8 **(a)** State the quantities, other than momentum, that are conserved in a nuclear reaction.

.....

.....[2]

(b) A stationary nucleus of uranium-238 decays to a nucleus of thorium-234 by emitting an α-particle. The kinetic energy of the α-particle is 6.69×10^{-13} J.

(i) Show that the kinetic energy E_k of a mass m is related to its momentum p by the equation

$$E_k = \frac{p^2}{2m}.$$

[1]

(ii) Use the conservation of momentum to determine the kinetic energy, in keV, of the thorium nucleus.

kinetic energy = ... keV [3]