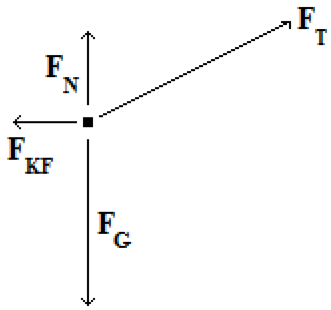
1a.

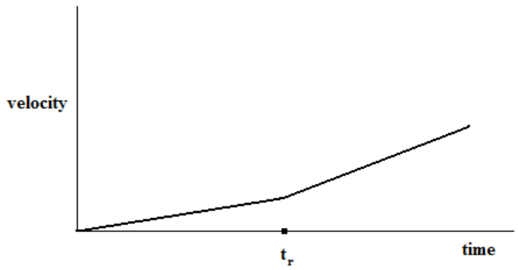


1b. $0 = F_G + F_N + F_{T,y}$
$0 = (20)(-9.8) + F_N + (55)(\sin 20^o)$
$F_N = 177.2N$

1c. $\Sigma F = ma$
$F_{T,x} + F_{KF} = ma$
$(55)(\cos 20^o) + -[(0.22)(177.2)] = (20)(a)$
$a = 0.635 m/s^2$

1d. Use a kinematics box or the equation $\Delta s = ½(a)(\Delta t^2)$
$3 = ½(0.635)(\Delta t^2)$
$\Delta t = 3.07s$

1e.



2a. $21 = (2.4)(\Delta t)$

$\Delta t = 8.75s$

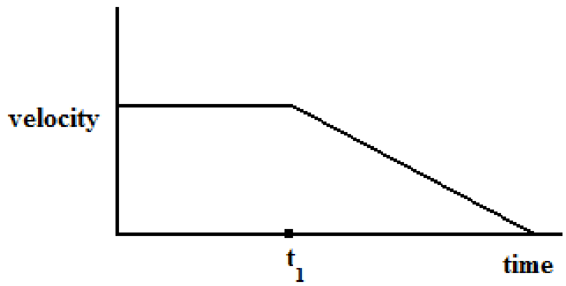
2b. $0 = mg\sin\theta + [-\mu(mg)\cos\theta]$

$0 = (25)(98)(\sin 15^{\circ}) - (\mu)(25)(9.8)(\cos 15^{\circ})$

$\mu = 0.268$

2c. i. constant negative acceleration with a gradually decreasing positive velocity

ii.



2d. The magnitude of the acceleration will be greater as it slides up the hill. Friction acts opposite to the direction of motion, so that when the sled slides up the hill, friction and gravity act together (down the hill) creating a greater net force than when the sled slides down the hill and friction and gravity act in opposite directions (gravity down the hill, friction up the hill).

3a. $a = \frac{\Sigma F}{\Sigma m} = \frac{mg}{m+m} = \frac{g}{2} = 4.9\text{m/s}^2$

3b. Use a kinematics box or the equation $\Delta s = ½(a)(\Delta t^2)$
$1 = ½(4.9)(\Delta t^2)$
$\Delta t = 0.639\text{s}$

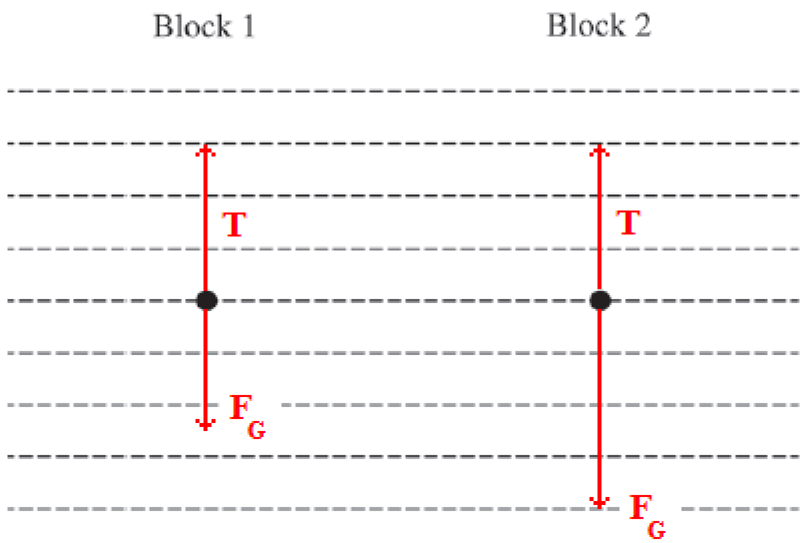
3c. Block A will accelerate at 4.9m/s^2 for 1m.

3d. Block A will coast until it reaches the end of the table. Because the system accelerates at 4.9m/s^2 for 0.639s, this coasting velocity will be 3.13m/s.

3e. Use kinematics boxes in the x and y dimensions or the equation $\Delta s = ½(a)(\Delta t^2)$
$2 = ½(9.8)(\Delta t^2)$
$\Delta t = 0.639\text{s}$ during the flight of block A
$\Delta x = v \cdot \Delta t = (3.13)(0.639) = 2\text{m}$

3f. A massive rope increases the mass of the system, decreasing its acceleration as block B falls. This gives block A a smaller coasting velocity as it leaves the table, thus decreasing the distance it flies to the right as it falls.

4a.



4b. $\Sigma F = m \cdot a$

$m_2g - m_1g = (m_1 + m_2) \cdot a$

$a = \frac{g(m_2 - m_1)}{m_1 + m_2}$

4c. Smaller. The net force in the numerator stays the same, but the inertial mass in the denominator increases, decreasing the acceleration.

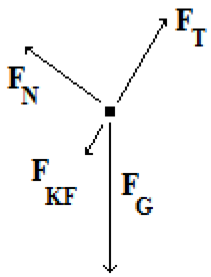
5a. $(10 + 10)(a) = (10)(9.8) - (10)(9.8)(\sin 60^\circ) - (0.20)(10)(9.8)(\cos 60^\circ)$

$a = 0.166 m/s^2$

5b. $(10)(0.166) = (10)(9.8) + F_T$

$F_T = -96.34N$

5c.



5d. The force of gravity on the hanging block will always be greater than the force of gravity on the incline block because that second force of gravity is reduced by a factor of $\sin\theta$. This will create a net force in the direction of the force of gravity on the hanging block.

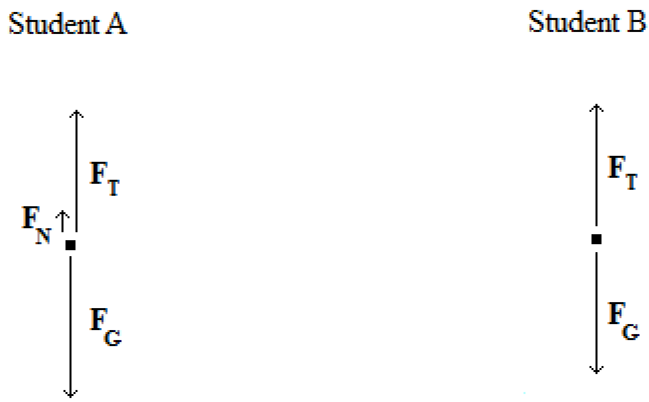
5e. $(10)(a) = (10)(9.8)(\sin 60^\circ) - (0.20)(10)(9.8)(\cos 60^\circ)$

$a = 7.51 m/s^2$

$v_f^2 = 0^2 + 2(7.51)(2)$

$v_f = 5.48 m/s$

6a.



6b. $0 = F_G + F_N + F_T$
$0 = (70)(-9.8) + F_N + (60)(9.8)$
$F_N = 98N$

6c. $ma = F_G + F_T$
$(60)(0.25) = (60)(-9.8) + F_T$
$F_T = 603N$

6d. $0 = F_G + F_N + F_T$
$0 = (70)(-9.8) + F_N + 603$
$F_N = 83N$
Because there is still a normal force, Student A is still on the floor

6e. $0 = F_G + F_N + F_T$
$0 = (70)(-9.8) + 0 + F_T$
$F_T = 686N$

$ma = F_G + F_T$
$(60)(a) = (60)(-9.8) + 686$
$a = 1.63/s^2$