Name: Key -Hour _____

Relativity Notes

weird stuff!

Up until 1905 the laws of motion were based on the theories of Newton.

Newton's Laws (inertia, F=ma, action/reaction) work, but only at low speeds.

1905: Einstein's **Theory of Relativity-** At the speed of light: **Length decreases** to zero, **mass increases** to infinity, **time slows** to a stop, and mass can be converted into energy!

The **speed of light** (c) in a vacuum will always = 3×10^8 m/s 186,000 miles/s
Ultimate speed!

Cool Stuff Einstein Predicted:

To an observer:

1) At the speed of light, time slows down from observers pt. of view

Should time travel be possible? _____

2) At the speed of light, length appears to decrease (get shorter)

3) At the speed of light, mass increases

Has this stuff been proven?

Yes! In laboratories such as Fermilab, just outside of Chicago, scientists can accelerate particles to speeds around 99% the speed of light. These fast-moving particles decay much more slowly and their masses have been found to increase 1000's of times!

Einstein's Most Famous Equation:

Remember: K.E. = $\frac{1}{2}mv^2$

You can continually apply energy to an object, but there is a limit on velocity so therefore the mass of an object must increase! mass and energy are equivalent. Or: **When you add energy to an object, it's the same as adding mass**

1 gram of matter has more energy contained in it than is used to power Minneapolis for 1 day!

THE LAST EQUATION OF THE YEAR:

$E = mc^2$

E = energy (J)
m = mass (kg)
c = 3×10^8 (m/s)

How much energy is contained in a penny with a mass of 4 grams?

m = .004g

$E = .004(3 \times 10^8)^2 = 3.6 \times 10^{14}$ J