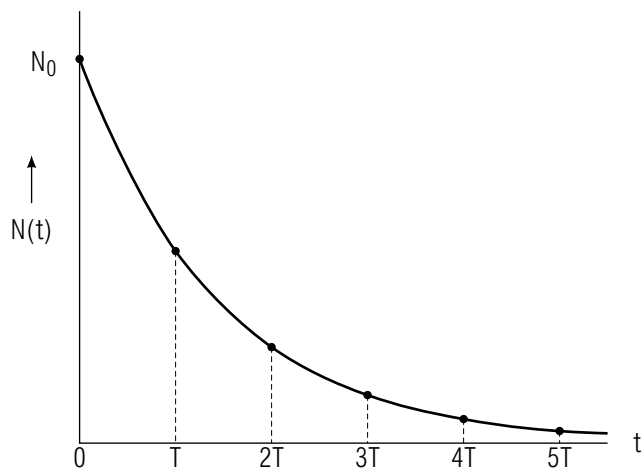


## SOME USES OF RADIOACTIVITY



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by  
Peter Signell

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Title: **Some Uses of Radioactivity**

Author: P. Signell, Department of Physics, Michigan State University,  
East Lansing, MI 48824; (517) 353-2047

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**Input Skills:**

1. Use the exponential decay law and rate of decay data to deduce decay parameters and also rates at other times (MISN-0-311) or (MISN-0-264).

**Output Skills (Knowledge):**

- K1. Starting from the exponential decay law, derive the relationship between the “disintegration constant” (also called “decay constant”) and the “half-life.”
- K2. Solve these problems in *Physics*, Alonso and Finn: 22.14c (including a numerical check), 22.16, and 22.17. Closed book, no answers provided.

**External Resources (Required):**

1. M. Alonso and E.J. Finn, *Physics*, Addison-Wesley (1970). See this module’s Local Guide for availability.

**Post-Options:**

1. “Quantum Tunnelling Through a Barrier: Pictures, Probability Flow, Reactions” (MISN-0-250).

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Andrew Schnepf	Webmaster
Eugene Kales	Graphics
Peter Signell	Project Director

ADVISORY COMMITTEE

D. Alan Bromley	Yale University
E. Leonard Jossem	The Ohio State University
A. A. Strassenburg	S. U. N. Y., Stony Brook

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### 1. Procedure

Read Sections 22.1, 22.2, 22.7, 22.8 in *Physics*, by M. Alonso and E. J. Finn (Addison-Wesley, 1970) (see this module's *Local Guide* for availability).<sup>1</sup>

### 2. Problems

22.13 There are  $3.15 \times 10^7$  sec/yr.

22.14 In addition, compute the *activity* of the short-lived and long-lived substances separately, numerically, at the solution-time. Check the ratio.

22.16 (revised): Find:

- a. no.  $\text{Fe}^{59}$  atoms at  $t = 0$ ;
- b. no.  $\text{Fe}^{59}$  atoms at  $t = 12$  days;
- c. no.  $\text{Fe}^{59}$  atoms in oil sample;
- d. no.  $\text{Fe}^{59}$  atoms in all oil;
- e. fraction of all  $\text{Fe}^{59}$  atoms which are in the oil;
- f. mass of Fe in oil.

### 3. Answers

22.13: Book answer is OK.

22.16:  $1.874 \times 10^{15}$ ,  $1.558 \times 10^{15}$ ,  $5.514 \times 10^9$ ,  $2.095 \times 10^{11}$ ,  $1.345 \times 10^{-4}$ , 3.4 mg.

22.17: 1160 B.C.

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<sup>1</sup>For an examination of the microscopic details of the nuclear  $\alpha$ -decay process see "Quantum Tunnelling Through a Barrier: Pictures, Probability Flow, Reactions" (MISN-0-250).

## LOCAL GUIDE

**Reference:** The readings for this module, from *Physics* by Alonso and Finn, are available in the Physics-Astronomy Library. Ask for "the readings for CBI Unit 252." Do not ask for the book.

## MODEL EXAM

1. See Output Skill K1 in this module's *ID Sheet*.
2. Problem 22.16, A & F (Output Skill K2).

### **Brief Answers:**

1. See this module's *textual material*.
2. See this module's *ANSWERS* section.