a free body diagram showing the forces on the balloon next to your action-reaction pair diagram.
   c. Explain how these two types of diagrams are different.

a.



b.



$\vec{F}_D = \vec{F}_{DB}$ = Drag force (air resistance)
$\vec{F}_T = \vec{F}_{AB}$ = Thrust force (air on balloon)
$\vec{w} = \vec{F}_{EB}$ = weight (Earth on Balloon)

F_{GB} = Force Earth on Balloon
F_{BE} = Force Balloon on Earth

F_{BA} = Force of Balloon on air (inside)
F_{AB} = Force of Air (inside) on Balloon

F_{DB} = Drag force on balloon (Air (outside) on Balloon)

F_{BD} = Force of Balloon on Air (outside)

c. A FBD only includes forces on the object of interest and is useful for understanding the motion of the object of interest. Force pairs are useful for determining what forces actually act on the object by analyzing not only the forces on the object but the forces exerted by the object itself.

5.0kg

4. A bucket is lowered into a well. Find the tension in the rope for the following two circumstances:
   a. Acceleration of 2 m/s^2
   b. Constant velocity

$m = 5.0kg$

$a = 2.0 m/s^2$

a.

$\Sigma F_y = T - w = -ma$

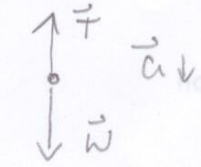
$T = w - ma$

$= mg - ma$

$T = m(g-a)$

$= 5.0kg\,(9.8 m/s^2 - 2.0 m/s^2)$

$\boxed{T = 39N}$



b. $T = m(g-a)$ $a = 0$ for constant velocity

$T = 5.0kg\ 9.8 m/s^2$

$\boxed{T = 49N}$

$\Sigma\vec{F} = m\vec{a}$ $\quad w = mg$ $\quad f = \mu n$ $\quad \vec{g} = -9.8 m/s^2$

$\sin\theta = \text{opp/hyp}$ $\quad \cos\theta = \text{adj/hyp}$ $\quad \tan\theta = \text{opp/adj}$

$x_f = x_i + v_{xi}\Delta t + \frac{1}{2} a_x(\Delta t)^2$ $\quad v_{xf} = v_{xi} + a_x\Delta t$ $\quad v_{xf}^2 = v_{xi}^2 + 2a_x(\Delta x)$