

- 1) a) $28.0 \text{ cm} \times \frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} = 0.28 \text{ m}$
 b) $1000. \text{ m} \times \frac{1 \text{ km}}{1 \times 10^3 \text{ m}} = 1.000 \text{ km}$
 c) $9.28 \text{ cm} \times \frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \times \frac{1 \text{ mm}}{1 \times 10^{-3} \text{ m}} = 92.8 \text{ mm}$
 d) $10.68 \text{ g} \times \frac{1 \text{ mg}}{1 \times 10^{-3} \text{ g}} = 1.068 \times 10^4 \text{ mg}$
 e) $6.8 \times 10^4 \text{ mg} \times \frac{1 \times 10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ kg}}{1 \times 10^3 \text{ g}} = 0.068 \text{ kg}$
 f) $8.54 \text{ g} \times \frac{1 \text{ kg}}{1 \times 10^3 \text{ g}} = 8.54 \times 10^{-3} \text{ kg}$
 g) $25.0 \text{ mL} \times \frac{1 \times 10^{-3} \text{ L}}{1 \text{ mL}} = 0.025 \text{ L}$
 h) $22.4 \text{ L} \times \frac{1 \text{ }\mu\text{L}}{1 \times 10^{-6} \text{ L}} = 2.24 \times 10^7 \text{ }\mu\text{L}$
- 2) a) $4.5 \text{ cm} \times \frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \times \frac{1 \text{ fm}}{1 \times 10^{-15} \text{ m}} = 4.5 \times 10^{13} \text{ fm}$
 b) $12 \text{ nm} \times \frac{1 \times 10^{-9} \text{ m}}{1 \text{ nm}} \times \frac{1 \text{ cm}}{1 \times 10^{-2} \text{ m}} = 1.2 \times 10^{-6} \text{ cm}$
 c) $8 \text{ km} \times \frac{1 \times 10^3 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ mm}}{1 \times 10^{-3} \text{ m}} = 8 \times 10^6 \text{ mm}$
 d) $164 \text{ mg} \times \frac{1 \times 10^{-3} \text{ g}}{1 \text{ mg}} = 0.164 \text{ g}$
 e) $0.65 \text{ kg} \times \frac{1 \times 10^3 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mg}}{1 \times 10^{-3} \text{ g}} = 6.5 \times 10^5 \text{ mm}$
 f) $5.5 \text{ kg} \times \frac{1 \times 10^3 \text{ g}}{1 \text{ kg}} = 5.5 \times 10^3 \text{ g}$
 g) $0.468 \text{ L} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = 468 \text{ mL}$
 h) $9.0 \text{ }\mu\text{L} \times \frac{1 \times 10^{-6} \text{ L}}{1 \text{ }\mu\text{L}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = 9.0 \times 10^{-3} \text{ mL}$
- 3) a) $650.89 \text{ Gm} \times \frac{1 \times 10^9 \text{ m}}{1 \text{ Gm}} \times \frac{1 \text{ pm}}{1 \times 10^{-12} \text{ m}} = 6.5089 \times 10^{23} \text{ pm}$
 b) $249 \text{ cm} \times \frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \times \frac{1 \text{ km}}{1 \times 10^3 \text{ m}} = 2.49 \times 10^{-3} \text{ km}$
 c) $45.14 \text{ dm} \times \frac{1 \times 10^{-1} \text{ m}}{1 \text{ dm}} \times \frac{1 \text{ Mm}}{1 \times 10^6 \text{ m}} = 4.514 \times 10^{-6} \text{ Mm}$
 d) $570 \text{ hg} \times \frac{1 \times 10^2 \text{ g}}{1 \text{ hg}} \times \frac{1 \text{ }\mu\text{g}}{1 \times 10^{-6} \text{ g}} = 5.7 \times 10^{10} \text{ }\mu\text{g}$
 e) $2383.7 \text{ Mg} \times \frac{1 \times 10^6 \text{ g}}{1 \text{ Mg}} \times \frac{1 \text{ mg}}{1 \times 10^{-3} \text{ g}} = 2.3837 \times 10^{12} \text{ mg}$
 f) $39.46 \text{ }\mu\text{g} \times \frac{1 \times 10^{-6} \text{ g}}{1 \text{ }\mu\text{g}} \times \frac{1 \text{ cg}}{1 \times 10^{-2} \text{ g}} = 3.946 \times 10^{-3} \text{ cg}$
 g) $139.42 \text{ pL} \times \frac{1 \times 10^{-12} \text{ L}}{1 \text{ pL}} \times \frac{1 \text{ nL}}{1 \times 10^{-9} \text{ L}} = 0.13942 \text{ nL}$
 h) $5.23 \times 10^{-4} \text{ TL} \times \frac{1 \times 10^{12} \text{ L}}{1 \text{ TL}} \times \frac{1 \text{ kL}}{1 \times 10^3 \text{ L}} = 5.23 \times 10^5 \text{ kL}$
- 4) a) $42.2 \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = 107 \text{ cm}$
 b) $0.64 \text{ m} \times \frac{1 \text{ cm}}{1 \times 10^{-2} \text{ m}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 25 \text{ in}$
 c) $2.00 \text{ in}^2 \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^2 = 12.9 \text{ cm}^2$
 d) $42.8 \text{ kg} \times \frac{1 \text{ lb}}{0.45359 \text{ kg}} = 94.4 \text{ lb}$
 e) $3.5 \text{ qt} \times \frac{0.946 \text{ L}}{1 \text{ qt}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = 3300 \text{ mL}$
 f) $20.0 \text{ L} \times \frac{1 \text{ gal}}{3.785 \text{ L}} = 5.28 \text{ gal}$
- 5) a) $35.6 \text{ m} \times \frac{1 \text{ cm}}{1 \times 10^{-2} \text{ m}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in}} = 117 \text{ ft}$
 b) $16.5 \text{ km} \times \frac{1 \text{ mi}}{1.609 \text{ km}} = 10.3 \text{ mi}$
 c) $4.5 \text{ in}^3 \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \left(\frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \right)^3 \times \left(\frac{1 \text{ mm}}{1 \times 10^{-3} \text{ m}} \right)^3 = 7.4 \times 10^4 \text{ mm}^3$
 d) $95 \text{ lb} \times \frac{453.59 \text{ g}}{1 \text{ lb}} = 4.3 \times 10^4 \text{ g}$
 e) $20.0 \text{ gal} \times \frac{3.785 \text{ L}}{1 \text{ gal}} = 75.7 \text{ L}$

$$f) 4.5 \times 10^4 \text{ ft}^3 \times \left(\frac{12 \text{ in}}{1 \text{ ft}} \right)^3 \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \left(\frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \right)^3 = \boxed{1.3 \times 10^3 \text{ m}^3}$$

$$4.5 \times 10^4 \text{ ft}^3 \times \left(\frac{1 \text{ m}}{3.281 \text{ ft}} \right)^3 = \boxed{1.3 \times 10^3 \text{ m}^3}$$

$$6) a) (27 \text{ cm}) \times (21 \text{ cm}) \times (4.4 \text{ cm}) = \boxed{2.5 \times 10^3 \text{ cm}^3}$$

$$b) (27 \text{ cm}) \times (21 \text{ cm}) \times (4.4 \text{ cm}) \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{1 \times 10^{-3} \text{ L}}{1 \text{ mL}} = \boxed{2.5 \text{ L}}$$

$$c) (27 \text{ cm}) \times (21 \text{ cm}) \times (4.4 \text{ cm}) \times \left(\frac{1 \text{ in}}{2.54 \text{ cm}} \right)^3 = \boxed{150 \text{ in}^3}$$

$$7) (16 \text{ in}) \times (8.0 \text{ in}) \times (10. \text{ in}) \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{1 \times 10^{-3} \text{ L}}{1 \text{ mL}} = \boxed{21 \text{ L}}$$

$$(16 \text{ in}) \times (8.0 \text{ in}) \times (10. \text{ in}) \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{1 \times 10^{-3} \text{ L}}{1 \text{ mL}} \times \frac{1 \text{ gal}}{3.785 \text{ L}} = \boxed{5.5 \text{ gal}}$$

$$(16 \text{ in}) \times (8.0 \text{ in}) \times (10. \text{ in}) \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \left(\frac{1 \times 10^{-2} \text{ m}}{1 \text{ cm}} \right)^3 = \boxed{0.021 \text{ m}^3}$$

$$8) 250.0 \text{ mL HCl} \times \frac{1.19 \text{ g HCl}}{1 \text{ mL HCl}} \times \frac{1 \text{ kg HCl}}{1 \times 10^3 \text{ g HCl}} = \boxed{297.5 \text{ kg HCl}}$$

$$9) 25.0 \text{ mL Hg} \times \frac{13.6 \text{ g Hg}}{1 \text{ mL Hg}} = \boxed{340. \text{ g Hg}}$$

$$10) \text{ density} = \frac{\text{mass}}{\text{volume}} \quad (\text{The only time you use this equation is when you are specifically told to calculate density!})$$

$$a) d = \frac{1032 \text{ g}}{1 \text{ L} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}}} = \boxed{1.032 \text{ g/mL}}$$

$$b) d = \frac{1032 \text{ g} \times \frac{1 \text{ kg}}{1 \times 10^3 \text{ g}}}{1 \text{ L}} = \boxed{1.032 \text{ kg/L}}$$

$$c) d = \frac{1032 \text{ g} \times \frac{1 \text{ lb}}{453.59 \text{ g}}}{1 \text{ L} \times \frac{1 \text{ gal}}{3.785 \text{ L}}} = \boxed{8.612 \text{ lb/gal}}$$

$$11) 3.1 \text{ L} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} \times \frac{1.03 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ lb}}{454.59 \text{ g}} = \boxed{7.0 \text{ lb}}$$

$$12) \quad \text{density} = \frac{\text{mass}}{\text{volume}} \quad d = \frac{24.12 \text{ g}}{25.00 \text{ mL}} = 0.9648 \frac{\text{g}}{\text{mL}}$$

$$13) \quad 100. \text{ g H}_2\text{SO}_4 \times \frac{1 \text{ mL H}_2\text{SO}_4}{1.84 \text{ g H}_2\text{SO}_4} = 54.3 \text{ mL H}_2\text{SO}_4$$