

6 (a) State what is meant by a fundamental particle.

.....  
..... [1]

(b) (i) Particle Q is a meson with a charge of 0.

Determine a possible quark composition for Q.

..... [2]

(ii) Particle Q has a mass of 0.67 u and a kinetic energy of  $2.1 \times 10^{-16}$  J.

Calculate the speed of particle Q.

speed = .....  $\text{ms}^{-1}$  [3]

(c) Radium-228 ( $^{228}_{88}\text{Ra}$ ) is a radioactive nuclide.

(i) State the number of electrons in a neutral atom of radium-228.

number of electrons = ..... [1]

(ii) A nucleus of radium-228 undergoes a series of decays to form nucleus X.  
During the process, 5  $\alpha$ -particles and 4  $\beta^-$  particles are emitted.

Determine the number of protons and the number of neutrons in nucleus X.

number of protons = .....  
number of neutrons = ..... [2]

[Total: 9]