

Check-Up

30

Knowledge of other metric units

- a) How much does a litre of water weigh, in kilograms?
- b) A pupil has a 0.2-litre bottle of medicine for use at lunch-time. How many medicine-spoonfuls does this bottle hold?
- c) In the medicine cupboard is a tube of 0.015 kg of hydrocortisone cream and an inhaler containing 100 micrograms (100 μg) of Ventolin. Write these two quantities in grams.

Answers to check-up 30

- a) 1 kg. b) 40. c) $0.015 \text{ kg} = 15 \text{ g}$; $100 \text{ } \mu\text{g} = 0.0001 \text{ g}$.

Discussion and explanation of check-up 30

Liquid volume is usually measured in litres. A litre is the same volume as a thousand cubic centimetres. Imagine a cube with side 10 cm: that's the same volume as a litre! A kilogram is the weight of a litre of water. (NB: I use 'weight' in the colloquial sense. Some readers will be aware that we should say that a kilogram is the *mass* of a litre of water. For a discussion of the distinction, see chapter 22 of my book, *Mathematics Explained for Primary Teachers, 3rd edition, 2006*). Readers will be familiar with litre-cartons of milk and fruit juice. Since these materials are not very different in density from water – especially the economy range from the supermarket – if you put one of these cartons on the kitchen scales you will see that it registers about a kilogram or 1000 grams.

Units derived from the litre are: the millilitre, ml ($1000 \text{ ml} = 1 \text{ litre}$, $1 \text{ ml} = 0.001 \text{ litres} = \text{a thousandth of a litre}$); the centilitre, cl ($100 \text{ cl} = 1 \text{ litre}$, $1 \text{ cl} = 0.01 \text{ litres} = \text{a hundredth of a litre}$); the decilitre, dl ($10 \text{ dl} = 1 \text{ litre}$, $1 \text{ dl} = 0.1 \text{ litres} = \text{a tenth of a litre}$). A miserly cup of coffee in the head's office would be about 1 decilitre (100 ml). The mid-morning mug of coffee in the staff-room would be about 2 decilitres (200 ml). The bottle of wine you drink when you get home from school may be labelled 750 ml, or 75 cl, or 7.5 dl, or 0.75 litres. You should get five 150-ml glasses out of this. The 0.2 litres in the medicine bottle is therefore 200 ml. Medicine spoons are usually designed for 5-ml doses, hence 40 spoonfuls in the bottle. If you feel more at home with pints than litres, then you should note that a pint is about 568 ml or 0.568 litres, or rather more than half a litre. Even though petrol is no longer sold in gallons, this old imperial measure still surfaces occasionally in conversation. So, for reference, a gallon is about $4\frac{1}{2}$ litres. Out of interest, ask your colleagues if they know roughly how many miles to the litre they can do in their car. I find that most people still talk about miles per gallon.

Since a kilogram is 1000 grams (1000 g), we can convert between the two by multiplying or dividing by 1000. So, for example, $0.015 \text{ kg} = 15 \text{ g}$. The old imperial pound-weight is about 454 g, or 0.454 kg. Most produce that used to be sold in packs of one pound or half a pound are now sold in 500-g or 250-g packs. In (c) I have introduced another prefix, *micro*, symbolised by the Greek

letter μ (mu). This stands for 'one millionth'. So a microgram, used for very small quantities, is 0.000001 g. The $100\mu\text{g}$ in this question is therefore $100 \times 0.000001 \text{ g} = 0.0001 \text{ g}$.

Summary of key ideas

- ◆ Liquid volume is measured in litres: a litre is the same volume as 1000 cm^3 .
- ◆ $1 \text{ litre} = 10 \text{ dl}$ (10 decilitres) = 100 cl (100 centilitres) = 1000 ml (1000 millilitres).
- ◆ 1 litre of water weighs the same as 1 kilogram (1 kg).
- ◆ $1 \text{ kg} = 1000 \text{ g}$ (1000 grams).
- ◆ A medicine spoon holds 5 ml; a wine bottle holds 750 ml.
- ◆ Some useful equivalents in imperial units: a pint is rather more than half a litre (about 568 ml); a gallon is about four and a half litres; a kilogram is rather more than two pounds (about 2.2 pounds).

Further practice

Do not use a calculator.

- 30.1** Purchasing factor 20 sun-screen prior to a class field-trip, a teacher has a choice of paying £6.50 for half a litre or £5 for 400 ml. Without using a calculator, decide which is the better buy.
- 30.2** A medicine bottle is labelled 1.25 dl. Write this volume in litres and then in millilitres. How many medicine-spoonfuls is this?
- 30.3** Which is greater: a) a quarter of a pound or 100 g? b) half a pint or 330 ml? c) 40 litres or 8 gallons? d) 10 stone or 70 kg? (1 stone = 14 pounds)
- 30.4** Standard photocopier paper is 80 g per m². So, what is the weight of one sheet of A4 paper? What is the weight of a ream, in kg? Assuming an envelope weighs no more than four sheets, how many sheets of this paper can you confidently post with one first-class stamp (maximum weight allowed 60 g)?