

REVIEW QUESTIONS

## Chapter 18

1. For each element below, use the information given to determine the number of protons, neutrons and electrons in its nucleus.

a)  ${}_{36}^{84}\text{Kr}$        $p^+ = \underline{36}$        $n^0 = \underline{48}$

b)  ${}_{56}^{137}\text{Ba}$        $p^+ = \underline{56}$        $n^0 = \underline{81}$

c)  ${}_{95}^{243}\text{Am}$        $p^+ = \underline{95}$        $n^0 = \underline{148}$

2. Complete each equation below, and classify the type of decay:



3. Half-life of a radionuclide is 5 days. How many days will it require for a 160-g sample of this radionuclide to decay to 5 grams?

$$160 \text{ g} \xrightarrow{1} 80 \text{ g} \xrightarrow{2} 40 \text{ g} \xrightarrow{3} 20 \text{ g} \xrightarrow{4} 10 \text{ g} \xrightarrow{5} 5 \text{ g}$$

$$5 \text{ half-lives} \times \frac{5 \text{ days}}{1 \text{ half-life}} = 25 \text{ days}$$

4. A sample of a particular radionuclide starts with a mass of 32 g. Twelve hours later, 0.5 g of this isotope remains. What is the half-life of this radionuclide?

$$32 \text{ g} \xrightarrow{1} 16 \text{ g} \xrightarrow{2} 8 \text{ g} \xrightarrow{3} 4 \text{ g} \xrightarrow{4} 2 \text{ g} \xrightarrow{5} 1 \text{ g} \xrightarrow{6} 0.5 \text{ g}$$

$$\frac{12 \text{ hours}}{6 \text{ half-lives}} = 2 \text{ hrs/half-life}$$

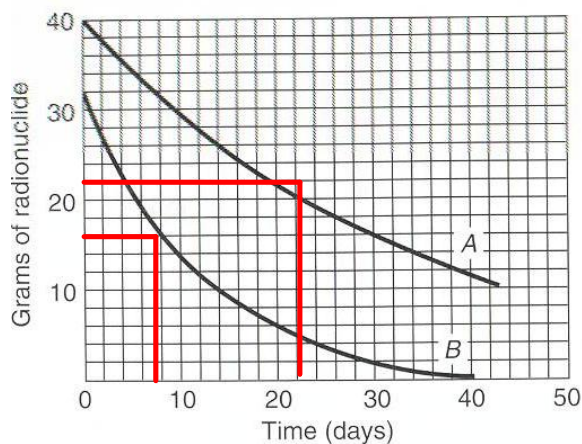
5. For each pair of nuclides given, determine which is radioactive, and give a reason for your choice:

a)  ${}_{9}^{17}\text{F}$  and  ${}_{16}^{32}\text{S}$  Reason: less neutrons (8) than protons (9)

b)  ${}_{26}^{56}\text{Fe}$  and  ${}_{88}^{226}\text{Ra}$  Reason: atomic number greater than 83

c)  ${}_{11}^{23}\text{Na}$  and  ${}_{9}^{20}\text{F}$  Reason: odd number of neutrons (11) and protons (9)

6. Use the graph provided below to find the half-life of radionuclides A and B.



**A = 22 days**

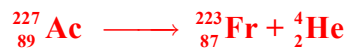
**B = 8 days**

7. Write equations for the following decays:

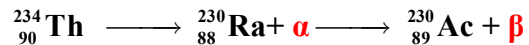
a) Beta decay of  ${}_{26}^{56}\text{Fe}$



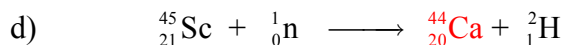
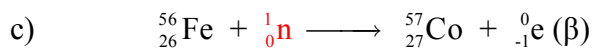
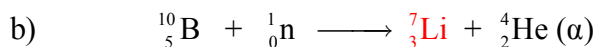
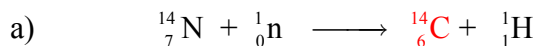
b) Alpha decay of  ${}_{89}^{227}\text{Ac}$



8. Determine the type of radiation given off in the following decay:



9. Complete the following equations:



10. Calculate the nuclear binding energy of  ${}_{26}^{56}\text{Fe}$  (in J/mol) from the following mass data:

$${}_{26}^{56}\text{Fe} = 55.9349 \text{ g/mol}$$

**Mass of nucleus = atomic mass – mass of 26 electrons**

$$\text{n}^0 = 1.0087 \text{ g/mol}$$

$$55.9349 \text{ g} - 26(0.00055 \text{ g}) = 55.9206 \text{ g}$$

$$\text{p}^+ = 1.0073 \text{ g/mol}$$

**Mass of protons + neutrons = 26(p<sup>+</sup>) + 30(n<sup>0</sup>)**

$$[26(1.0073 \text{ g}) + 30(1.0087 \text{ g})] = 56.4508 \text{ g}$$

$$\text{e}^- = 0.00055 \text{ g/mol}$$

$$\text{Mass defect} = 56.4508 \text{ g} - 55.9206 \text{ g} = 0.5302 \text{ g}$$

**Binding energy = E = mc<sup>2</sup>**

$$E = (5.302 \times 10^{-4} \text{ kg})(3.00 \times 10^8 \text{ m/s})^2 = 4.77 \times 10^{13} \text{ J}$$