Review

Student Text Pages
356 to 357

Suggested Timing
60–75 min

Tools
- grid paper
- graphing calculator

Related Resources
- G–1 Grid Paper
- BLM 6–8 Chapter 6 Review

Study Guide

Use the following study guide to direct students who have difficulty with specific questions to appropriate examples to review.

Question	Section(s)	Refer to
1	6.1	Example 2 (page 316)
2	6.1	Example 2 (page 316)
3	6.2	Example 1 (page 324)
4	6.2	Example 3 (page 325)
5	6.2	Example 4 (pages 326–327)
6	6.2	Example 2 (pages 324–325)
7	6.2	Example 2 (pages 324–325), Example 3 (page 325)
8	6.3	Example 1 (pages 332–333), Example 2 (pages 333–336)
9	6.3	Example 2 (pages 333–336)
10	6.3	Investigate (pages 331–332)
11	6.3	Example 3 (pages 336–337)
12	6.4	Example 1 (page 343)
13	6.4	Example 3 (page 345)
14	6.4	Example 2 (page 344)
15	6.4	Example 4 (pages 345–346)
16	6.5	Example 1 (pages 349–350)
17	6.5	Example 3 (page 352)
18	6.5	Example 2 (pages 351–352)
19	6.5	Example 2 (pages 351–352)

Problem Wrap-Up

Student Text Page
357

Suggested Timing
40–75 min

Tools
- computer
- Internet
- library

Related Resources
- BLM 6–9 Chapter 6 Problem Wrap-Up Rubric

Summative Assessment
- Use **BLM 6–9 Chapter 6 Problem Rubric** to assess student achievement.

Level 3 Sample Response

Many radioactive substances undergo a spontaneous reaction known as nuclear decay, in which the radioactive substance is converted into a different material while energy is released. The nuclear decay equation is $N(t) = N_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$, where $N(t)$ is the number of particles, or mass, of a radioactive substance as a function of time, t; N_0 is the initial number of radioactive particles, or initial mass; and h is the half-life of the radioactive substance, that is, the time required for a sample to decay to one-half of its initial amount.

Nuclear decay is important in a number of fields such as nuclear power generation, medical treatment, and carbon dating of fossilized archaeological artefacts.

Sample Problems:

1. A radioactive sample with a half-life of 20 min has an initial mass of 100 g. How much will remain after:
a) 5 min? **b)** 1 h?

2. A radioactive sample having an initial mass of 50 mg decays to 40 mg after 3 h. What is its half-life?

Solution to Sample Problems:

1. Substitute $N_0 = 100$ and $h = 20$ into the decay equation and solve for $N(5)$ and $N(60)$:

a) $N(t) = N_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$

$= 100\left(\frac{1}{2}\right)^{\frac{t}{20}}$

$N(5) = 100\left(\frac{1}{2}\right)^{\frac{5}{20}}$

$\doteq 84$

Approximately 84 g will remain after 5 min.

b) $N(60) = 100\left(\frac{1}{2}\right)^{\frac{60}{20}}$

$= 100(0.125)$

$= 12.5$

After 1 h, 12.5 g will remain.

2. Substitute $N_0 = 50$ and $N(3) = 40$ and solve for h.

$$N(t) = N_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$$
$$40 = 50\left(\frac{1}{2}\right)^{\frac{3}{h}}$$
$$0.8 = \left(\frac{1}{2}\right)^{\frac{3}{h}}$$
$$\log 0.8 = \log\left(\frac{1}{2}\right)^{\frac{3}{h}}$$
$$\log 0.8 = \frac{3}{h}\log\left(\frac{1}{2}\right)$$
$$h\log 0.8 = 3\log\left(\frac{1}{2}\right)$$
$$h = 3\left[\frac{\log\left(\frac{1}{2}\right)}{\log 0.8}\right]$$
$$\doteq 9.3$$

Therefore the half-life of this substance is approximately 9.3 h.

Level 3 Notes

Look for the following:

- Nuclear decay equation and variables are correctly identified with correct units identified or implied
- Some accurate background information is provided
- Two problems are posed and correctly solved with no errors, or one or two minor errors

What Distinguishes Level 2

- Nuclear decay equation is correctly identified but variables are not all correctly identified, or units are omitted or incorrect
- Background information is very brief or not entirely accurate
- Two problems are posed and solved with a few minor errors

What Distinguishes Level 4

- Nuclear decay equation and variables are correctly identified and clearly explained with correct units clearly identified
- Significant accurate background information of particular relevance and interest to the topic is provided
- Two problems are posed and correctly solved with no errors, accompanied by thorough explanation in the form of integrated narrative and/or multiple representations (i.e., equations, graphs, words, etc.)