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) $^{84}_{36}Kr$ p^+ = **36** n^0 = **48**

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

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

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

a) $^{8}_{5}B \longrightarrow {}^{8}_{6}C + {}^{0}_{-1}e$ Type: **beta decay**

b) $^{210}_{84}Po \longrightarrow {}^{206}_{82}Pb + {}^{4}_{2}He$ Type: **alpha decay**

c) $^{60}_{27}Co \longrightarrow {}^{60}_{28}Ni + {}^{0}_{-1}e$ Type: **beta 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 g $\xrightarrow{1}$ **80 g** $\xrightarrow{2}$ **40 g** $\xrightarrow{3}$ **20 g** $\xrightarrow{4}$ **10 g** $\xrightarrow{5}$ **5 g**

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

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

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

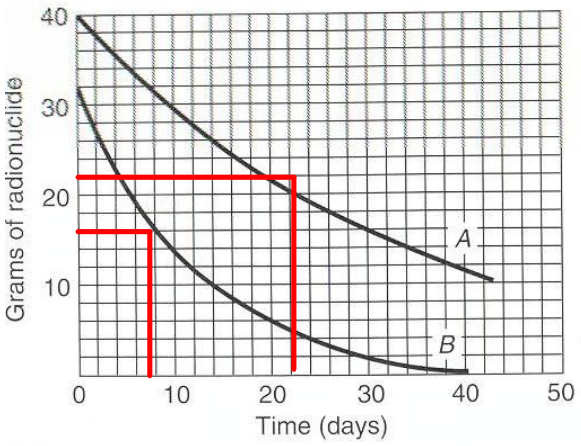
5. For each pair of nuclides given, determine which is radioactive, and give a reason for your choice:

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

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

c) $^{23}_{11}Na$ and $^{20}_{9}F$ 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 $^{56}_{26}Fe$

$$^{56}_{26}Fe \longrightarrow {}^{56}_{27}Co + {}^{0}_{-1}e$$

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

$$^{227}_{89}Ac \longrightarrow {}^{223}_{87}Fr + {}^{4}_{2}He$$

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

$$^{234}_{90}\mathbf{Th} \longrightarrow {}^{230}_{88}\mathbf{Ra} + \alpha \longrightarrow {}^{230}_{89}\mathbf{Ac} + \beta$$

9. Complete the following equations:

a) $^{14}_{7}\mathrm{N} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{14}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H}$

b) $^{10}_{5}\mathrm{B} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{7}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}\ (\alpha)$

c) $^{56}_{26}\mathrm{Fe} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{57}_{27}\mathrm{Co} + {}^{0}_{-1}\mathrm{e}\ (\beta)$

d) $^{45}_{21}\mathrm{Sc} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{44}_{20}\mathrm{Ca} + {}^{2}_{1}\mathrm{H}$

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

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

$n^0 = 1.0087$ g/mol

$p^+ = 1.0073$ g/mol

$e^- = 0.00055$ g/mol

Mass of nucleus = atomic mass – mass of 26 electrons

55.9349 g – 26(0.00055 g) = 55.9206 g

Mass of protons + neutrons = 26(p^+) + 30(n^0)

[26(1.0073 g) + 30(1.0087 g)] = 56.4508 g

Mass defect = 56.4508 g – 55.9206 g = 0.5302 g

Binding energy = E = mc^2

E = $(5.302\times10^{-4}$ kg$)(3.00\times10^{8}$ m/s$)^2 = 4.77\times10^{13}$ J