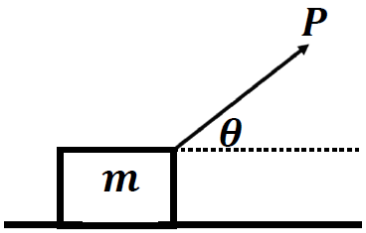
Quiz Average 7.50 **Quiz High Score** 10

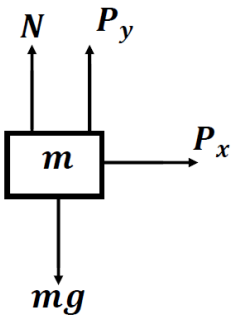
PH 220 **Quiz # 04 (10 pts)** **Name** Solution

A crate has a mass of 7.11 kg and is being pulled on by a force $P = 64.9$ N @ $38.0°$ above horizontal as shown on the right. Assume there is no friction between the crate and the horizontal surface. What is the normal force the floor is exerting on the crate?



A. 69.7 N **B.** 18.6 N **C.** 40.0 N **D.** **29.7 N**

Free Body Diagram and Sum of Forces Equations:



$$\sum F_x = P_x = P\cos(\theta) = ma_x$$

$$\sum F_y = N + P_y - mg = ma_y = 0$$

$$N = mg - P_y = mg - P\sin(\theta)$$

$$N = mg - P\sin(\theta) = (7.11\ kg)\left(9.80\ {}^{m}/_{s^2}\right) - (64.9\ N)\sin(38.0°)$$

$$N = 69.7\ N - 40.0\ N = 29.7\ N$$

So, the correct answer is D !

You take a small ball which has a mass of 0.135 kg and you want to throw the ball straight up with a speed of $27.4\ {}^{\mathrm{m}}/_{\mathrm{S}}$. Your hand moves a distance of 0.125 m in taking the ball at rest and providing the speed when it leaves your hand. What is the average force your hand exerts on the ball?

A. $37.0.\mathrm{N}$ **B.** $811.\mathrm{N}$ **C.** $\mathbf{405.N}$ **D.** $14.8\ \mathrm{N}$

$$\boldsymbol{F_{ave} = ma}$$

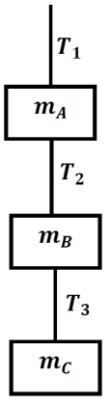
Find acceleration from

$$\boldsymbol{v_f^2 = v_0^2 + 2aS = 2aS}$$

$$\boldsymbol{a = \frac{v_f^2}{2S}}$$

$$\boldsymbol{F_{ave} = m\frac{v_f^2}{2S} = (0.135\ kg)\frac{(27.4\ {}^{m}/_{s})^2}{2(0.125\ m)} = (0.135\ kg)\frac{750.76\ {}^{m^2}/_{s^2}}{0.250\ m} = 405.N}$$

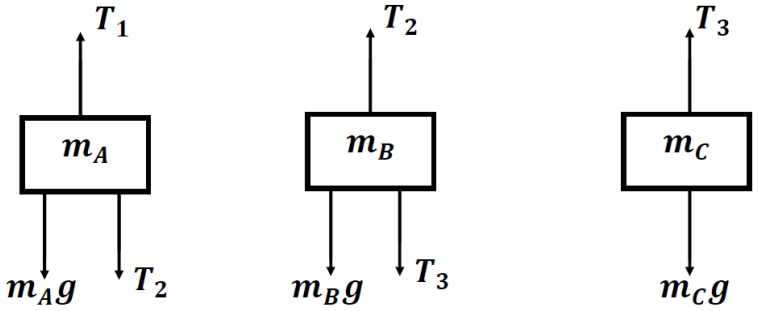
So, the correct answer is C !



As shown on the left three masses are connected by two ropes (T_2 and T_3) with a third rope (T_1) connected to only the top mass. The masses are $m_A = 27.2\ \text{kg}, m_B = 17.3\ \text{kg}, \text{and } m_C = 33.1\ \text{kg}$. The masses are all at rest. What is the tension in rope T_2?

A. $760.\text{N}$ **B.** $\mathbf{494.N}$ **C.** $170.\text{N}$ **D.** $324.\text{N}$

Free Body Diagrams



$$\sum F_C = T_3 - m_C g = m_C a_C = 0$$

$$T_3 = m_C g$$

$$\sum F_B = T_2 - T_3 - m_B g = m_B a_B = 0$$

$$T_2 = T_3 + m_B g = m_C g + m_B g = (m_C + m_B) g$$

$$T_2 = (17.3\ kg + 33.1\ kg)\left(9.80\ {}^{m}/_{s^2}\right) = (50.4\ kg)\left(9.80\ {}^{m}/_{s^2}\right) = 494.N$$

So, the correct answer is B !

A constant force $\vec{F} = 56.6\ \text{N}\ \widehat{(\imath)}$ causes an object to have a displacement which follows the relationship $\vec{x} = (2.30t^2 - 6.76t + 11.8)\text{m}\ \widehat{(\imath)}$. What is the mass of the object?

A. $\mathbf{12.3\ kg}$ **B.** $24.6\ \text{kg}$ **C.** $5.78\ \text{kg}$ **D.** $7.71\ \text{kg}$

Newton's second law tells us that $\boldsymbol{m = \frac{\vec{F}}{\vec{a}}}$
We can find acceleration by differentiating x twice

$$\boldsymbol{v = \frac{dx}{dt} = \frac{d}{dt}(2.30t^2 - 6.76t + 11.8) = 4.60t - 6.76}$$

$$\boldsymbol{a = \frac{dv}{dt} = \frac{d}{dt}(4.60t - 6.76) = 4.60}$$

$$\boldsymbol{m = \frac{\vec{F}}{\vec{a}} = \frac{56.6\ N\ \widehat{(\imath)}}{4.60\ {}^{m}/_{s^2}\ \widehat{(\imath)}} = 12.3\ kg}$$

So, the correct answer is A !

During a flood, a rescue helicopter is pulling a person to safety. The person has a mass of $73.2\ \text{kg}$. The maximum safe tension the rescue cable can withstand before it might break is $871.\text{N}$. What is the greatest acceleration that the person can be pulled to safety with?

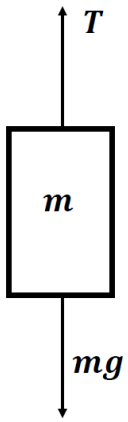
A. $\mathbf{2.10\ {}^{m}/_{s^2}}$ **B.** $11.9\ {}^{\text{m}}/_{\text{s}^2}$ **C.** $9.80\ {}^{\text{m}}/_{\text{s}^2}$ **D.** $0.00\ {}^{\text{m}}/_{\text{s}^2}$

Free Body Diagram and Sum of Forces Equations:

$$\boldsymbol{\sum F = T - mg = ma}$$

$$\boldsymbol{a = \frac{T}{m} - g = \frac{871.N}{73.2\ kg} - 9.80\ {}^{m}/_{s^2}}$$

$$\boldsymbol{a = 11.90\ {}^{m}/_{s^2} - 9.80\ {}^{m}/_{s^2} = 2.10\ {}^{m}/_{s^2}}$$



So, the correct answer is A !

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