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UNITS, PHYSICAL QUANTITIES, AND VECTORS

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1.1. REPLY: Convert to feet and then to inches.  
SETUP:  $1 \text{ m} = 3.2808 \text{ ft}$ ;  $1 \text{ cm} = 0.01 \text{ m}$ ;  $1 \text{ in} = 2.54 \text{ cm}$   
ANSWER:  $(60)(0.01 \text{ m}) \left( \frac{3.2808 \text{ ft}}{1 \text{ m}} \right) \left( \frac{1 \text{ in}}{2.54 \text{ cm}} \right) = 7.87 \text{ in}$   
EVALUATE:  $1 \text{ m} = 100 \text{ cm}$ ;  $1 \text{ in} = 2.54 \text{ cm}$   
1.2. REPLY: Convert volume into  $\text{in}^3$  to  $\text{m}^3$ .  
SETUP:  $1 \text{ L} = 1000 \text{ cm}^3$ ;  $1 \text{ m} = 100 \text{ cm}$   
ANSWER:  $(1000 \text{ cm}^3) \left( \frac{1 \text{ m}}{100 \text{ cm}} \right)^3 = 28.9 \text{ m}^3$   
EVALUATE:  $1 \text{ m}^3$  is greater than  $1 \text{ cm}^3$  so the volume in  $\text{m}^3$  is a smaller number than the volume in  $\text{cm}^3$ , which is  $473 \text{ cm}^3$ .  
1.3. REPLY: Notice the speed of light is  $c = 3.0 \times 10^8 \text{ m/s}$ . Convert 1.00 year into  $\text{s}$ .  
SETUP: The speed of light is  $c = 3.00 \times 10^8 \text{ m/s}$ ;  $1 \text{ yr} = 3.156 \times 10^7 \text{ s}$   
ANSWER:  $r = \frac{c \cdot t}{4\pi} = \frac{(3.00 \times 10^8 \text{ m/s})(3.156 \times 10^7 \text{ s})}{4\pi} = 7.26 \times 10^{14} \text{ m}$   
EVALUATE:  $3.16 \times 10^7 \text{ s}$  (1 year)  $\approx 3.16 \times 10^7 \text{ s}$ ;  $3.00 \times 10^8 \text{ m/s} \times 3.16 \times 10^7 \text{ s} = 9.48 \times 10^{15} \text{ m}$   
1.4. REPLY: Convert the units being used kg and  $\text{m}^3$  to  $\text{cm}^3$ .  
SETUP:  $1 \text{ kg} = 1000 \text{ g}$ ;  $1 \text{ m} = 100 \text{ cm}$   
ANSWER:  $(1.8 \times 10^3 \text{ kg}) \left( \frac{1 \text{ g}}{1000 \text{ kg}} \right) \left( \frac{1 \text{ m}^3}{10^6 \text{ cm}^3} \right) = 1.8 \text{ cm}^3$   
EVALUATE: The ratio for conversion from a cubic because we need to convert  $\text{cm}^3$  to  $\text{m}^3$ .  
1.5. REPLY: Convert volume and then  $\text{m}^3$  to  $\text{L}$ .  
SETUP:  $1 \text{ L} = 1000 \text{ cm}^3$ ;  $1 \text{ m} = 100 \text{ cm}$   
ANSWER:  $(127 \text{ m}^3) \left( \frac{100 \text{ cm}}{1 \text{ m}} \right)^3 \left( \frac{1 \text{ L}}{1000 \text{ cm}^3} \right) = 1.27 \times 10^6 \text{ L}$   
EVALUATE: The volume is  $1.27 \times 10^6 \text{ L}$  so the volume in  $\text{cm}^3$  is a large number than the volume in  $\text{m}^3$ .

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