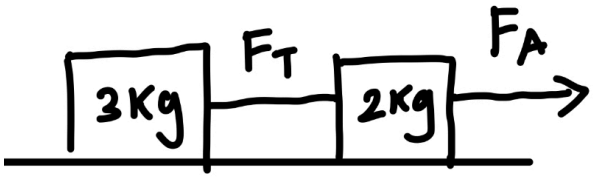
Multibody Systems

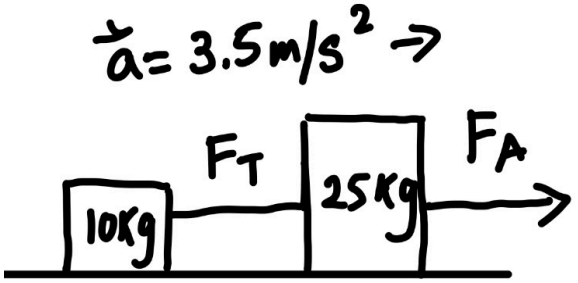
1. Imagine you are accelerating forward on a frictionless surface (don't ask how) while dragging a 100kg box connected to a rope attached to your back. You would feel some kind of force pulling you back of course. Clearly the box isn't growing hands and pulling the rope back. Why do you feel a force pulling you back (hint: Newton's third law)?

2. A 2kg box is connected to a 3kg box with a rope on a frictionless surface. The 2kg box is pulled to the right with an applied force of 50N.



a) Draw a FBD for the 2kg box, the 3kg box and the system
b) Determine the acceleration of the 2kg box.
c) Determine the tension force between the 2kg box and 3kg box.

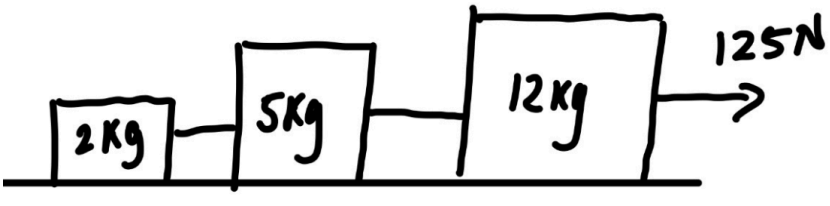
3. A 25kg box is connected to a 10kg box with a rope on a frictionless surface. The 25kg box is pulled to the right with some applied force.



a) If the 10kg box accelerates at 3.5m/s^2, find the applied force.
b) Find the tension force between the boxes.

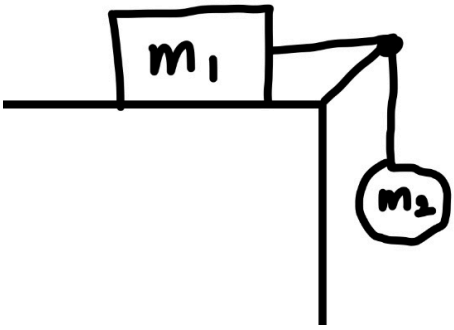
4. Three boxes of mass 2kg, 5kg, 12kg (in that order from left to right) are connected with a rope. The 12kg box is pulled to the right with an applied force of 125N.

a) Draw a FBD of each box and the entire system (4 FBDs in total)
b) Find the acceleration of the system
c) Find the tension force between the 2kg box and the 5kg box.



5. Redo 2b and 2c except now incorporate friction force. The coefficient of friction is μ=0.2. (bonus: redo q3 as well).

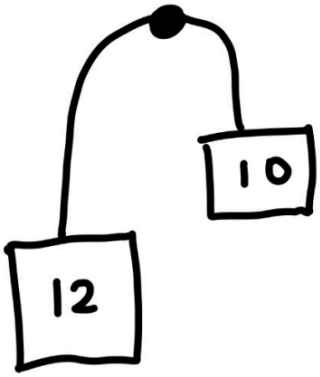
6. A 12kg box on a frictionless table is connected by a string to an 8kg ball hanging off the table.



a) Find the acceleration of the 12kg box.
b) Find the tension force in the string.

7. A 12kg box on a table with a coefficient of friction of μ=0.3. It is connected by a string to a ball with an unknown mass hanging off the table. If the box accelerates at 2.5m/s^2, find the mass of the ball.

8. A 12kg box and a 10kg box is connected via Atwood's machine.



a) Find the acceleration of the system.
b) Find the tension force of the rope.

9. The 10kg box in question 8 is replaced with an unknown mass. If the unknown mass accelerates downwards at 5.2m/s^2, calculate the mass of the new box.