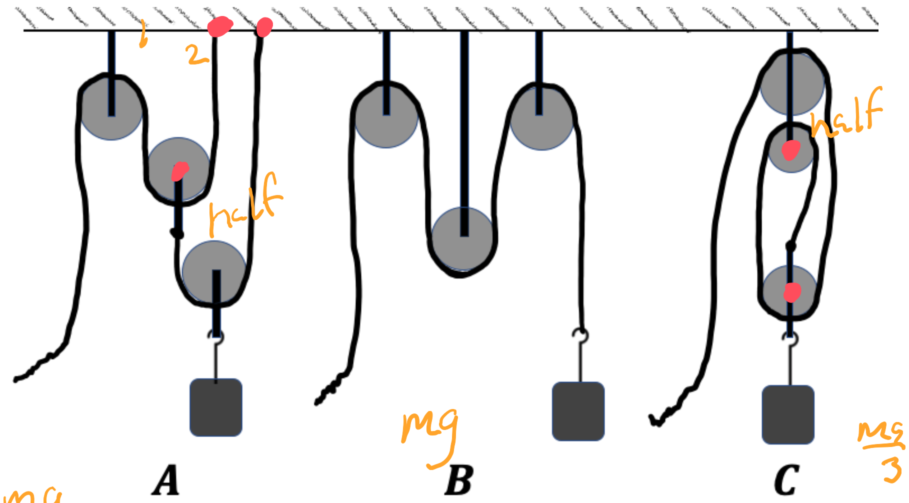
Problem 1

Shown below are three different ways of arranging three massless, frictionless pulleys and some light rope. Rank these according to the amount of tension you'd have to place on the free end of the rope in order to keep the mass suspended in the air and motionless. (It is the same hanging mass in all three cases.)

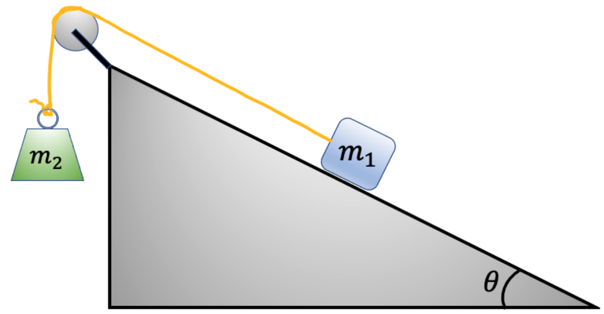


$\frac{mg}{4}$

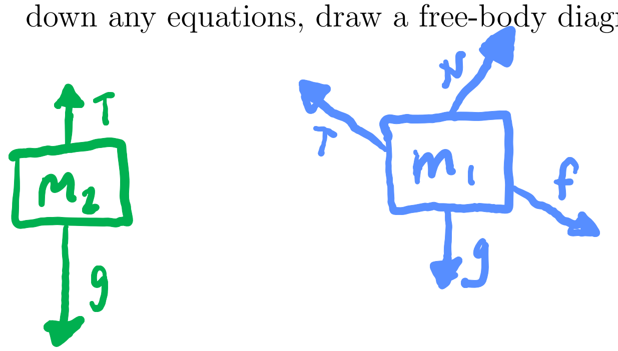
B > C > A

Problem 2

Block m_1 (15 kg) is currently sliding up the ramp. It is connected to block m_2 (18 kg) by a light string and a massless/frictionless pulley. The coefficient of kinetic friction between m_1 and the ramp is $\mu_k = 0.30$, and the angle of incline is $\theta = 35°$.



(a) Our goal in this problem is to find the acceleration of block m_2. But before writing down any equations, draw a free-body diagram for each block.



(b) What is the acceleration of m_2? (Work **symbolically**. Don't plug in numbers until the very last step.)

$T = mg$ $T_1 = m_1 g \sin\theta \cdot u_k$

$T_2 = ma - T_1 \rightarrow ma = T_2 + T_1 \rightarrow a = \frac{T_2 + T_1}{m_2}$

$T_1 = 15 \cdot 9.8 \sin 35 \cdot .3 = 25.29\,N$

$a = \frac{176.4 + 25.29}{18} = \boxed{11.25\, m/s^2}$

$T_2 = 18 \cdot 9.8 = 176.4$

(c) Perform a limit check on your symbolic answer above: as $m_1 \to 0$, what limit does the acceleration a approach? Does your result make physical sense?

$a = \frac{T_1 + T_2}{m_2}$

$m/s^2 = \frac{N}{kg}$ ✓

Yes