Momentum and Impulse

-Momentum is the product of mass and velocity
-momentum is a vector quantity and is always in the direction of the velocity
-units are $\underline{kg \cdot m}$
　　　　　s

Equation

$$\vec{p} = m\vec{v}$$

where m=mass (kg)
　　　v=velocity (m/s)

Example

Determine the momentum of a 0.300kg hockey puck travelling across the ice at 5.55m/s?

Impulse

-Impulse is the product of the force exerted on an object and the time interval over which the force acts
-essentiallyit is equal to the change in momentum that occurs during the interaction
-units are $\underline{kg \cdot m}$
$\qquad$ s

Equation

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

where F is the force applied (N)
t is the time it is applied for (s)

Example

If a golf club exerts an average force of 5.25×10^3 N[W] on a golf ball over a time interval of 5.45×10^{-4}s, what is the impulse of the interaction?

Impulse-Momentum Theory

-since impulse is the change in momentum, we can quantify the relationship in an equation
-impulse is a vector quantity and the direction of the impulse is the same as the direction of the *change* in momentum

$$\vec{F}\Delta t = mv_2 - mv_1$$

Example

A student practises her tennis volleys by hitting a ball against a wall.

a) If the 0.600kg ball travels at 48m/s before hitting the wall and then bounces directly backward at 35m/s, what is the impulse of the interaction?

b) If the duration of the interactions is 25ms, what is the average force exerted on the ball by the wall?