

**Problem Set**

1. Write out a detailed proof of the fact that, given two numbers in scientific notation,  $a \times 10^n$  and  $b \times 10^n$ ,  $a < b$ , if and only if  $a \times 10^n < b \times 10^n$ .
  - a. Let  $A$  and  $B$  be two positive numbers, with no restrictions on their size. Is it true that  $A \times 10^{-5} < B \times 10^5$ ?
  - b. Now, if  $A \times 10^{-5}$  and  $B \times 10^5$  are written in scientific notation, is it true that  $A \times 10^{-5} < B \times 10^5$ ? Explain.
2. The mass of a neutron is approximately  $1.674927 \times 10^{-27}$  kg. Recall that the mass of a proton is  $1.672622 \times 10^{-27}$  kg. Explain which is heavier.
3. The average lifetime of the Z boson is approximately  $3 \times 10^{-25}$  seconds, and the average lifetime of a neutral rho meson is approximately  $4.5 \times 10^{-24}$  seconds.
  - a. Without using the theorem from today's lesson, explain why the neutral rho meson has a longer average lifetime.
  - b. Approximately how much longer is the lifetime of a neutral rho meson than a Z boson?