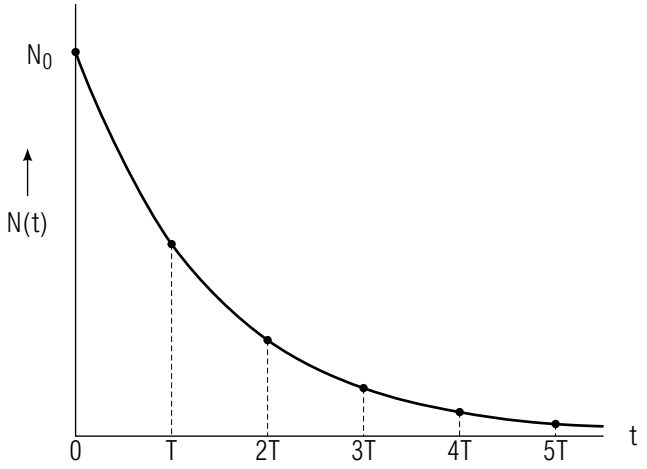
PHYSNET

MISN-0-252

SOME USES OF RADIOACTIVITY



Project PHYSNET Physics Bldg. Michigan State University East Lansing, MI

SOME USES OF RADIOACTIVITY

by

Peter Signell

Title: **Some Uses of Radioactivity**

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Length: 1 hr; 8 pages

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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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).[1]

2. Problems

22.13 There are 3.15×10^7 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. Fe^{59} atoms at $t = 0$;

b. no. Fe^{59} atoms at $t = 12$ days;

c. no. Fe^{59} atoms in oil sample;

d. no. Fe^{59} atoms in all oil;

e. fraction of all Fe^{59} atoms which are in the oil;

f. mass of Fe in oil.

3. Answers

22.13: Book answer is OK.

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

22.17: 1160 B.C.

[1]For an examination of the microscopic details of the nuclear α-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.