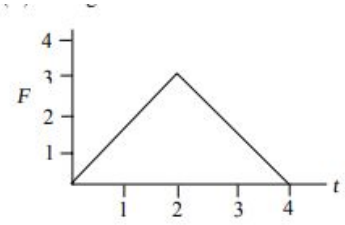
1. As fuel burns the mass of a rocket decreases. If at a certain point the mass of a rocket is half its original mass and velocity is twice the original velocity, how are momentum and energy affected?
   (A) momentum and kinetic energy are unchanged.
   (B) momentum is unchanged and kinetic energy is doubled.
   (C) momentum is halved and kinetic energy is doubled.
   (D) momentum is halved and kinetic energy is unchanged.
   (E) momentum is halved and kinetic energy is quadrupled.

2. A 5 kg mass undergoes a change in momentum of 10 kg·m/s during a 4 s period of time. What is its impulse?
   (A) need to know force
   (B) 10 kg·m/s
   (C) 20 kg·m/s
   (D) 40 kg·m/s
   (E) 50 kg·m/s

3. A 5000 kg rocket is at rest in deep space. The rocket burns fuel pushing 10 kg of exhaust gases rearward at 4000 m/s. This process takes 10 s. During the time interval what average force is applied to the rocket?
   (A) 1000 N
   (B) 2000 N
   (C) 3000 N
   (D) 4000 N
   (E) 5000 N

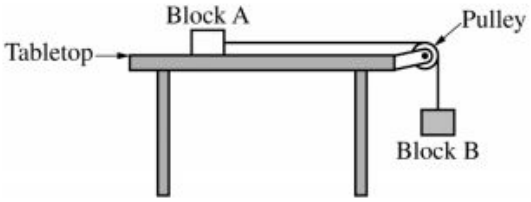
4. A 2 kg ball going 10 m/s follows a path that is perpendicular to the surface of a wall. It impacts the wall and looses 20 % of its momentum in the collision. What is the balls impulse?
   (A) 4 kg·m/s
   (B) 8 kg·m/s
   (C) 16 kg·m/s
   (D) 36 kg·m/s
   (E) 40 kg·m/s



5. What would be the speed of a 3 kg mass, originally traveling at 2 m/s, that undergoes the motion graphed above?
   (A) Need more info.
   (B) 1 m/s
   (C) 2 m/s
   (D) 3 m/s
   (E) 4 m/s

6. When no external forces act, momentum is conserved in
   (A) elastic collisions.
   (B) inelastic collisions.
   (C) perfectly inelastic collisions.
   (D) explosions.
   (E) All are correct.

7. A 2 kg ball moving at 3 m/s collides with a 4 kg that is stationary. If the collision is perfectly inelastic, what is the speed of the 2 kg ball after the collision?
   (A) −1 m/s
   (B) −0.5 m/s
   (C) 1 m/s
   (D) 1.5 m/s
   (E) 2.0 m/s



2. (12 points, suggested time 25 minutes)

This problem explores how the relative masses of two blocks affect the acceleration of the blocks. Block A, of mass m_A, rests on a horizontal tabletop. There is negligible friction between block A and the tabletop. Block B, of mass m_B, hangs from a light string that runs over a pulley and attaches to block A, as shown above. The pulley has negligible mass and spins with negligible friction about its axle. The blocks are released from rest.

(a)

i. Suppose the mass of block A is much <u>greater</u> than the mass of block B. Estimate the magnitude of the acceleration of the blocks after release.

Briefly explain your reasoning without deriving or using equations.

ii. Now suppose the mass of block A is much <u>less</u> than the mass of block B. Estimate the magnitude of the acceleration of the blocks after release.