

Chapter 13 The Standard Model. Revision Questions page 369-371 – Multiple Choice Answers

Q	Ans	Explanation
1	C	Leptons and quarks are particles of matter that have no substructure. Baryons are composites of quarks so are not elementary. Photons are force carriers and are not matter particles.
2	C	Leptons include electrons, muons and taus and their antiparticles, as well as their corresponding neutrinos and antineutrinos.
3	C	The electromagnetic force relies on the photon; the weak force relies on the W and Z bosons; and gravity is carried by waves, but it is hypothesised that the force particle would be the graviton. You don't have to know about hypothesised 'gravitons' for the External Exam. Remember too that gravitational force is one of the fundamental forces but is NOT a part of the Standard Model.
4	B	The strong nuclear has a very <u>small</u> range of the order of 10^{-15} m. All the rest are correct.
5	A	Nucleons are attracted to each other by the strong nuclear force and the carrier of this force is the gluon. [Note: the nucleons are made of quarks and the gluon holds the quarks together but there is a residual strong nuclear force that holds the nucleons together]. The syllabus doesn't distinguish between the two types of strong nuclear force. Learn that the strong nuclear force is between quarks or between nucleons (protons and neutrons) and is mediated by gluons.
6	A	Ordinary matter in the universe is in the form of protons and neutrons which may be present in atoms. Protons and neutrons are made from u and d quarks. About 75% of the universe is hydrogen which just has a proton in the nucleus so in fact there are probably more protons (uud) than neutrons (udd), and hence more up quarks than down quarks. But that isn't one of the options and I am just telling you that because it is interesting. You could win money at a party knowing that.
7	B	The muon is a lepton and is an elementary particle. A neutron is made of udd quarks; a baryon is a composite of 3 quarks or 3 antiquarks, and a hadron is anything made of quarks.
8	B	That is the definition of the strong nuclear force. The rest are wrong.
9	C	All have mass except the photon. If a particle can travel at the speed of light it must be massless.
10	B	Gravitation is explained in terms of gravitational waves but this is not a part of the standard model.

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