		Answer the following questions (45 M for each)
		Notes: m_H=1.007825 u, m_n=1.008665 u, m_α=4.00150u, , N_A =6.022×10^{23} nuclei/mole
1	a	How many half-lives will it take for 50 g of ^{99}Tc to decay to 6.25 g?
	b	What are the Basic principles of radiation protection?
	c	How much water shielding do you require, if you want to reduce the intensity of a 500 keV monoenergetic gamma ray beam (narrow beam) to 1% of its incident intensity? The half value layer for 500 keV gamma rays in water is 7.15 cm. Does the attenuation coefficient of the substance depend on the photon energy?
2	a	What is radioactivity?
	b	Compute the Q-values and α-particle energies for plutonium-239 given the following data: m(^{239}Pu^{94}) =239.05216 u, m(^{235}U^{92}) =235.043923 u.
	c	What is the mechanism of NaI Scintillation detector to detect radiation?
3	a	Discuss the different mechanisms by which photons interact with matter.
	b	What is Bragg peak and why it is important for radiotherapy and discuss accordingly the differences between x-ray and proton therapy?
	c	A 5.0 gm sample absorbs 3.5 Ci of 100 keV electrons in 5.0 min. What is the absorbed dose in rad and Gray?
4	a	What are the differences (in a few points) between? 1- LET and REL. 2- ALARA and maximum permissible dose. 3- LET and RBE. 3- Auger electron and hydrated electron. 5- Direct and indirect action of radiation. 6- Response of normal and tumor cells to radiation.
	b	Calculate the binding energy of ^{12}C.
	c	A bone fragment is found in the desert. If it has a mass of carbon (due to only ^{14}C and ^{12}C) of 200 g, how old is it if it has activity of 15 decays per second? The ratio of ^{14}C to ^{12}C is 1.3×10^{-12}.

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