

Solutions for Practice Problems

6. a. $8 \times 10^{-7} \text{ kg}$; b. $7 \times 10^{-3} \text{ kg}$
 c. $3.96 \times 10^{-19} \text{ kg}$; d. $4.6 \times 10^{-12} \text{ kg}$
 7. a. $2 \times 10^{-8} \text{ m}^2$; b. $-1.52 \times 10^{-11} \text{ m}^2$
 c. $3.0 \times 10^{-9} \text{ m}^2$
 d. $0.46 \times 10^{-18} \text{ m}^2 = 4.6 \times 10^{-19} \text{ m}^2$

8. a. $5.0 \times 10^{-7} \text{ mg} + 4 \times 10^{-8} \text{ mg}$
 $= 5.0 \times 10^{-7} \text{ mg} + 0.4 \times 10^{-7} \text{ mg}$
 $= 5.4 \times 10^{-7} \text{ mg}$

b. $6.0 \times 10^{-3} \text{ mg} + 2 \times 10^{-4} \text{ mg}$
 $= 6.0 \times 10^{-3} \text{ mg} + 0.2 \times 10^{-3} \text{ mg}$
 $= 6.2 \times 10^{-3} \text{ mg}$

c. $3.0 \times 10^{-2} \text{ pg} - 2 \times 10^{-6} \text{ ng}$
 $= 3.0 \times 10^{-2} \times 10^{-12} \text{ g} - 2 \times 10^{-6} \times 10^{-9} \text{ g}$
 $= 3.0 \times 10^{-14} \text{ g} - 0.2 \times 10^{-14} \text{ g}$
 $= 2.8 \times 10^{-14} \text{ g}$

9. a. $(2 \times 10^4 \text{ m})(4 \times 10^8 \text{ m}) = 8 \times 10^{4+8} \text{ m}^2$
 $= 8 \times 10^{12} \text{ m}^2$

b. $(3 \times 10^4 \text{ m})(2 \times 10^6 \text{ m}) = 6 \times 10^{4+6} \text{ m}^2$
 $= 6 \times 10^{10} \text{ m}^2$

c. $(6 \times 10^{-4} \text{ m})(5 \times 10^{-8} \text{ m})$
 $= 30 \times 10^{-4-8} \text{ m}^2$
 $= 3 \times 10^{-11} \text{ m}^2$

d. $(2.5 \times 10^{-7} \text{ m})(2.5 \times 10^{16} \text{ m})$
 $= 6.25 \times 10^{-7+16} \text{ m}^2$
 $= 6.3 \times 10^9 \text{ m}^2$

10. a. $\frac{6 \times 10^8 \text{ kg}}{2 \times 10^4 \text{ m}^3} = 3 \times 10^{8-4} \text{ kg/m}^3$
 $= 3 \times 10^4 \text{ kg/m}^3$

b. $\frac{6 \times 10^8 \text{ kg}}{2 \times 10^{-4} \text{ m}^3} = 3 \times 10^{8-(-4)} \text{ kg/m}^3$
 $= 3 \times 10^{12} \text{ kg/m}^3$

c. $\frac{6 \times 10^{-8} \text{ m}}{2 \times 10^4 \text{ s}} = 3 \times 10^{-8-4} \text{ m/s}$
 $= 3 \times 10^{-12} \text{ m/s}$

d. $\frac{6 \times 10^{-8} \text{ m}}{2 \times 10^{-4} \text{ s}} = 3 \times 10^{-8-(-4)} \text{ m/s}$
 $= 3 \times 10^{-4} \text{ m/s}$

11. a. $\frac{(3 \times 10^4 \text{ kg})(4 \times 10^4 \text{ m})}{6 \times 10^4 \text{ s}}$
 $= \frac{12 \times 10^{4+4} \text{ kg} \cdot \text{m}}{6 \times 10^4 \text{ s}}$
 $= 2 \times 10^{8-4} \text{ kg} \cdot \text{m/s} = 2 \times 10^4 \text{ kg} \cdot \text{m/s}$

The evaluation may be done in several other ways. For example

$$\begin{aligned} & (3 \times 10^4 \text{ kg})(4 \times 10^4 \text{ m}) / (6 \times 10^4 \text{ s}) \\ &= (0.5 \times 10^4 \text{ kg/s})(4 \times 10^4 \text{ m}) \\ &= (0.5 \text{ kg/s})(4 \times 10^4 \text{ m}) \\ &= 2 \times 10^4 \text{ kg} \cdot \text{m/s} \end{aligned}$$

b. $(2.5 \times 10^6 \text{ kg})(6 \times 10^4 \text{ m}) / (5 \times 10^{-2} \text{ s}^2)$
 $= 15 \times 10^{6+4} \text{ kg} \cdot \text{m} / (5 \times 10^{-2} \text{ s}^2)$
 $= 3 \times 10^{10-(-2)} \text{ kg} \cdot \text{m/s}^2$
 $= 3 \times 10^{12} \text{ kg} \cdot \text{m/s}^2$