- refrigeration (reduction of temperature)
- preserving large blocks of food (reducing surface area)
- choosing foodstuffs that naturally decay more slowly (chemical nature of reactants)

Explore an Issue: Debate: Food Preservation

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(a) (Answers will vary, but should include research from several stated sources, organized into relevant categories (e.g., from the manufacturing industry, from health-watch groups, from the medical community), and used to back up the students' arguments.)
(b) (Answers will vary, but should outline how and possibly why the vote changed.)

PRACTICE

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Making Connections

8. (Answers will vary, depending on career chosen and geographical location.)

PRACTICE

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Understanding Concepts

9. (a) $k = Ae^{-E_a/RT}$

At $T = 20^\circ C$,

$$E_a/RT = \frac{2.00 \times 10^5}{8.31 \times 293}$$

$$E_a/RT = 82.1$$

$$k_{20\ 200} = A \times e^{-82.1}$$

$$k_{20\ 200} = A \times 2.2 \times 10^{-36}$$

At $T = 25^\circ C$,

$$E_a/RT = \frac{2.00 \times 10^5}{8.31 \times 298}$$

$$E_a/RT = 80.8$$

$$k_{25\ 200} = A \times e^{-80.8}$$

$$k_{25\ 200} = A \times 8.1 \times 10^{-36}$$

$$\frac{k_{25\ 200}}{k_{20\ 200}} = \frac{A \times 8.1 \times 10^{-36}}{A \times 2.2 \times 10^{-36}}$$

$$\frac{k_{25\ 200}}{k_{20\ 200}} = 3.7$$

An increase in temperature of 5°C increases the rate almost four times.

(b) At $E_a = 180$ kJ/mol

$$E_a/RT = \frac{1.80 \times 10^5 \text{ J/mol}}{8.31 \times 293}$$

$$E_a/RT = 73.9$$

$$k_{20\ 180} = A \times e^{-73.9}$$

$$k_{20\ 180} = A \times 8.0 \times 10^{-33}$$

$$\frac{k_{20\ 180}}{k_{20\ 200}} = \frac{A \times 8.0 \times 10^{-33}}{A \times 2.2 \times 10^{-36}}$$