PHYS1120
Summer 2025

**Show all work for credit!**
**Due Date: 15 August**

---

1. **Calculate the binding energy of $^{12}$C in MeV. (Hint: Neutrons have mass $1.008665$ u, protons have mass $1.007825$ u, $^{12}$C has atomic mass $12$ u, and $1$ u is $1.660539 \times 10^{-27}$ kg).**

2. **Doubly ionized Lithium is a hydrogen-like atom.**
   (a) **Calculate the energy (in eV) of the $n = 3$ state.**
   (b) **Calculate the energy (in eV) of the $n = 2$ state.**
   (c) **Find the wavelength of the emitted photon for the electron transition $n = 3 \to 2$ state.**

3. **$^{235}$U has a half-life of $7.04 \times 10^8$ years, and atomic mass $235.043924$ u. Consider a sample of $^{235}$U with a starting mass of $50$ g.**
   (a) **What is the initial decay rate of this sample?**
   (b) **What is the rate of decay after $1$ billion years?**
   (a) **How long would it take for $90$ % of this sample to degrade?**

---

**Answer key: (1) $92.4$ MeV; (2a) $-13.6$ eV; (2b) $-30.6$ eV; (2c) $73.1$ nm; (3a) $1.085 \times 10^{-4}$ Ci; (3b) $5.747 \times 10^{-6}$ Ci; (3c) $2.339$ billion years.**

**How many hours (approximately) did it take you to complete this assignment?**