Homework - Worksheets

b) $^{210}_{82}Pb \longrightarrow {}^{210}_{83}Bi + {}^{0}_{-1}e$

$82p^+$
$128n$

$83p^+$
$127n$

c) $^{218}_{84}Po \longrightarrow {}^{214}_{82}Pb + {}^{4}_{2}He$

Table 25.2

Decay Processes

Beta Emission

$^{66}_{29}Cu \longrightarrow {}^{66}_{30}Zn + {}^{0}_{-1}e$

$^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

Electron Capture

$^{59}_{28}Ni + {}^{0}_{-1}e \longrightarrow {}^{59}_{27}Co$

$^{37}_{18}Ar + {}^{0}_{-1}e \longrightarrow {}^{37}_{17}Cl$

Positron Emission

$^{8}_{5}B \longrightarrow {}^{8}_{4}Be + {}^{0}_{+1}e$

$^{15}_{8}O \longrightarrow {}^{15}_{7}N + {}^{0}_{+1}e$

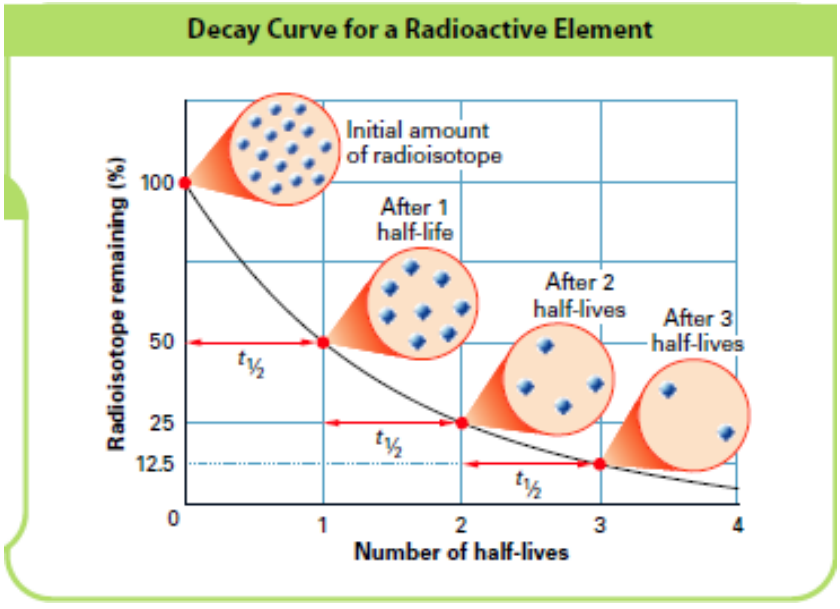
Alpha Emission

$^{226}_{88}Ra \longrightarrow {}^{222}_{86}Rn + {}^{4}_{2}He$

$^{232}_{90}Th \longrightarrow {}^{228}_{88}Ra + {}^{4}_{2}He$

Half-Life

A half-life ($t_{1/2}$) is the time required for one-half of the nuclei of a radioisotope sample to decay to products. After each half-life, half of the existing radioactive atoms have decayed into atoms of a new element.



Sample Problem

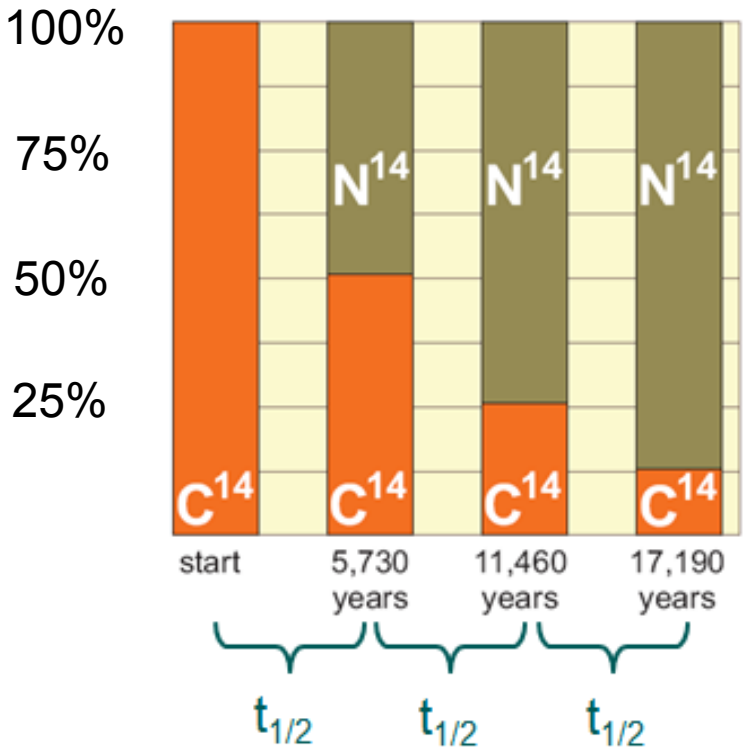
Carbon-14 emits beta radiation and decays with a half-life ($t_{1/2}$) of 5730 years. Assume you start with a mass of 2.00×10^{-12} g of carbon-14.

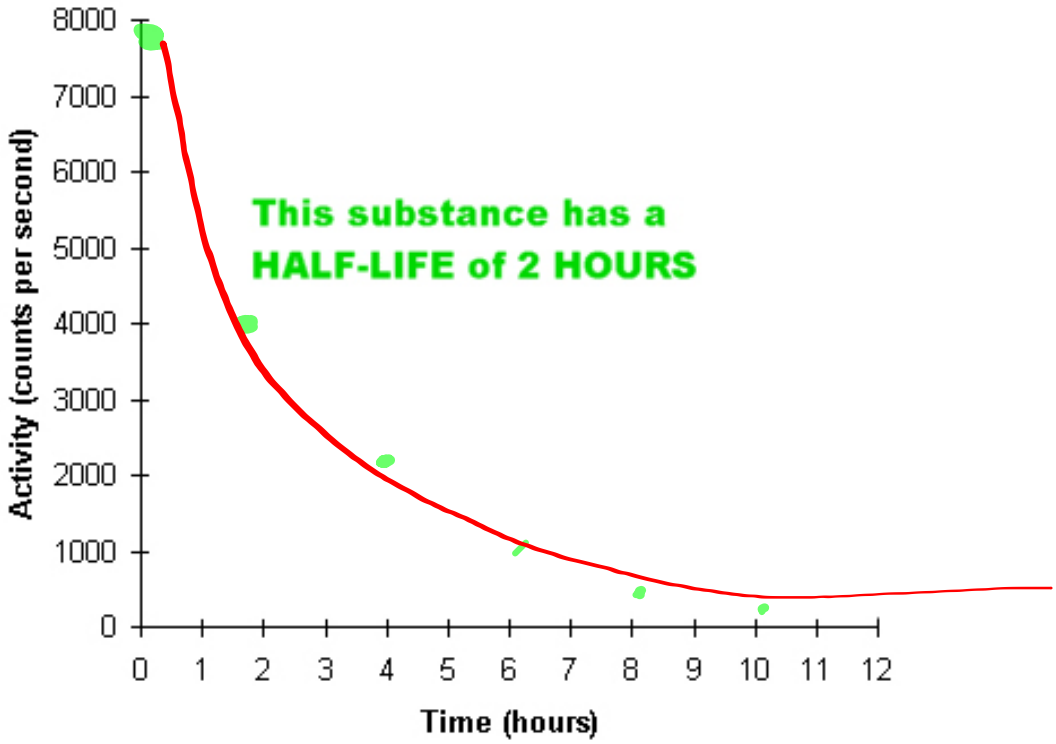
a) How long is three half-lives?
b) How many grams of the isotope remain after three half-lives?

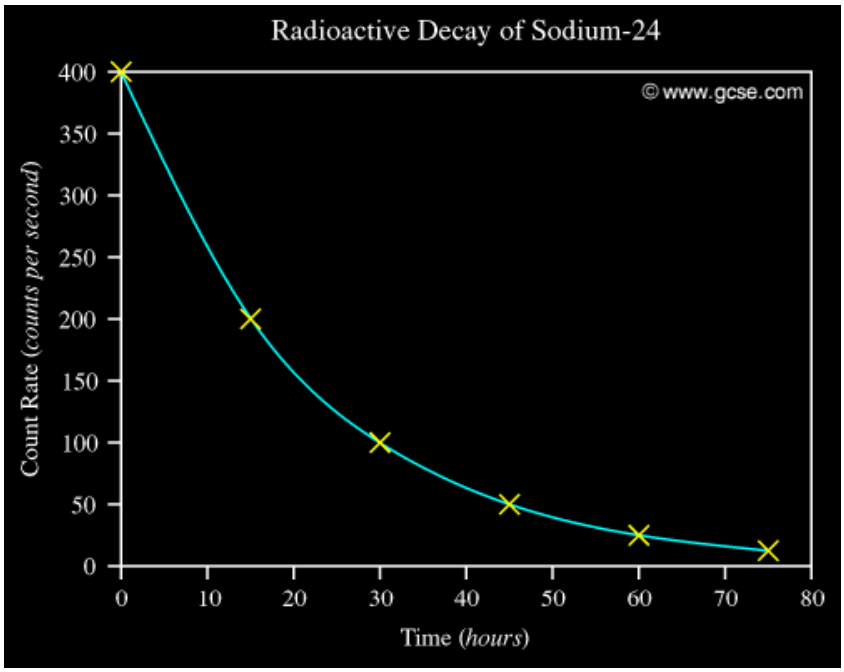
a) $5730 \text{ years} \times 3 = 17190 \text{ years}$

b) $2.00 \times 10^{-12} \text{ g} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} =$

$2.50 \times 10^{-13} \text{ g}$


100%
75%
50%
25%
C^{14}
N^{14}
C^{14}
N^{14}
C^{14}
N^{14}
C^{14}
start
5,730 years
11,460 years
17,190 years
$t_{1/2}$
$t_{1/2}$
$t_{1/2}$


8000
7000
6000
5000
4000
3000
2000
1000
0
Activity (counts per second)
This substance has a
HALF-LIFE of 2 HOURS
0 1 2 3 4 5 6 7 8 9 10 11 12
Time (hours)

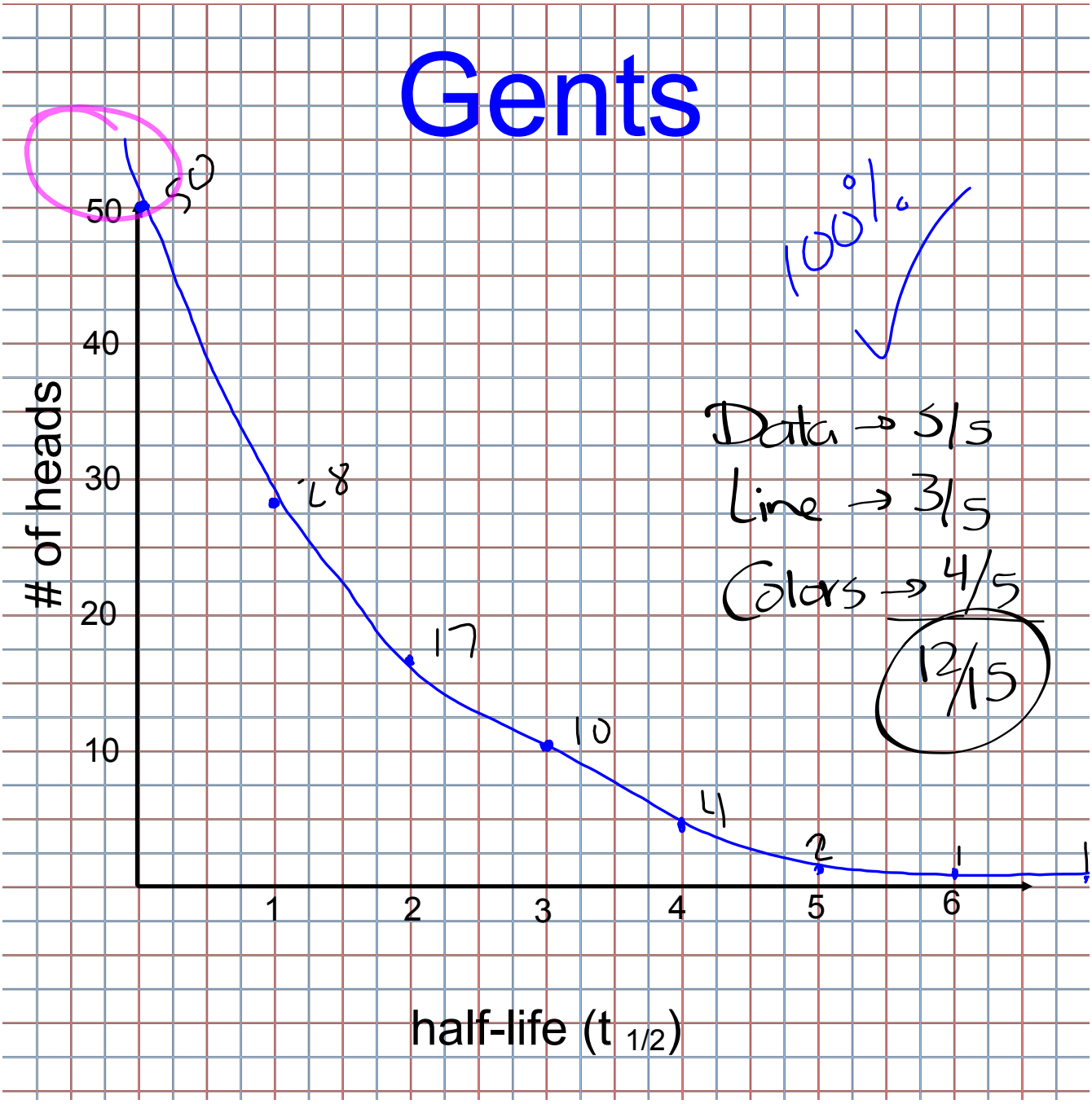

Radioactive Decay of Sodium-24
© www.gcse.com
Count Rate (counts per second)
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
Time (hours)

Coin experiment

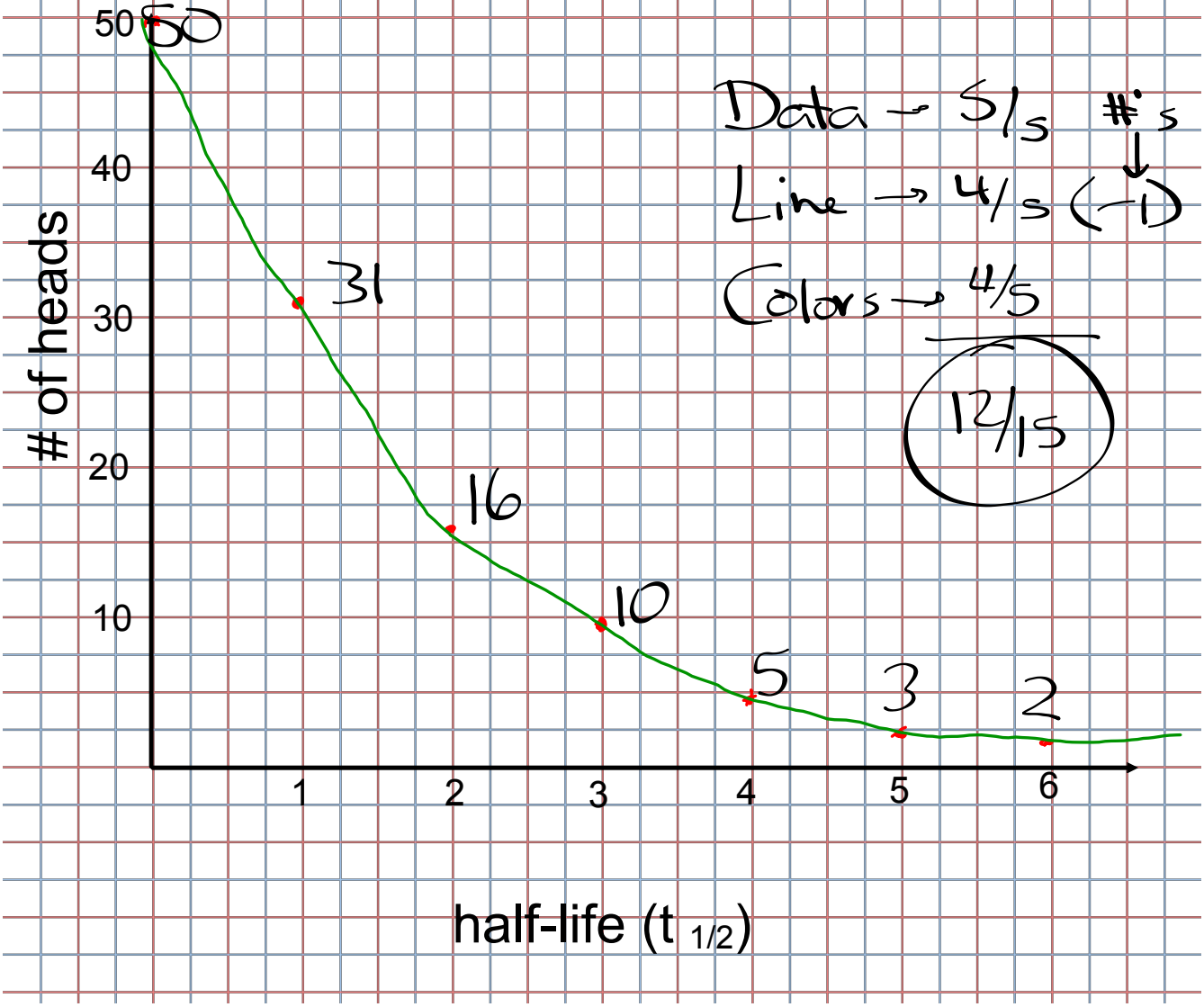
Flip a coin 50 times, and plot the number of heads (y-axis), with the number of trials (x-axis).

Tails = decayed isotopes

Heads = remaining isotopes


Gents
50
40
30
20
10
# of heads
50
28
17
10
4
2
1
1
1
2
3
4
5
6
half-life ($t_{1/2}$)
100%
Data → 5/5
Line → 3/5
Colors → 4/5
12/15

Ladies


50
40
30
20
10
# of heads
50
31
16
10
5
3
2
1
2
3
4
5
6
half-life ($t_{1/2}$)
Data → 5/5 #'s
Line → 4/5 (-1)
Colors → 4/5
12/15