

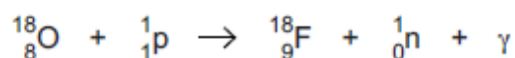
A Level Physics A

H556/02 Exploring physics

Question Set 22

1(a)

The nuclear reaction below shows how the isotope of fluorine-18 ($^{18}_9\text{F}$) is made from the isotope of oxygen-18 ($^{18}_8\text{O}$).



The oxygen-18 nucleus is **stationary** and the proton has kinetic energy of $0.25 \times 10^{-11} \text{ J}$. The binding energy of the $^{18}_8\text{O}$ nucleus is $2.24 \times 10^{-11} \text{ J}$ and the binding energy of the $^{18}_9\text{F}$ nucleus is $2.20 \times 10^{-11} \text{ J}$. The proton and the neutron have zero binding energy.

- (i) Explain why a high-speed proton is necessary to trigger the nuclear reaction shown above. [2]

- (ii) Estimate the minimum wavelength λ of the gamma ray photon (γ). [2]

$\lambda = \dots\dots\dots \text{ m}$ [3]

- (iii) Fluorine-18 is a positron emitter. Name a medical imaging technique that uses fluorine-18 and state one benefit of the technique. [2]

- (b) Describe how the components of a computerised axial tomography (CAT) scanner can produce high-quality images of the internal structures of a patient. [4]

Total Marks for Question Set 22: 11

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