

22. (a) We find the volume in cubic centimeters

$$193 \text{ gal} = (193 \text{ gal}) \left( \frac{231 \text{ in}^3}{1 \text{ gal}} \right) \left( \frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 = 7.31 \times 10^5 \text{ cm}^3$$

and subtract this from  $1 \times 10^6 \text{ cm}^3$  to obtain  $2.69 \times 10^5 \text{ cm}^3$ . The conversion  $\text{gal} \rightarrow \text{in}^3$  is given in Appendix D (immediately below the table of Volume conversions).

(b) The volume found in part (a) is converted (by dividing by  $(100 \text{ cm/m})^3$ ) to  $0.731 \text{ m}^3$ , which corresponds to a mass of

$$(1000 \text{ kg/m}^3) (0.731 \text{ m}^3) = 731 \text{ kg}$$

using the density given in the problem statement. At a rate of  $0.0018 \text{ kg/min}$ , this can be filled in

$$\frac{731 \text{ kg}}{0.0018 \text{ kg/min}} = 4.06 \times 10^5 \text{ min} = 0.77 \text{ y}$$

after dividing by the number of minutes in a year (365 days)(24 h/day) (60 min/h).