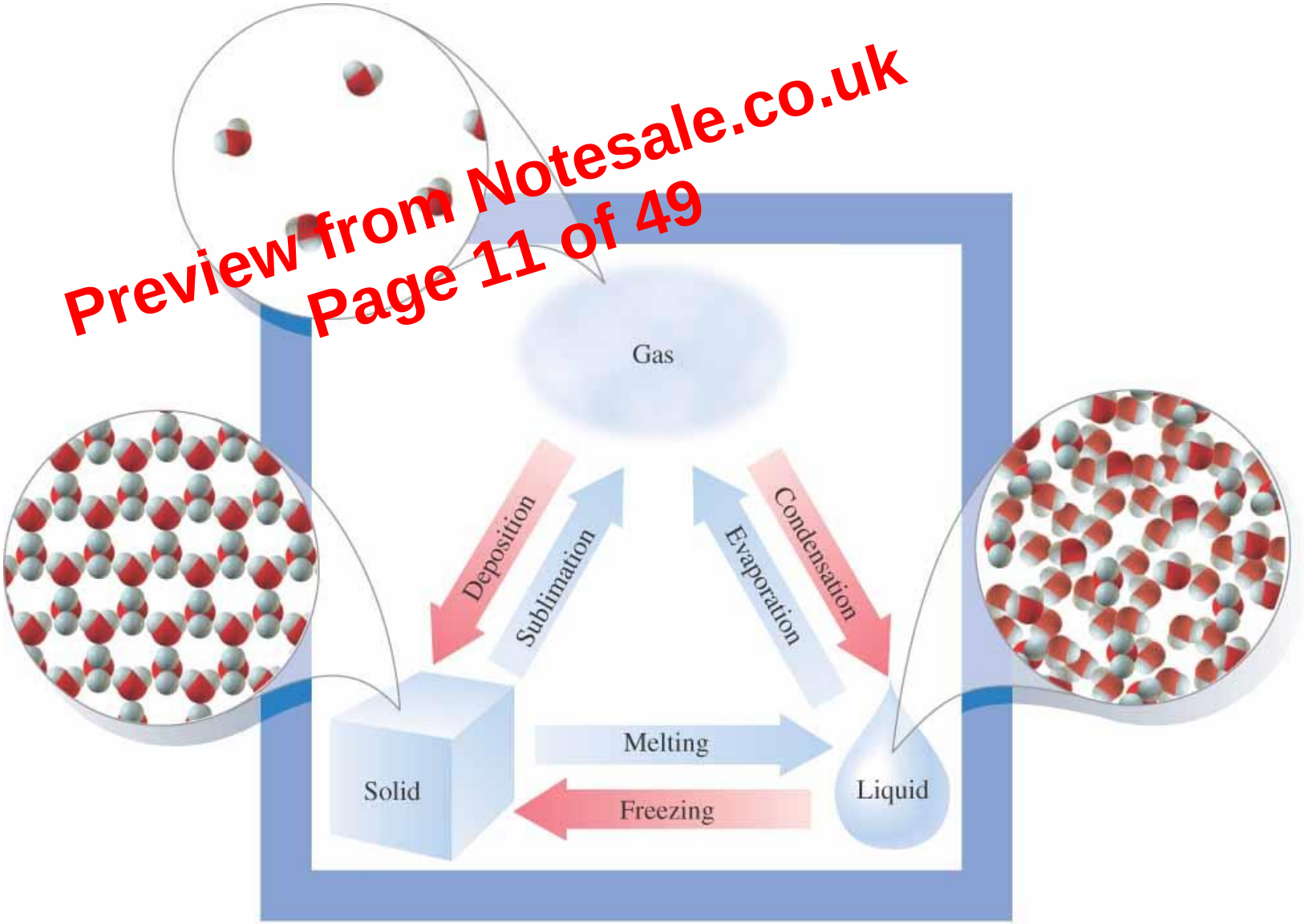


Matter - anything that occupies space and has ***mass***

mass – measure of the quantity of matter

SI unit of mass is the ***kilogram*** (kg)

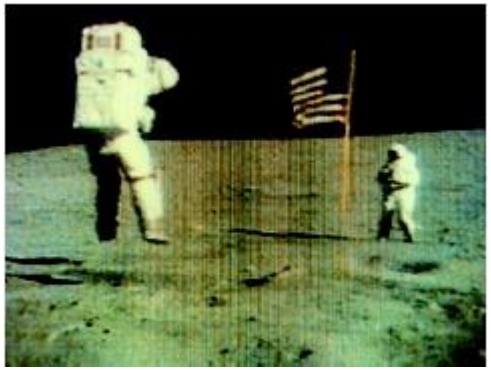
1 kg = 1000 g = 1 x 10^3 g

weight – force that gravity exerts on an object

weight = *c* x mass

on earth, *c* = 1.0

on moon, *c* ~ 0.1

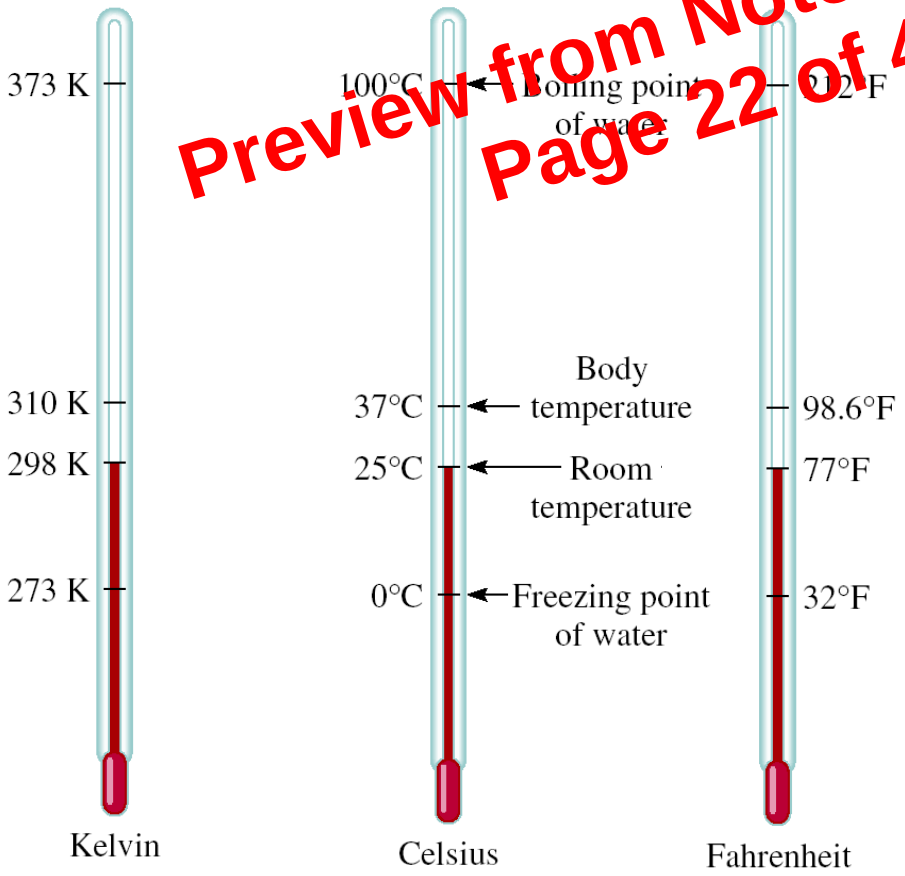


A 1 kg bar will weigh

1 kg on earth

0.1 kg on moon

A Comparison of Temperature Scales



$$K = {}^0C + 273.15$$

$273.15\ K = 0\ {}^0C$

$373.15\ K = 100\ {}^0C$

$$^0F = \frac{9}{5} \times {}^0C + 32$$

$32\ {}^0F = 0\ {}^0C$

$212\ {}^0F = 100\ {}^0C$

Example 1.2

Solution These three parts require that we carry out temperature conversions, so we need Equations (1.2), (1.3), and (1.4). Keep in mind that the lowest temperature on the Kelvin scale is zero (0 K); therefore, it can never be negative.

(a) This conversion is carried out by writing

$$\frac{9^\circ\text{F}}{5^\circ\text{C}} \times (224^\circ\text{C}) + 32^\circ\text{F} = 435^\circ\text{F}$$

(b) Here we have

$$(-452^\circ\text{F} - 32^\circ\text{F}) \times \frac{5^\circ\text{C}}{9^\circ\text{F}} = -269^\circ\text{C}$$

(c) The melting point of mercury in kelvins is given by

$$(-38.9^\circ\text{C} + 273.15^\circ\text{C}) \times \frac{1\ \text{K}}{1^\circ\text{C}} = 234.3\ \text{K}$$

Example 1.3

(f) 3000 mL -- This is an ambiguous case. The number of significant figures may be four (3.000×10^3), three (3.00×10^3), two (3.0×10^3), or one (3×10^3).

This example illustrates why scientific notation must be used to show the proper number of significant figures.

Example 1.4

Solution In addition and subtraction, the number of decimal places in the answer is determined by the number having the lowest number of decimal places. In multiplication and division, the significant number of the answer is determined by the number having the smallest number of significant figures.

(a)

$$\begin{array}{r} 11{,}254.1\ \text{g} \\ +\quad 0.1983\ \text{g} \\ \hline 11{,}254.2983\ \text{g} \end{array} \longleftarrow \text{round off to } 11{,}254.3\ \text{g}$$

(b)

$$\begin{array}{r} 66.59\ \text{L} \\ -\ 3.113\ \text{L} \\ \hline 63.477\ \text{L} \end{array} \longleftarrow \text{round off to } 63.48\ \text{L}$$

Example 1.6

Check From the preceding conversion factors you can show that 1 L = 1×10^{-3} m^3. Therefore, a 275-L storage tank would be equal to 275×10^{-3} m^3 or 0.275 m^3, which is the answer.

Example 1.7

Solution In Example 1.7 we saw that $1\ cm^3 = 1 \times 10^{-6}\ m^3$. The conversion factors are

$$\frac{1\ kg}{1000\ g} \quad \text{and} \quad \frac{1\ cm^3}{1 \times 10^{-6}\ m^3}$$

Finally

$$?\ kg/m^3 = \frac{0.808\ \cancel{g}}{1\ \cancel{cm^3}} \times \frac{1\ kg}{1000\ \cancel{g}} \times \frac{1\ \cancel{cm^3}}{1 \times 10^{-6}\ m^3} = 808\ kg/m^3$$

Check Because $1\ m^3 = 1 \times 10^6\ cm^3$, we would expect much more mass in $1\ m^3$ than in $1\ cm^3$. Therefore, the answer is reasonable.