

Physics 14-04 Relativistic Momentum

Name: _____

Law of Conservation of Momentum

- The _____ momentum of a closed _____ does not _____.

$$p = mv$$

- However, when _____ approaches _____, we must adjust the _____

$$p = \frac{mv}{\sqrt{1 - \frac{v^2}{c^2}}}$$

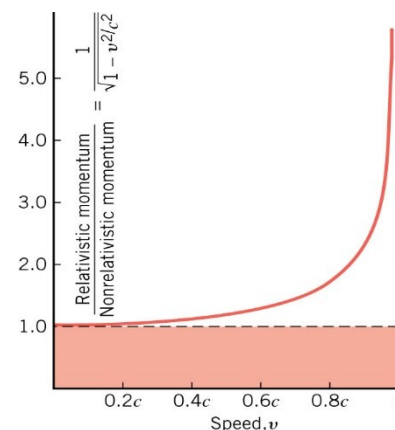
- _____ momentum is always _____ than _____ momentum because

- $\sqrt{1 - \frac{v^2}{c^2}} < 1$

- Since we _____ by the radical in the formula, the result is a _____ number.

- Notice that when the _____ is near 0, the _____ momentum is near the _____.

- When the speed is near c , the _____ momentum increases _____.



In a game of Dom'Jot, a small ball (0.5 kg) is hit across a table. If the ball moves at 3 m/s and the speed of light in a vacuum is 4 m/s, what is the relativistic momentum of the ball?

The nonrelativistic momentum?



Practice Work

- Find the momentum of a helium nucleus having a mass of 6.68×10^{-27} kg that is moving at $0.200c$. (OpenStax 28.35) **4.09×10^{-19} kg m/s**
- What is the momentum of an electron traveling at $0.980c$? (OpenStax 28.36) **1.35×10^{-21} kg m/s**
- What is the velocity of an electron that has a momentum of 3.04×10^{-21} kg·m/s? Note that you must calculate the velocity to at least four digits to see the difference from c . (OpenStax 28.39) **2.988×10^8 m/s**
- Find the velocity of a proton that has a momentum of 4.48×10^{-19} kg·m/s. (OpenStax 28.40) **2.00×10^8 m/s**
- (a) Calculate the speed of a $1.00\text{-}\mu\text{g}$ particle of dust that has the same momentum as a proton moving at $0.999c$. (b) What does the small speed tell us about the mass of a proton compared to even a tiny amount of macroscopic matter? (OpenStax 28.41) **1.12×10^{-8} m/s, mass of proton is tiny**