
The following questions are about elementary particles.

1. State what is meant by an elementary particle, and what are the three types?
2. List the four forces, and their carriers. What are their relative strengths, and their ranges?
3. List which forces electrons are influenced by.
4. List which forces quarks are influenced by.

The following questions are about hadrons.

5. List the two types of hadron .
6. What is the quark makeup of a baryon? Use the symbol “q” for quark and “ \bar{q} ” for antiquark.
7. What is the quark makeup of a meson? Use the symbol “q” for quark and “ \bar{q} ” for antiquark.

A particle has the quark combo of (uds).

8. What type of hadron is this particle?
9. What is its charge?

The following questions are about the standard model.

10. State the three-family structure of quarks in the standard model. Be sure to list the family number and the particles within that family.

11. State the three-family structure of leptons in the standard model. Be sure to list the family number and the particles within that family.

12. What is the Higgs particle (or Higgs boson)? (from video)

13. What is the significance of the Higgs boson in the context of the standard model? (from video)

The following questions are about conservation.

14. Is lepton number conserved in total, like baryon number, or is it conserved in another way? How is it conserved?

15. Use conservation principles to find out if the following reactions are possible: (complete on a separate page)
 (γ is a photon; π^0 is a pion, p is a proton, n is a neutron, e is an electron, ν is a neutrino, etc.)

Use the given format:

Reaction:	$p + e^- \rightarrow n + \nu_e$
Charge "C"	
Baryon # "B"	
Lepton # "L"	

(a) $p + e^- \rightarrow n + \nu_e$

(e) $e^- + e^+ \rightarrow \gamma + \gamma$

(b) $p + p \rightarrow p + p + \bar{p} + e^+ + \nu_e$

(f) $e^- + e^+ \rightarrow n + \gamma$

(c) $p + \bar{p} \rightarrow p + \bar{p} + \pi^0$

(g) $p + \bar{p} \rightarrow n + \bar{\nu}$

(d) $p + \bar{p} \rightarrow \pi^0 + \pi^0$

(h) $e^- + \mu^+ \rightarrow \gamma + \gamma$

Write each reaction on a separate page.