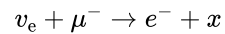

HL Paper 3

This question is about the standard model.

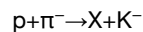
- a. State what is meant by the standard model. [3]
- b. Use the conservation of lepton number and charge to deduce the nature of the particle x in the following reaction. [1]



- c. State what is meant by deep inelastic scattering. [1]
-

This question is about linear accelerators.

- b. A moving proton is incident on a stationary pion, producing a kaon (K meson) and an unknown hadron X according to the reaction given below. [2]



- (i) State, with a reason, the electric charge of X .
- (ii) State, with a reason, if X is a baryon **or** a meson.
- c. In a deep inelastic scattering experiment, protons of momentum 2.70×10^{-18} N s are scattered by gold nuclei. [3]

Given that the diameter of nucleons is of the order 10^{-15} m and the diameter of quarks is less than 10^{-18} m, determine if these protons will be able to resolve

- (i) nucleons within the gold nuclei.
- (ii) quarks within the gold nuclei.
- d. Outline how deep inelastic scattering experiments led to the conclusion that gluons exist. [2]
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