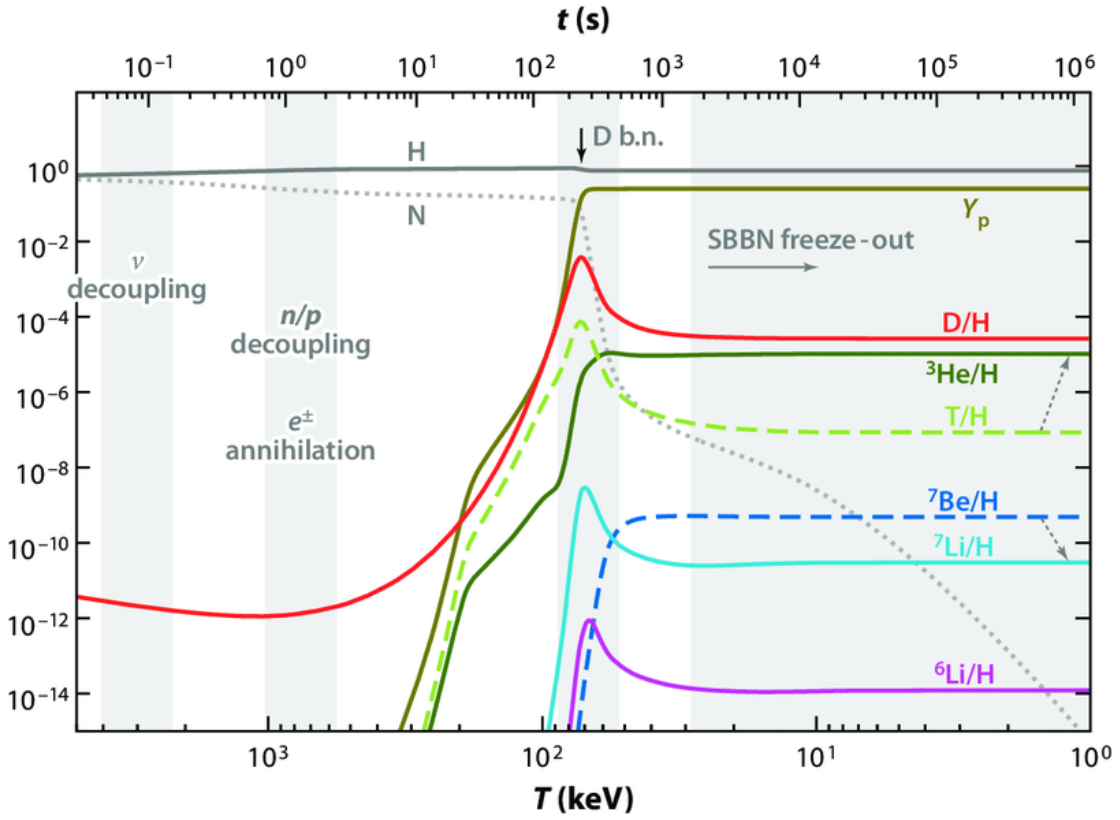
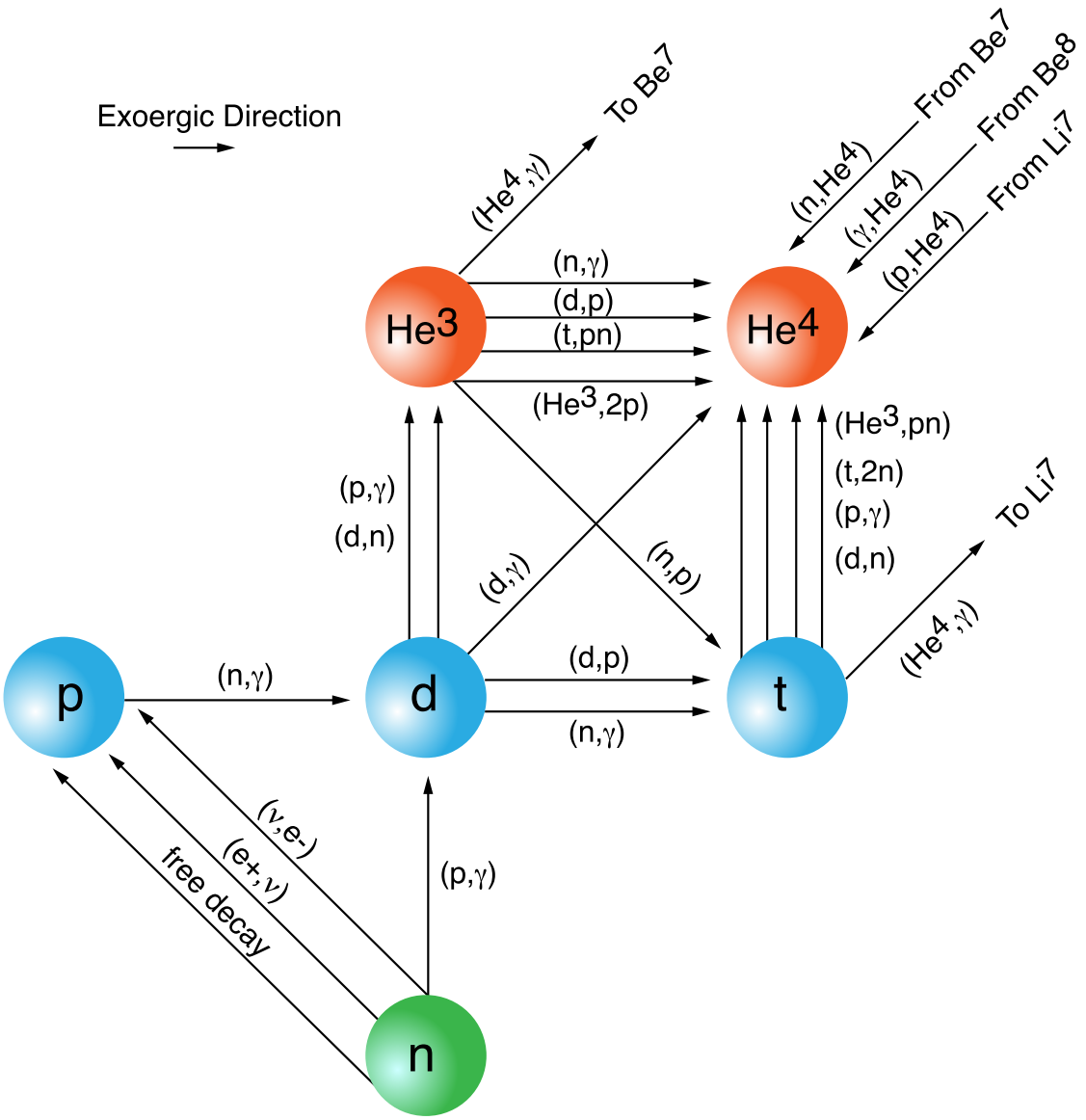
Question 1

Find the graph about the mass fractions of isotopes in the Big Bang Nucoeosynthesis(BBN). Try to explain what you found.



source: https://www.annualreviews.org/doi/pdf/10.1146/annurev.nucl.012809.104521

在宇宙形成初期，隨著溫度下降，氫逐漸合成其他元素如 $^{2}\mathrm{H}$、$^{3}\mathrm{H}$、$^{3}\mathrm{He}$ 等等輕元素，在並在後續的反應中形成 $^{7}\mathrm{Li}$、$^{7}\mathrm{Be}$、$^{8}\mathrm{Be}$ 等等較重的元素，並且因為並且中子（N）迅速的被消耗



source: https://cococubed.com/code_pages/net_bigbang.shtml

Question 2.

Find the rest mass of protons, electrons and hydrogens. Use what you found to calcute the binding energy of a hydrogen(13.6eV).

$$ {}_1^1\mathrm{p}^+ + \mathrm{e}^- \rightarrow {}_1^1\mathrm{H} $$

$$ \Delta m = m_H - (m_p + m_e) $$

$$ E = \Delta m c^2 $$

element	mass(kg)	source
m_H	$1.67353283776 \cdot 10^{-27}$	https://en.wikipedia.org/wiki/Isotopes_of_hydrogen

element	mass(kg)	source
m_p	$1.67262192369 \cdot 10^{-27}$	https://en.wikipedia.org/wiki/Proton
m_e	$9.1093837015 \cdot 10^{-31}$	https://en.wikipedia.org/wiki/Electron_mass

$$\begin{aligned}\Delta m &= 1.67353283776 \cdot 10^{-27} - (1.67262192369 \cdot 10^{-27} + 9.1093837015 \cdot 10^{-31})(kg) \\ &= -2.43001499738 \cdot 10^{-35}(kg) \\ E &= \Delta m c^2 = -2.18701349764 \cdot 10^{-18}(J) \\ &= -13.65026459148(eV)\end{aligned}$$

> Da to Kg: https://www.unitconverters.net/weight-and-mass/dalton-to-kilogram.htm