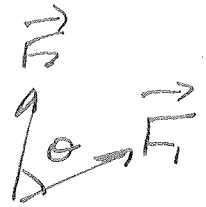
Physics 1C0

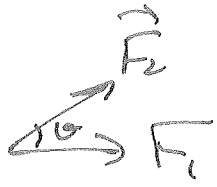
Extra Credit #10

Understanding Newton's Laws → These

multiple choice questions are answered well by ~~Pate~~ Mastering Physics, so I have nothing to add, except to the last question. It's kind of weird!



$\Sigma \vec{F} = \vec{F_1} + \vec{F_2}$, $F_1 = 4N$, $F_2 = 10N$

If we pick $\vec{F_1}$ to be along the x-axis 

$\Sigma F_x = F_1 + F_2 \cos\theta = 4N + 10N\cos\theta$

$\Sigma F_y = F_2 \sin\theta = (10N)\sin\theta$

$\Sigma F^2 = \Sigma F_x^2 + \Sigma F_y^2 = (4N + 10N\cos\theta)^2 + (10N\sin\theta)^2$

$= 16N^2 + 80N^2\cos\theta + 100N^2\cos^2\theta + 100N^2\sin^2\theta$

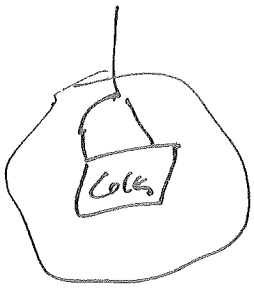
$= 16N^2 + 80N^2\cos\theta + 100N^2(\underbrace{\cos^2\theta + \sin^2\theta}_{1}) = 116N^2 + 80N^2\cos\theta$

$\Rightarrow$ ~~$\Sigma F^2 = 116N^2$~~ so we know $-1 < \cos\theta < 1 \Rightarrow$ ~~$36 \le \Sigma F^2 \le 196$~~

$\Rightarrow 6N \le \Sigma F \le 14N$

Free-Body Diagrams → Answered well

Lifting A Bucket



Forces on Bucket: Tension, $\vec{T}$ up

Weight Down: $\vec{w}$ $\quad w = mg = (6kg)(9.8 m/s^2)$

$= 58.8N$

Fbd

No Acceleration $\Rightarrow \sum \vec{F} = 0$

$\Rightarrow \sum F_y = 0$

$\Rightarrow T - w = 0$

$\Rightarrow T = w = 58.8N$

b) Now $a_y = 3 m/s^2$. The only difference is that now

$$\sum F_y = ma_y \Rightarrow T - w = ma_y \Rightarrow T = w + ma_y$$

$$\Rightarrow T = 58.8N + (6kg)(3 m/s^2) = 58.8N + 18N = 76.8N$$

c) Downward Acceleration: $a_y = -3 m/s^2$

$T - w = ma_y$ still so $T = w + ma_y = 58.8N + 6kg(-3 m/s^2)$

$\Rightarrow T = 58.8N - 18N = 40.8N$