Modern Physics : PHYS 3704

Midterm I

NAME:_____

1) A spaceship is designed to go to the nearest star (4.3 LYr away) so fast that the crew aboard ages exactly a single year on their trip there.

What percentage of the speed of light the spacecraft must be going?

How much time passes by on the earth while the spacecraft is enroute?

2) The spaceship in question #1 has a radio reciever that was designed to listen to 88.9 MHz, the alternative radio station.

Find the frequency at which the earth's ground station must transmit to the ship enroute so that the transmission can be received.

3) A π^+ (rest mass 139.5 Mev) has a total energy of 150.7 Mev when it decays into a muon (rest mass 105.7Mev) and a neutrino (massless).

If the neutrino is emited moving backwards, determine the total energy and direction of the muon.

How does this energy compare to the 139.5-105.7=33.8 Mev of energy available for the decay due to the mass difference? Why?

4) A star is found whose peak emitted light is at wavelength that is 3 times that of our sun. The surface temperature of the sun is about 5800 ^{o}K. What is the surface temperature of that star?

5) Light of wavelength $\lambda = 277nm$ is incident upon a particular metal electrode in a vacuum. It causes a photocurrent.

Which of the following metal(s) could it NOT be?

Na 2.28eV
Al 4.08eV
Pb 4.14eV
Zn 4.31eV
Fe 4.40eV
Cu 4.70eV
Ag 4.73eV
Pt 6.35eV

Now, a retarding voltage of .36 volts is placed on the electrode and causes the photocurrent to cease. What is the metal?