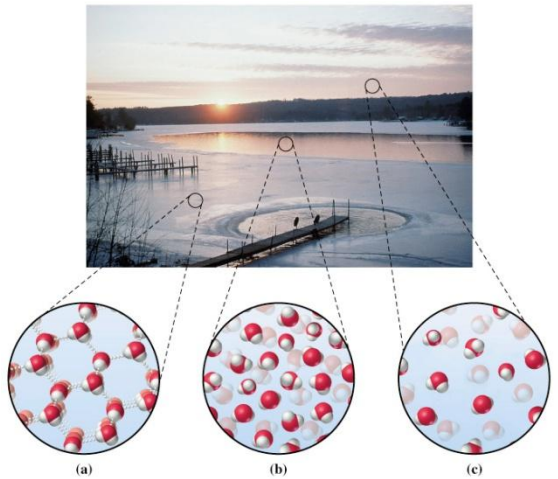
General Chemistry

Principles and Modern Applications

Petrucci • Harwood • Herring

8th Edition



Chapter 1: Matter—Its Properties and Measurement

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Contents

- Physical properties and states of matter
- Système International Units
- Uncertainty and significant figures
- Dimensional analysis

http://cwx.prenhall.com/petrucci/chapterhttp://cwx.prenhall.com/petrucci/chapter1http://cwx.prenhall.com/petrucci/chapter1/deluxe.html

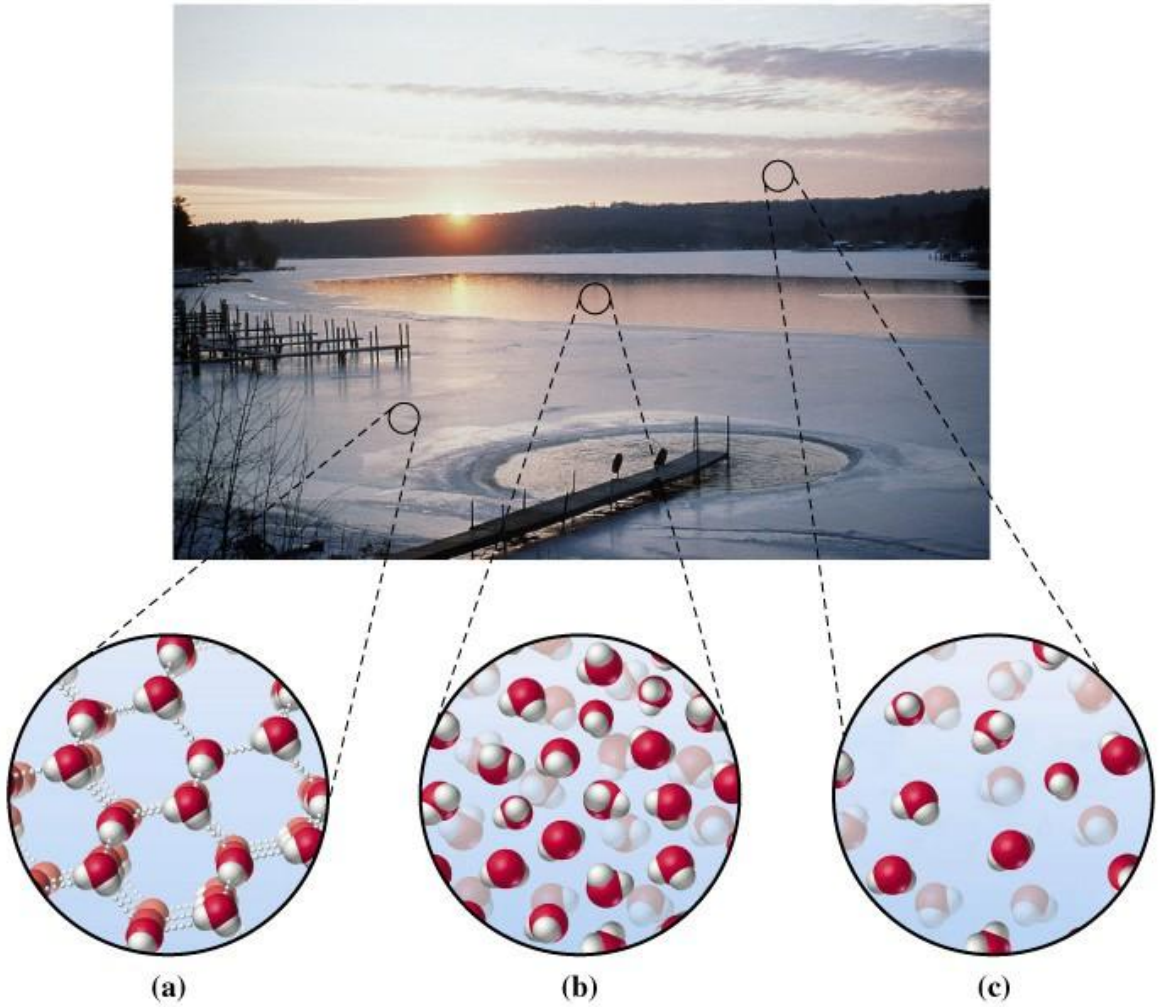
Properties of Matter

Matter: Occupies space, has mass and inertia

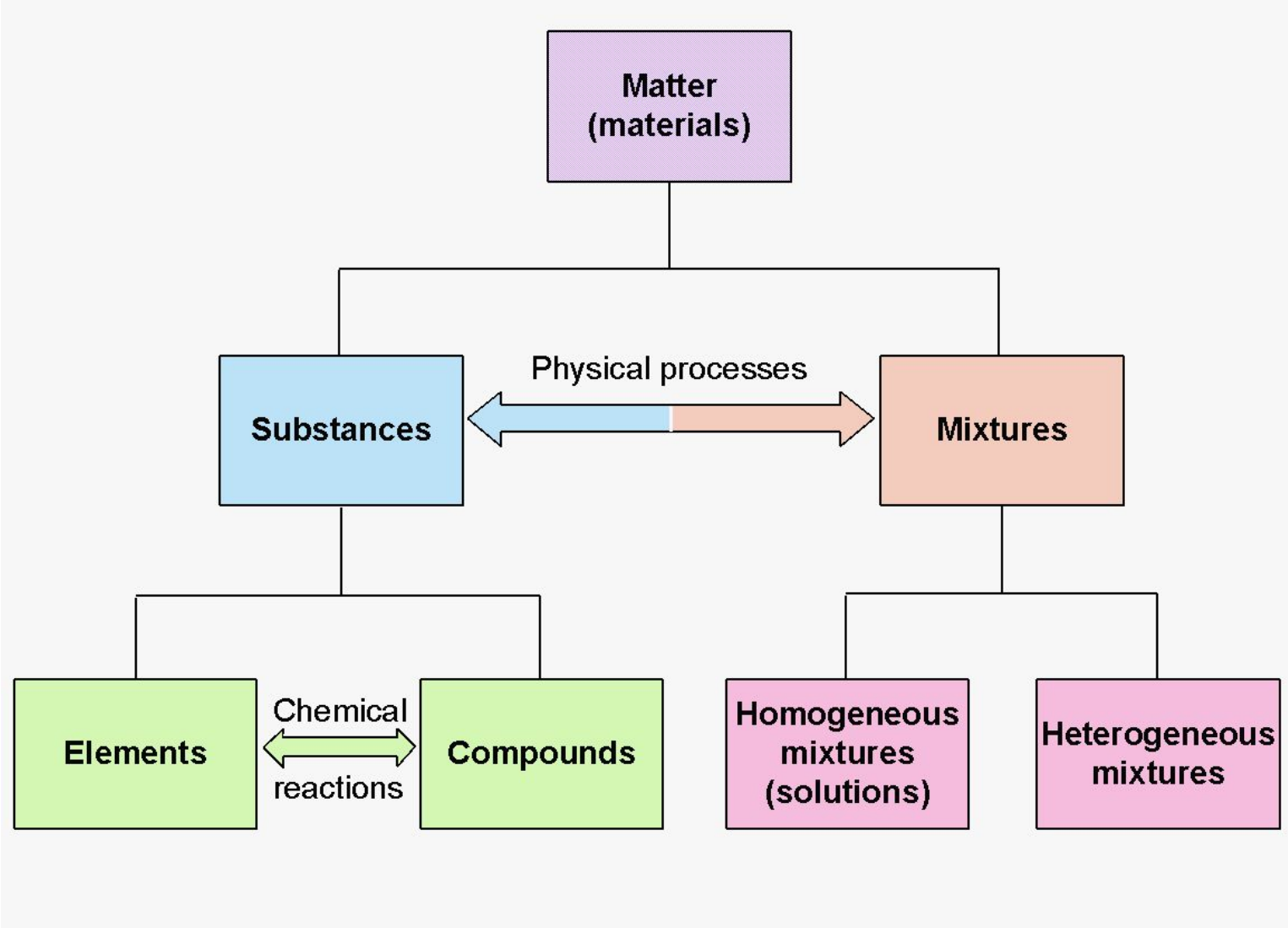
Composition: Parts or components
ex. H_2O, 11.9% H and 88.81% O

Properties: Distinguishing features
physical and chemical properties

States of Matter



Classification of Matter



Separations

(a)

(b)

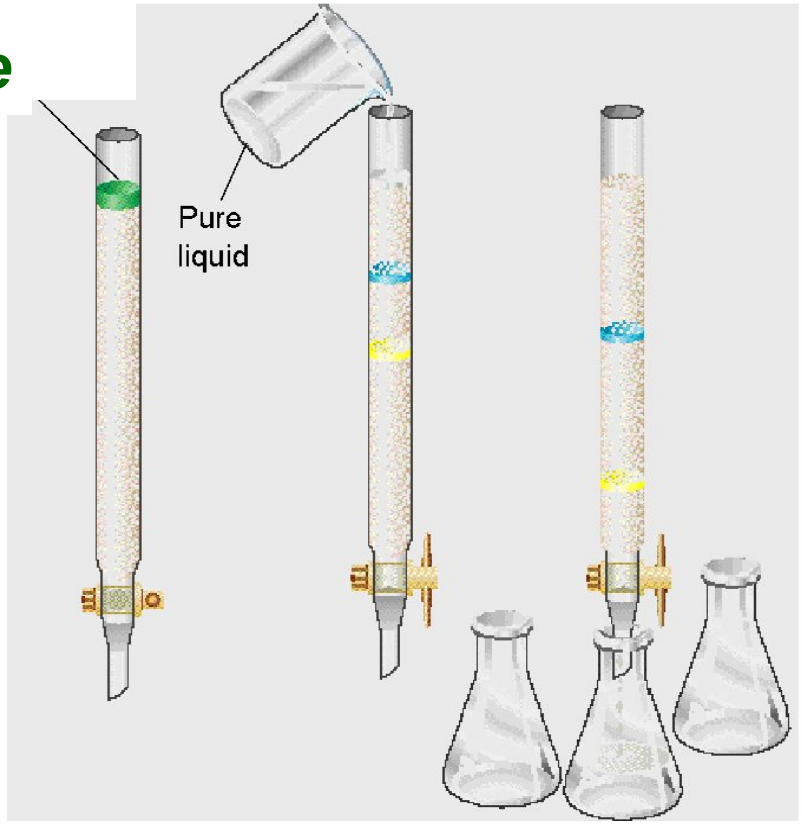
(c)

(d)

Separating Mixtures

Chromatography

mixture



Significant Figures

Count from left from first non-zero digit.

Number	**Significant Figures**
6.29 g	3
0.00348 g	3
9.0	2
1.0×10^{-8}	2
100 eggs	infinite
$\pi = 3.14159$	various

Adding and subtracting.

Use the number of decimal places in the number with the fewest decimal places.

$$\begin{array}{r} 1.14 \\ 0.6 \\ \underline{11.676} \\ 13.416 \end{array} \quad \square \quad 13.4$$

Significant figures

Multiplying and dividing.

Use the fewest significant figures.

$$0.01208 \div 0.236$$

$$= 0.0512$$

$$= 5.12 \times 10^{-2}$$

Rounding Off

3rd digit is increased if 4th digit ≥ 5

Report to 3 significant.figures.

10.235	□	10.2
12.4590	□	12.5
19.75	□	19.8
15.651	□	15.7

Units

S.I. Units

Length metre, m

Mass Kilogram, kg

Time second, s

Temperature Kelvin, K

Quantity Mole, 6.022×10^{23} mol^{-1}

Derived Quantities

Force Newton, kg m s^{-2}

Pressure Pascal, kg m^{-1} s^{-2}

Eenergy Joule, kg m^2 s^{-2}

Other Common Units

Length Angstrom, Å, 10^{-8} cm

Volume Litre, L, 10^{-3} m^3

Energy Calorie, cal, 4.184 J

Pressure

1 Atm = 101.325 kPa

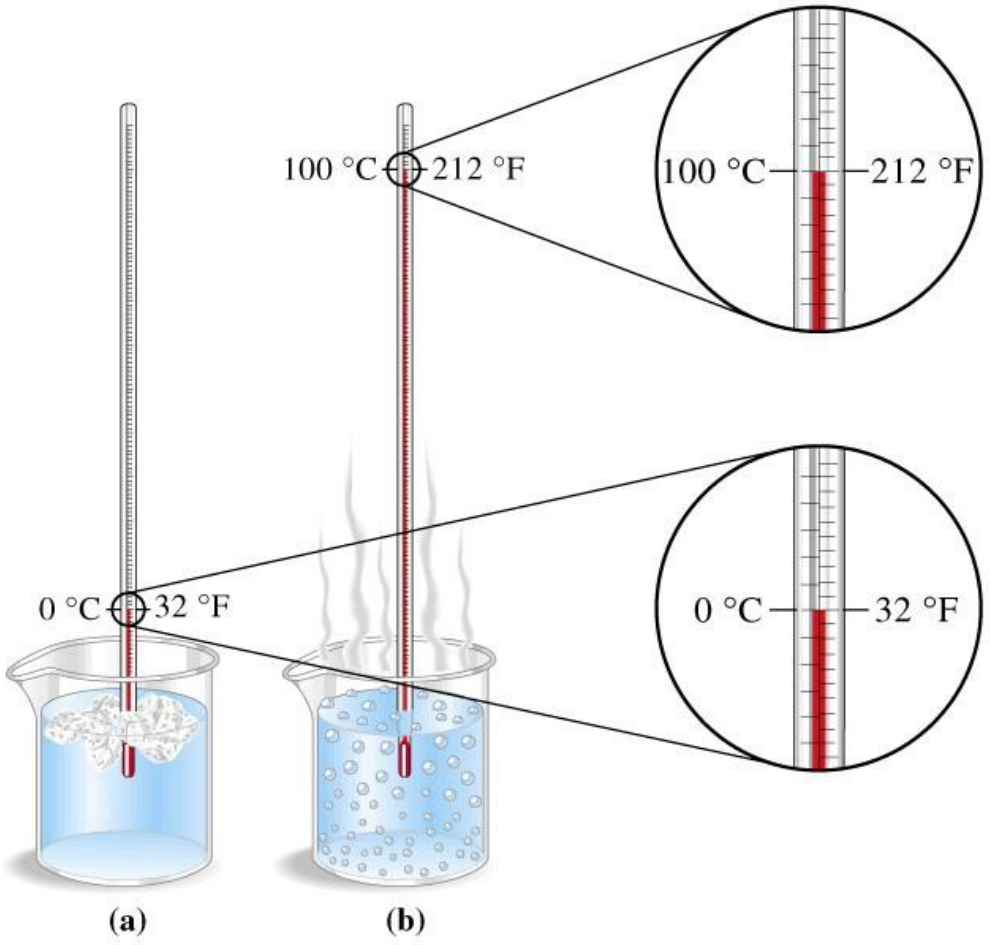
1 Atm = 760 mm Hg

TABLE 1.2 SI Prefixes

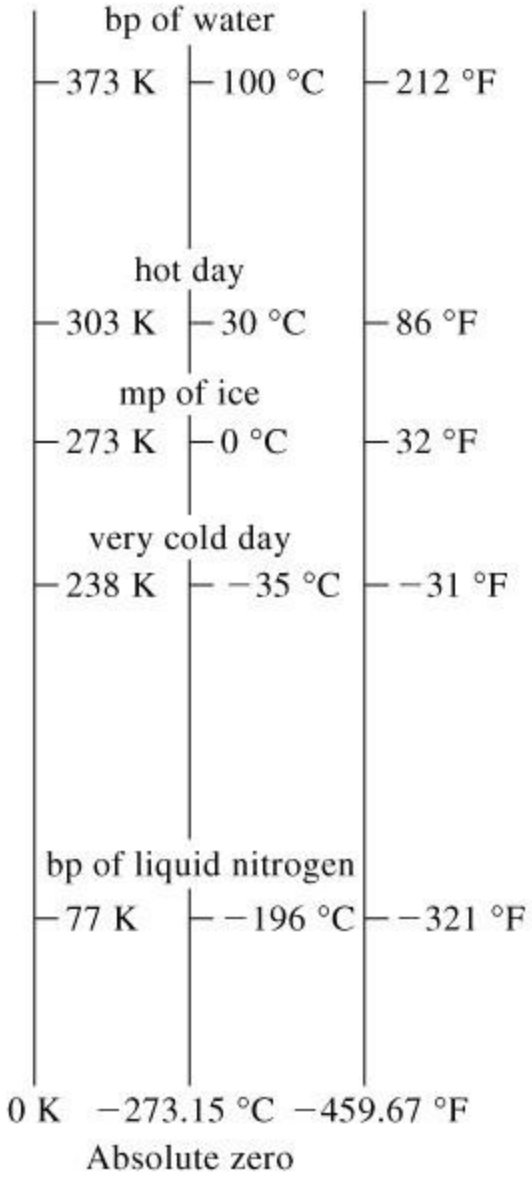
Multiple	Prefix
10^{18}	exa (E)
10^{15}	peta (P)
10^{12}	tera (T)
10^{9}	giga (G)
10^{6}	mega (M)
10^{3}	kilo (k)
10^{2}	hecto (h)
10	deca (da)
10^{-1}	deci (d)
10^{-2}	centi (c)
10^{-3}	milli (m)
10^{-6}	micro (μ)[a]
10^{-9}	nano (n)
10^{-12}	pico (p)
10^{-15}	femto (f)
10^{-18}	atto (a)

[a] The Greek letter μ (pronounced "mew").

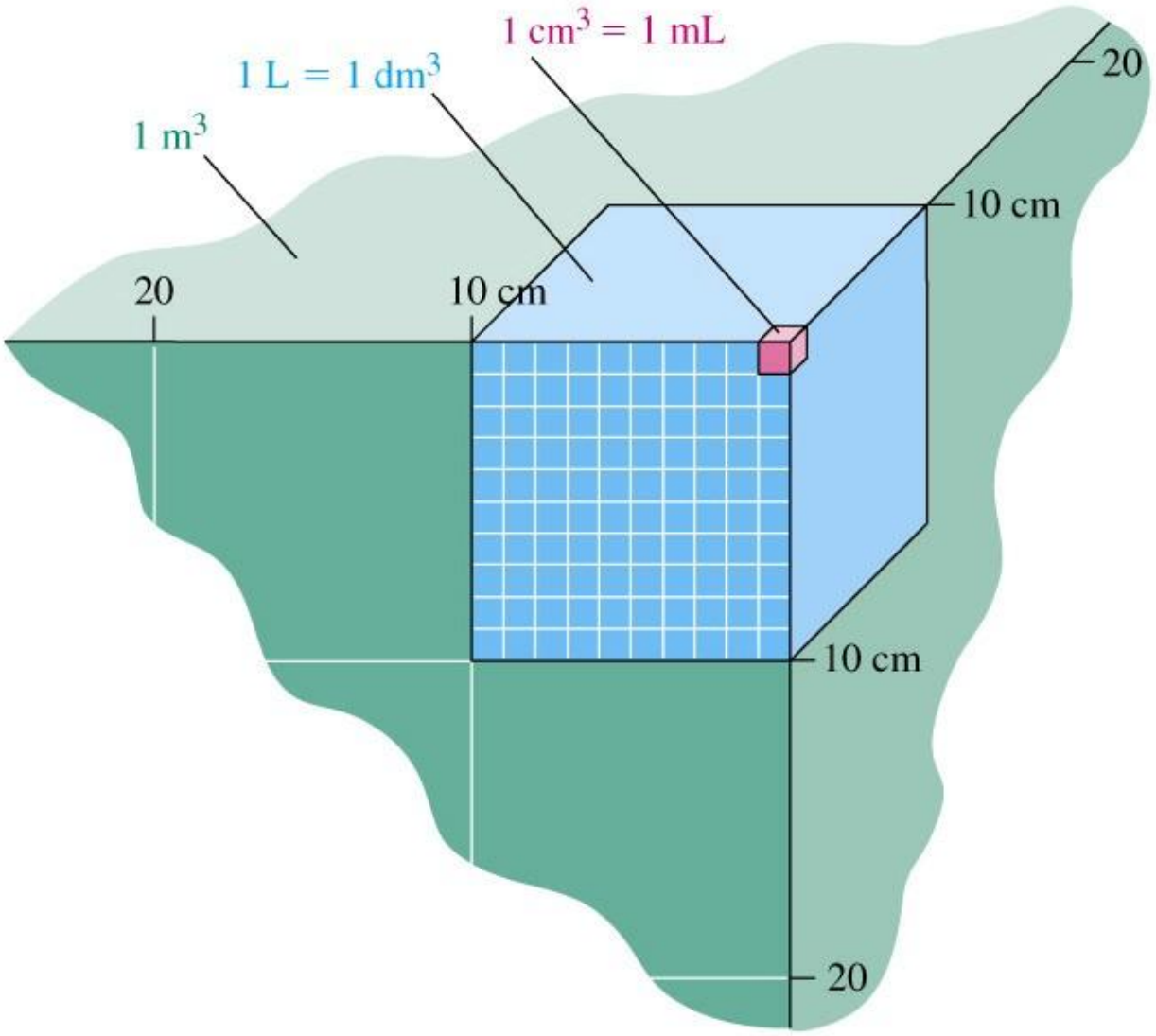
Temperature



Relative Temperatures



Volume



Density

$$\delta = m/V$$

$$m = V\delta \qquad\qquad V = m/\delta$$

g/mL

Mass and volume are extensive properties

Density is an intensive property

Conversion

What is the mass of a cube of osmium that is 1.25 inches on each side?

Have volume, need density = $22.48 g/cm^3$

(converts in. to cm) (converts cm to cm^3) (converts cm^3 to g osmium)

$$\text{? g osmium} = \left[1.25 \text{ in.} \times \frac{2.54 \text{ cm}}{1 \text{ in.}}\right]^3 \times \frac{22.48 \text{ g osmium}}{1 \text{ cm}^3} = 719 \text{ g osmium}$$

Wrong units

The Gimli Glider, Q86, p30

Uncertainties

- Systematic errors.
  - Thermometer constantly 2°C too low.
- Random errors
  - Limitation in reading a scale.
- Precision
  - Reproducibility of a measurement.
- Accuracy
  - How close to the real value.

End of Chapter Questions

1, 3, 5, 12, 14, 17,

18, 20, 30, 41, 49,

50, 61, 72, 74, 79

