Dimensional Analysis

* Dimensional analysis is a problem-solving method that uses the fact that any number or expression can be multiplied by one without changing its value

Example 1

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How many centimetres are in 6.00 inches?

Solution:

$$6.00 \text{ inches} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = 15.2 \text{ cm}$$

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Solution:

24.0 cm x $$\frac{1 \text{ inch}}{2.54 \text{ cm}}$$ = 9.45 inches

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* You can also use dimensional analysis to string multiple factors together:

* Example: How many seconds are in to years?

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$$\frac{2.0 \text{ years}}{} \times \frac{365 \text{ days}}{\text{Year}} \times \frac{24 \text{ hr}}{\text{day}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{60 \text{ seconds}}{\text{min}}$$

$$= 6.3 \times 10^7 \text{ seconds}$$

Try It

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Hint 1 cm³ = 1 mm³

Try It

$$\frac{1 \text{ cm}^3}{10.5 \text{ g}} \times \frac{1000 \text{ mm}^3}{1 \text{ cm}^3 \ 1} \times \frac{1}{22.8 \text{ mm}} \times \frac{1}{76.1 \text{ mm}} \times \frac{25.92 \text{ g}}{1}$$

$$= 1.42 \text{ mm}$$

Solution

* Aluminum metal reacts with chlorine according to the following reaction

* $Al_{(s)} + Cl_{2(g)} \rightarrow AlCl_{3(s)}$

* What mass of aluminum metal is required ti make 8.10 g of aluminum chloride.

Try It!

* Aluminum metal reacts with chlorine according to the following reaction

* $2Al_{(s)} + 3Cl_{2(g)} \rightarrow 2AlCl_{3(s)}$

* What mass of chlorine metal is required ti make 8.10 g of aluminum chloride.

WAIT . . . Did you balance?

Solution

$$8.10 \text{ g AlCl}_3 \times \frac{1 \text{ mol AlCl}_3}{133.34 \text{ g AlCl}_3} \times \frac{2 \text{ mol Al}}{2 \text{ mol AlCl}_3} \times \frac{26.9815 \text{ g Al}}{1 \text{ mol Al}}$$

$$= 1.64 \text{ g Al}$$