Transition skills

1.1 Balancing equations

Balance the equations below.

1. .....C + ...O_2 $\longrightarrow$ .....CO

2. .....Ba + ...H_2O $\longrightarrow$ .....$Ba(OH)_2$ + ...H_2

3. .....C_2H_6 + ...O_2 $\longrightarrow$ .....CO_2 + ...H_2O

4. .....HCl + ...$Mg(OH)_2$ $\longrightarrow$ .....$MgCl_2$ + H_2O

5. .....N_2 + ...O_2 $\longrightarrow$ .....NO

6. .....Fe_2O_3 + ...C $\longrightarrow$ .....Fe + ...CO_2

7. .....CH_3CH_2OH + ...[O] $\longrightarrow$ .....CH_3COOH + ...H_2O

8. .....HNO_3 + ...CuO $\longrightarrow$ .....$Cu(NO_3)_2$ + H_2O

9. .....Al^{3+} + ...e^- $\longrightarrow$ .....Al

10. .....$[Fe(H_2O)_6]^{3+}$ + ...CO_3^{2-} $\longrightarrow$ .....$Fe(OH)_3(H_2O)_3$ + ...CO_2 + ...H_2O
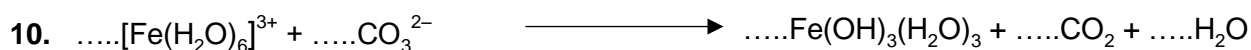
(10 marks)

Transition skills

1.2 Writing equations from text

The following questions contain a written description of a reaction. In some cases the products may be missing as you will be expected to predict the product using your prior knowledge.

For more advanced equations you may be given some of the formulae you need.

For each one, write a balanced symbol equation for the process.   (10 marks)

1. The reaction between silicon and nitrogen to form silicon nitride Si_3N_4.

    ....

2. The neutralisation of sulfuric acid with sodium hydroxide.

    ....

3. The preparation of boron trichloride from its elements.

    ....

4. The reaction of nitrogen and oxygen to form nitrogen monoxide.

    ....

5. The combustion of ethanol (C_2H_5OH) to form carbon dioxide and water only.

    ....

6. The formation of silicon tetrachloride ($SiCl_4$) from SiO_2 using chlorine gas and carbon.

    ....

7. The extraction of iron from iron(III) oxide (Fe_2O_3) using carbon monoxide.

    ....

8. The complete combustion of methane.

    ....

9. The formation of one molecule of ClF_3 from chlorine and fluorine molecules.

    ....

10. The reaction of nitrogen dioxide with water and oxygen to form nitric acid.

    ....

Transition skills

2.1 Expressing large and small numbers

Standard form and scientific form

Large and small numbers are often expressed using powers of ten to show their magnitude. This saves us from writing lots of zeros, expresses the numbers more concisely and helps us to compare them.

In standard form a number is expressed as;

$$a \times 10^n$$

where **a** is a number between 1 and 10 and **n** is an integer.

Eg, 160 000 would be expressed as 1.6×10^5

Sometimes scientists want to express numbers using the same power of ten. This is especially useful when putting results onto a graph axis. This isn't true standard form as the number could be smaller than 1 or larger than 10. This is more correctly called **scientific form**.

Eg, 0.9×10^{-2}, 2.6×10^{-2}, 25.1×10^{-2} and 101.6×10^{-2} are all in the same scientific form.

1. Express the following numbers using standard form.

   a. 1 060 000
   b. 0.001 06
   c. 222.2

   (3 marks)

2. The following numbers were obtained in rate experiments and the students would like to express them all on the same graph axes. Adjust the numbers to a suitable scientific form.

   | 0.1000 | 0.0943 | 0.03984 | 0.00163 |

   (3 marks)

3. Calculate the following without using a calculator. Express all values in standard form.

   a. $\dfrac{10^9}{10^5}$

   b. $\dfrac{10^7}{10^{-7}}$

   c. $\dfrac{1.2 \times 10^6}{2.4 \times 10^{17}}$

   d. $(2.0 \times 10^7) \times (1.2 \times 10^{-5})$

   (4 marks)

Transition skills

2.2 Significant figures, decimal places and rounding

For each of the numbers in questions 1–6, state the number of significant figures and the number of decimal places.

		Significant figures	Decimal places
1	3.131 88		
2	1000		
3	0.000 65		
4	1006		
5	560.0		
6	0.000 480		

(6 marks)

7. Round the following numbers to (i) 3 significant figures and (ii) 2 decimal places.

   a. 0.075 84
   b. 231.456

(4 marks)