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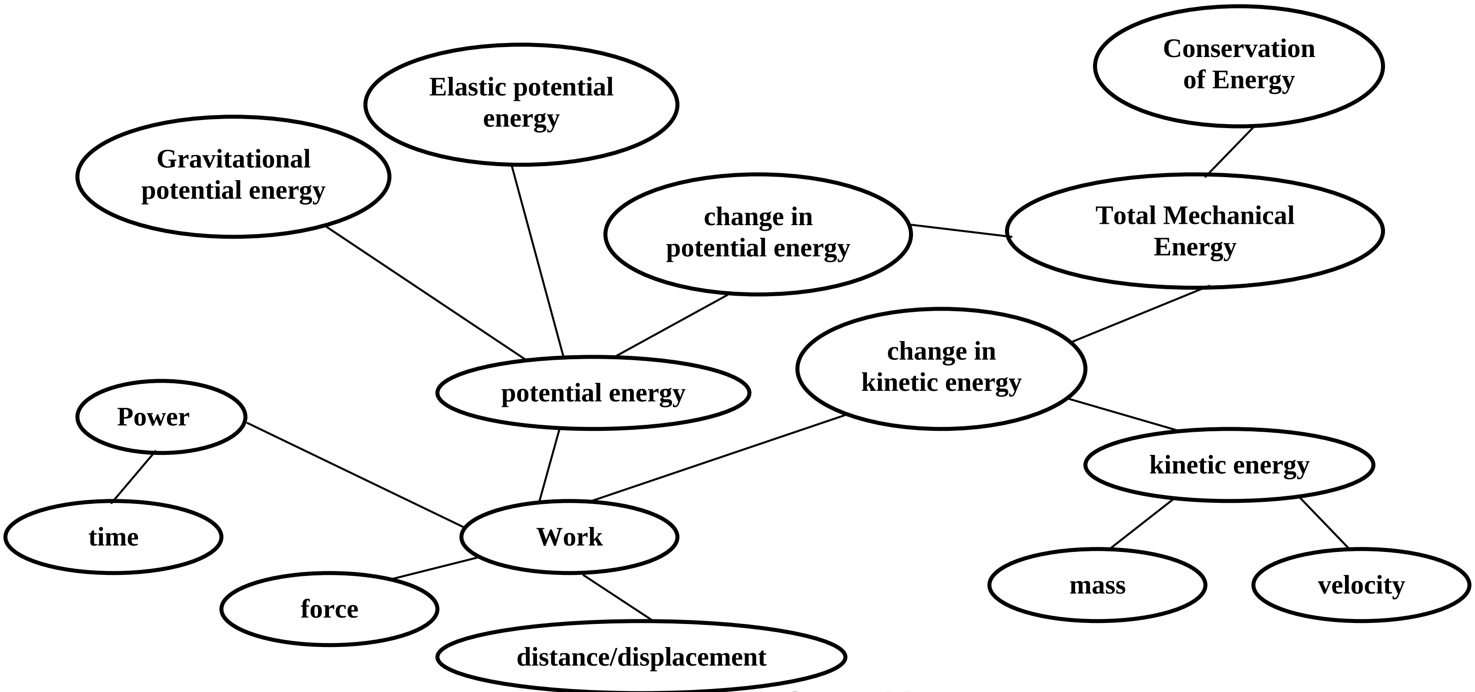
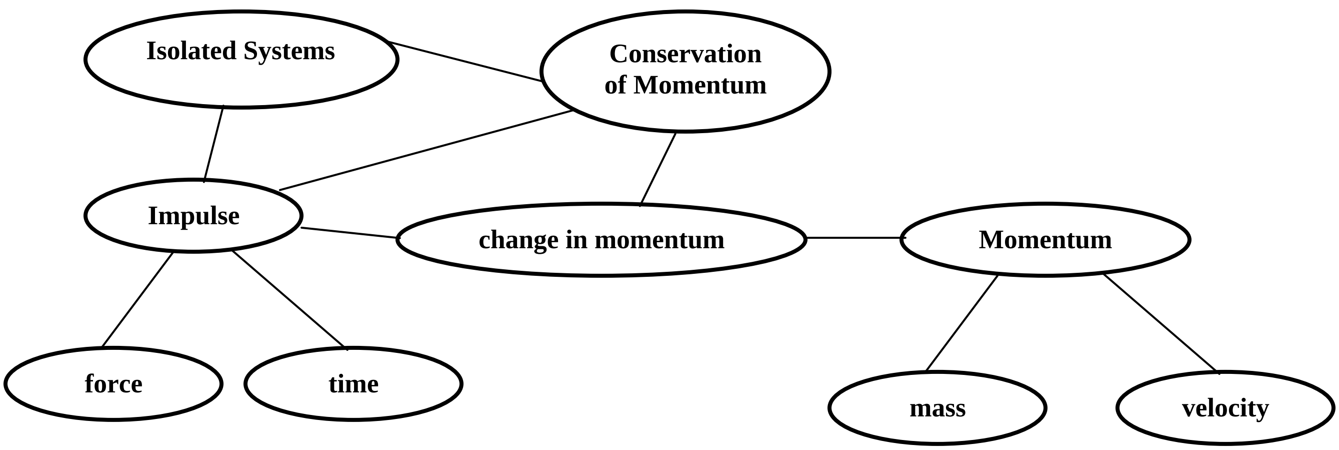
Mr. Croom's Physics Chapter 6: Momentum

Energy and Momentum Concept Map



Momentum Concept Map



BuzzWords: isolated system, closed system**,** conservation of momentum

Notes on Work and Energy:
- Work is done by an external force acting on the object in question over a certain distance. (W = Fd)
- Work causes a change in the kinetic energy of the system. ($W = \Delta E_K$)

Notes on Impulse and Momentum:
- An impulse is caused by an external force acting on the object in question over a certain time. (**J** = **F**t)
- An impulse causes a change in the momentum of the system. (**J** = Δ**p**)

Comparison of Work and Energy equations to Impulse and Momentum Equations:

Definition of momentum:	$p = m\,v$	**Definition of kinetic energy**:	$E_k = {}^1/_2\, m\, v^2$
Definition of impulse:	$J = F\,t$	**Definition of work**:	$W = F\,d$
Impulse – Momentum theorem:	$J = \Delta p$	**Work – Energy theorem**:	$W = \Delta E_k$
	$\Delta p = m\,\Delta v$		$\Delta E_k = E_{kf} - E_{ki}$
	$\Delta p = p_f - p_i$		

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Notes on 1 Dimensional Collision Theory:

1. **Elastic Collision** is defined as a collision in which the objects involved bounce or ricochet off of each other, and there is **NO LOSS OF MECHANICAL ENERGY**, i.e., there is simply a transfer of kinetic energy from one object in the system to another object in the system. Examples of nearly elastic collisions include many atomic and subatomic particle collisions and collisions in ideal gasses.

2. **Inelastic Collision** is defined as a collision in which some kinetic energy is transferred to other sources, such as sound energy, thermal energy, and especially, the *energy of deformation*. **ALL** real life collisions are some type of inelastic collision.

3. **Perfectly Inelastic Collision** is defined as a collision in which **BOTH objects stick together** after the collision. **Much** kinetic energy is transferred during this type of collision.

In all inelastic collisions, a varying amount of kinetic energy is transferred out of the system. Therefore, kinetic energy is NOT conserved. However, in ALL collisions, momentum IS conserved.

All collision problems done in class will either be perfectly elastic or perfectly inelastic collisions.

Perfectly Elastic Collisions:

To find the velocity of each object after a perfectly elastic collision, use the following two equations:

To find $\mathbf{v_{1f}}$ (final velocity of object 1, use this equation: $$\mathbf{v_{1f}} = \left(\frac{\mathbf{m_1 - m_2}}{\mathbf{m_1 + m_2}}\right)\mathbf{v_{1i}} + \left(\frac{\mathbf{2m_2}}{\mathbf{m_1 + m_2}}\right)\mathbf{v_{2i}}$$

To find $\mathbf{v_{2f}}$ (final velocity of object 2, use this equation: $$\mathbf{v_{2f}} = \left(\frac{\mathbf{2m_1}}{\mathbf{m_1 + m_2}}\right)\mathbf{v_{1i}} - \left(\frac{\mathbf{m_1 - m_2}}{\mathbf{m_1 + m_2}}\right)\mathbf{v_{2i}}$$

Perfectly Inelastic Collisions:

To find the velocity of the system of objects after a perfectly inelastic collision, use the single equation below:

$$\mathbf{v_f} = \frac{\mathbf{m_1 v_{1i} + m_2 v_{2i}}}{\mathbf{m_1 + m_2}}$$

Notes: