



# **A Level Physics A**

**H556/02** Exploring physics

## **Question Set 21**

- 1 An isotope of polonium-213 ( $^{213}_{84}\text{Po}$ ) first decays into an isotope of lead-209 ( $^{209}_{82}\text{Pb}$ ) and this lead isotope then decays into the stable isotope of bismuth (Bi).

Fig. 24 shows two arrows on a neutron number  $N$  against proton number  $Z$  chart to illustrate these two decays.

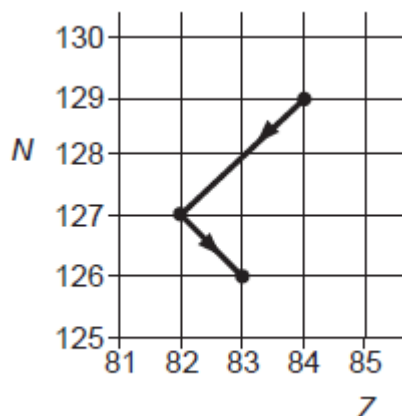
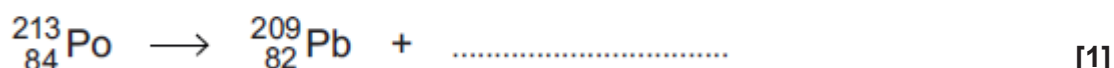


Fig. 24

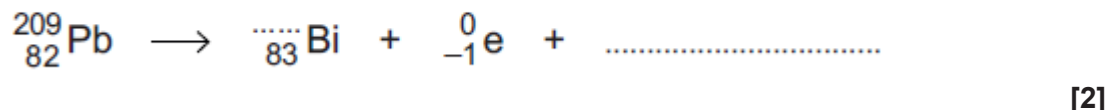
- (a) Complete the nuclear decay equations for

- (i) the polonium isotope



- (ii)

the lead isotope.



- (b) A pure sample of polonium-213 is being produced in a research laboratory.

The half-life of  $^{213}_{84}\text{Po}$  is very small compared with the half-life of  $^{209}_{82}\text{Pb}$ .

After a very short time, the ionising radiation detected from the sample is mainly from the beta-minus decay of the lead-209 nuclei.

- (i) Briefly describe and explain an experiment that can be carried out to confirm the beta-minus radiation emitted from the lead nuclei. [2]

- (ii) The activity of the sample of  $^{209}_{82}\text{Pb}$  after 7.0 hours is 12 kBq.

The half-life of  $^{209}_{82}\text{Pb}$  is 3.3 hours.

Calculate the initial number of lead-209 nuclei in this sample.

number of nuclei = ..... [4]

**Total Marks for Question Set 21: 9**

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