AP Physics - Unit 2 Dynamics

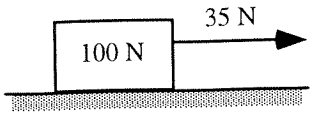
Tipper #2 - Unit 2

1/5

#1.

B3-SCT86: Box Pulled on Rough, Horizontal Surface—Frictional Force on Box

A 100 N box is initially at rest on a rough, horizontal surface. The coefficient of static friction is 0.6, and the coefficient of kinetic friction is 0.4. A constant 35 N horizontal force to the right is applied to the box. Four students are discussing the frictional force exerted on the box by the rough surface 1 second after the force is first applied:



Al: *"The frictional force is 60 N since the box will not be moving and the* coefficient of static friction is 0.6 with a normal force of 100 N."

Brianna: "The frictional force is 40 N since the coefficient of kinetic friction is 0.4 and there is a normal force of 100 N."

Carlos: "The frictional force is 35 N since the box will not be moving and the frictional force will cancel out the applied force of 35 N."

David: "It is 40 N for the kinetic frictional force and 60 N for the static frictional force. The normal force is 100 N and the coefficient of kinetic friction is 0.4, giving 40 N for the kinetic friction. Similarly, for the static frictional force it is 60 N since it has a coefficient of static friction of 0.6."

With which, if any, of these students do you agree?

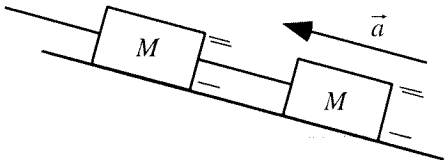
Al _____ Brianna _____ Carlos _____ David _____ None of them _____

Explain your reasoning.

#2.

B3-SCT83: Blocks on a Smooth Incline—Tension

Two blocks are tied together with a rope and are pulled so that they accelerate up a smooth (frictionless) incline. Three students are comparing the tension in the rope between the blocks to the magnitude of the force that the lower block exerts on that rope:



Alberto: "I think the tension has to be larger because it is causing the lower block to accelerate up the incline. If it was the same, then the block wouldn't accelerate."

Benifacio: "I disagree. Force equals mass times acceleration, and the accelerations of the rope and the lower block are the same. The rope hardly weighs anything compared to the block, so it can't exert as much force. The force the block exerts has to be greater."

Connie: "I agree that the rope and the block have exactly the same acceleration since they are moving together. But I think that means that the force has to be the same."

With which, if any, of these students do you agree?

Alberto____ Benifacio _____ Connie _____ None of them_____

Explain your reasoning.

#3

B3-WBT82: Newton's Second Law Equation—Physical Situation

The equation below results from the application of Newton's Laws to an object:

$$27\ \text{N} - (\mu)(14\ \text{kg})(9.8\ \text{m/s}^2) = 0$$

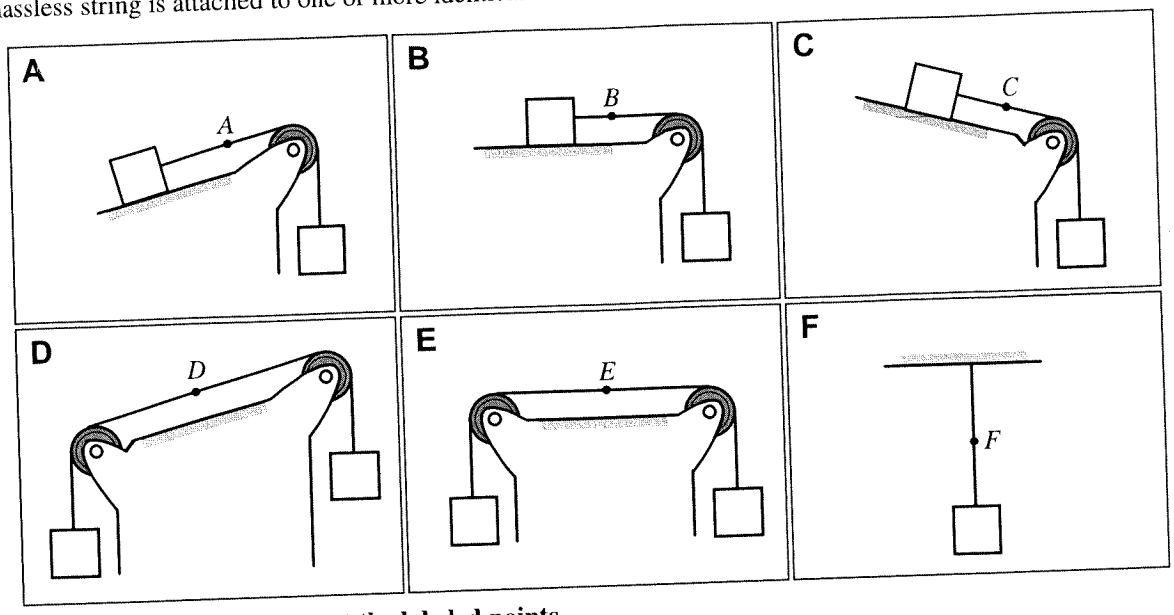
Draw a physical situation that would result in this equation, and explain how your drawing is consistent with the equation.

Tipper #2 - Unit 2

#4

B3-RT81: HANGING MASS—STRING TENSION

A massless string is attached to one or more identical blocks at rest. All the pulleys are frictionless and massless.



Rank the tension in the strings at the labeled points.

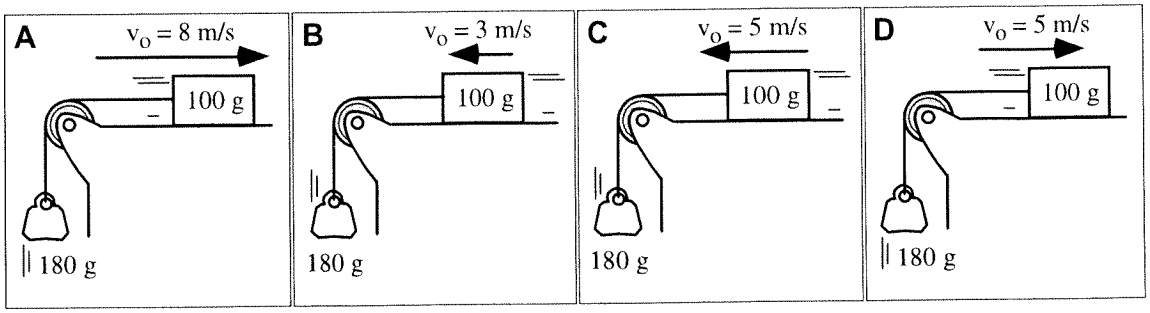
1	2	3	4	5	6	OR			
Greatest					Least		All the same	All zero	Cannot determine

Explain your reasoning.

#5

B3-RT74: HANGING STONE CONNECTED TO BOX ON ROUGH SURFACE—ACCELERATION

In each case shown below, a box is sliding along a horizontal surface. There is friction between the box and the horizontal surface. The box is tied to a hanging stone by a massless rope running over a massless, frictionless pulley. All these cases are identical except for the different initial velocities of the boxes.



Rank the magnitudes of the accelerations of the boxes at the instant shown.

1	2	3	4	OR			
Greatest			Least		All the same	All zero	Cannot determine

Explain your reasoning.

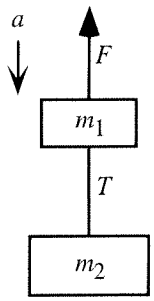
Tipper # 2 - unit 2

3/5

#6

B3-LMCT85: Two Connected Objects Accelerating Downward—Tension in String

Two objects with masses of m_1 = 6 kg and m_2 = 10 kg are connected by a massless string. They are pulled upward by an applied force F. Since this force is smaller than the total weight of the objects, there is a constant downward acceleration of 3 m/s^2. The tension in the string connecting the objects is labeled T.



Identify from choices (i)–(iv) how each change described below will affect the tension (T) in the string between the objects.

Compared to the case above, this change will:

(i) ***increase*** the tension in the string.
(ii) ***decrease*** the tension in the string but not to zero.
(iii) ***decrease*** the tension in the string **to zero**.
(iv) *have* ***no effect*** on the tension in the string.
(v) *have an* ***indeterminate*** effect on the tension in the string.

All of these modifications are the only changes to the initial situation shown in the diagram.

(a) The mass of m_1 is decreased to 5 kg and the mass of m_2 is increased to 11 kg. _____
Explain your reasoning.

(b) The mass of m_1 is increased to 7 kg and the mass of m_2 is decreased to 9 kg. _____
Explain your reasoning.

(c) The applied force F is increased and the acceleration is 2 m/s^2 downward. _____
Explain your reasoning.

(d) The applied force F is increased and the acceleration is 4 m/s^2 upward. _____
Explain your reasoning.

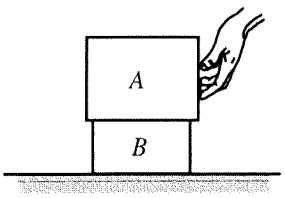
(e) The applied force F is decreased and the acceleration is 4 m/s^2 downward. _____
Explain your reasoning.

Tipper # 2 -Unit 2

4/5

#7 **B3-QRT91: STACKED BLOCKS SLOWING DOWN—FRICTION FORCES**

A student pushes two blocks across a desk. At the instant shown, the blocks are *slowing down*. The force exerted on block A by the student is directed horizontally to the left. The mass of block A is greater than the mass of block B.



(a) The magnitude of the friction force exerted on block A by block B

(i) is *greater than* the magnitude of the friction force exerted on block B by block A.
(ii) is *less than* the magnitude of the friction force exerted on block B by block A.
(iii) is *equal to* the magnitude of the friction force exerted on block B by block A.
(iv) cannot be compared to the magnitude of the friction force exerted on block B by block A based on the information given.

Explain your reasoning.

(b) The magnitude of the friction force exerted on block B by the desk

(i) is *greater than* the magnitude of the friction force exerted on block B by block A.
(ii) is *less than* the magnitude of the friction force exerted on block B by block A.
(iii) is *equal to* the magnitude of the friction force exerted on block B by block A.
(iv) cannot be compared to the magnitude of the friction force exerted on block B by block A based on the information given.

Explain your reasoning.

(c) The magnitude of the friction force exerted on block A by block B

(i) is *greater than* the magnitude of the force exerted on block A by the hand.
(ii) is *less than* the magnitude of the force exerted on block A by the hand.
(iii) is *equal to* the magnitude of the force exerted on block A by the hand.
(iv) cannot be compared to the magnitude of the force exerted on block A by the hand based on the information given.

Explain your reasoning.

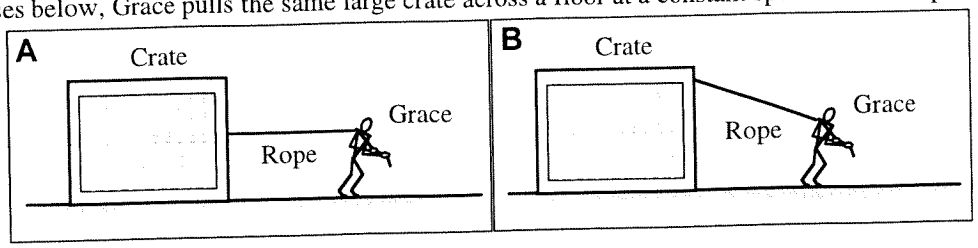
Tipper #2 - Unit2

5/5

#8.

B3-CT73: Pulling a Crate Across Floor—Applied Force

In both cases below, Grace pulls the same large crate across a floor at a constant speed of 1.48 m per second.



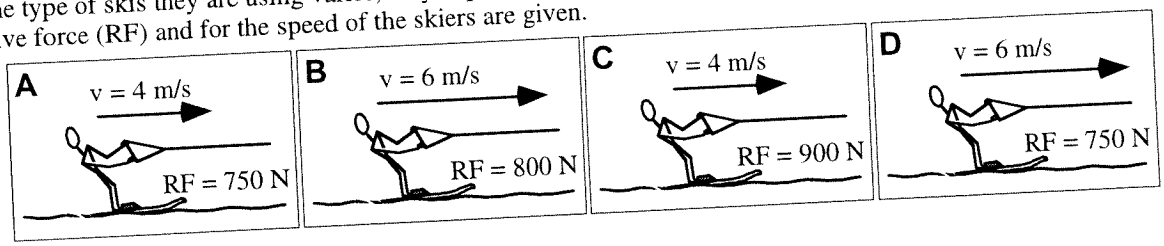
Is the magnitude of the force exerted by Grace on the rope (i) *greater* in Case A, (ii) *greater* in Case B, or (iii) *the same* in both cases? _____

Explain your reasoning.

#9

B3-RT71: Water Skiers—Tension

Water skiers are pulled at a constant speed by a towrope attached to a speedboat. Because the weight of the skiers and the type of skis they are using varies, they experience different resistive forces from the water. Values for this resistive force (RF) and for the speed of the skiers are given.



Rank the tension in the towrope.

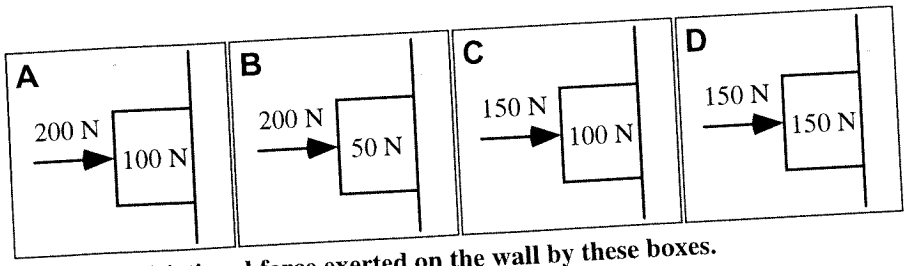
☐ 1 Greatest ☐ 2 ☐ 3 ☐ 4 Least OR ☐ All the same ☐ All zero ☐ Cannot determine

Explain your reasoning.

#10

B3-RT89: Boxes Held Against Vertical Surfaces—Frictional Forces on the Wall

A box is held at rest against a rough, vertical surface by a force pushing horizontally as shown. Values for the applied force and the weight of the boxes are given. The boxes are all made of the same material and the walls are identical.



Rank the magnitude of the frictional force exerted on the wall by these boxes.

☐ 1 Greatest ☐ 2 ☐ 3 ☐ 4 Least OR ☐ All the same ☐ All zero ☐ Cannot determine

Explain your reasoning.