16 The neutral lambda Λ^0 particle is a baryon of mass 1116 MeV/c^2 and contains one strange quark.

(a) The table shows quarks and their relative charge.

Quark	Charge / *e*
u	+2/3
d	–1/3
s	–1/3

State, with justification, the quark content of a Λ^0 particle.

(2)

(b) Calculate the mass of the Λ^0 particle in kg.

(3)

Mass of Λ^0 particle = ... kg

(c) A student suggests five ways a Λ^0 particle might decay. These are

$$\Lambda^0 \rightarrow p + \pi^-$$
$$\Lambda^0 \rightarrow e^+ + e^-$$
$$\Lambda^0 \rightarrow n + \pi^0$$
$$\Lambda^0 \rightarrow n$$
$$\Lambda^0 \rightarrow p + \pi^0$$

Deduce which of these decay processes are **not** possible.

(6)

(d) Lambda particles were first detected in experiments which made use of cosmic rays entering the atmosphere. Cosmic rays are mainly high-energy protons which have a mass less than that of a lambda particle.

Explain why a cosmic ray could lead to the creation of a lambda particle.

(2)

(e) The Λ^0 particle cannot be directly observed in particle experiments, however some of the decay products can.

Explain why the Λ^0 particle cannot be directly observed but information about it can be obtained by studying its decay particles.

(3)

(Total for Question 16 = 16 marks)