Name:_____ Pre Lecture Assignment

Enrico Fermi once said to his student (and future Nobel Laureate) Leon Lederman,

"Young man, if I could remember the names of these particles, I would have been a botanist!"

Go to the following Web site, http://www.particleadventure.org/ click on Start Here and find each of the following. Write a short answer for each question. Please type all answers.

Use the arrow in the upper right hand corner to scroll through the web pages. You need to set aside at least one hour to complete this. This is to be completed before tomorrows lecture.

1) Define fundamental-No structure, not made up of anything simpler
2) What is a quark?-Fundamental particle, protons and neutrons are made up of.
3) How many particles have we discovered?-about 200
4) What is the Standard Model and what composes it?-It explains the world that holds us together and is composed of:
   a) 6 quarks
   b) 6 leptons
   c) Force carrier particles
   d) Gravity not included
5) What are antiparticles?-Behave exactly as regular particles, but opposite charge. Gravity affects both the same.
6) Why is there more matter than antimatter in the universe?-We don't know
7) What are the names of the six different types of quarks? up, down, top, bottom, strange, and charm
8) What kind of charge does a quark have?-Fractional
9) What are Hadrons?-Particles made up of quarks
10) What are Baryons?-Hadrons made up of three quarks
11) What are protons made up of? Two up and one down quark
12) What are neutrons made up of? One up and two down quarks.
13) What are Mesons?-Hadrons composed of a quark and an antiquark
14) What are pions made of?- an up quark and a down antiquark
15) What are kaons made of?-A strange quark and an antiquark
16) Only a small fraction of the mass of a hadron comes from quarks. Where does the rest of the mass come from?-Most of the mass of the hadron comes from the particles kinetic and potential energy.
17) What are leptons?-Point like structures without internal structure.
18) What is the best known lepton?-electron
19) Which leptons have the same charge as the electron?-Muon and Tau

Name:_____ Pre Lecture Assignment

20) Which lepton has no charge and minimal mass-neutrino
21) All visible matter in the universe is made from?- the first generation of matter particles -- up quarks, down quarks, and electrons.
22) The most fundamental particles are? 6 quarks and 6 leptons along with their antiparticles
23) What are the four fundamental interactions?
    a) Weak
    b) Strong
    c) Gravity
    d) Electromagnetic
24) The carrier particle of the electromagnetic force is?-photon
25) Gluons have what kind of charge?-color
26) What are gluons?-These are the carrier particle of quarks.
27) What is color?-The charge on a quark. It is different than charge of an electron
28) What holds a nucleus together?-Residual strong force
29) All flavor changes are due to what?-The weak interaction
30) What is the Pauli exclusion principle?-No two particles can exist in the same state.
31) What are fermions?-Particles that obey the Pauli exclusion principle. They have odd ½ integer spin
32) What are some types of fermions?-Lepton, quarks
33) What are bosons?-Particles do not obey the Pauli exclusion integer spin
34) What are some types of bosons?
    a) Force carrier
    b) meson
35) What is radioactivity?- The release of energetic particles due to the decay of the unstable nuclei of atoms
36) What is a virtual particle?-One that exists for a very short amount of time. This follows from the Heisenberg uncertainty principle.
37) What is beta decay?-Beta decay is a neutron converted into a proton leaving an electron and antineutrino
38) List 3 unsolved mysteries in particle physics and briefly explain them.
    a) We do not know why there are three generations of particles
    b) Why do certain particles have mass? Maybe Higgs particle
    c) Majority of Universe is made of dark matter. What is dark matter?
    d) Grand Unification Theory
    e) Superymmetry
    f) String Theory
    g) Higher Dimensions