Binding Energy and Mass defect

Data:

Particle	Relative Charge	Electric Charge (C)	Relative Mass (u)	Mass (kg)
Electron	-1	-1.60×10^{-19}	5.485779×10^{-4}	9.109390×10^{-31}
Proton	+1	$+1.60 \times 10^{-19}$	1.007276	1.672623×10^{-27}
Neutron	0	0	1.008665	1.674929×10^{-27}
1u = 1.6605×10^{-27} kg				
1eV = 1.60×10^{-19} Joules				
The 'cheating' equivalence shortcut ***1u= 931.5 MeV***				

Problem

${}^{4}_{2}H$ is the most abundant isotope of helium. Its mass is 6.6447×10^{-27}kg. What is

a) The mass defect?

b) The binding energy of the nucleus in joules?

c) The binding energy of the nucleus in electron volts?

Questions:

1) ${}^{238}_{92}U$ decays into ${}^{234}_{90}Th$ and an alpha particle

a) Write down the full decay equation

b) How much energy is released.

Mass of ${}^{238}_{92}U$ = 238.0508u
Mass of ${}^{234}_{90}Th$ = 234.0426u
Mass of ${}^{4}_{2}\alpha$ = 4.0026u

2) Calculate the mass defect and binding energy the nuclide ${}^{10}_{5}B$ where the mass of ${}^{10}_{5}B$ atom = 10.0129 u

3) Oxygen has an unstable isotope O-17 that has a mass of 17.00454. If the mass of a neutron is 1.00898 u and the mass of a proton is 1.00814 u, calculate the binding energy of the oxygen nucleus in MeV.

4) A thorium atom of mass 232.038 u decays by the emission of an alpha particle to a radium atom of mass 228.031 u. If the alpha particle has a mass of 4.003 u, how much energy in J is released in the process ?

5) The fusion reaction below is one of the final stages in the fusion process that occurs in the Sun.

$$^{2}_{1}H \quad + \quad ^{3}_{1}H \quad \rightarrow \quad ^{4}_{2}He \quad + $$

(a) Complete the reaction identifying the missing particle.

(b) Calculate the energy released in the fusion reaction using the following information (you will also need the mass of the other particle).

$^{2}_{1}H$ = 3.345×10^{-27} Kg

$^{3}_{1}H$ → 5.008×10^{-27} Kg

$^{4}_{2}He$ 6.647×10^{-27} Kg