Name: _____

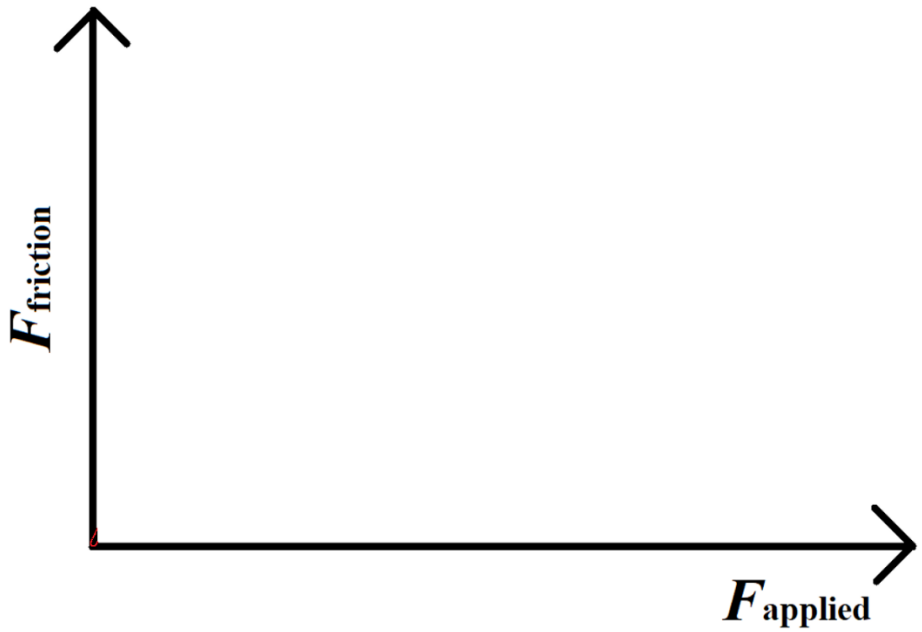
Class: _____

Due Date: _____

Physics Topic 11C – Applying Newton's Second Law of Motion to Stacked Blocks

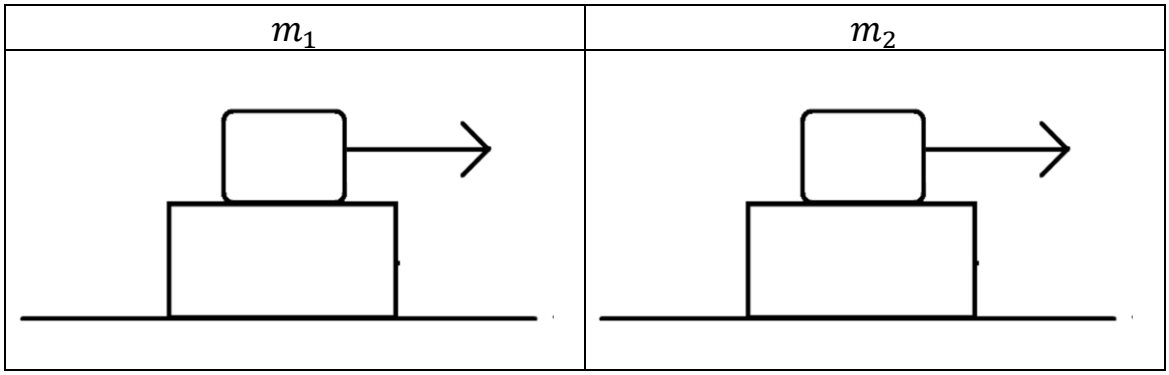
Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: A pulling force is applied to a block on a rough horizontal surface. Draw a graph which shows the *force of friction vs. applied force* acting on the block.



2. E: A block with mass m_2 is sitting on a horizontal frictionless table. On top of that block is another block of mass m_1. The coefficient of static friction between the two blocks is μ. A pulling force F_{pull} is applied to m_1 so both blocks accelerate to the right.

   a. **Use a pencil!** Label the forces on each object.

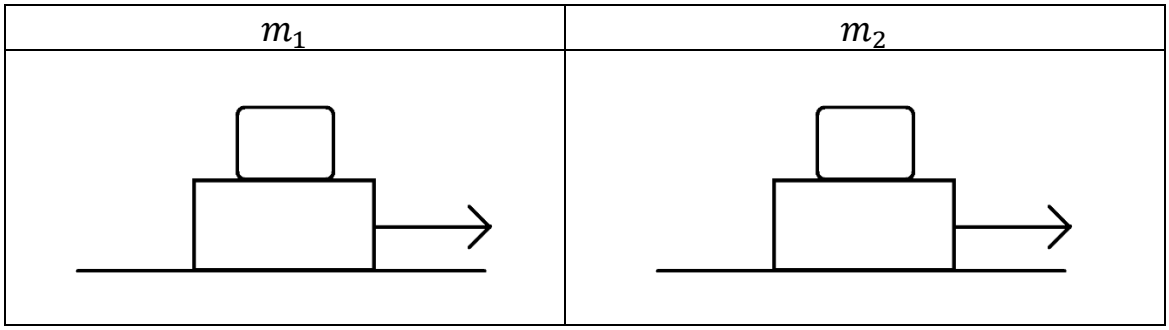


   b. When the pulling force is small the two blocks move together. Determine an equation for the acceleration of the two blocks.

   c. If the pulling force F_{pull} is too great then the two blocks do not move together. Determine an equation for the minimum pulling force F_{pull} in which m_1 slides relative to m_2.

3. E: A block with a mass $m_2 = 5.00$ kg is sitting on a horizontal table. On top of m_2 is another block of mass $m_1 = 3.00$ kg. The coefficient of kinetic friction between m_2 and the surface is $\mu_{2,s} = 0.500$. A pulling force of 70.0 N is applied to m_2 so both blocks accelerate to the right.

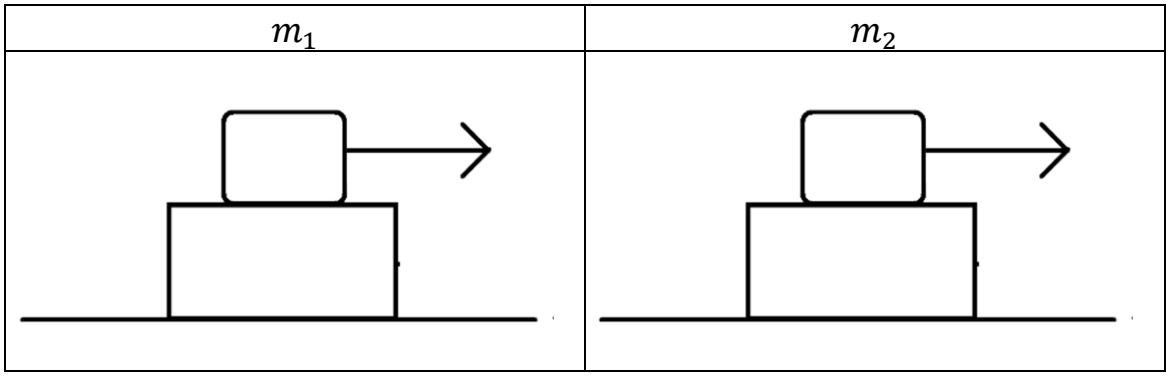
   a. **Use a pencil!** Label the forces on each object.



   b. Calculate the minimum coefficient of static friction between the two blocks so m_1 does not slip.

4. E: A block with mass $m_2 = 6.00$ kg is sitting on a horizontal frictionless table. On top of m_2 is another block of mass $m_1 = 3.00$ kg. The coefficient of static friction between the two blocks is $\mu = 0.650$. A pulling force F_{pull} is applied to m_1 so both blocks accelerate to the right.

   a. **Use a pencil!** Label the forces on each object.

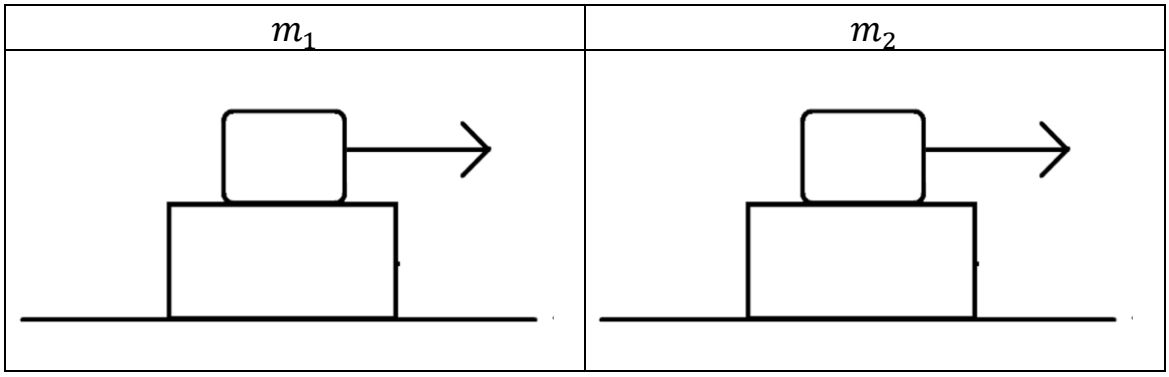


   b. Determine the magnitude of the maximum force F_{max} which results in both of the blocks moving together without slipping.

c. If the pulling force F_{pull} is too great then the two blocks do not move together. Determine an equation for the minimum pulling force F_{pull} in which m_1 slides relative to m_2.

5. E: A block of mass $m_1 = 3.00$ kg rests above the flat horizontal surface of a block with a mass $m_2 = 6.00$ kg. Mass m_2 rests on a smooth frictionless horizontal surface. The coefficient of static friction between m_1 and m_2 is $\mu_{\text{static}} = 0.200$ while the coefficient of dynamic/kinetic friction between m_1 and m_2 is $\mu_{\text{dynamic}} = 0.100$. A pulling force of 7.00 N is applied to the right of mass m_1.

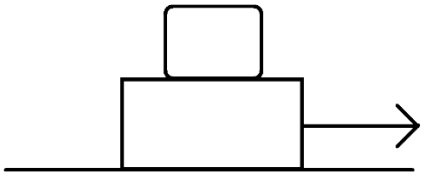
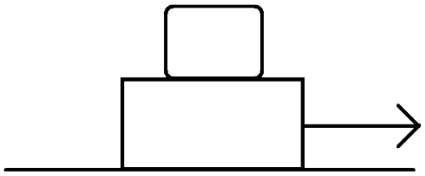
   a. **Use a pencil!** Label the forces on each object.



   b. Determine the direction and magnitude of the acceleration of m_2.

6. E: A block of mass $m_2 = 45.0$ kg is placed on a smooth frictionless horizontal table. Another block of mass $m_1 = 15.0$ kg is placed on top of m_2. The coefficient of static friction between m_1 and m_2 is 0.600 and the coefficient of dynamic/kinetic friction is 0.400. A pulling force is applied to m_2.

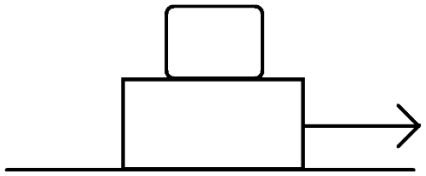
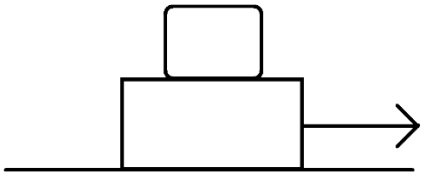
   a. **Use a pencil!** Label the forces on each object.

m_1	m_2
	

   b. Calculate the acceleration of m_1 when a pulling force of 400. N is applied to m_2.

7. E: Mass m_1 rests on top of mass m_2. A pulling force on mass m_2 acts towards the right. The coefficient of static friction between m_1 and m_2 is $\mu_{1,2}$. The coefficient of dynamic friction between m_2 and the horizontal surface is $\mu_{2,s}$.

   a. Label the forces on each object.

m_1	m_2
	

   b. Both masses are moving to the right together with a constant velocity. Determine the force of friction from the surface on m_2.

   c. Now both masses are moving to the right together with a constant acceleration. Determine an equation for the maximum F_{pull} in which m_1 does not slip.