(d) $r = k[A]^2[C]^1$

$= 0.30\ L^2/(mol^2 \cdot s) \times (0.40\ mol/L)^2 \times 0.40\ mol/L$

$r = 1.9 \times 10^{-2}\ mol/(L \cdot s)$

PRACTICE

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Understanding Concepts

7. (a) 72 a is three half-lives.
Remaining mass, $m = 0.084\ g \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$

$m = 0.0105\ g$

(b) 192 a is eight half-lives.
Remaining mass, $m = 0.084 \times (\frac{1}{2})^8$

$= \frac{0.084\ g}{256}$

$m = 3.3 \times 10^{-4}\ g$

80 years,

8. (a) $t_{1/2} = \frac{0.693}{k}$

$= \frac{0.693}{2.34 \times 10^{-3}\ s^{-1}}$

$t_{1/2} = 296\ s$

(b) 12.5% is 1/8 or $(1/2)^3$,which suggests three half-lives have passed.

The time elapsed will be $3 \times 296\ s = 888\ s$.

Making Connections

9. Radioisotopes in such patients emit dangerous radioactive particles within the body and to the surroundings, but this emission declines over time. The most appropriate isotopes are those with a short half-life.

SECTION 6.3 QUESTIONS

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Understanding Concepts

1. First-order reaction implies a rate law in which only one species is present, with a rate dependence of one (e.g., $r = k[A]^1$).
Second-order reaction implies a rate law in which two molecules are present, with a total rate dependence of two (e.g., $r = k[A]^2$ or $r = k[A][B]$).
2. (a) The orders of reaction are: 1 with respect to $Cl_{2(g)}$, and 2 with respect to $NO_{(g)}$.

(b) The rate would double.

(c) The rate would multiply by 9.

(d) $k = \frac{r}{[Cl_2]\ [NO]^2}$

$= \frac{0.0242\ mol/(L \cdot s)}{0.20\ mol/L \times (0.20\ mol/L)^2}$

$k = 3.0\ L/(mol \cdot s)$

(e) $r = k\ [Cl_2]\ [NO]^2$

$= 3.00\ L/(mol \cdot s) \times 0.44\ mol/L \times (0.025\ mol/L)^2$

$r = 8.2(5) \times 10^{-4}\ mol/(L \cdot s)$

3. (a) $r = k$ [antibiotic]

   (b) $t_{1/2} = 0.693/k$

   $$= \frac{0.693}{1.40\ a^{-1}}$$

   $t_{1/2} = 0.495$ a

   (c) 2.0 a is about 4 half-lives.

   $m = 20\ g \times (1/2)^4$

   m = ~~2.5~~ g 1.25 g

4. 1.84×10^6 a is $\frac{1.84 \times 10^6\ a}{2.3 \times 10^8\ a}$ = 8 half-lives

   $m = 10.0\ g \times (\frac{1}{2})^8$

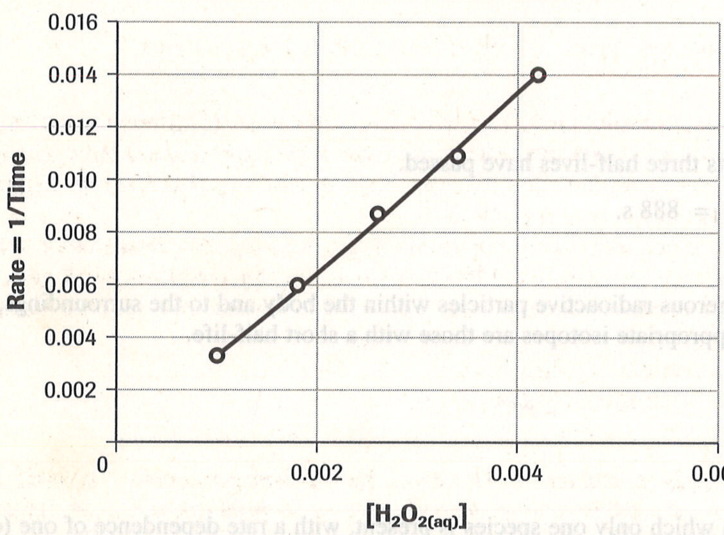
   $m = 0.039$ g

Applying Inquiry Skills

5. **Analysis**

   (a) The order of reaction can be determined by plotting 1/time vs. $[H_2O_2]$.

First-Order Plot at Different Concentrations



Second-Order Plot at Different Concentrations