6 **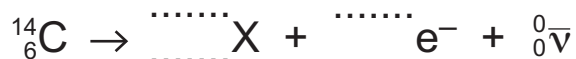(a)** The nuclide $^{14}_{6}C$ (carbon-14) is unstable and undergoes β^- decay, emitting a high-energy electron and an antineutrino to form a new nuclide X. The equation for this decay is shown.

$$^{14}_{6}C \rightarrow \,^{\dots}_{\dots}X + \,^{\dots}_{\dots}e^- + \,^{0}_{0}\overline{\nu}$$

Complete the equation. [2]

(b) **(i)** State the equation for β^- decay in terms of the fundamental particles involved.

[1]

(ii) Use your equation from **(b)(i)** to show how charge is conserved in β^- decay.

[1]

(c) Neutrinos were first proposed to exist more than 20 years before they were directly detected, in order to explain a particular experimental observation about β-decay.

(i) State an observation about β-decay that is explained by the existence of neutrinos.

....

....

.... [1]

(ii) Suggest how the existence of neutrinos explains the observation in **(c)(i)**.

....

....

.... [1]

[Total: 6]