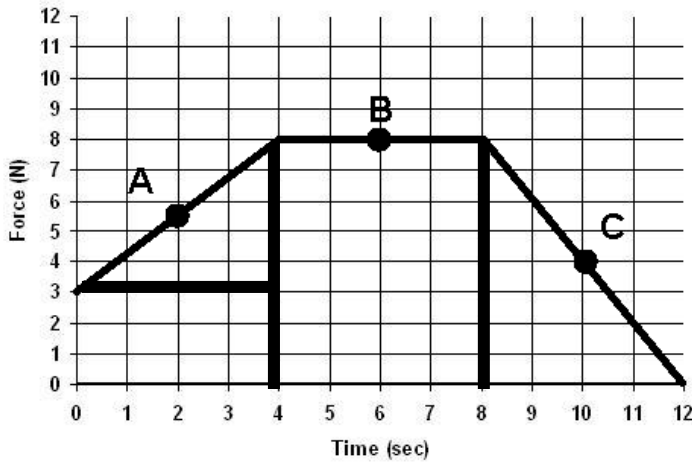


Reading Impulse Graphs

Graph 1 Force vs. Time

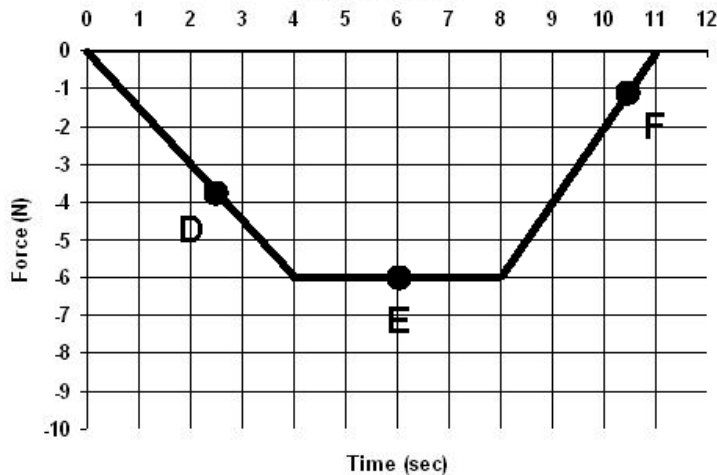


Forces cause acceleration: $F = ma$. When an object accelerates (changes of velocity) its momentum also changes. Also, the longer a force acts on an object the more momentum it will gain. So, $F\Delta t = \Delta p$ (a force for any amount of time causes a change of momentum). We define $F\Delta t$ as "impulse". Impulse = $F\Delta t$.

The area of *any* graph is x times y (length times width). For these graphs: $x(y)$ is $F(t)$, which is the impulse on the object. By finding the area under this graph we find impulse and we will know the Δp .

The area under Graph A is easily calculates, though it does require that we find the four areas shown. Add them all up and you have the total impulse for Graph A. Notice that each of these areas are positive.

Graph 2 Force vs. Time



Graph 2 shows all negative forces. Negative forces cause negative accelerations, meaning the object being pushed or pulled will slow down or get faster in the negative direction.

Graph 1 has all positive forces. No where on graph 1 is there a negative force, so nowhere is the object slowing down. Often students look at the line of letter C and think the object is slowing down. At letter C the object is still encountering a positive force, only a weaker force than at B. So we say it is still accelerating just not as fast. It would have to be below the x -axis (like Graph 2) to be slowing down.

The object is speeding up at letters A, B, and C. At letter B it is speeding up the fastest. At letters D, E, and F the object is slowing down (if going in the positive direction) or speeding up in the negative direction.

Questions:

(Answers are at the bottom of the page.)

- 1) Which graph shows positive forces?
- 2) Which graph shows negative forces?
- 3) Which letter shows the greatest negative acceleration?
- 4) Which letter shows the greatest positive acceleration?
- 5) Which letter shows the object slowing down, but not very much?
- 6) Which letter shows the smallest positive acceleration?

Answers:

- 1) Graph 1; 2) Graph 2; 3) Letter E; 4) Letter B;
5) Letter F (smallest negative force); 6) Letter C (smallest positive force)