Radiation Biology, Protection and Applications  
(PHYS-450) 

Quizzz  
Week 8  

SOLUTIONS  

Problem 1:  
Radiation energy spectra can be categorized into two main groups: those that consist of one or more discrete energies (line spectra) and those that consist of a broad distribution of energies (continuous spectra). For each of the radiation sources listed below, indicate whether « line » or « continuous » is a better description: 

a) Alpha particles  
LINE  
b) Beta particles  
CONTINUOUS  
c) Gamma rays  
LINE  
d) Characteristic X-rays  
LINE  
e) Conversion electrons  
LINE  
f) Auger electrons  
LINE  
g) Fission fragments  
CONTINUOUS  
h) Bremsstrahlung  
CONTINUOUS  
i) Annihilation radiation  
LINE
Problem 2:
Which has the higher energy: a conversion electron from the \( L \) shell or from the \( M \) shell, if both arise from the same nuclear excitation energy?

\[
E_{e^-} = E_{\text{ex}} - E_{\text{binding}}
\]

\( E_{\text{binding}} (L) > E_{\text{binding}} (M) \)

\( E_{e^-} (L) < E_{e^-} (M) \)

Thus, a conversion electron from the\( M \) shell will have higher energy than the electron from the \( L \) shell, if both arise from the same nuclear excitation energy.

Problem 3:

Determine \( ^A_z X \) in the following nuclear reactions:

a) \( ^2_1 H + ^4_A X \rightarrow ^4_2 He + ^4_2 He \)

b) \( ^{14}_7 N + ^4_A X \rightarrow ^{17}_8 O + ^1_1 H \)

c) \( ^A_z X \rightarrow ^{60}_{27} Co + \gamma \)

d) \( ^A_z X + ^2_2 He \rightarrow ^{12}_6 C^+ + ^0_1 n \)