

Quiz

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1. What is the mass of photon?

This question usually comes up in the context of wondering whether photons are really "massless," since, after all, they have nonzero energy. The problem is simply that people are using two different definitions of mass. The overwhelming consensus among physicists today is to say that photons are massless.

2. What is the size of a quark?

A quark has never demonstrated any measurable size. Like an electron, it is a "fundamental particle", one of the few particles from which all else is made.

3. What is the difference between electrical charge and color charge?

Electrical charge: the quantity of matter responsible for electrical phenomena carried by a particle. Color charge: a charge responsible for the strong force acting on quarks and anti-quarks. They constantly change their color as they exchange gluons with other quarks.

4. Explain the difference between a boson and fermion.

Fermions have half- integral spin and only one per state, but bosons have integral spin and many can occupy the same state.

5. Describe what type of particle is both a boson and a hadron. Give an example.

Bosons are one of the two fundamental classes of particles, the other being fermions. Bosons are characterized by Bose–Einstein statistics and all have integer spins. Bosons may be either elementary, like photons and gluons, or composite, like mesons. For example, W boson and Z boson, Graviton, Higgs boson.

Hadrons are defined as strongly interacting composite particles. Hadrons are either: composite fermions (especially 3 quarks), in which case they are called baryons and composite bosons (especially 2 quarks), in which case they are called mesons. For example, Hyperons, Pentaquarks, tetraquark.

6. Explain the purpose of a bubble chamber.

A bubble chamber uses as the detecting medium a superheated liquid that boils into tiny bubbles of vapour around the ions produced along the tracks of subatomic particles.

7. What are leptons made of?

Matter is made up of atoms, and atoms are made of electrons and nuclei, bound by the electromagnetic force. Electrons have negative electric charge and their mass is small in comparison to that of the nuclei. Nuclei are made up of

protons and neutrons. In turn, protons and neutrons are made up of point-like particles called the "up" and "down" quarks.

8. Name two leptons and two baryons.

Electron neutrino and muon. udd and ssc.

9. Explain what quantities are conserved at each vertex of a Feynman diagram. Everything! If there's a symmetry in your theory then the associated Noether charge must be conserved at a Feynman vertex. every vertex corresponds to an interaction term in the Lagrangian. These are automatically constructed to be Lorentz invariant so angular momentum and spin had better be conserved. Color or electric charge must be conserved at each vertex because the symmetry transformation exactly guarantees that contributions from interaction terms cancel transformations of the kinetic terms.

10. Explain what an "exchange particle" is. Include its function and provide an example. Exchange or virtual particles interact with particles to produce the effects of attraction or repulsion. They do this by shuttling back and forth between the particles, carrying small packets of energy. For repulsion, the effect is much the same as two ice-skaters passing a heavy ball between them. They might start off close together, but as the ball is passed between them, the skaters will diverge from each other.

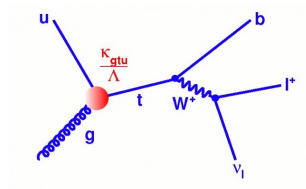


Figure 1: exchange particle