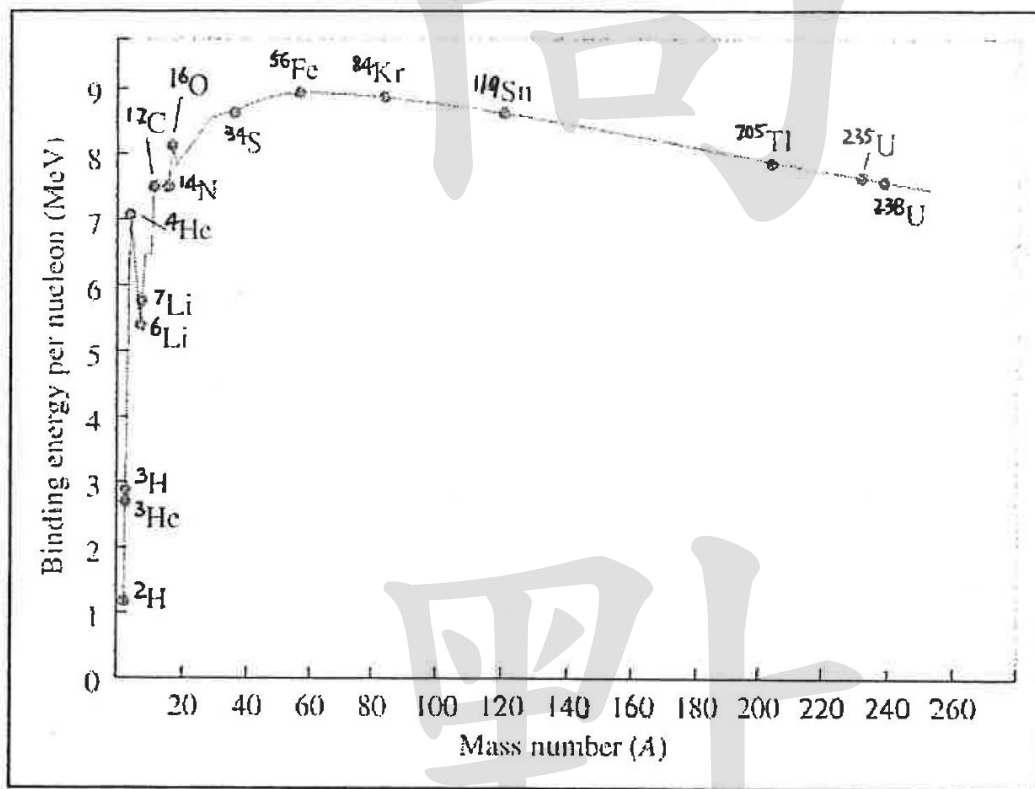


臺灣綜合大學系統 109 學年度學士班轉學生聯合招生考試試題

科目名稱	普通化學 A	類組代碼	共同考科
		科目碼	E0017

10. Consider the following graph of binding energy per nucleon as a function of mass number. The graph is shown in the next page. Please answer the following questions.
- What does this graph tell us about the relative half-lives of the nuclides?
 - Which nuclide shown is the most thermodynamically stable? Which if the least thermodynamically stable?
 - What does this graph tell us about which nuclides undergo fusion and which under fission to become more stable? Support your answer.



ANS:

- 本圖無法得知各物種的放射性半衰期
- 原則上原子核愈重, binding energy 愈大, binding energy 最大的安定核種為 Fe 但熱力學最穩定的核種為 H, 因為 binding energy 最小, 最不需要耗費較大的 binding energy 去維繫原子核的安定。最不熱力安定的核為 ^{238}U , 因為原子量最重, 但維繫核穩定的 binding energy 太小, 不足以維繫 ^{238}U 核的穩定性, 故其為最熱力不穩定的放射性核種。
- H 可做核融合(nuclear fusion), 因為 binding energy 小, ^{235}U , ^{238}U 可做核分裂(nuclear fission), 因為太重的原子 binding energy 卻太小, 會造成核的不穩定, 可進行核分裂。

鍵合能(Binding energy)

討論氯 35，乃由 17 個質子，18 個中子，及 17 個電子組成

$$17(1.007276 \text{ u}) + 18(1.008665 \text{ u}) + 17(0.000549 \text{ u}) \\ = 35.288995 \text{ u}$$

而氯 35 實際測得之質量為 34.968853 u 兩者之差

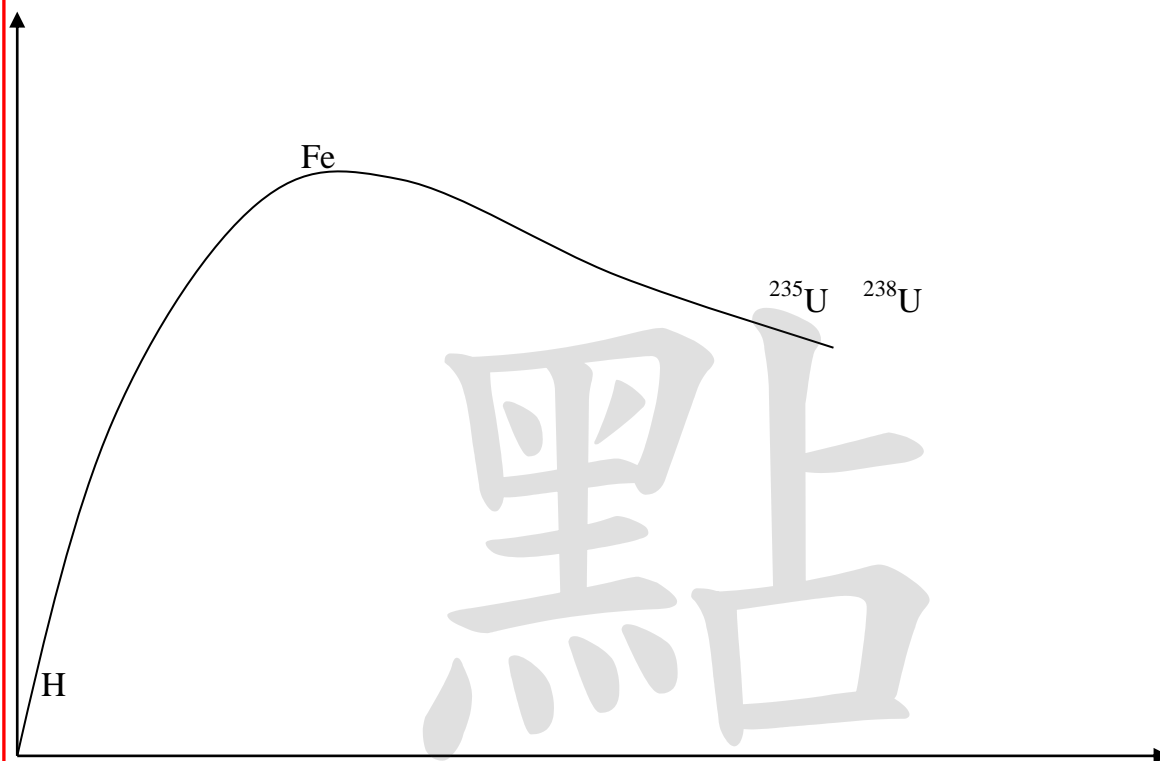
$$\Delta m = 35.288995 \text{ u} - 34.968853 \text{ u} = 0.320142 \text{ u}$$

(此為 binding energy)

$$0.320142 \text{ u} \times 931.502 \text{ MeV/u} = 298.213 \text{ MeV}$$

一核之鍵合能可視為一核之核成子被推出去所需之能量，或在一組核成子結合為一個核，釋出之能量。(某些計算可略去電子質量)

鍵合能(Binding energy)



原子序

(不安定核其鍵合能在質量數增大後反而鍵合能減小之區域)

普化講義第八冊, p.71