HOW TO DO HALF LIFE CALCULATIONS

STEP BY STEP

FOR REFERENCE

Number of half-lives	1	2	3	4	5
Percent remaining	50 %	25 %	12.5 %	6.25 %	3.25 %

STEP 1

Read the question and underline the important information.

Example:

Cesium-124 has a half life of 31 seconds. A sample of Cesium – 124 in a laboratory has an initial mass of 40mg.

a. Calculate the amount of time it will take for the sample to decay to 5mg.

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STEP 2 – FOR QUESTIONS THAT ASK FOR TIME

Figure out how many half lives have occurred. By dividing by 2 from the initial mass until you reach the final mass.

$$40mg \underset{1}{\div 2} = 20mg \underset{2}{\div 2} = 10mg \underset{3}{\div 2} = 5g$$

= 3 half lives

STEP 3 – FOR QUESTIONS ASKING FOR TIME

Multiply the number of half lives by the length of the half life

3 half lives x 31sec = $\boxed{93\text{sec}}$

STEP 2 – FOR QUESTION ASKING HOW MUCH IS LEFT

Divide the total time by the length of one half life

b. Calculate how much Cesium – 124 will remain after 124 s (2 min 4 seconds).

$$\frac{124 \text{ sec}}{31 \text{ sec}} = 4 \text{ half lives.}$$

STEP 3: FOR QUESTIONS ASKING HOW MUCH IS LEFT

Now divide the initial mass by 2 – for the number of half lives that have taken place.

$$40 \div 2 = 20 \div 2 = 10 \div 2 = 5 \div 2 = \boxed{2.5\text{mg}}$$

1 2 3 4

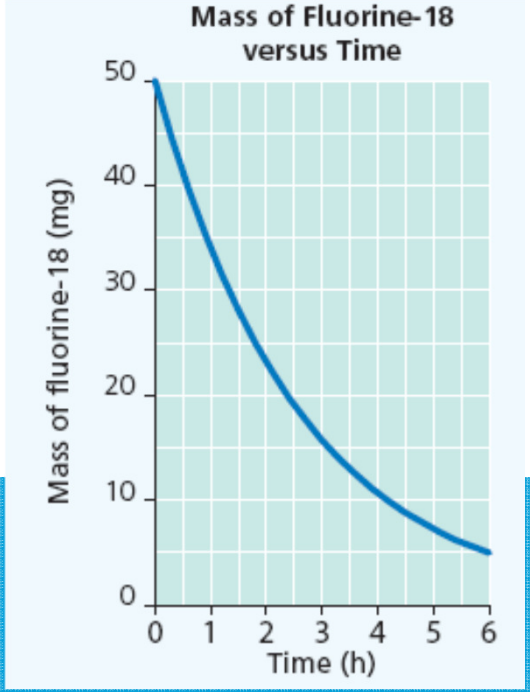
NOW TRY THE 2ND EXAMPLE ON YOUR OWN

A sample of Fluorine-18 in a laboratory has an initial mass of 50mg. Fluorine-18 has a half life of 1.8 hours.

a. Calculate the amount of time it will take for the initial mass of fluorine-18 to be reduced from 50mg to 12.5 mg. You can use the graph to confirm your answer.

b. Calculate what mass of Fluorine-18 remains after 5.4h.

You can use the graph to confirm your answer.



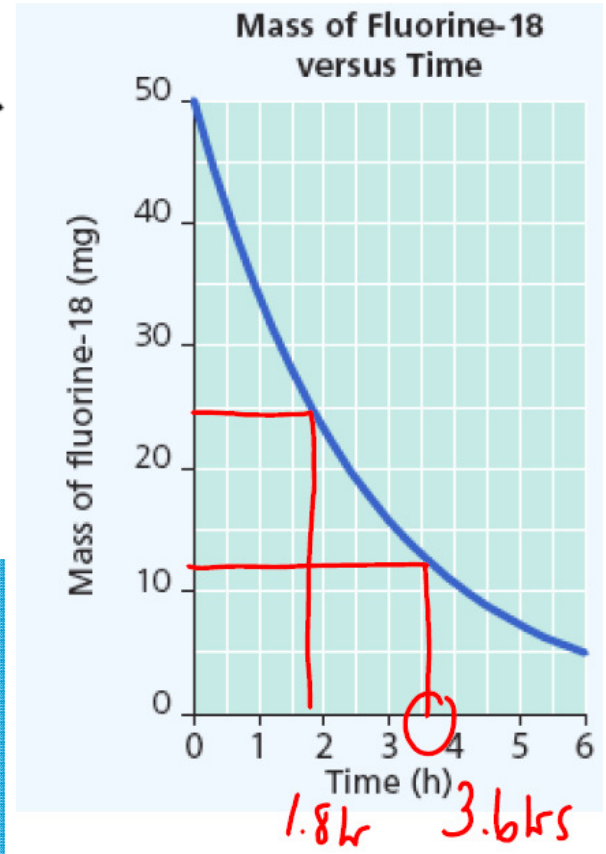
ANSWER TO PART A

$50 \div 2 = 25mg \div 2 = 12.5mg$

1 2

$2 \times 1.8hr = 3.6hrs$

Answer confirmed by the graph



ANSWER TO PART B

$$\frac{5.4\text{ hrs}}{1.8\text{ hrs}} = 3 \text{ half lives}$$

$$\text{so } 50 \underset{1}{-} 25 \underset{2}{-} 12.5 \underset{3}{-} \boxed{6.25\text{mg}}$$

SIDE NOTE AND HW

Side note: Carbon dating can be used to date things that were once living – the half life of Carbon-14 is 5730 years.

Uranium-235 and 238 have been used to date rocks because they have really long half lives. – (refer to chart on periodic table)

Homework: pg. 296 #3, 4 and 6

U235 = 710 million yrs

U 238 = 4.5 billion yrs