

## Higher Standard Model Questions

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1. What is meant by the term '**Standard Model**'?
  
2. Scientific notation is based on **powers of ten**.  
What are the powers of ten known as?
  
3. During **beta emission** a **second particle** was found to be emitted at the same time.
  - a) What **name** is given to the **second particle**?
  - b) Comment on the **mass** and **charge** of the **second particle**.
  
4. a) State the **names** of the **two different types of matter**.  
b) Comment on the **comparisons** of these two different types of matter.  
c) **What would happen** if these **two types** of matter **collided** with each other?
  
5. a) What are **protons and neutrons** in the nucleus **known as**?  
b) What is the name of the **fundamental particles** that make up protons and neutrons?
  
6. a) **How many generations** of **quarks** are there?  
b) **How many types of quark** are there in each generation?  
c) What happens to the **mass** between **each generation** of quark?
  
7. Quarks and leptons exist in pairs.
  - a) **What does** the Greek term '**lepton**' mean in **English**?
  - b) How does the **mass of a quark and a lepton compare** in each pair?
  - c) What does each pair of **leptons consist of**?
  
8. a) What does a **proton** consist of **in terms of quarks**?  
b) What does a **neutron** consist of **in terms of quarks**?  
c) What are **electrons** made up of?

9. All of the quarks and leptons have anti-matter equivalents.

**How do these matter and anti-matter particles compare** with each other?

10. a) i) **What does** the Greek term '**hadron**' **mean** in **English**?

ii) Why are neutrons not used in collision experiments at CERN even though they are hadrons?

b) i) What do a **pair of quarks** form when **they combine**?

ii) Are these particles **short or long lived**?

c) i) What do a **triplet of quarks** form when they combine?

ii) Are these particles **short or long lived**?

11. a) **State the names** of the **four fundamental non-contact forces** of nature.

b) Which of these forces is involved with **beta decay** which produces a proton, a neutron and **anti-neutrinos**?

c) Which of these forces is by far the **smallest in terms of magnitude** and will only produce a significant force when involving masses in the order of planets?

d) Which of these forces **binds atoms together** and all matter would break apart without it?

e) i) Which of these forces **holds the nucleus together in an atom** and is the only force experienced by quarks?

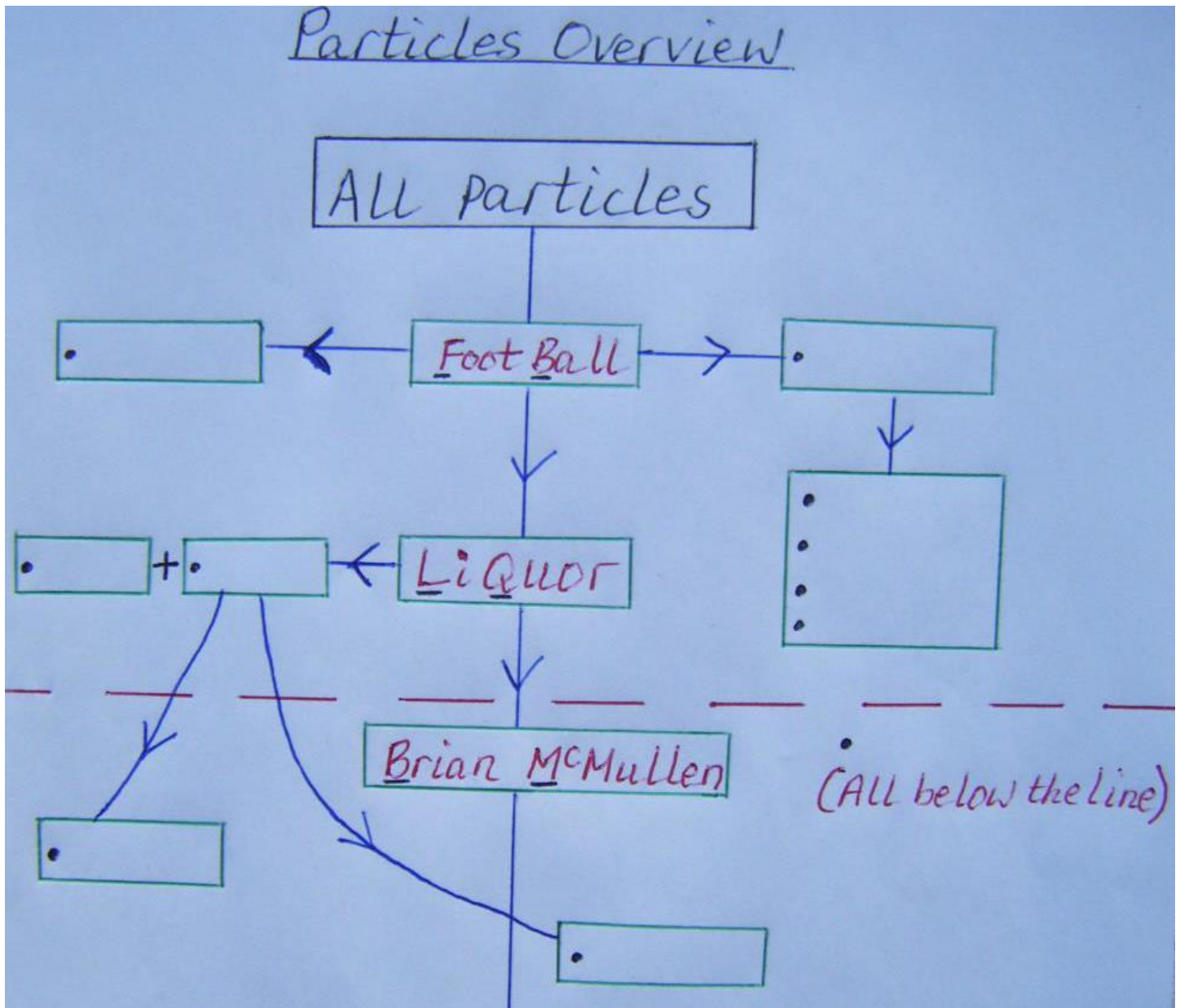
ii) **Up to what range** is this force dominant?

12. a) What are gauge-bosons?

b) What do gauge-bosons **carry between particles**?

c) **Describe** the **action** of a gauge-boson. (Think of the action of a bullet from a gun fired at a target!!!)

13. What is the name given to the **exchange particles** that allow the **strong nuclear force** to be exerted in the nucleus?
14. What is the name given to the **exchange particles** that allow the **electromagnetic force** to be exerted in an atom?
15. a) Fill in the blanks(?) of the particle overview below. (Hints in the spine of the diagram!!!)



b) How are all **particles classified below the horizontal line** in the particle overview?

c) What is a **fermion**?