Ratio and proportion

- Expressing a proportion as a fraction, decimal or percentage
- Comparing proportions
- Comparing two quantities using a ratio
- Simplifying a ratio and sharing an amount in a given ratio

Keywords

You should know

explanation 1

1 The proportions of the main gases that make the atmosphere on Earth are shown below. Unfortunately, they are mixed in with the proportions for the planet Mars.

| Other 1% | Nitrogen 3% | Carbon dioxide 95% | Oxygen 21% | Nitrogen 78% | Other 2% |

Copy and complete these tables by working out which information must go where.
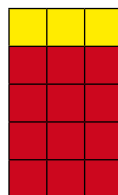
We need oxygen to breathe ...

Planet	Gas	Proportion
Earth		
	Total	100%

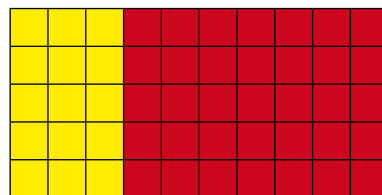| Planet	Gas	Proportion
Mars		
	Total	100%

2 These diagrams are made from red and yellow squares.

a Write down which diagram has

  i the most red squares

  ii the higher proportion of red squares

b Find the proportion of red squares in each diagram as

  i a fraction

  ii a percentage

A   B

3 In a football match, team A had 25 shots at goal with 17 on target.

Team B had 18 shots at goal with 12 on target.

  a Write the proportion of shots on target for each team as a percentage.

  b Which team seems to be more accurate?

4 Look at the statements written on these cards.

> Nine out of the top twenty fencers are left-handed.

> 82% of people are right-handed.

> Six of Europe's best ten table-tennis players are right-handed.

> Five out of the top twenty-five tennis players are left-handed.

  a Use the statements to write the following proportions as percentages.

    i Left-handed people out of all people.

    ii Left-handed tennis players in the world's top twenty-five.

    iii Left-handed players among Europe's best ten table-tennis players.

    iv Left-handed fencers out of the top twenty in the world.

  b What do your answers to part **a** suggest? Give a possible reason for this.

5 The table gives some information about typical brain weight and body weight for several species.

Species	Brain weight	Body weight
Dolphin	1700 g	170 000 g
Elephant	4000 g	4 000 000 g
Horse	420 g	350 000 g
Human	1400 g	70 000 g
Rabbit	12 g	2400 g
Rat	2.5 g	200 g

  a Do you think that brain weight is a good way to compare intelligence across species? Explain your answer.

  b Write brain weight as a proportion of body weight for each species.
Give your answers as fractions in their lowest terms.

  c Write the proportions found in part **b** as percentages.

  d Use your answers to part **c** to list the species in order, highest first.

  e Do you think that your list gives the species in order of intelligence?

Explain your answer.

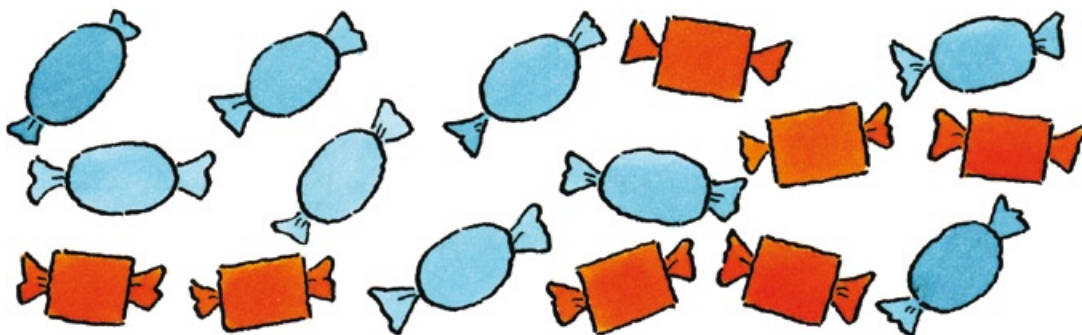**6** A typical tree shrew has a brain weight of 2.5 g and a body weight of 100 g.

    a What is brain weight as a proportion of body weight for the tree shrew as a percentage?

    b Compare this result with your answers to question **5**. What do you think this shows?

(explanation 2a) (explanation 2b)

7 Danny and Nadia are going to share some sweets.

    a What is the ratio of blue sweets to orange sweets?

    b What is the ratio of orange sweets to blue sweets?

    c What is the ratio of blue sweets to the total number of sweets?

    d Danny eats one of the orange sweets.

       What is the new ratio of blue sweets to orange sweets in its simplest form?

    e Nadia then eats 3 sweets. This makes the ratio of blue sweets to orange sweets $2:1$.

       How many blue sweets did Nadia eat?

8 Write each of these ratios in its simplest form.

    a $8:12$ **b** $27:9$ **c** $24:30$ **d** $30:25$

    e $62:31$ **f** $24:32$ **g** $7:21$ **h** $45:30$

    i $42:56$ **j** $120:270$ **k** $55:132$ **l** $68:51$

9 Write each of these ratios in its simplest form.

   a £1:2p   **b** 25cm:1m   **c** 10cm:1mm

   d 1km:200m   **e** £1.45:£2.90   **f** 40mm:3cm

   g 16cm:1m   **h** 12mm:6cm   **i** 97m:97km

10 Find the missing quantities.

   a £2:☐p = 4:1   **b** ☐mm:15cm = 1:5   **c** 3kg:☐g = 50:1

   d ☐cm:1m = 2:5   **e** 0.5m:☐cm = 2:1   **f** 1.2km:☐m = 3:4

11 In a survey, 55% of students in their first year at university said that they could drive a car. Write the ratio of drivers to non-drivers in its simplest form.

12 5% of Swedish Finewool sheep are black and the rest are white.
Write the ratio of black sheep to white sheep as simply as possible.

13 The ratio of occupied seats to empty seats for a theatre performance was 7:2.
What fraction of the seats were empty?

14 An internet company found that $\frac{7}{8}$ of its customers had access to broadband.
What is the ratio of broadband users to non-broadband users?

15 Yasmin mixes blue and yellow paint in the ratio 13:7 to make a shade of green.
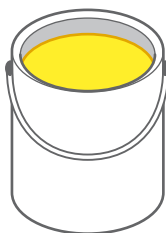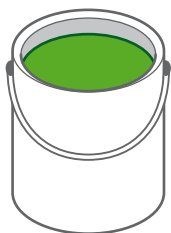
   a What percentage of the paint Yasmin uses is yellow?

   b Find the amount of blue paint she should use to make the following amounts of green paint.

   i 60 litres   **ii** 140 litres   **iii** 10 litres

explanation 3

16 Asad and Sarah share £400 in the ratio 5:3. How much does each receive?

17 In the diagram, AP:PB = 8:5.

A ———————————————————— P —————————— B

   a Find the distance AP if AB is 39 cm.

   b Find the distance PB if AB is 52 cm.

   c Find the distance AP if PB is 25 cm.

18 A shade of purple is made by mixing blue and red paint in the ratio 8:7.

Calculate the amount of each colour needed to make the following quantities.

   a 30 litres   **b** 75 litres   **c** 7.5 litres

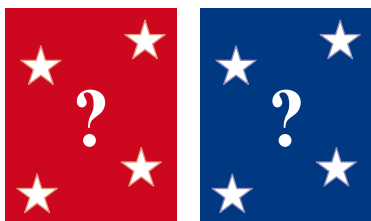**19** The ratio of girls to boys on a school trip is 5:4.

Find the number of girls if there are

   a 56 boys   **b** 72 boys   **c** 189 pupils altogether

20 A red number and a blue number are hidden from view.

Seven times the red number is the same as nine times the blue number.

   a What is the ratio of the red number to the blue number?

   b Find the numbers if

      i their sum is 80   **ii** their difference is 120