Bank Questions / Ch.3/ Environmental Radiation

Q1/Which type of radiation interact strongly with matter?

a) Beta
b) Alpha
c) Neutron
d) proton

Q2/ What are three ways can photon interact with mater?

Q3/ The Compton effect can be explained on the basis of _____

a) Wave nature of light
b) Quantum theory of light
c) Ray optics
d) Wave optics

Q4/What kind of photon is required for the Compton effect to occur?

a) Visible Light Photon
b) X-ray Photon
c) Infrared
d) UV Photon

Q5/The expression for Compton shift is _____

a) $h/m_0c \cos\theta$
b) $h/m_0c(1-\cos\theta)$
c) $h/m_0c \sin\theta$
d) $h/m_0c (1-\sin\theta)$

Q6/ X rays of wavelength 0.15 nm are scattered from a block of carbon. What is the wavelength of X-rays scattered at 0^0?

a) 0.15 nm
b) 0.154 nm
c) 0.165 nm
d) 0.178 nm

Q7/X-rays with wavelength 0.1 nm are scattered from a carbon block. The scattered radiations are viewed at right angles to the direction of incident beam. What is the Compton shift?

a) 0.0014 nm
b) 0.0024 nm
c) 0.0034 nm
d) 0.0044 nm

Q8/Charge and momentum are conserved in Pair Production.

a) True
b) False

Q9/A photon of energy 4.1 MeV is incident on a lead nucleus, causing the creation of electron-positron pair. They travel perpendicular to the initial direction of the photon. The energy of the electron is _____

a) 4.1 MeV
b) 2.05 MeV
c) 1.02 MeV
d) 0.51 MeV

Q10/ What is pair production and pair annihilation?

Q11/Why does pair production need a nucleus?

Q12/ what factors effect beam attenuation?

Q13/ what does linear absorption coefficient depend on?

Q14/A positron has a mass number of _____, a charge of _____, and a mass equal to that of a(an) _____.

(a) 0, 1+, proton
(b) 1, 2+, proton
(c) 0, 1+, electron
(d) 1, 2+, electron
(e) 0, 0, proton

Q15/Which type of radiation is the least penetrating?

(a) alpha
(b) beta
(c) gamma
(d) x-ray
(e) neutron

Q16/Which of the following describes what occurs in the fission process?

(a) A heavy nucleus is fragmented into lighter ones.
(b) A neutron is split into a neutron and proton.
(c) Two light nuclei are combined into a heavier one.
(d) A proton is split into three quarks.
(e) A particle and anti-particle appear in an area of high energy density.

Q17/ Boron rods in a nuclear reactor are used to

(a) absorb excess neutrons
(b) absorb alpha particle
(c) slow down the reaction
(d) speed up the reaction

Q18/ Amount of energy deposited per unit path length is called----------.

Q19/ How far will 5MeV alpha particles penetrate in skin, given the density of the skin 1gm/cm^3.

Q20/ Bones appear more clear than soft tissues in the radiographic film?

Q21/ The fractional number of photons removed from a beam per cm of absorber is called the _____.

- A. Linear attenuation coefficient
- B. Mass absorption coefficient
- C. Scatter coefficient
- D. Mean attenuation length

Q22/ The process whereby energy is transferred from a photon beam to electrons in the medium is called _____.

- A. Electron capture
- B. Absorption
- C. Bremsstrahlung
- D. Scatter

Q23/ A photoelectric interaction occurs between an 8 keV photon and a K shell electron. A 3.6 keV photoelectron is emitted. The binding energy of the K shell is _____ keV.

- A. 3.6
- B. 4.0

- C. 4.4
- D. 8.0

  E. 11.6

Q24/ The probability, per gram, of a Compton interaction:

- A. Increases as energy increases.
- B. Is independent of energy.
- C. Is proportional to $E^{2}Z^{2}$
- D. Is proportional to $Z^{3}E^{-3}$
- E. None of the above.

Q25/ Which type of nuclear radiation has the shortest range in tissue? (assume equal energy)

- A. Gamma rays
- B. Betas
- C. Neutrinos
- D. Alphas

  E. Neutrons

Q26/ Directly ionizing radiation includes all of the following *EXCEPT*:

- A. Electrons
- B. Positrons
- C. Alpha particles
- D. Neutrons

  E. Betas

Q27/ What is the three possible occurrences when x or gamma photons in the primary beam pass through matter.

Q28/ The Probability of photoelectric Occurrence depends on the following ----------, --------, ---------, and ----------.

Q29/ What is the Byproducts of Compton Scatter?

Q30/ The Compton process is most important for energy absorption for soft tissues in the range from -------- keV to -----MeV.

Q31/ An electron and the positron destroy each other during interaction Known as the ---------- reaction.

Q32/ In annihilation reaction two gamma photons are released with an energy of -------- MeV.

Q33/ Pair production in medical science is used for --------, ----------, and ------.
Q34/ Pair production probability increases with increasing photon energy

True or False

Q35/ Pair production probability increases with atomic number approximately as Z^3.

True or False

Q36/ The most important parameter used for characterization of x-ray or gamma ray penetration into absorbing media is the ----------.

Q37/ Linear attenuation coefficient depends upon:

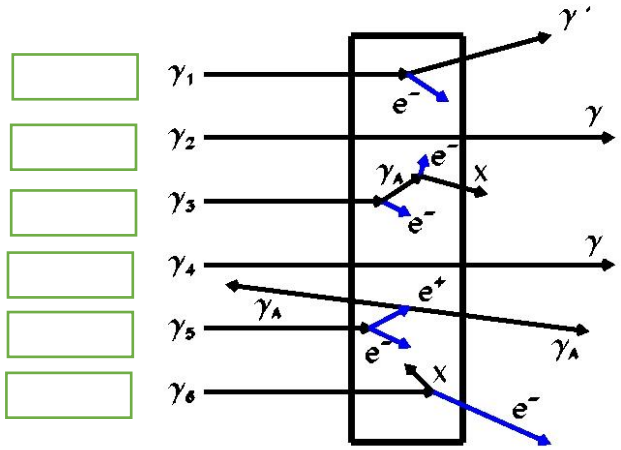
- Energy $h\nu$ of the photon beam
- Atomic number Z of the absorber

True or False

Q38/ Linear attenuation coefficient may be described as the ----------.

Q39/ linear attenuation coefficient, μ (units m^{-1}), measures probability per unit path length of a photon interaction in an absorber; depends on -------- and ---------.

Q40/ Point the type of photon interactions with matter in the follow boxes?



Q41/ The linear attenuation coefficient for 200 keV x rays in lead is 1.0×10^{3} m^{-1}. What is the fraction of such photons remaining after penetrating a lead sheet of thickness 2.0 mm?

Q42/ The attenuation length or **mean free path of photon is defined as----------.**

Q43/ High speed neutrons are "thermalized" by inelastic collisions in hydrogenous materials**.**

True or False

Q44/ The macroscopic cross-section is the probability that a neutron will undergo a reaction per unit path length travelled in the material.

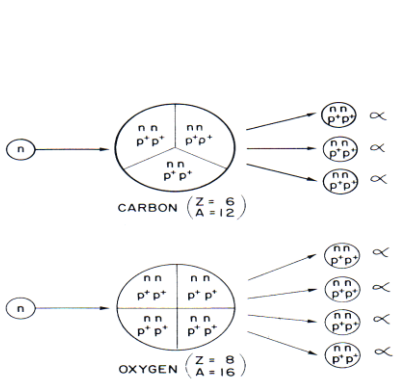
True or False

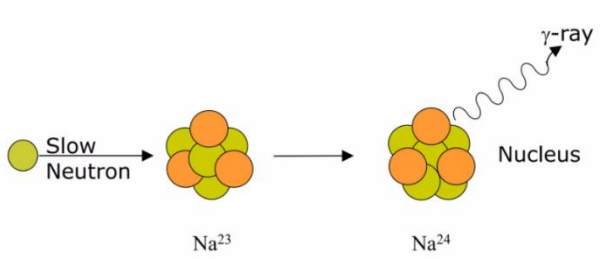
Q45/Calculate the half thickness of water for fast neutrons? Note: the macroscopic cross section in this interaction = 0.103cm^{-1}

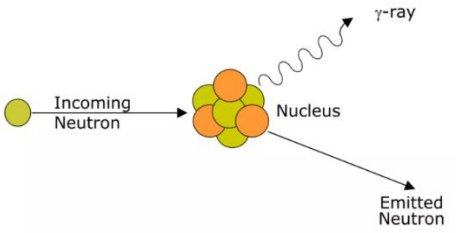
Q46/ Neutrons lose their energy by *elastic collision* with nuclei of similar mass. In soft tissues interaction of a fast neutron with the hydrogen nuclei (protons) is the dominant process of energy transfer.

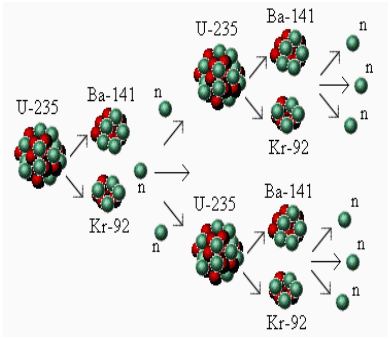
True or False

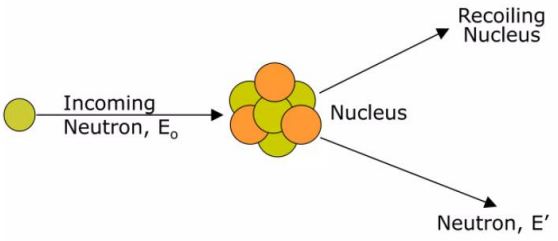
Q47/ Classify the type of neutron interaction with nucleus?











Q48/In neutron fission reaction, a stray neutron strikes an atom of U235. It absorbs the neutron and becomes an unstable atom of U-236. It then undergoes fission. These neutrons can strike other U-235 atoms to initiate their fission.

True or False

Q49/Neutron are useful in ----------, ----------, and ----------.

Q50/Energetic charged particles interact with matter by electrical forces and lose kinetic energy via: ----------, ----------, and ----------.

Q51/Specific ionization is defined as ----------, and is depend on the ---------, -

--------, ----------, and ---------.

Q52/The mass absorption coefficient for Compton scattering is independent of the atomic number (Z) of the absorber whereas the mass absorption coefficient for photoelectric effect depends strongly on Z**.**

True or False

Q53/ Why is the sky is blue?

The sky is blue due to phenomenon called Raleigh scattering. This scattering refers to the scattering of electromagnetic radiation by particles of a much smaller wavelength. These shorter wavelengths correspond to blue hues, hence why when we look at the sky, we see it as blue.

Q54/ The energy of particles of non-ionizing radiation is low, and instead of producing charged ions when passing through matter, non-ionizing electromagnetic radiation has only sufficient energy to change the rotational, vibrational or electronic valence configurations of molecules and atoms. This produces thermal effects.

True or False