PHYS 301 Time Dilation Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 

1. Muons are produced in the upper atmosphere (about 10,000 m above sea level) when cosmic rays bombard earth. The appearance of them at Earth’s surface can be explained using relativity. The average lifetime of a muon at rest is 2.200 µs. A typical muon’s speed is 0.998c. Determine how far a muon can travel according to (a) classical physics and (b) relativity.

1. The elementary particle known as the *positive kaon* (K+) is unstable in that it can *decay* into other particles. Although the decay occurs randomly, we find that, on average, a positive kaon has a lifetime of 0.1237 µs when stationary—that is, when the lifetime is measured in the rest frame of the kaon. If a positive kaon has a speed of 0.990*c* relative to a laboratory reference frame when the kaon is produced, how far can it travel in that frame during its lifetime according to *classical physics* (which is a reasonable approximation for speeds much less than *c*) and according to special relativity (which is correct for all physically possible speeds)?