**Half-Life Questions Solutions**

1. The activity of a radioisotope changes from 6000 Bq to 375 Bq over a period of 60 minutes. What is the half-life of this element?
**15 minutes**
2. A sample of iodine-131 was measured to have an activity of 832 Bq. The half-life of iodine-131 is 8 hours. How much time will it take for the activity to fall to 52 Bq?
**32 hours**
3. Sodium-24 has a half-life of 15 hours. If a sample of this radioisotope has an activity of 10 million decays per second now, determine its activity in 5 days’ time. (This is best done mathematically rather than using a table.)
**3.91 × 104 Bq**
4. One product of nuclear power plants is the isotope caesium-137, which has a half-life of 30 years. How many years will it take for the activity of a sample of 137-caesium to reduce to one eighth of its original value?
**90 years**
5. C-14 is formed in the upper atmosphere by the interaction of nitrogen and cosmic rays. Living creatures breathe in C-14, dead ones don’t. The half-life of C-14 is 5730 years. One gram from a modern wooden spoon is tested and found to give, on average, 0.26 Bq. One gram of carbon is obtained from the tomb of Hemaka in Egypt. Over a one-hour period 480 counts are registered.
6. How many becquerels does this correspond to?
**0.133 Bq**
7. What date does this suggest for Hemaka’s tomb?
**~3700 BC**
8. After an animal dies it no longer takes in carbon-14, so the ratio of radioactive C-14 to stable C-12 gradually decreases. C-14 undergoes -decay and has a half-life of about 5730 years. The decay rate of C-14 in a living animal is around 15 decays per minute per gram of carbon. An archaeologist finds an animal bone which has 200 g of carbon. The -decay rate from the whole bone is 748 decays/minute.
9. What is the equation for the -decay of C-14?
$$\begin{matrix}14\\6\end{matrix}C\rightarrow \begin{matrix}14\\7\end{matrix}N+\begin{matrix}0\\-1\end{matrix}β$$
10. What is the approximate age of the bone?
**~11,460 years old**
11. A cave containing ancient human bones is discovered. Living matter with an equal amount of carbon had 8.0 times as much carbon 14 as the bones. Taking the half-life of carbon-14 as 5730 years, find the approximate age of the bones.
**~17,190 years old**