

# Problem Set 1

## Due SES #4

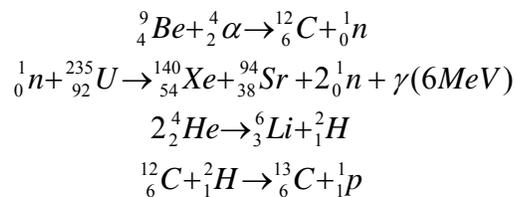
[EL] = Lewis, Elmer L. *Fundamentals of Nuclear Reactor Physics*. Burlington, MA: Academic Press, 2008. ISBN: 9780123706317.

Suggested Problems: [EL] Chapter 1, Problems 1.4, 1.5, 1.6, 1.7, 1.11

**Question 1:** Why is the binding energy per nucleon relatively stable for heavy atoms?

**Question 2:** What are the advantages of a thorium fuel cycle?

**Question 3:** Calculate the Q values for the following reactions and determine whether or not the nuclear reactions are endothermic or exothermic.



**Question 4:** Calculate the total binding energy of Pu-239 and Xe-135.

**Question 5:** Assuming that promethium and samarium concentrations can be represented with the equations:

$$\frac{dp}{dt} = \gamma_P \Sigma_r \phi - \lambda_P \Gamma(t)$$

$$\frac{dS}{dt} = \lambda_P P(t) - \sigma_\alpha^3 \Phi S(t)$$

What are the equilibrium concentrations of each isotope?

After reaching equilibrium, the reactor is shut down so that  $\phi = 0$  after  $t=0$ . What are the equations that represent the concentrations of each isotope?

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