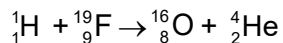**7** In a nuclear reaction, a stationary fluorine-19 is bombarded with a proton having a kinetic energy of 5.00 MeV. The following reaction may occur.

$$_1^1H + _9^{19}F \rightarrow _8^{16}O + _2^4He$$

The following data may be used for the calculation.

Rest mass of $_9^{19}F$	18.998403 u
Rest mass of $_0^1n$	1.008665 u
Rest mass of $_1^1H$	1.007825 u
Rest mass of $_2^4He$	4.003860 u

(a) Explain what is meant by

(i) binding energy of a nucleus,

....

....[1]

(ii) mass defect of a nucleus.

....

....[1]

(b) Calculate the binding energy per nucleon, in MeV, for fluorine-19.

binding energy per nucleon = ... MeV [3]

(c) Use the answer in **(b)** and the following data to determine the total kinetic energy of the products. Assume no photon is emitted in this reaction.

	Binding energy per nucleon/MeV
Oxygen-16	7.72
Helium-4	6.82

total kinetic energy = …………………..………. J [2]

(d) Determine the rest mass of $^{16}_{8}O$.

rest mass of $^{16}_{8}O$ = …………………..………. kg [2]

[Total: 9]