# AP CHEMISTRY

## TOPIC 10: NUCLEAR CHEMISTRY, REVIEW , PART I

Day 119:

**CLEARLY SHOW THE METHOD USED AND THE STEPS INVOLVED IN ARRIVING AT YOUR ANSWERS**

A CALCULATOR **SHOULD NOT** BE USED FOR QUESTION #1:

1. The decay of the radioisotope I-131 was studied in a laboratory. I-131 is known to decay to beta ( $_{-1}^{0}e$ ) emission.

   a) Write a balanced nuclear equation for the decay of I-131.

$$_{53}^{131}I \;\rightarrow\; _{54}^{131}Xe \;+\; _{-1}^{0}e$$
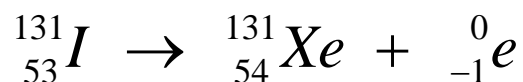
   b) What is the source of the beta particle emitted from the nucleus?

*A neutron is converted into a proton as a result of this action, an electron is ejected from the nucleus .*

The radioactivity of a sample of I-131 was measured. The data collected are plotted on the graph below.
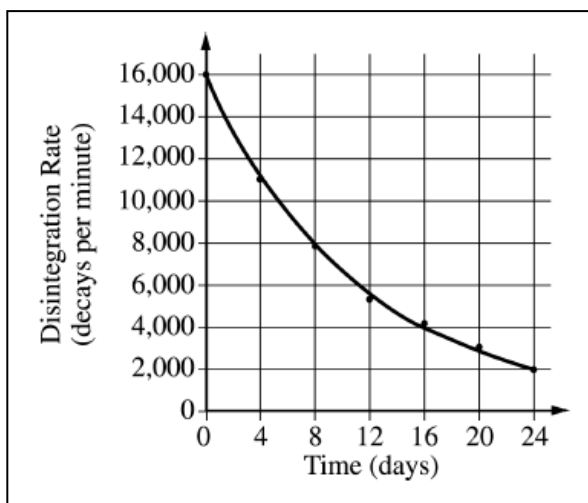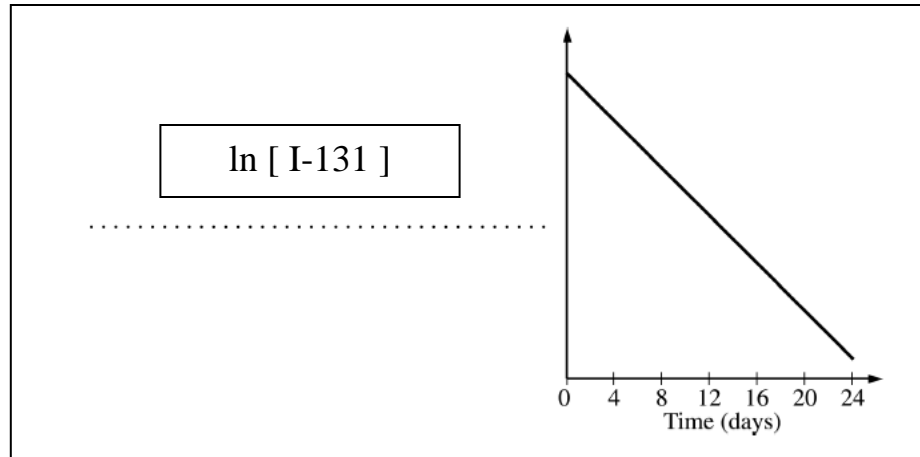


   c) Determine the half-life, $t_{1/2}$ , of I-131 using the graph above. Explain

*The half-life is 8 days.*

*The time required for the disintegration rate to fall from 16,000 to one-half its initial value (8,000).*

d) The data can be used to show that the decay of I-131 is a first-order reaction, as indicated on the graph below.



( i )  Label the vertical axis of the graph abovc.

( ii )  What are the units of the rate constant, $k$ , for the decay reaction?

$$days^{-1} \quad OR \quad \frac{1}{days} \quad OR \quad time^{-1} \quad OR \quad \frac{1}{time}$$

( iii )  Explain how the half-life of I-131 can be calculated using the slope of the line plotted on the graph.

***The slope of the line is $-k$. The slope is negative,. The half-life can then be calculated using the relationship:***

$$t_{1/2} = \frac{\ln{(0.5)}}{-k}$$

( iv )  Compare the value of the half-life of I-131 at $25^0C$ to its value at $50^0C$.

***The half-life value will be the same at different temperatures. The half-life of a nuclear decay process is independent of temperature (unlike chemical reactions)***