L08 - Systems with Pulleys

Newton's Second Law of Motion: When an external non-zero net force acts on an object, the object accelerates in the direction of the net force.

The magnitude of the acceleration is directly proportional to the magnitude of the net force and inversely proportional to the mass of the object.

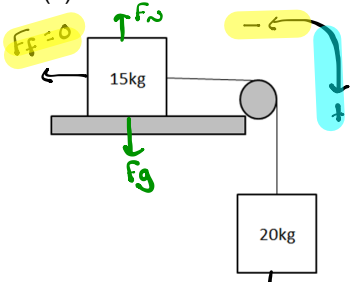
$$\vec{a} = \frac{\vec{F}}{m}$$

Net Force, Mass, and Acceleration

A grey table has an extremely smooth surface (frictionless). If a 15kg mass on the table is tied to a 20kg mass just off the edge of the table...

(a) How quickly will the *system* accelerate?

(b) What is the tension in the rope?



System

① $F_{net} = F_g + F_f$
$= (+196.2) + (-0)$
$= 196.2N$

② $a = \frac{F_{net}}{m} = \frac{196.2N}{35kg}$
$a = 5.61 m/s^2$

Item - 20kg

③ $F_{net} = ma$
$= (20)(5.61)$
$= 112.2N$

④ $F_{net} = F_g + F_T$
$+112.2 = (+196.2) + F_T$
$F_T = -84N$

Alternative

Item - 15kg

③ $F_{net} = ma$
$= (15)(5.61)$
$= 84.15N$

④ $\vec{F}_{net} = \vec{F}_T + \vec{F}_f$
$+84.15 = F_T + (-0)$
$F_T = 84.15N$

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Practice

Pg 150 #1

Pg 152 #1-2

Pg 153 #3 (Two buckets)

HINT: Draw a Free-Body Diagram for the bottom bucket

Pg 157 #1-2

Challenge

Pg 158 #9

HINT: To find the Tension, draw a Free-Body Diagram for the 2kg mass.