

Newton's Third Law

- For every force there is an equal and opposite force on a different object.
- In math form $F_1 = -F_2$
- Because of Newton's 2nd law – $F = ma$ – this can be rewritten as
- $m_1 a_1 = -m_2 a_2$

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- Using the formula $v_2 = v_1 + at$ and doing some algebra we can get
- $m_1 v_{1B} + m_2 v_{2B} = m_1 v_{1A} + m_2 v_{2A}$
- Newton's 3rd law in this form is called the Law of Conservation of Momentum
- Momentum has the symbol in equations of p where the equation is $p = mv$. Momentum has units of kg m/s
- $p_{1B} + p_{2B} = p_{1A} + p_{2A}$

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- Doing some other algebra we can get the equation $F\Delta t = m\Delta v$
- $F\Delta t$ is called impulse with units of N s (Newton seconds)
- $m\Delta v$ is the change in momentum

Newton's Third Law Summary

We have four new equations

1. $F_1 = -F_2$

2. $p = mv$

3. $m_1 v_{1B} + m_2 v_{2B} = m_1 v_{1A} + m_2 v_{2A}$ OR
 $p_{1B} + p_{2B} = p_{1A} + p_{2A}$

4. $F\Delta t = m\Delta v$

And two new quantities

1. momentum p kg m/s

2. impulse $F\Delta t$ N s

Newton's Third Law

Along with the equations is the basic concept that anytime there is a force there are two objects (at least) interacting and that these force on one, as well as the time, is the same size as the opposite force (and time) on the other.