Radioactive Half-Life Module: Testing

This little document contains some ideas for testing for understanding of the concepts your students have dealt with in the *Radioactive Half-Life* Practical. They are just ideas, and will need some "fleshing out" depending on how you choose to organise your tests.

You should be aware that the Module discusses radioactivity mainly in terms of the decay constant λ. Some texts instead use the *lifetime* τ. The Guide to the Module briefly connects the 2 views.

In addition to the usual questions about the relationships between half-life, activity, decay constants, lifetimes, etc. you might wish to ask one or more questions based on the following ideas:

Question 1: 2 radioactive nuclei, A and B, have decay constants which are related by:

$$\lambda_A = 2\,\lambda_B$$

What is the relation between the half-lives of the two nuclei?

Question 2: In the *Radioactive Half-Life* Practical you calculated the half-life of the dice assuming that each trial was performed every 60 seconds and that when a die came up with a 6 that corresponded to it having decayed since the previous trial. What is the half-life of the dice if each trial was performed every 15 seconds?

Question 3: In the *Radioactive Half-Life* Practical you calculated the half-life of the dice assuming that each trial was performed every 60 seconds and that when a die came up with a 6 that corresponded to it having decayed since the previous trial. What if you assume that when a die comes up a 4, 5 or 6 this corresponds to it having decayed since the previous trial. What is the half-life of the dice if each trial was performed every 60 seconds?

Question 4 : In the standard view of Physics, radioactive decay is a truly random process. However, in classical Physics the principle of *causality* says that 2 identical systems always behave identically. Is the standard view of radioactivity in conflict with classical causality?

These notes were written by David M. Harrison, April 2005