Test Review # 1

5/02/24 11:50 am

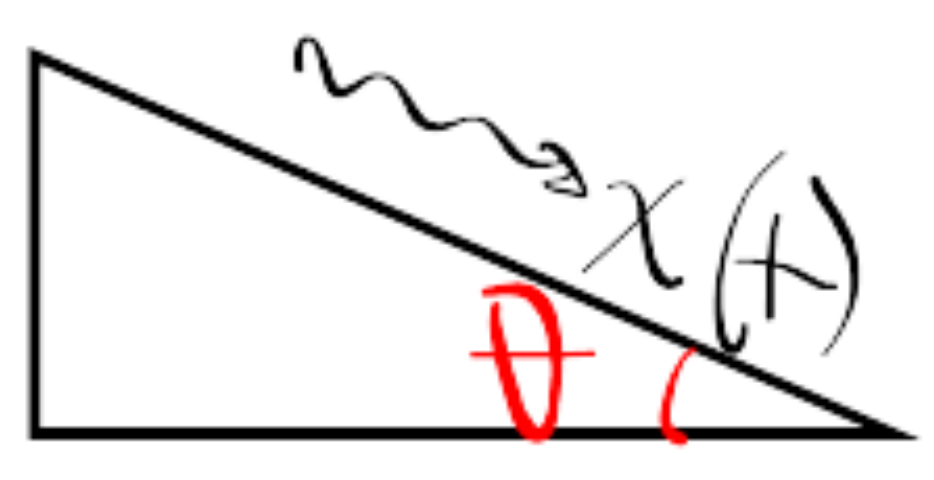
4. A body of mass 200 kg is placed at the top of an inclined plane that makes an angle of 30° with the horizontal. The coefficient of friction is 0.200. Find

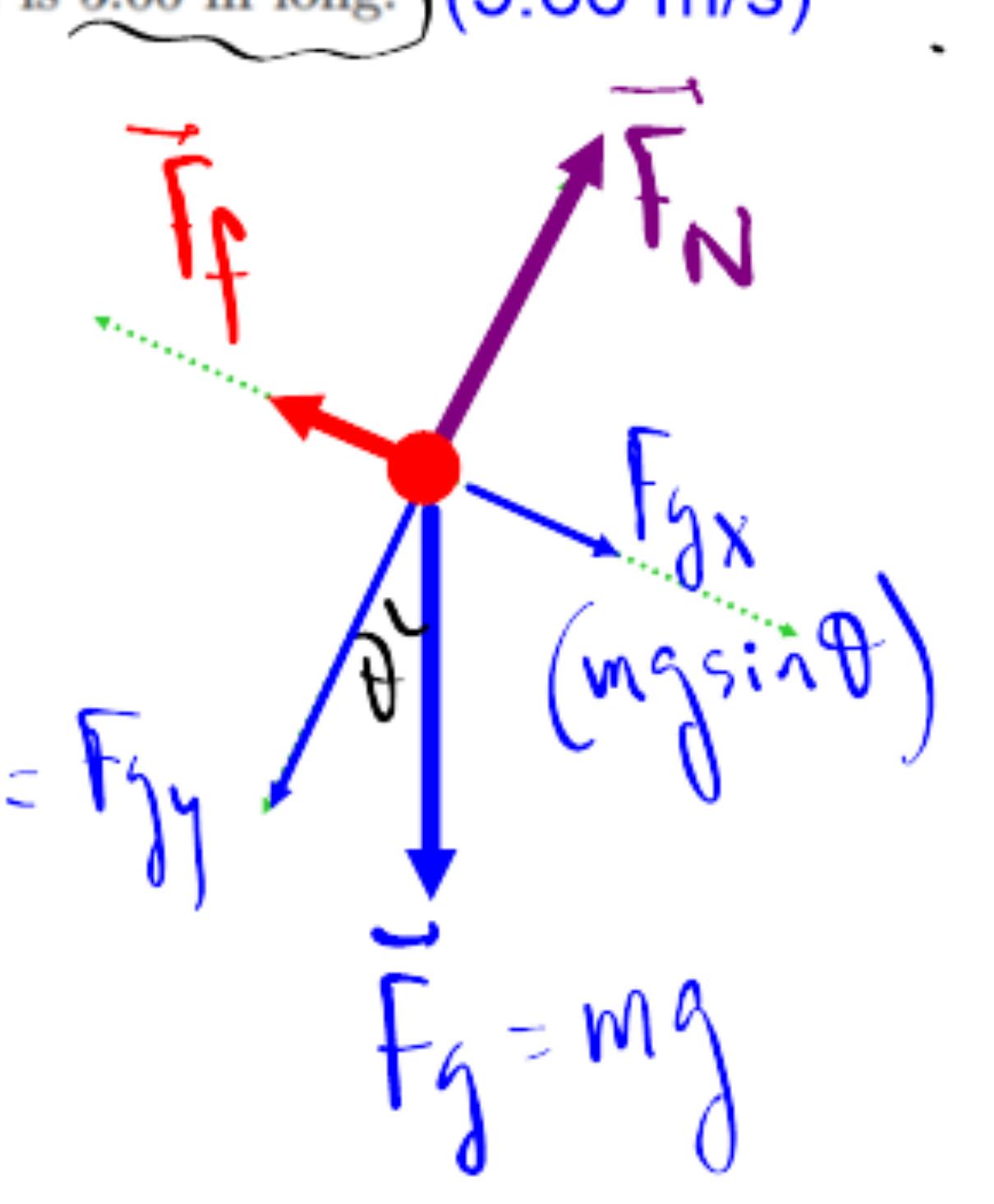
   a. the net force on the body; (641 N)
   b. the body's acceleration; and (3.20 m/s^2)
   c. the speed of the body at the bottom of the plane if the plane is 5.00 m long. (5.66 m/s)

$v_x = v_{x0} + a_x t$

$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$

* $v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$ *





$mg\cos\theta = F_{gy}$

$\vec{F}_{net_x} = m \cdot \vec{a}_x$

$F_{gx} - F_f = m \cdot a$

$F_g\sin\theta - \mu \cdot F_N = m \cdot a$

$mg\sin\theta - \mu \cdot mg\cos\theta = m \cdot a$

a) $F_{net} = 200 \times 9.8 \times \sin(30°) - 0.2 \times 200 \times 9.8 \times \cos(30°)$

$F_{net} = 641\ N$

b) $a = \frac{F_{net}}{m} = \frac{641\ N}{200\ kg} = 3.20\ \frac{m}{s^2}$

c) $v = ?$

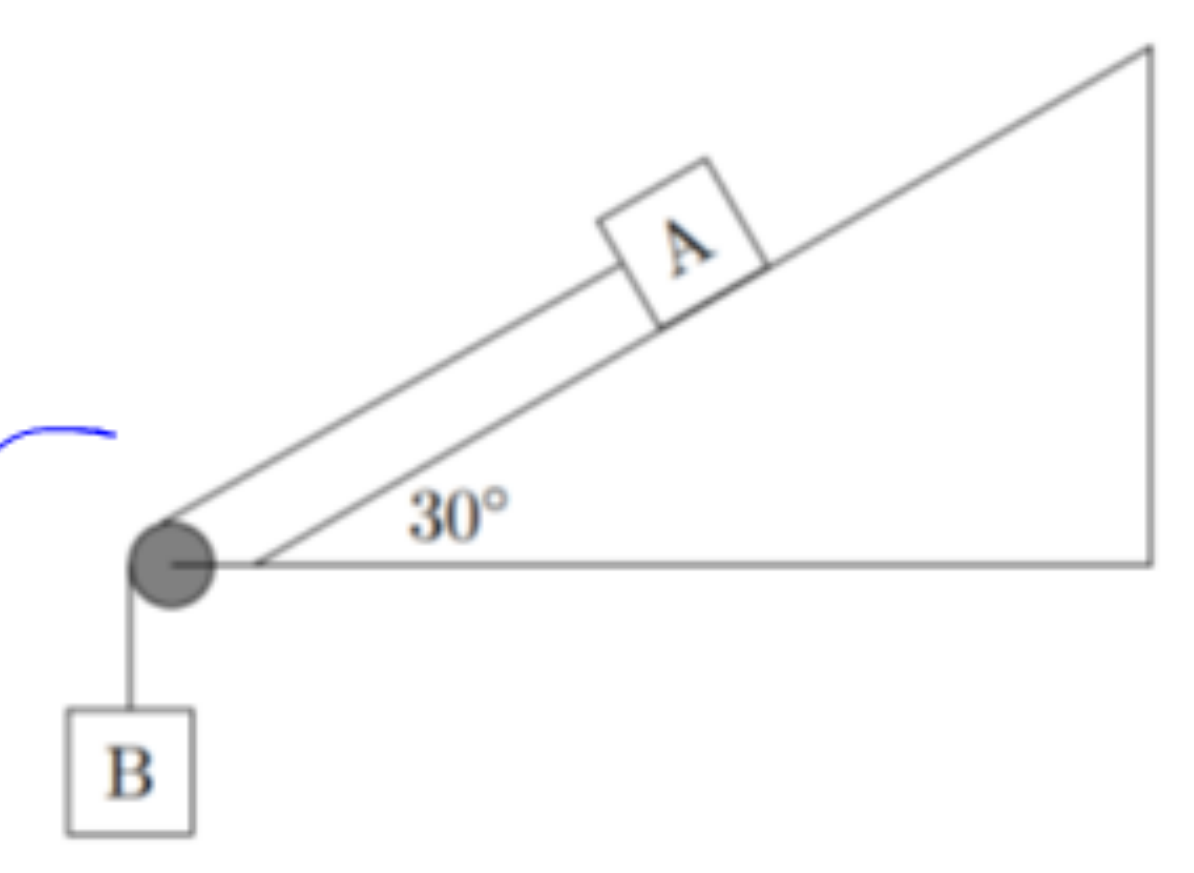
$v^2 = v_0^2 + 2a\Delta x$

$v^2 = 0^2 + 2 \times 3.20 \times 5 = 32.0$

$v = \sqrt{32.0} = 5.66\ \frac{m}{s}$

5. Two blocks are joined as in the diagram below. The mass of A is 30 kg, and the mass of block B is 12 kg. Calculate the acceleration of block A if the coefficient of friction is 0.20. (5.1 m/s^2)

Forces on A: Gravity, Normal, Friction, Tension



Forces on B: Gravity, Tension

$\vec{F}_{net} = m_A \cdot \vec{a}$

$F_T + F_{gx} - F_f = m_A \cdot a$

$F_T + m_A g\sin\theta - \mu \cdot F_N = m_A \cdot a$

$F_T + m_A g\sin\theta - \mu \cdot m_A g\cos\theta = m_A \cdot a$

$F_T = ?$ $a = ?$

Need Another Equation!

$\vec{F}_{net} = m_B \cdot \vec{a}$

$F_g - F_T = m_B \cdot a$

$m_B \cdot g - F_T = m_B \cdot a$

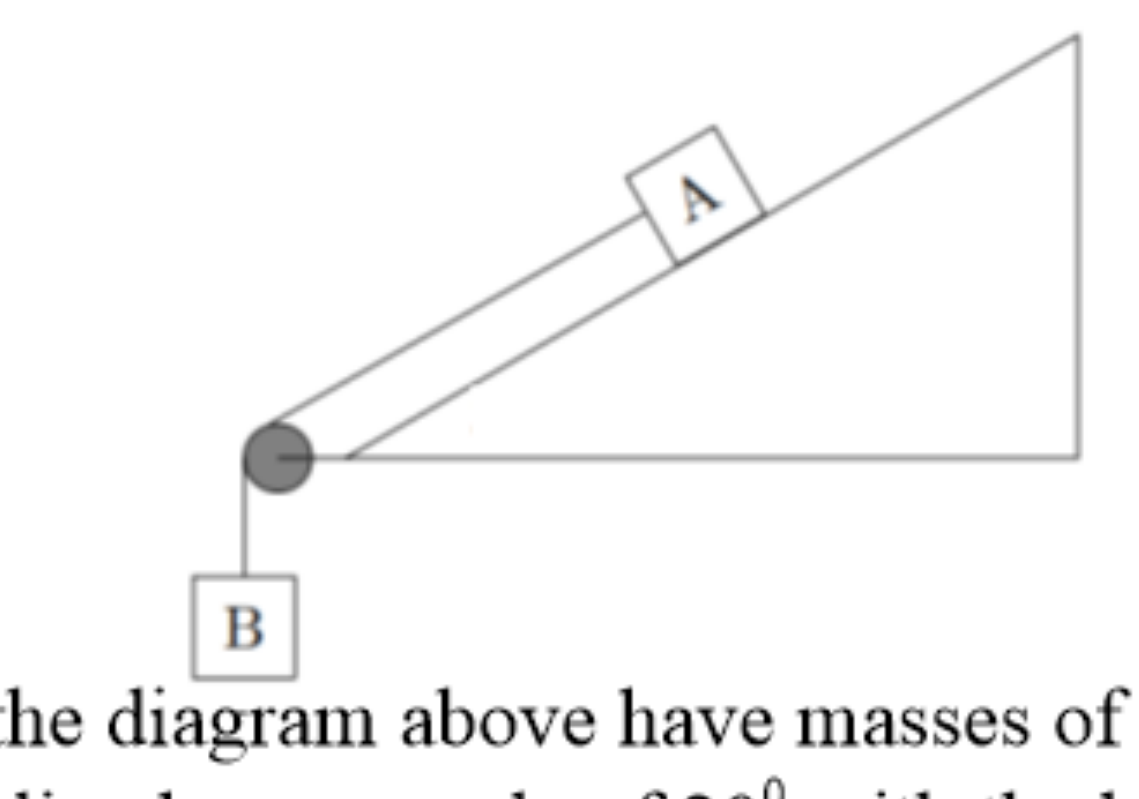
$\cancel{F_T} + m_A g\sin\theta - \mu \cdot m_A g\cos\theta = m_A \cdot a$

$+ \quad m_B \cdot g - \cancel{F_T} = m_B \cdot a$

$m_A g\sin\theta - \mu m_A g\cos\theta + m_B \cdot g = m_A \cdot a + m_B \cdot a$

$30 \times 9.8 \times \sin(30) - 0.2 \times 30 \times 9.8 \times \cos(30°) + 12 \times 9.8 = a(30+12)$

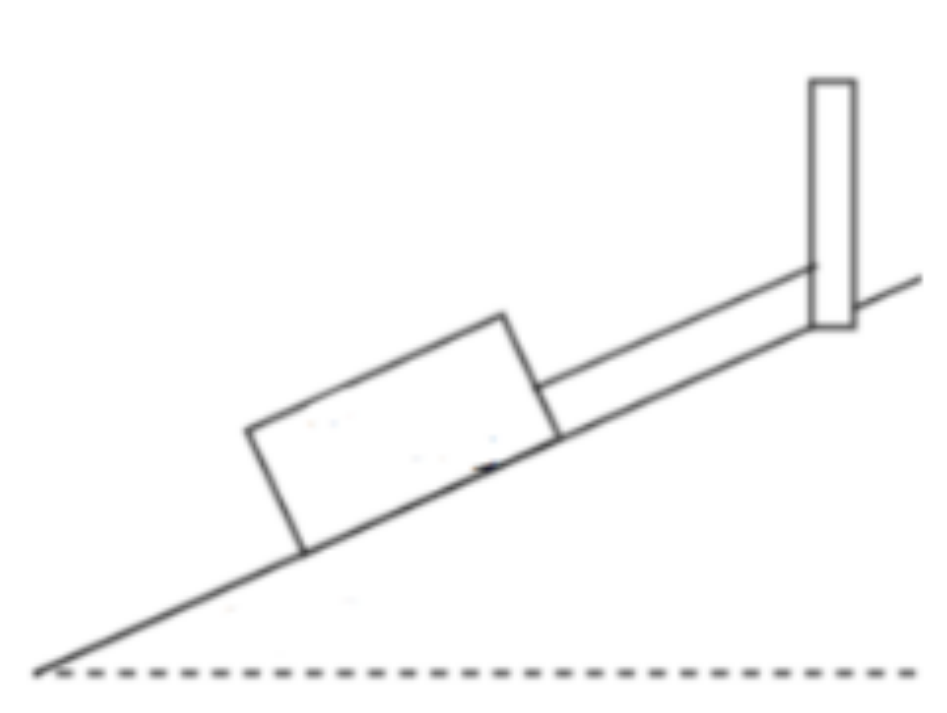
$\frac{213.7}{42} = a = 5.09 \approx 5.1\ \frac{m}{s^2}$



(0.63)

6. Blocks A and B in the diagram above have masses of 4.0 kg and 1.0 kg respectively. If the incline has an angle of 20° with the horizontal, find the coefficient of static friction to keep block A from sliding down the incline plane.

7. A 10.2 kg block on a plane incline 32° is at rest. However, the tension in the cable is not the only thing holding the block back. Static friction is also applying a force. If the coefficient of static friction between the block and the surface is 0.37, determine the tension in the rope. (21.6 N)



8. Two blocks are connected by a string over a frictionless, massless pulley such that one is resting on an inclined plane and the other is hanging over the top edge of the plane, as shown in **Figure 26.** The hanging block has a mass of 16.0 kg, and the one on the plane has a mass of 8.0 kg. The coefficient of kinetic friction between the block and the inclined plane is 0.23. The blocks are released from rest.

   a. What is the acceleration of the blocks?
   b. What is the tension in the string connecting the blocks?

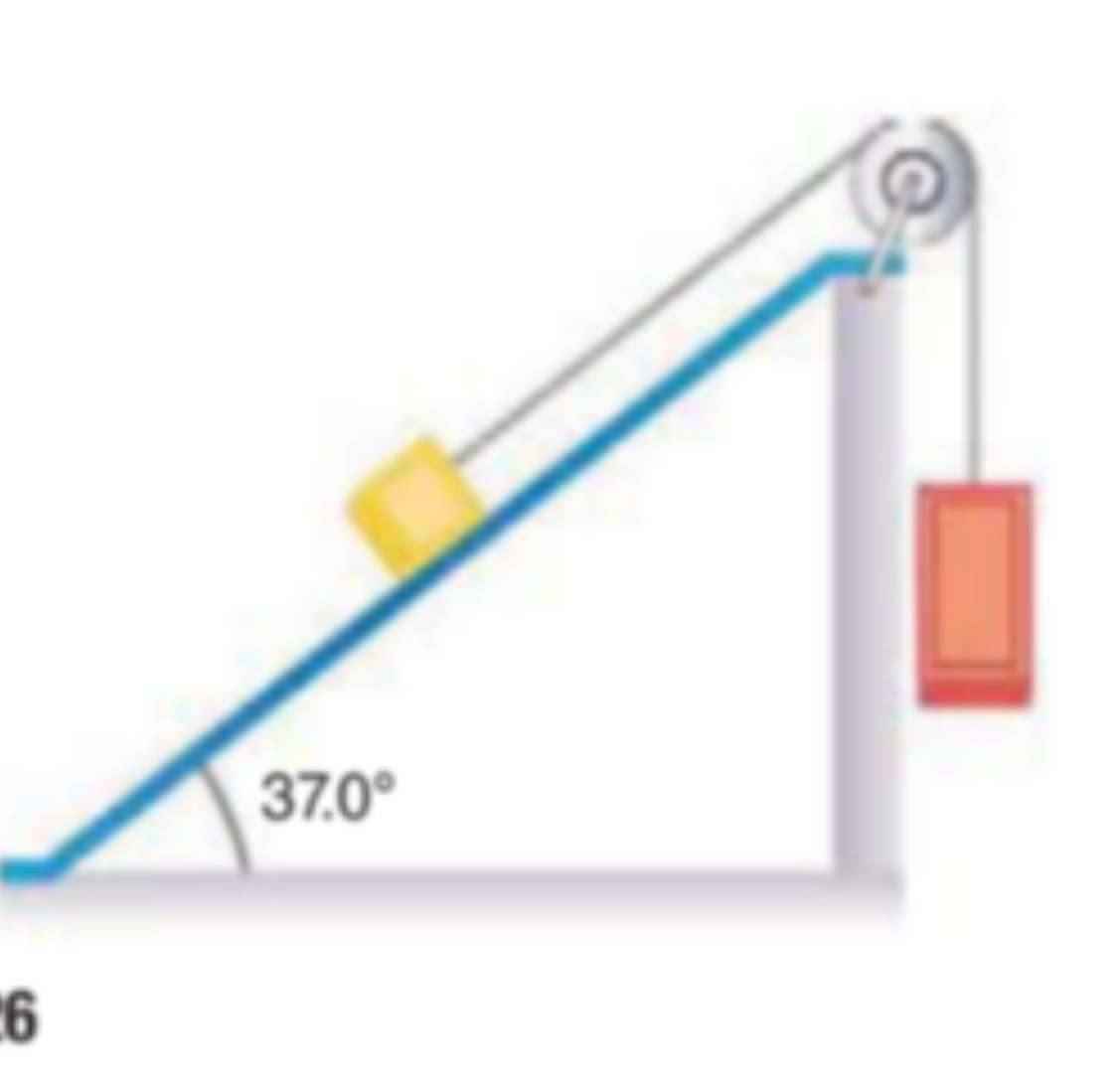


Figure 26