AP Physics 1

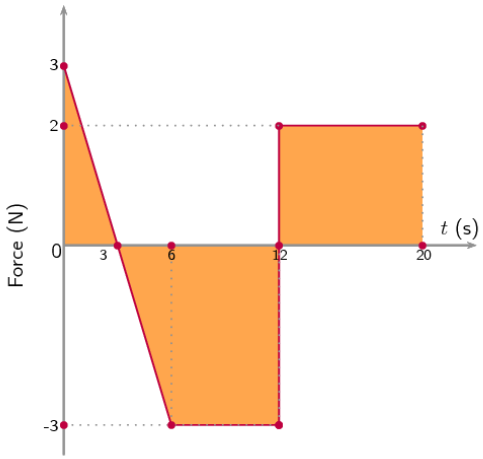
Target Quiz

Momentum and Impulse

1. Under what conditions can two objects have identical momentums?

   a. Only if they both have the same mass.
   b. Only if they both have the same speed
   c. Only if they both have the same velocity
   d. Only if they both have the same mass and speed
   e. None of the above correspond to valid conditions of identical momentums.

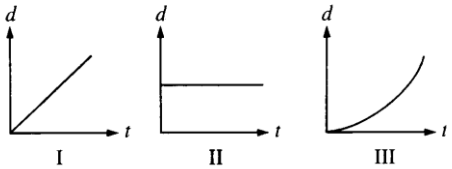
2. A Force acts on an object according to the graph below. Use the graph to answer the following questions.



   a. True or False: The total impulse imparted by the force over the 20 second interval is negative.
   b. True or False: The object's total momentum change will be positive after the 20 s interval.
   c. At what time(s), if any, does the object come to rest?

3. True or False: If two identical impulses are imparted to two objects of identical mass, the magnitude of the acceleration of the objects will be identical.

4. Three objects can only move along a straight, level path. The graphs below show the position *d* of each of the objects plotted as a function of time *t*.



4. The magnitude of the momentum of the object is increasing in which of the cases?
   (A) II only (B) III only (C) I and II only (D) I and III only (E) I, II, and III

5. Is the rate at which a force changes when it acts on an object equal to the object's momentum change? Explain your reasoning!

Answers and Solutions

1. The correct answer is e.

   None of the answers are correct. To be identical, the product of mass and speed must be the same for both objects AND since momentum is a vector quantity, they must also be moving in the same direction!

2.

   a. False. Calculating the positive and negative areas and comparing we get a greater positive area. Since the area under the curve of an F vs t graph corresponds to the Impulse, the total impulse in this case is positive.
   b. False: Since the total impulse, calculated from the total area, is negative, the object's total momentum change will also be negative according to the Impulse-Momentum principle. The positive area = 16 Ns and the negative area = 18 Ns.

   c. Times when the object comes to rest correspond to times where the total impulse or momentum change are equal and opposite. These are regions on the graph for which the areas are equal and opposite.

3. False: Identical impulses do not require that the forces in each case be identical. By Newton's 2nd law, if the forces imparted aren't identical neither will be the resulting accelerations.

4. The correct answer is B.

   Momentum depends on mass and velocity (speed and direction). Regardless of the masses, if their speeds are changing then so will their momentums. Recall that the slope of a d vs t graph corresponds to the velocity, so analyzing the slopes of the graphs we can see that Graphs I and II have constant and zero slopes, respectively, which results in no speed change, thus no momentum change. Graph III has a changing (increasing) slope, so this graph corresponds to an increasing momentum since it shows and increasing speed.

5. No, just the opposite, since it is force that changes momentum through an imparting impulse.