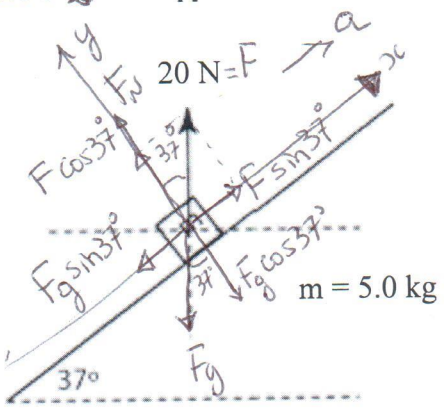
QUIZ#4- CHAPTER 5
DATE: 07/10/19

Name: Key Id#: Sect.#:

A 5.0-kg block slides on a frictionless 37° incline plane. A vertical force of 20 N is applied to the block.

a) Calculate the acceleration of the block.




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

x-axis: $F\sin 37° - F_g \sin 37° = ma$

$20\sin 37° - 5\times 9.8 \sin 37° = 5a$

$\Rightarrow a = \frac{12 - 29.5}{5} = -3.5\ m/s^2$

the block is going to move down the incline with magnitude of $a = 3.5\ m/s^2$

b) Calculate the normal force on the block.

y-axis: $F_N + F\cos 37° - F_g \cos 37° = 0$ (no motion along y-axis)

$F = F_g \cos 37° - F\cos 37°$

$= 39.1 - 15.97 = \boxed{23.1\ N}$

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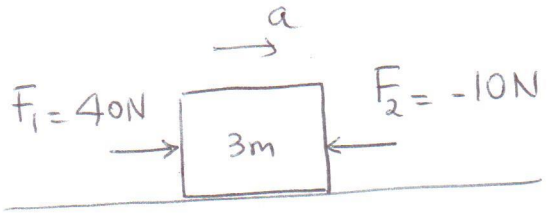
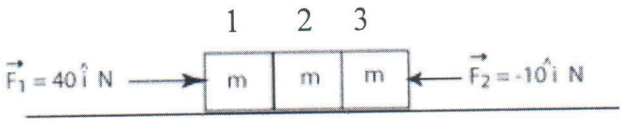
Three equal mass blocks each of mass =2.0 kg can move together over a horizontal frictionless surface. Two forces, $F_1 = 40\hat{i}\ N$ and $F_2 = -10\hat{i}\ N$ are applied on the three masses system as shown in the figure.

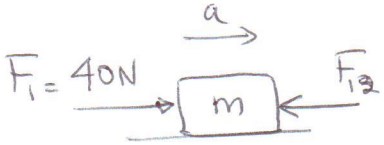
(a) Calculate the acceleration of the block 2.




$F_{net} = ma \Rightarrow 40-10 = 3ma \Rightarrow a = \frac{40-10}{3\times 2} = \boxed{5\ m/s^2}$

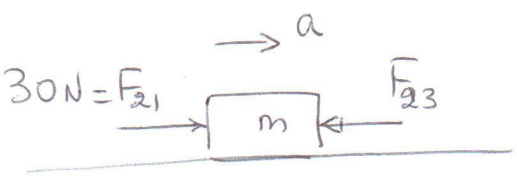
(b) Calculate the net force on block 1.




$40 - F_{12} = ma = 2\times 5 = 10$

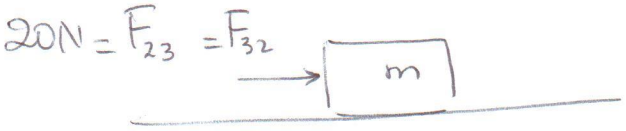
$\Rightarrow F_{12} = 40-10 = \boxed{30\ N}$ to the left

(c) Calculate the net force on block 2.




$30 - F_{23} = ma = 2\times 5 = 10$

$F_{23} = 30 - 10 = \boxed{20\ N}$ to the left




$F_{32} = 20\ N$ to the right

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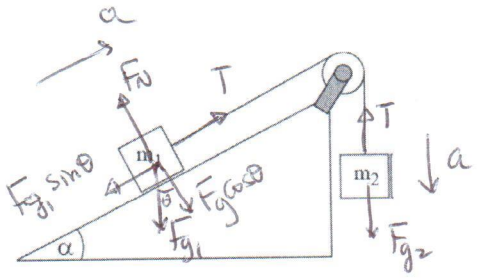
A block with mass $m_1 = 2.0$ kg is placed on an inclined plane with slope angle $\alpha = 35^0$ and is connected to a second hanging block with mass $m_2 = 4.0$ kg by a light cord passing over a massless and frictionless pulley. The incline in frictionless.

(a) Calculate the acceleration of mass $m_1$.




mass $m_1$:

$x$-axis $\Rightarrow$ $T - m_1 g \sin\theta = m_1 a$

$y$-axis $\Rightarrow$ $F_N - m_1 g \cos\theta = 0$

mass $m_2$:

$y$-axis: $T - m_2 g = -m_2 a \Rightarrow T = m_2(g-a)$

$\rightarrow m_2(g-a) - m_1 g \sin\theta = m_1 a \Rightarrow a(m_1+m_2) = m_2 g - m_1 g \sin\theta$

$$a = \frac{(m_2 - m_1\sin\theta)\, g}{m_2+m_1} = \frac{(4 - 2\sin 35^\circ)\times 9.8}{6} = 4.7\ m/s^2$$

(b) Calculate the tension in the string.

$$T = m_2(g-a) = 4(9.8-4.7) = 20.4\ N$$