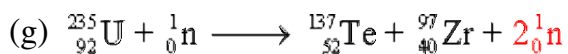
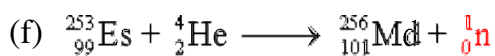
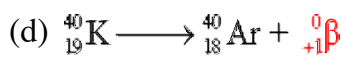
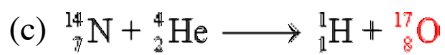


Practice Problems Week 10

1. Write balanced nuclear equations for the following:



2. Iodine-134 has a half-life of 52.0 minutes. If you begin with 1.28 mg of the isotope, how much is left after 0.289 days?

Well, the half-life is given in minutes, so let's convert 0.289 days into minutes:

$$0.289 \text{ da} \times \frac{24 \text{ hr}}{1 \text{ da}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 416 \text{ min}$$

Now! How many times will 52.0 minutes/half-life go into 416 minutes?

$$\frac{416 \text{ min}}{52.0 \frac{\text{min}}{\text{half-life}}} = 8.00 \text{ half-lives}$$

So, we know that

$$m = m_0 \left(\frac{1}{2} \right)^n \quad (\text{mass} \equiv \text{initial mass times } 1/2 \text{ to the power of half-lives})$$

$$m = 1.28 \text{ mg} \left(\frac{1}{2} \right)^8 = 1.28 \text{ mg} \left(\frac{1}{256} \right) = 0.00500 \text{ mg} = 5.00 \mu\text{g}$$

3. A 64.0 mg sample of ^{235}Pu decays to 2.00 mg in 130 minutes. What is the half-life of this isotope?

So, what fraction of the initial mass 64.0 mg is 2.00 mg? It's 2.00/64.0

or $1.00/32.0$. But $1.00/32.0$ is $1.00/(2.00)^5$. So it has been divided by two, five times, meaning the time span of five half-lives has passed. So, if 130 minutes is five half-lives, then one half-life is

$$\frac{130 \text{ minutes}}{5.00 \text{ half-lives}} = 26.0 \frac{\text{minutes}}{\text{half-life}}$$

4. How many weeks have passed if a 32.0 mg sample of a radioactive nuclide has decayed to 2.00 mg?
($t_{1/2} = 6.5$ days)

The basic question here is: "How many times has the mass been divided by two?" That would be the number of half-lives. Then we multiply that number by 6.5 days and convert to weeks:

$$32.0 \text{ mg} \times \left(\frac{1}{2}\right)^n = 2.0 \text{ mg}$$

$$\text{So } \left(\frac{1}{2}\right)^n \text{ must equal } \frac{1}{16}. \text{ Well, } \frac{1}{16} = \left(\frac{1}{2}\right)^4$$

So we have four half-lives each at 6.5 days making 26 days or 3.7 weeks.