7 **(a)** The radioactive decay of some nuclei gives rise to the emission of α-particles. State

(i) what is meant by an α-particle,

.....[1]

(ii) two properties of α-particles.

1. .....

.....

2. .....

.....
[2]

(b) One possible nuclear reaction involves the bombardment of a stationary nitrogen-14 nucleus by an α-particle to form oxygen-17 and another particle.

(i) Complete the nuclear equation for this reaction.

$$^{14}_{7}\mathrm{N} + {}^{\cdots\cdots}_{\cdots\cdots}\alpha \rightarrow {}^{17}_{8}\mathrm{O} + \ldots\ldots\ldots\ldots \quad [2]$$

(ii) The total mass-energy of the nitrogen-14 nucleus and the α-particle is less than that of the particles resulting from the reaction. This mass-energy difference is 1.1 MeV.

1. Suggest how it is possible for mass-energy to be conserved in this reaction.

.....

.....[1]

2. Calculate the speed of an α-particle having kinetic energy of 1.1 MeV.