Sabrina Fox.

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P20 Unit B - Dynamics UA pt. A
Due Thursday, Nov. 1

1. This phenomenon can be explained using Newton's 3rd Law - When a force is applied to an object, the object will produce a force that is equal in magnitude but opposite in direction of the applied force. When you are walking in the canoe, your feet are applying a force onto the bottom of the canoe. The canoe will respond by moving with the same amount of force in the opposite direction, causing the canoe to move backwards as you move forwards.

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2. $\vec{F}_{net} = 2.5 \times 10^3 N$

$t = 5.0 s$

$v_f = 48 km/h = 13.3 m/s$

$v_i = 0 km/h = 0 m/s$

$$\vec{a} = \frac{v_f - v_i}{t}$$

$$\vec{a} = \frac{(13.3 m/s) - (0 m/s)}{(5.0 s)}$$

$$\vec{a} = 2.67 m/s^2$$

2/2

$$\vec{F}_{net} = m\vec{a}$$

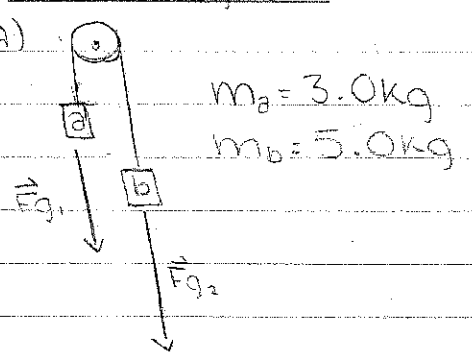
$$(2.5 \times 10^3 N) = m(2.67 m/s^2)$$

$$\frac{(2.5 \times 10^3 N)}{(2.67 m/s^2)} = m$$

$$937.5 kg = m$$

$$9.4 \times 10^2 kg = m$$

3. a)



$m_a = 3.0 kg$

$m_b = 5.0 kg$

$\vec{F}_N = 94.2\,N$

1) $\vec{F}_f = \mu \vec{F}_N$

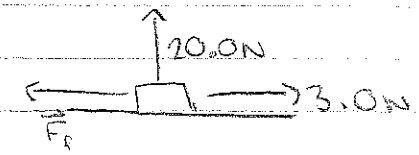
$\vec{F}_f = (0.11)(94.2\,N)$

$\vec{F}_f = 10\,N$

5. $\vec{F}_N = 20.0\,N$

$\vec{F}_f = \vec{F}_{app} = 3.0\,N$

$\mu = ?$



2) $\vec{F}_f = \mu \vec{F}_N$

$(3.0\,N) = \mu (20.0\,N)$

$\frac{(3.0\,N)}{(20.0\,N)} = \mu$

$0.15 = \mu$

6a) $\vec{a} = \frac{\Delta v}{t}$

$\vec{a} = \frac{(100\,m/s) - (400\,m/s)}{(4.0 \times 10^{-4}\,s)}$

$\vec{a} = -750000\,m/s^2$

2) $\vec{F} = m\vec{a}$

$\vec{F} = (0.008\,kg)(-750000\,m/s^2)$

$\vec{F} = -6000\,N$

$\vec{F} = -6.0 \times 10^3\,N$

b) $\vec{d} = \left(\frac{\vec{v}_f + \vec{v}_i}{2}\right) t$

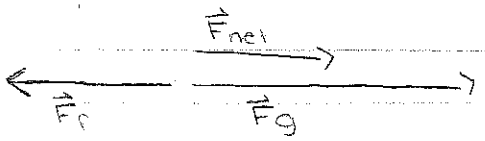
$\vec{d} = \left(\frac{100\,m/s + 400\,m/s}{2}\right)(4.0 \times 10^{-4}\,s)$

$\vec{d} = \left(\frac{500\,m/s}{2}\right)(4.0 \times 10^{-4}\,s)$

$\vec{d} = (250\,m/s^2)(4.0 \times 10^{-4}\,s)$

$\vec{d} = 0.1\,m$

9.



$F_{net} = \vec{F}_g + \vec{F}_f$

$m\vec{a} = m\vec{g} + \vec{F}_f$

$m(2.9 m/s^2) = (5.0 kg)(9.81 m/s^2) + (24 N)$

$m(2.9 m/s^2) = (49.05 N) + (-24 N)$

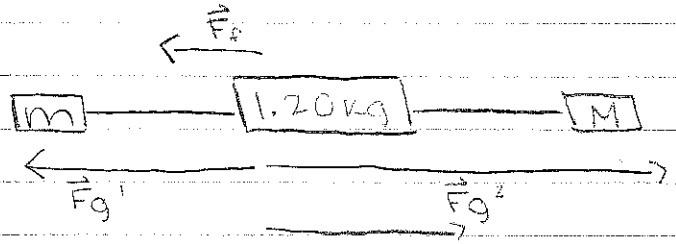
3 $m(2.9 m/s^2) = (25.05 N)$

$m = \frac{(25.05 N)}{(2.9 m/s^2)}$

$m = 8.64 kg$

$8.64 kg - 5.0 kg = \underline{3.6 kg}$

10.



$F_{net} = \vec{F}_{g1} + \vec{F}_{g2} + \vec{F}_f$

$m\vec{a} = m_1\vec{g} + m_2\vec{g} + F_N\mu$

$(4.2 kg)\vec{a} = (1.00 kg)(-9.81 m/s^2) + (2.00 kg)(9.81 m/s^2) + (1.20 kg)(9.81 m/s^2)(0.140)$

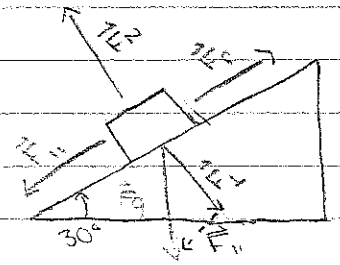
3 $(4.2 kg)\vec{a} = (-9.81 N) + (19.62 N) + (1.65 N)$

$(4.2 kg)\vec{a} = (8.16 N)$

$\vec{a} = \frac{(8.16 N)}{(4.2 kg)}$

$\vec{a} = \underline{1.94 m/s^2}$

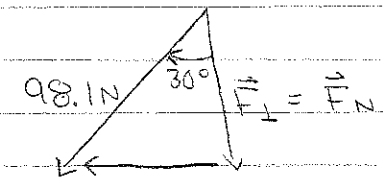
12.



a) $\vec{F}_g = m\vec{a}$

$\vec{F}_g = (10kg)(9.81 m/s^2)$

$\vec{F}_g = 98.1\,N$



$\cos = \frac{adj}{hyp}$

$\cos(30°) = \frac{\vec{F}_\perp}{98.1N}$

$\vec{F}_\perp = \cos(30°)(98.1N)$

$\vec{F}_\perp = 84.96\,N$

$\vec{F}_\perp = \vec{F}_N$

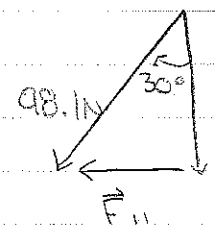
$\vec{F}_N = 84.96\,N$

$\vec{F}_f = \vec{F}_N \mu$

$\vec{F}_f = (84.96N)(0.30)$

$\vec{F}_f = 25\,N$

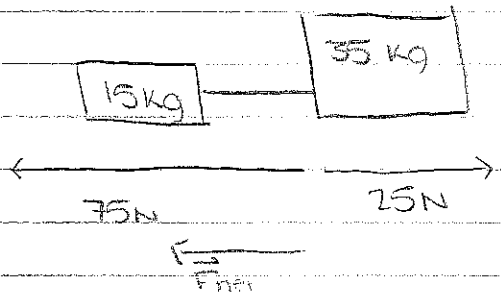
b)



$\sin = \frac{opp}{hyp}$

$\sin(30°) = \frac{\vec{F}_\parallel}{98.1N}$

14.



$\vec{F}_{net} = \vec{F}_{app} + \vec{F}_s$

$m\vec{a} = \vec{F}_{app} + \vec{F}_s$

$(50kg)\vec{a} = (-75N) + (25N)$

$(50kg)\vec{a} = (-50N)$

$\vec{a} = \frac{(-50N)}{(50kg)}$

$\vec{a} = -1.0 m/s^2$