A 10 MeV photon undergoes pair production with a target nucleus, and a 6 MeV electron is observed. What is the energy of its paired positron?

A. 4 MeV  
B. 3 MeV  
C. 2 MeV  
D. 1 MeV  

\[ h\nu - 2m_e c^2 = E_e' + E_p' \]
\[ 10 - 1 = 6 + x \]
\[ => x = 3 \]

A 21 MeV photon undergoes pair production with a target nucleus. Which electron/positron energy outcome is most likely?

A. 19 MeV electron, 1 MeV positron  
B. 15 MeV electron, 5 MeV positron  
C. 10 MeV electron, 10 MeV positron  
D. 2 MeV electron, 19 MeV positron  

A 21 MeV photon undergoes pair production with a target nucleus. Which electron/positron energy outcome is most likely?

B. 15 MeV electron, 5 MeV positron  

Which answer correctly lists the order of the dominant photon interaction mechanisms as photon energy is increased?

A. Compton → Photoelectric → Pair Production  
B. Photoelectric → Compton → Pair Production  
C. Photoelectric → Rayleigh → Compton → Pair Production  
D. Rayleigh → Photoelectric → Compton → Pair Production  

Which answer correctly lists the order of the dominant photon interaction mechanisms as photon energy is increased?

B. Photoelectric → Compton → Pair Production
Compton interactions are _____ for diagnostic imaging because...

A. Good; they are at higher energies and can reach deep into the patient
B. Good; because they are approximately independent of Z
C. Bad; because they cause scattered photons to reach the detector
D. Bad; because absorption probability barely changes with photon energy

Compton interactions are ____ for diagnostic imaging because...

C. Bad; because they cause scattered photons to reach the detector

For an incident photon of energy 2 MeV interacting with target material via pair production, the mass attenuation coefficient is 0.04 cm²/g. Estimate the mass energy transfer coefficient.

A. 0.01 cm²/g
B. 0.02 cm²/g
C. 0.03 cm²/g
D. 0.04 cm²/g

For an incident photon of energy 2 MeV interacting with target material via pair production, the mass attenuation coefficient is 0.04 cm²/g. Estimate the mass energy transfer coefficient.

B. 0.02 cm²/g

\[ \frac{K_e}{\rho} = \frac{K}{\rho} \left( \frac{E}{h\nu} \right) = \left( \frac{0.04 \text{ cm}^2 \text{ g}^{-1}}{\text{MeV}^{-1}} \right) \left( \frac{2 \text{ MeV}}{2 \text{ MeV}} \right) = 0.02 \text{ cm}^2 \text{ g}^{-1} \]

Why is concrete used as a shielding material for a radiation therapy room rather than lead?

A. Concrete has a greater mass attenuation coefficient than lead.
B. Concrete has a greater linear attenuation coefficient than lead.
C. Concrete is much easier to work with than lead.

Why is concrete used as a shielding material for a radiation therapy room rather than lead?

C. Concrete is much easier to work with than lead.
The penetrating ability of 50 MeV photons in soft tissue is ______ the penetrating ability of 75 MeV photons.

A. Greater than  
B. Less than  
C. Equal to  

Photons in this energy range interact with soft tissue primarily via pair production, for which the attenuation coefficient increases with increasing energy. The attenuation coefficient for 50 MeV photons is less than the attenuation coefficient for 75 MeV photons, so the penetrating ability is greater.