L8 The History of the Universe

12/16

L8.1 Roughly how long ago was the Big Bang?

L8.2 Which chemical elements were formed as a result of the Big Bang? Give the percentage abundance (by mass) of the main two.

L8.3 Approximately how much time elapsed after Creation before protons and neutrons were formed from the 'quark soup'?

L8.4 A very important event occurred when the atoms formed from the loose nuclei and electrons (plasma).

a) How much time passed between Creation and the formation of the atoms?

b) What was the approximate temperature of the Universe at that time?

c) Which band of electromagnetic radiation was brightest in the Universe at that time?

d) Why is it impossible to 'see' events earlier than the atomic formation by looking at very distant objects using optical telescopes?

e) The radiation emitted during this process is still out there. What do we now call it?

f) How uniform is this radiation?

L8.5 Originally, the four forces were indistinguishable. Give the chronological order in which the forces separated off from the original Unified Force.

L8.6 The average density of the Universe might be less than, equal to or greater than the 'critical density', ρ_0. Assuming that the escape velocity when at distance R from a mass M is given by $v = \sqrt{\frac{2GM}{R}}$, derive an expression for ρ_0 in terms of the Hubble constant H_0 if Newton's Law of Gravitation holds for the Universe at large.

L8.7 In a Universe obeying Newton's Law of Gravitation, what will eventually happen if its density is:

a) equal to ρ_0?

b) greater than ρ_0?

L8.8 What is meant by a 'closed' Universe?

L8.9 The Cosmological Principle assumes that the Universe is _____ and _____. Give these words and their meaning in normal language.

L8.10 Olbers' Paradox tells us that the Universe can't be both _____ and _____, given that the night sky is black.