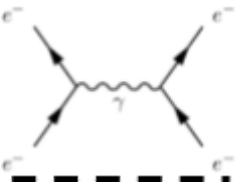
Particles and Waves

The Standard Model



1) The standard model can be thought of consisting of quarks and leptons with the force carrying particles called bosons.

    a) There are six matter quarks and six antimatter quarks. Name the six matter quarks.
    b) Name the six leptons that make up ordinary matter.
    c) Bosons are the particles responsible for forces in the standard model. Name the three bosons in the standard model.

2) State which of these statements are true or false.

    a) Leptons are fundamental particles which means they cannot be broken down further.

    b) Hadron is a particle made up of quarks.

    c) A meson is a particle made up of three or more quarks.

    d) a baryon is made up of three quarks.

    e) A hadron is a fundamental particle.

    f) a proton is made up of two up quarks and a down quark.

    g) an electron is made up of two quarks

    h) The particle that causes the strong force is called the photon.

    i) the anti proton has the same charge as the proton

    j) When a proton meets an antiproton a new larger particle is created.

    k) the top quark has an electric charge of +⅔

    l) a neutron is made up of an up and two down quarks.

    m) the weak force acts over a greater distance than the strong force

    n) hadrons are particles made up of three quarks.

    o) quarks can exist on their own

3) A lambda particle is made up with an UP, DOWN and STRANGE quark.
Determine the electric charge of the lambda particle.

4) A particle called omega minus Ω^{-1} is made up of three strange quarks.
Show that the overall charge of the omega minus particle is -1.

5) Determine the electric charge of these particles and state whether they are mesons or baryons given their quark makeup.

   a) Lambda $\Lambda = uds$
   b) Kaon = $\overline{s}\,d$
   c) Pion = $\overline{d}u$
   d) proton = uud
   e) B zero = $d\overline{b}$

6) The force mediating particles are called bosons. Name the boson associated with the strong force.

7) Name the boson associated with the weak force.

8) There is a boson associated with giving mass to the particles. Can you name this famous particle that was discovered in 2012 at CERN

9) Two children are throwing a heavy ball at each other. How does this analogy help describe and explain bosons as a mediating particle in forces?

10) Give an example, or meaning of the following terms:

   a) a lepton
   b) a hadron
   c) a boson
   d) a quark
   e) a meson
   f) the standard model.