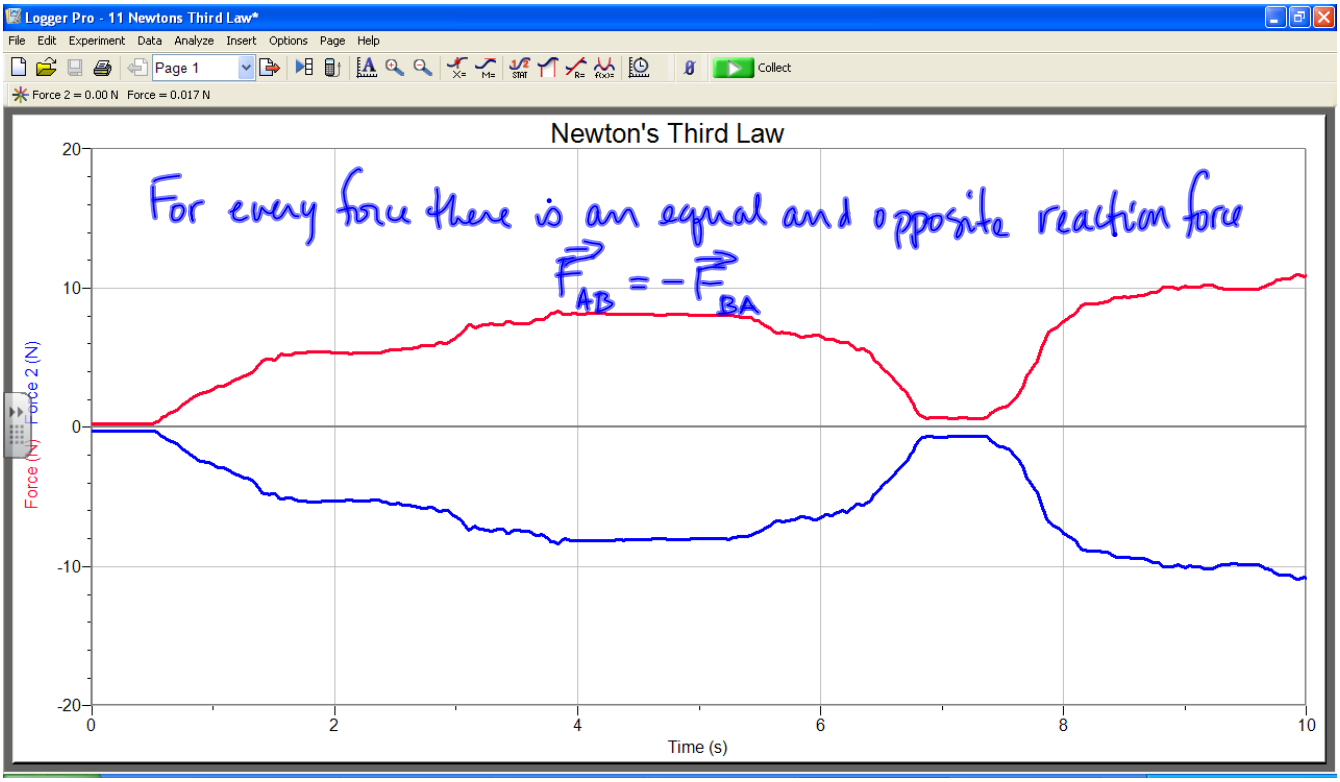

Logger Pro - 11 Newtons Third Law*
File Edit Experiment Data Analyze Insert Options Page Help
Page 1
Collect
Force 2 = 0.00 N Force = 0.017 N
Newton's Third Law
For every force there is an equal and opposite reaction force
$\vec{F}_{AB} = -\vec{F}_{BA}$
Force (N) Force 2 (N)
20
10
0
-10
-20
0
2
4
6
8
10
Time (s)

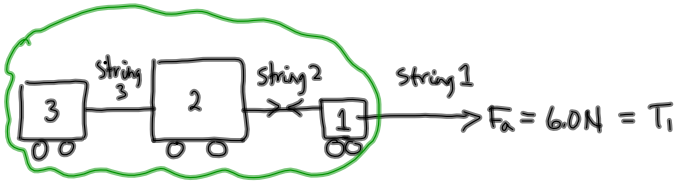
Newton's Third Law

Example

$m_1 = 0.5\,kg$

$m_2 = 1.5\,kg$

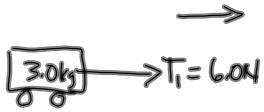
$m_3 = 1.0\,kg$



$T_1 = ?$
$T_2 = ?$
$T_3 = ?$
} the tension in each string

frictionless

Consider the total mass of 3.0kg as one object



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

$T_1 = m_{total}\,a$

$6.0N = (3.0kg)a$

$a = 2.0\,m/s^2$

Consider only m_1:

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

$T_1 - T_2 = m_1 a$

$6.0N - T_2 = (0.5kg)(2.0m/s^2)$

$6.0N - T_2 = 1.0N$

$T_2 = 5.0N$

Consider only cart 2:

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

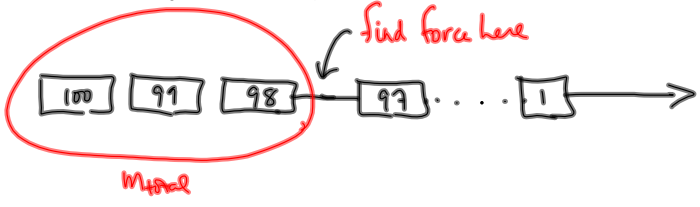
$T_2 - T_3 = m_2 a$

$5.0N - T_3 = (1.5kg)(2.0m/s^2)$

$5.0N - T_3 = 3.0N$

$T_3 = 2.0N$

What if you had a train with 100 cars and wanted to know the force in the coupling between car # 97 and 98



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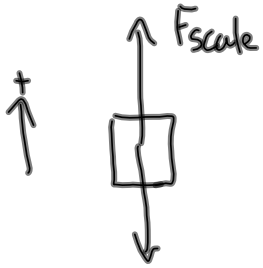
$m = 55\,kg$

a) $F_{scale} = ?$, $a = 0$

b) $F_{scale} = ?$, $\vec{a} = 0.75\,m/s^2$ [up]



a) not moving

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

$F_{scale} - F_g = ma$ ($a = 0$)

$F_{scale} - F_g = 0$

$F_{scale} = F_g$

$F_{scale} = 539.55N$

$(5.4 \times 10^2\,N)$

b) $\vec{F}_{net} = m\vec{a}$

$F_{scale} - F_g = ma$

$F_{scale} - 539.55N = (55kg)(+0.75m/s^2)$ ($-9.81\,m/s^2$) ← cut elevator cable

$F_{scale} = 41.25N + 539.55N$ ($-539.55N$)

$F_{scale} = 5.8 \times 10^2 N$ ← Feel lighter than normal

ON ← feel "weightless"

If you have a + acceleration, then you feel heavier
(going up/speeding up OR going down/slowing down)

If you have a - acceleration, then you feel lighter
(going up/slowing down OR going down/speeding up)

If you have no acceleration, then you feel normal
(not moving OR constant velocity)

What if the elevator cable is cut? feel "weightless"
$F_{scale} = 0N$

TO DO

① PP|182|18+19

② PP|186