

Chemistry

Section I – Part B (continued)

Marks

Question 19 (5 marks)

- (a) Describe the conditions under which a nucleus is unstable.

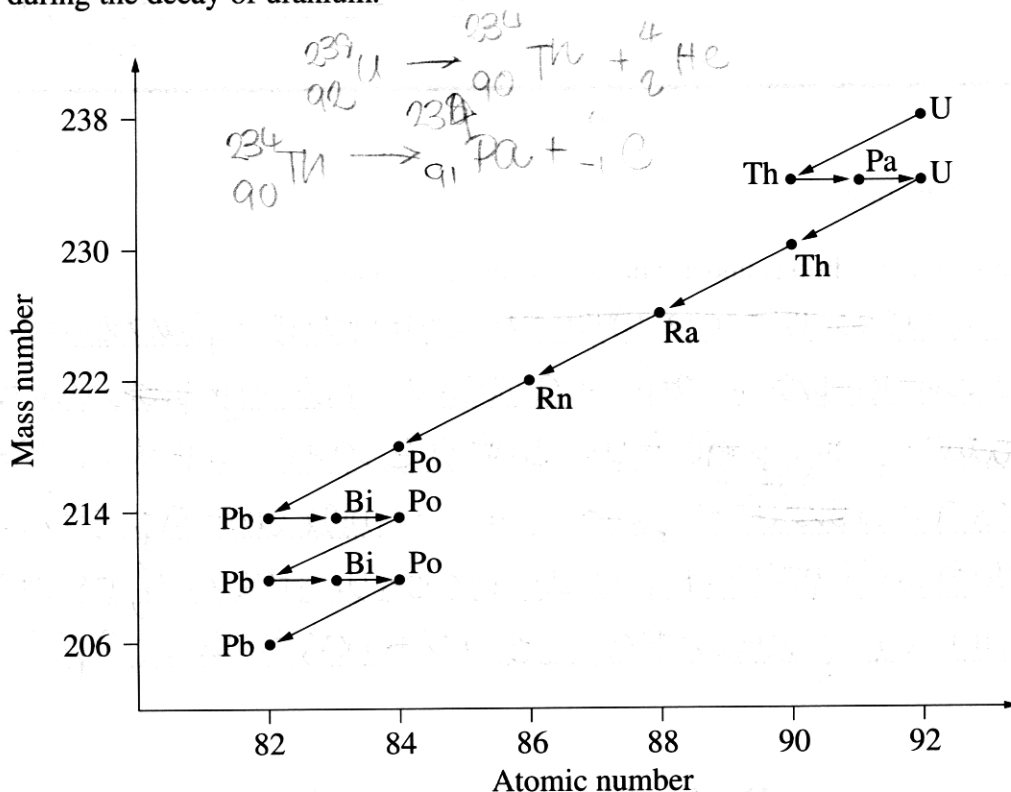
2

A nucleus ~~is unstable~~ when the stability is depended on the ~~proton-~~ neutron-to-proton ratio. If a nucleus have high ~~proton~~ neutron-to-proton ratio, it will emit a β particle. If the nucleus has a low ~~proton~~ ^{neutron} to proton ratio, it will emit a positron or an electron capture. A nucleus is also unstable if its atomic number is greater than 83 and tends to emit alpha particles.

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Question 19 (continued)

- (b) The following is a flow diagram showing the sequence of products released during the decay of uranium. 3



Use examples from the flow diagram to describe processes by which an unstable isotope undergoes radioactive decay.

From the diagram above, Uranium-238 can undergo radioactive decay by emitting an alpha particle, to change to Thorium-234: ${}_{92}^{238}\text{U} \rightarrow {}_{90}^{234}\text{Th} + {}_2^4\text{He}$. The unstable isotope can then undergo beta decay by emitting an electron to produce Protactinium-234: ${}_{90}^{234}\text{Th} \rightarrow {}_{91}^{234}\text{Pa} + {}_{-1}^0\text{e}$. These processes continue until a stable nucleus is produced, in this case, ${}_{82}^{206}\text{Pb}$ is the stable isotope, therefore, it does not undergo any further decay.

End of Question 19