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私立臺北醫學院八十九學年度第一學期期中考試(試)題紙 **教務處公佈專用**

系級	科目	目	授課教師	考試日期	學號	姓名
牙一	物理	物理	陳文雄	90年1月5日第 節		

※①請注意本試題共 張。如發現頁數不足及空白頁或缺印，應當場請求補齊，否則缺少部份概以零分計。
 ②每張試題卷務必填寫(學號)、(姓名)。

- The arsenic atom As ($Z=33$) has stable isotopes with mass number 73,74,75,76,and 77 . (a) Give the proper symbols for these isotopes . (b) Explain why they are called isotopes.
- The radium nucleus $^{226}_{88}\text{Ra}$ (鐳) is transformed to the radon nucleus Rn (氡) by emitting an α particle and a γ -ray photon with energy 0.18 MeV. (a) Write down the decay reaction and draw the decay scheme for this alpha decay. (b) The atomic mass: $^{226}_{88}\text{Ra}=226.025406\text{amu}$, the daughter nucleus $\text{Rn}=222.017574\text{amu}$, and $\alpha=4.002603\text{amu}$ ($1\text{amu}=931.5\text{MeV}$) (i) Calculate the Q value in MeV for this decay (ii) Is this decay process endothermic (吸熱) or exothermic (放熱)? Explain your answer. (iii) Calculate the maximum kinetic energy of the emitted α particle in MeV.
- A nitrogen-13 nucleus ($^{13}_7\text{N}$ 氮) decays into a carbon-13 nucleus (C-13 碳) by undergoing β^+ decay process with an emission of neutrino ν . The atomic mass: $^{13}_7\text{N}=13.0057388\text{amu}$ and $\text{C-13}=13.0033551\text{amu}$. (a) What is the emitted β^+ particle? (b) Write down this β^+ -decay reaction. (c) Calculate the maximum kinetic energy $E_{\max}$ of the emitted β^+ particle step by step as follows: (i) the mass of N-13 nucleus = $\underline{\quad}$ amu - $\underline{\quad}$ m_e . Where m_e is the mass of electron; (ii) the mass of C-13 nucleus = $\underline{\quad}$ amu - $\underline{\quad}$ m_e ; (iii) the mass of β^+ particle = $\underline{\quad}$; (iv) the mass of neutrino $\nu = \underline{\quad}$; (v) the Q value of this reaction = $\underline{\quad}$ amu - $\underline{\quad}$ $m_e = \underline{\quad}$ MeV.
- A cobalt nucleus ($^{60}_{27}\text{Co}$ 鈷) decays into the ground state of nickel nucleus (Ni 鎳) with an emission of a β^- particle and then with successive emission of two γ -ray photons: first emitting γ_1 with energy of 1.173 MeV and then emitting γ_2 with energy of 1.332 MeV. (a) What is the emitted β^- particle? (b) Write down the basic decay reaction and draw the decay scheme for this β^- decay. (c) What is the relationship between the parent nucleus Co and the daughter nucleus Ni? Explain your answer. (d) Which nucleus in this decay are called isomers? Explain your answer.
- The figure shows a Geiger counter and Geiger tube. Describe the basic principle of the Geiger counter for detecting the α particle, β particle, and the γ -ray photons.
- For ^{198}Au containing 1.0×10^9 atoms, (a) Find the transformation constant? (b) Find its initial active, and (c) Calculate the number of ^{198}Au atoms which disintegrate in three days?
- A radioactive Cesium sample ($^{136}_{55}\text{Cs}$ 銫, half-life = 13.1 days) has radioactivity of 10 mCi. (a) What is the decay probability per minute for each $^{136}_{55}\text{Cs}$ nucleus? (b) Calculate the mass of this radioactive Cs-136 sample. (c) How many disintegrations of this sample will occur in a day?
- A sodium-22 nucleus ($^{22}_{11}\text{Na}$ 鈉) decays into a neon-22 nucleus ($^{22}_{10}\text{Ne}$ 氖) by undergoing a k-shell electron capture process (a) Describe this k-capture process, ie., describe how the daughter nucleus $^{22}_{10}\text{Ne}$ is created in this k-capture process. (b) What will happen as this k-capture occur?
- A 1.6 mCi source of Rn (radon, $T_{1/2}=3.83$ days) is permanently implanted into a patient. (a) Determine the total emitted radiation in unit of mCi-hr. (b) If this source were left in place in the patient for four days, find the emitted radiation.

