12 (a) State what is meant by *nuclear fusion* and *nuclear fission*.

nuclear fusion: .....

.....

.....

nuclear fission: .....

.....

.....

[3]

(b) A nuclear reaction which may, in the future, be used for the generation of electrical energy is

$$^{2}_{1}\mathrm{H} + ^{3}_{1}\mathrm{H} \longrightarrow ^{4}_{2}\mathrm{He} + \mathrm{x}.$$

(i) Name the particle x.

.....[1]

(ii) Data for the binding energy per nucleon E_B of some nuclei are given in Fig. 12.1.

		binding energy per nucleon $E_B / 10^{-13}$ J
deuterium	$^{2}_{1}\mathrm{H}$	1.7813
tritium	$^{3}_{1}\mathrm{H}$	4.5285
helium	$^{4}_{2}\mathrm{He}$	11.3290

Fig. 12.1

1. State the binding energy per nucleon of x.

binding energy per nucleon = ... J

2. Calculate the energy change that takes place in this reaction.

energy change = ... J
[3]

(iii) Use your answer in **(ii) part 2** to determine the energy release when 2.0 g of deuterium ($^{2}_{1}\mathrm{H}$) reacts with 3.0 g of tritium ($^{3}_{1}\mathrm{H}$).

energy = ... J [1]

[Total: 8]