

HOMWORK PROBLEMS:

- 4a. Calculate the amount of energy (in kJ) is released in a nuclear reaction if the mass loss is 1.68×10^{-4} grams?

Answers:

$$\frac{1.68 \times 10^{-4} \text{ g}}{1000 \text{ g}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 1.68 \times 10^{-7} \text{ kg}$$

$$E = mc^2$$

$$E = (1.68 \times 10^{-7} \text{ kg}) \left(3.00 \times 10^8 \frac{\text{m}}{\text{sec}} \right)^2 = (1.68 \times 10^{-7} \text{ kg}) \left(\frac{9.00 \times 10^{16} \text{ m}^2}{\text{sec}^2} \right)$$

$$E = \frac{1.51 \times 10^{10} \frac{\text{kg} \cdot \text{m}^2}{\text{sec}^2}}{1 \left(\frac{\text{kg} \cdot \text{m}^2}{\text{sec}^2} \right)} \times \frac{1 \text{ Joule}}{1000 \text{ J}} = 1.51 \times 10^7 \text{ kJ}$$

- 4b. One mole of radium-226 decays by alpha emission to yield 4.8×10^8 kJ of energy. Calculate the energy that is released when 1 gram of radium-226 decays? (The nuclear mass of radium-226 is 225.9771 grams / mole)

Answers:

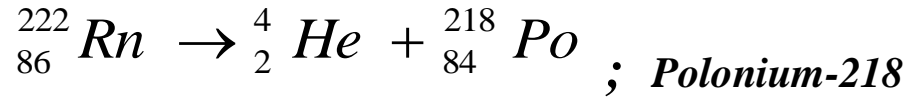
$$\frac{1 \text{ g Ra}}{225.9771 \text{ g}} \times \frac{1 \text{ mol Ra}}{1 \text{ mol Ra}} \times \frac{4.8 \times 10^8 \text{ kJ}}{1 \text{ mol Ra}} = 2.12 \times 10^6 \text{ kJ}$$

This is a Factor-Label problem... You do not need to use $E=mc^2$ to answer the question

Turn the page...

4c. When one mole of radon-222 decays by alpha emission, 5.4×10^8 kJ of energy are released. Calculate the mass that was converted into energy for this reaction?

Answers:



$$E = mc^2 ; m = \frac{E}{c^2}$$

$$\frac{5.4 \times 10^8 \text{ kJ}}{1 \text{ kJ}} \times \frac{1000 \text{ J}}{1 \text{ kJ}} \times \left(\frac{\text{kg} \cdot \text{m}^2}{\text{sec}^2} \right) = 5.4 \times 10^{11} \text{ kg} \cdot \frac{\text{m}^2}{\text{sec}^2}$$

$$m = \frac{E}{c^2} = \frac{\left(5.4 \times 10^{11} \text{ kg} \cdot \frac{\text{m}^2}{\text{sec}^2} \right)}{\left(3.00 \times 10^8 \frac{\text{m}}{\text{sec}} \right)^2} = \frac{5.4 \times 10^{11} \left(\text{kg} \cdot \frac{\text{m}^2}{\text{sec}^2} \right)}{\left(9.00 \times 10^{16} \frac{\text{m}^2}{\text{sec}^2} \right)}$$

$$m = \frac{5.4 \times 10^{11} \left(\text{kg} \cdot \frac{\text{m}^2}{\text{sec}^2} \right)}{\left(9.00 \times 10^{16} \frac{\text{m}^2}{\text{sec}^2} \right)} = \frac{5.4 \times 10^{11} \text{ kg} \cdot \text{m}^2 (\text{sec}^2)}{9.00 \times 10^{16} \text{ m}^2 (\text{sec}^2)} = 6.00 \times 10^{-6} \text{ kg}$$