

**Physics 2204**  
**Unit 2: Dynamics**  
**Worksheet 11: Introduction to Impulse**



**Student Name:** \_\_\_\_\_

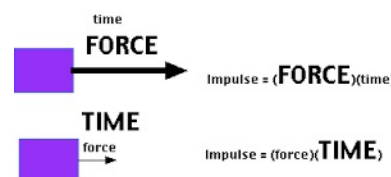
Impulse (J) is defined as the product of the unbalanced or net force and the time that the force is acting.

The equation for impulse is:

$$\text{Impulse} = \text{Force (N)} \cdot \text{Time (s)}$$

Or

$$\vec{J} = F \cdot \Delta t$$



- Unit is N · s
- It is a vector quantity
- The area under a force versus time graph represents impulse.

It turns out that having a net force is not enough to cause a change in the motion of an object. A net force must actually be present for some instant of time. A huge force acting for zero seconds accomplishes nothing. In fact, a small force acting for a long time can be as effective as a huge force acting for a short time.

**Example 1:**

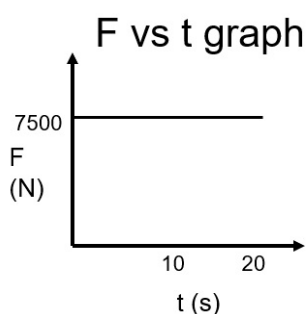
If the halfback experienced a force of 800 N for 0.9 seconds to the north, determine the impulse

**Example 2:**

A 0.10 Kg model rocket's engine is designed to deliver an impulse of 6.0 N·s. If the rocket engine burns for 0.75 s, what is the average force does the engine produce?

**Example 3:**

What was the impulse experienced by the object shown in the graph below?



## PART A: MULTIPLE CHOICE

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

1. What are the units for Impulse ?

- (A) N
- (B) N • s
- (C) N/s
- (D) s

2. Which formula is correct to calculate Impulse?

(A)  $\vec{J} = \vec{F} \bullet t$

(B)  $\vec{J} = \frac{t}{\vec{F}}$

(C)  $\vec{J} = \frac{\vec{F}}{t}$

(D)  $t = \vec{F} \bullet \vec{J}$

3. A golf ball is struck with a force of 8.0 N for a contact time of 0.15 s. What is the impulse on the ball?

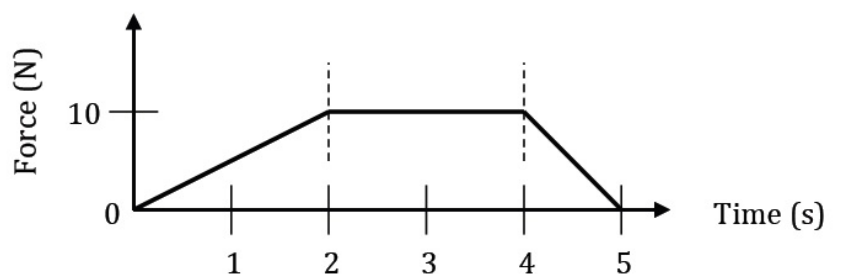
- (A) 0.12 N•s
- (B) 0.83 N•s
- (C) 1.2 N•s
- (D) 8.2 N•s

4. A dropped ball hits the ground and takes 0.15 s to come to a complete after experiencing an impulse of 112 N•s. How much force was applied to the ball over the 0.15 s time interval?

- (A)  $1.3 \times 10^{-3}$  N
- (B)  $1.7 \times 10^1$  N
- (C)  $1.1 \times 10^2$  N
- (D)  $7.5 \times 10^2$  N

5. An object of mass  $m = 2.0\text{kg}$  experiences a force in Newtons according to the Force vs. time graph shown here. For the time interval shown, what is the impulse?

- (A) 35 N•s
- (B) 70 N•s.
- (C) -35 N•s
- (D) -70 N•s



**PART B: WRITTEN RESPONSE**

1. What impulse is exerted in each of the following situations?
  - a) a force of 25 N [E] is exerted on a cart for 3.2 s.
  - b) a hockey stick is in contact with a puck for 0.05 s and exerts a force of 120.0 N.
  
2. A volleyball player hits a ball with a force of 200N. Find the impulse on the ball if his hand stays in contact with the football for 0.01s.
  
3. A hockey player applies an average force of 80N to a 0.25kg hockey puck for a time of 0.2s. Determine the impulse experienced by the hockey puck.
  
4. Aunt Mary needs to hang a picture in her bedroom. She uses a hammer to drive the nail into the wall. Find the force exerted by the hammer on the nail if the hammer stays in contact with the nail for 0.5s and has an impulse of 25Ns
  
5. The graphs below show the Force over Time, that was applied to an object. Calculate the impulse for each.

