

NAME: _____

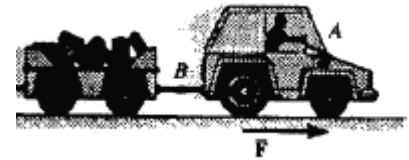
SCORE: _____

MER 201 PARTICLE MECHANICS

WINTER 2008 EXAM 2 EXTRA CREDIT

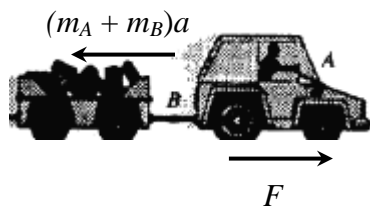
INSTRUCTIONS: Show all of your work. Extreme deductions will be imposed for lack of (D')FBDs.

PROBLEM: The baggage truck *A* has a mass of 400 kg and is used to pull the 100 kg car. Determine the tension in the coupling at *B* if the tractive force **F** on the truck is 500 N. The car wheels are massless and free to roll.



SOLUTION

D'FBD of truck and car*

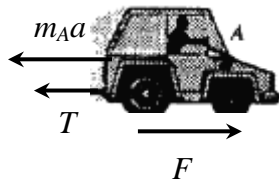


D'Alembert's Principle

$$\rightarrow \sum \mathcal{F} = 0 = F - (m_A + m_B)a$$

$$\text{solving, } a = \frac{F}{m_A + m_B} \left(= 1 \frac{\text{m}}{\text{s}^2} \right)$$

D'FBD of truck*



D'Alembert's Principle

$$\rightarrow \sum \mathcal{F} = 0 = F - T - m_A a$$

$$\text{solving, } T = F - m_A a = \frac{m_B}{m_A + m_B} F = \frac{100}{400 + 100} (500)$$

coupling tension $T = 100 \text{ N}$

* Forces in vertical direction (i.e., weights and normal forces) are not shown because they are irrelevant.