CL1 AP Dynamics 1
MUST SHOW ALL WORK

1. A block rests on a plane inclined at an angle. The coefficient of static friction for these surfaces is 0.8 and it is determined that the static friction force acting on the block is 51 N. If the block exerts a contact force of 140 N on the surface of the plane, which of the following is closest to the mass of the block?

   A. 6.4kg
   B. 14kg
   C. 15kg
   D. 17.5kg
   E. 24kg

2. A car is traveling on a level road at a constant, forward speed. Assuming that the car's tires roll without slipping, the friction force on the tires due to the road can best be described as

   A. zero
   B. a static friction force directed forwards
   C. a kinetic friction force directed forwards
   D. a static friction force directed backwards
   E. a kinetic friction force directed backwards

3.
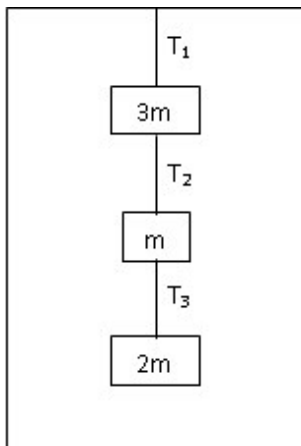
Three blocks with differing masses connected with light strings hang from the ceiling of an elevator which is accelerating DOWNWARDS at a = 0.2g. Which of the following expressions best describes T_2?

   A. $T_2 = 0.8mg$
   B. $T_2 = 1.6mg$
   C. $T_2 = 2.4mg$
   D. $T_2 = 3.6mg$
   E. $T_2 = 4.8mg$
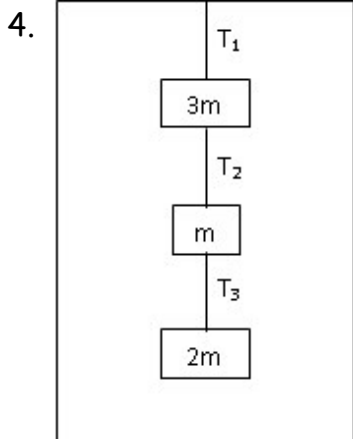
4.

Three blocks with differing masses connected with light strings hang from the ceiling of an elevator which is accelerating upwards at a = 0.2g. Which of the following expressions best describes the relative tensions in the strings?

  A. $T_1 = T_2 = T_3$
  B. $T_1 = 3T_2 = 5T_3$
  C. $T_1 = 3T_2 = 1.5T_3$
 D. $T_1 = 3T_2 = 2T_3$
  E. $T_1 = 2T_2 = 3T_3$

5.
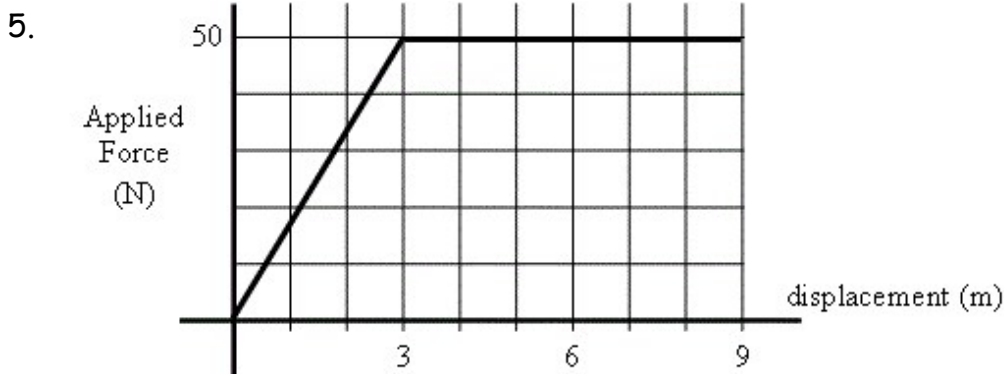
A mass is sliding at a constant velocity prior to reaching a surface where it encounters a constant kinetic friction force of 50 N. At the same instant that it encounters this surface; a force is applied in the direction of motion which varies over the next 9 meters as shown in the graph. At all times, the motion continues in the same direction.

Which of the following statements best describes the magnitude of the velocity and of the acceleration during the first 2 meters of displacement described by the graph?

  A. The velocity is increasing and the acceleration is increasing.
  B. The velocity is increasing and the acceleration is decreasing.
  C. The velocity is increasing and the acceleration is constant.
  D. The velocity is decreasing and the acceleration is increasing.
  E. The velocity is decreasing and the acceleration is decreasing.
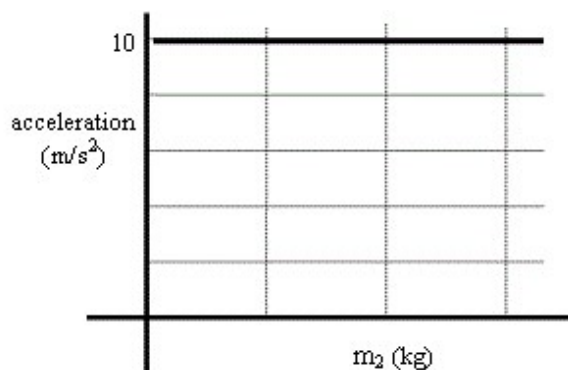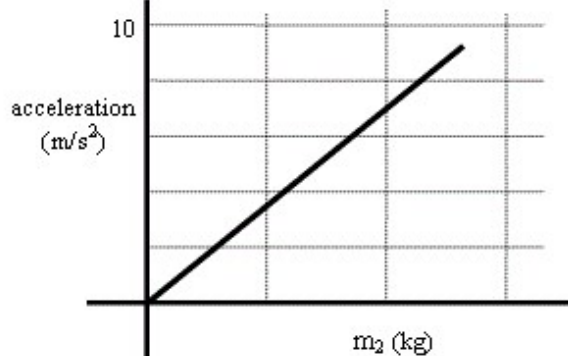 F. The velocity is decreasing and the acceleration is constant.

6.
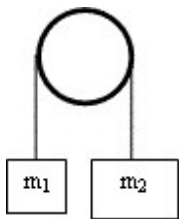
In a traditional Atwood's machine, two masses ($m_2 > m_1$) are connected by a light string and fixed pulley (assume negligible pulley mass and friction).

The acceleration of the system is measured in a series of experiments in which the larger mass, m_2 is continually increased. Which sketch below best represents the expected acceleration of the system as a function of the mass of m_2?
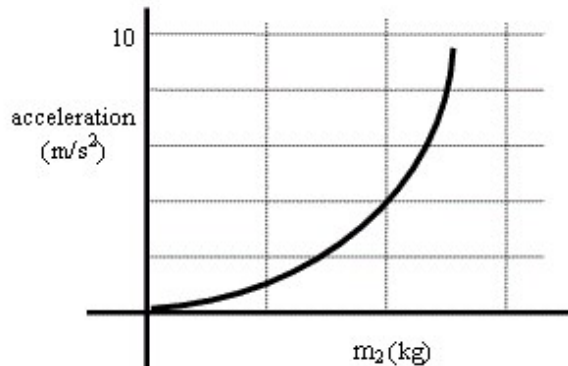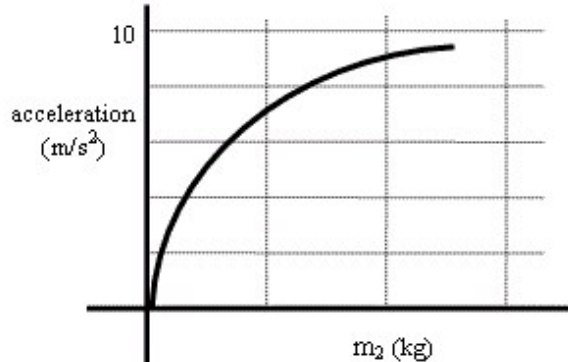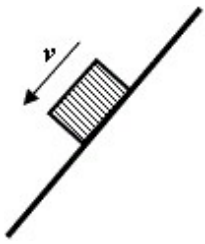
A.

acceleration (m/s^2)

m_2 (kg)

B.

acceleration (m/s^2)

m_2 (kg)

C.

acceleration (m/s^2)

m_2 (kg)

D.

acceleration (m/s^2)

m_2 (kg)

7.

The diagram shows a block moving down an incline at constant speed due, in part, to an external applied force. If the coefficient of kinetic friction for these surfaces equals 0.36, which of the following **best** describes the range of angles of the incline that would require this applied force to be directed up the incline?

  A. Nonsense, the applied force must be directed down the incline for all angles.
  B. The applied force must be directed up the incline for all angles.
  C. The applied force must be directed up the incline for all angles greater than 20°.
  D. The applied force must be directed up the incline for all angles greater than 30°.
  E. The applied force must be directed up the incline for all angles greater than 45°.
  F. The applied force must be directed up the incline for all angles greater than 60°.
 G. The applied force must be directed up the incline for all angles greater than 70°.

8. The diagram shows two masses hanging from ideal pulleys and a third mass on a horizontal surface, all connected by very light strings. The difference in the static and kinetic coefficients of friction for the surface is negligible and the coefficients can be described as $0 < \mu < 1$.
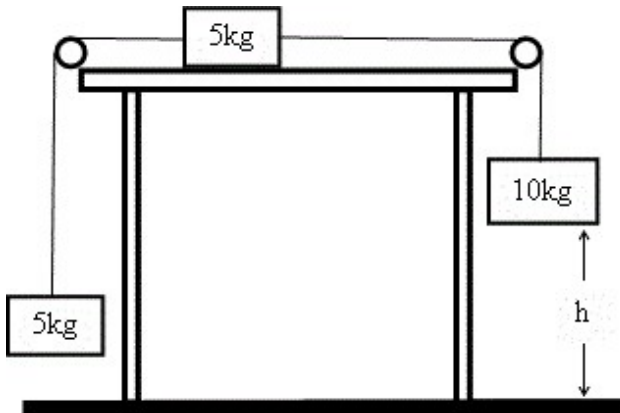
When the 10 kilogram mass is released from height (h), the acceleration of the system is best described as
  A. a = 0
  B. $0 < a < 3m/s^2$
  C. $3m/s^2 < a < 5m/s^2$
  D. $a = 5m/s^2$
  E. $a > 5m/s^2$

9. The pulley in the diagram has negligible mass and friction. What is the best explanation for the system remaining at rest?
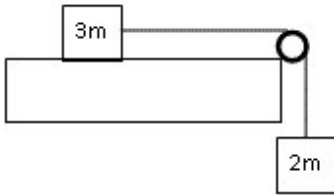
A. Regardless of friction, the larger mass is being supported.
B. Regardless of friction, the system needs a nudge to get it moving.
C. The coefficient of friction for the surface equals 0.33 or more.
D. The coefficient of friction for the surface equals 0.67 or more.
E. The coefficient of friction for the surface equals 1.5 or more.

Answer Key for CL1 AP1

Question 1: C   Question 2: B   Question 3: C

Question 4: E   Question 5: E   Question 6: D

Question 7: C   Question 8: B   Question 9: D