Grade 12 Physics

SPH4U

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Chapter 3

Unit 2: Energy and Momentum

3.1 Linear Momentum & Impulse

Linear Momentum

Linear Momentum is the product of an object's mass and its velocity:

$$\vec{p} = m\vec{v} \tag{3.1}$$

$\vec{p}$ is the Momentum in $(kg * \frac{m}{s})$

Newton called momentum "the **true Quantity of motion**". Why? Momentum is a combination of an object's **inertia**(its mass basically) and what it is doing (its **velocity**). He felt that it provided a more complete picture of what was required to cause a specific change in what an object was doing.

Impulse

Impulse is the **product of that force** acting on an object and the **duration** of time that the force acted on the object.

$$\vec{J} = \vec{F} * \Delta t \tag{3.2}$$

$\vec{J}$ = the impulse in (N*s)

The formula has a similar limitation to the formula for the work done on an object. Both formulas assume that the force acting on the object.

Thus, if the force acting on the object is not constant, we can find the impulse that the force provides by finding the area between the line/curve on a **Force vs Gravity graph**

Let's see some formula:

$$\sum \vec{J} = \sum \vec{F} * \Delta t$$
$$\sum \vec{J} = (m * \vec{a}) * \Delta t$$
$$\sum \vec{J} = (m * \frac{\vec{v_2} - \vec{v_1}}{\Delta t}) * \Delta t$$
$$\sum \vec{J} = m * \vec{v_2} - m * \vec{v_1}$$
$$\sum \vec{J} = \vec{p_1} - \vec{p_1}$$

$$\sum \vec{J} = \Delta \vec{p} \tag{3.3}$$