

Section 8.3

Mass and Temperature



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Mass

- Although weight and mass are not the same, on Earth they are proportional to each other.
 - *Mass* is a measure of the amount of matter in an object.
 - *Weight* is the measure of gravitational pull on an object.



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Metric System

- The *kilogram* is the basic unit of mass in the metric system.
 - Example: A man has the mass of about 75 kg.
- The *gram* is relatively small and used in place of the ounce.
 - Example: A nickel has the mass of about 5 g.
- The *milligram* is used in the medical and scientific fields.
- The *metric tonne* (*t*) is used to express mass of heavy items. One metric tonne = 1000 kg.



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Example: Choosing an Appropriate Unit

Determine which metric unit you would use to express the mass of the following.

- | | |
|-------------|--------------------|
| a) A spider | c) A bicycle |
| b) A nickel | d) A box of cereal |

Solution:

- | | |
|---------------|--------------|
| a) Milligrams | c) Kilograms |
| b) Grams | d) Grams |

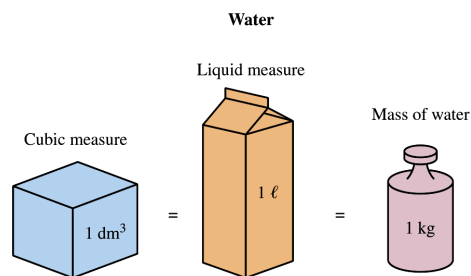


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Volume and Mass of Water

Volume in Cubic Units	Volume in Liters	Mass of Water
1 cm^3	= 1 mL	= 1 g
1 dm^3	= 1 L	= 1 kg
1 m^3	= 1 kL	= 1 t (1000 kg)



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Example: Capacity

A fish tank is 1 m long, 60 cm high and 260 mm wide.

- Determine the number of liters that the tank holds.
- What is the mass of the water in kilograms?



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Example: Capacity (continued)

Solution: $V = lwh$

- $= 1\text{m} \times 0.26\text{m} \times 0.6\text{m}$
 $= 0.156 \text{ m}^3$

Since 1 m^3 of water = 1 kL of water,
 $0.156 \text{ m}^3 = 0.156 \text{ kL}$, or 156 liters of water

- Since $1\text{L} = 1 \text{ kg}$, $156 \text{ L} = 156 \text{ kg}$ of water.



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Temperature

- The term degrees Celsius ($^{\circ}\text{C}$) is used to measure temperature.

Temperature		
$^{\circ}\text{C}$	$^{\circ}\text{F}$	Description
0°C	32°F	Water freezes
22°C	71.6°F	Comfortable room temperature
37°C	98.6°F	Body temperature
100°C	212°F	Water boils



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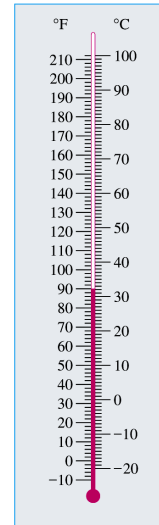
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Example: Choose °F or °C

- The temperature of a can of frozen juice is about 2 ___.
- The temperature of a person with a fever is about 101.5 ___.
- The temperature of a bowl of hot soup is about 175 ___.

Solution:

- a) °C b) °F c) °F



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Conversions

- To convert from Celsius to Fahrenheit use the following formula.
- To convert from Fahrenheit to Celsius use the following formula.

$$F = \frac{9}{5}C + 32$$

$$C = \frac{5}{9}(F - 32)$$



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Example: Conversions

The air temperature on a warm summer day is about 85°F. What is the equivalent temperature on the Celsius thermometer?

■ Solution: $C = \frac{5}{9}(F - 32)$

$$C = \frac{5}{9}(85 - 32)$$

$$C = \frac{5}{9}(53)$$

$$C \approx 29.4$$

- The equivalent temperature is about 29.4°C.



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Example: Conversions

The temperature of a cold glass of milk is about 5°C. What is the equivalent temperature on the Fahrenheit thermometer?

- Solution:

$$F = \frac{9}{5}C + 32$$

$$F = \frac{9}{5}(5) + 32$$

$$F = 9 + 32$$

$$F = 41$$

The equivalent temperature is about 41°F.



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