1. A particular subatomic particle has an expected lifetime (average value) of $2 \times 10^{-7}$ seconds when it at rest or moving slowly. Its rest mass is 80 times as massive as an electron’s. When it emitted from a nucleus in a particular reaction it appears to last $1.5 \times 10^{-6}$ seconds.

a) What is the speed of the particle?

b) What is it’s kinetic energy?

c) How far will a particle travel in the lab frame before decaying?

2. When a metal whose work function is 2.7 ev. is illuminated with light of wavelength $\lambda$, the maximum kinetic energy of the photoelectrons is 1.3 ev.

a) What is the wavelength $\lambda$?
b) What would be the maximum speed of an electron when the metal is illuminated by light of $\lambda = 300\text{nm}$?

3. A man has a problem seeing close-up objects (he is farsighted). His near point is 1.5 meters and he is tired of having his wife hold the newspaper across the table for him in the morning. Find the prescription (diopter power) for the reading glasses (mounted 2cm from his eyes, that he needs for correction to normal 25 cm. near point.)

4. Light consisting of all wavelengths between 700nm. and 400nm. Passes through a diffraction grating with 5000 lines per cm. Find the width of 2nd order "rainbow" displayed on a screen 2 meters from the grating.
5. Compare the energies of an x-ray and an electron which both have wavelengths of 1.5 nm.

1. Calculate the binding energy per nucleon for $^{202}_{80}$Hg.

2. Identify the missing particle and the type of nuclear reaction
   a) ______ ---> $^{65}_{28}$Ni +
   b) $^{216}_{84}$Po ---> ______ +
   c) ______ ---> $^{56}_{26}$Fe + $^0_e$ + ______
   d) $^{109}_{48}$Cd + ______ ---> $^{109}_{47}$Ag + ______
   e) $^{12}_{6}$C + ____ --> $^8_0$O

3. Find the speed of the positron released in the $^+$ decay of $^{22}_{11}$Na.

4. Find the speed of the alpha particle released in the decay of
8. Find the fraction of a sample of $^{214}\text{Pb}$ ($T_{1/2} = 26.8$ minutes) remaining after 2.5 hours.
Take home portion

An electron is in a rigid box. A 9 ev photon is absorbed and lifts the electron from ground state to the first excited state. What is the width of the box?

What is the likelihood of finding the electron (in first excited state) between x = L/4 and x = 3L/4 in the box of part one? (See calculating probabilities, section 40-3. Though this is for the hydrogen wave function the method is the same for the particle in the box)