Physics 11 - Unit 5
Momentum
5.3 - Conservation

Review

Sig Figs

- when ×/÷ you use ≠ least # of digits from your data
- when +/− you use ≠ least # of decimal places from your data

Unit Conversion

Calculate ≠ # of seconds in 7 years

1 yr = 365 days 1 day = 24 hrs 1 hr = 3600 s

$$7\,\text{yr}^{\text{top}} \times \frac{365\ \text{days}}{1\ \text{yr}_{\text{bottom}}} \times \frac{24\ \text{hrs}}{1\ \text{day}} \times \frac{3600\ \text{s}}{1\ \text{hr}}$$

$$= 220752000\ \text{seconds}$$

$$\hookrightarrow 2.20752 \times 10^{8}\ \text{seconds}$$

New

You have heard: nrg cannot be created or destroyed

We will apply this to the total momentum of a closed system

The total momentum of a system before a collision is the same after a collision.

$$\vec{p}_i = \vec{p}_f$$

$$\boxed{m_i v_i = m_f v_f}$$

i = initial : total system } all objects
f = final : total system }

$$m_{ci} v_{ci} + m_{Bi} v_{Bi} = m_{cBf} v_{cBf}$$

Ex: Two hockey players @ rest; one 90 kg player pushes another 105 kg player. What is the velocity of the 105 kg player if the 90 kg player moved back @ 10 km/hr?

$$\boxed{m_1 v_1 = m_2 v_2}$$

$m_1 = 90\text{kg}$

$v_1 = 10\,\text{km/hr} \times \frac{1\,\text{hr}}{3600\,\text{s}} \times \frac{1000\,\text{m}}{1\,\text{km}} = 2.78\,\text{m/s}$

$m_2 = 105\,\text{kg}$

$v_2 = ?$

$$(90\,\text{kg})(2.78\,\text{m/s}) = (105\,\text{kg})(?)$$

$$250\,\text{kg}\cdot\text{m/s} = (105\,\text{kg})(?)$$

$$\div 105\,\text{kg}$$

$$= 2.38\,\text{m/s} \longrightarrow \boxed{2.4\,\text{m/s} = v_2}$$

Ex 2 A 6.0×10^3 kg railway car is coasting along a track w/ a velocity = 5.5 m/s when suddenly a 3.0×10^3 kg load of sulphur is dumped into it. What is the new velocity (of the total system)

$$\boxed{m_c v_c + m_s v_s = m_{cs} v_{cs}}$$

$v_s = 0$

$m_c = 6.0\times10^3\,\text{kg}$

$v_c = 5.5\,\text{m/s}$

$m_s = 3.0\times10^3$

$m_{cs} = 9.0\times10^3\,\text{kg}$

$v_{cs} = ?$

$$(6.0\times10^3\,\text{kg})(5.5\,\text{m/s}) = (9.0\times10^3\,\text{kg})(v_{cs})$$

$$33\times10^3\,\text{kg}\cdot\text{m/s} = (9.0\times10^3\,\text{kg})(v_{cs})$$

$$\div 9.0\times10^3\,\text{kg}$$

$$3.66\,\text{m/s} = \boxed{v_2 = 3.7\,\text{m/s}}$$