

Writing Scientific English

A textbook of English as a
Foreign Language for students of
Physical and Engineering Sciences

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Unit 2 Dimensions and properties

Dimensions

The dimensions of an object are its length, height, volume etc.

A solid has three dimensions.

A surface has two dimensions.

A line has one dimension.

A point has no dimensions.

There are several different ways of describing dimensions in English. The simplest way—and the most common way outside the field of science and technology—uses *be* as the main verb. We will call it structure 1. Here are some examples:

	<i>be</i>		<i>adjective</i>
<i>x</i>	<i>is</i>	<i>3 centimeters</i>	<i>long.</i>
<i>The mountain</i>	<i>is</i>	<i>2,150 meters</i>	<i>high.</i>
<i>The river</i>	<i>is</i>	<i>50 meters</i>	<i>wide.</i>
<i>The well</i>	<i>is</i>	<i>45 meters</i>	<i>deep.</i>
<i>The pipes</i>	<i>are</i>	<i>4-5 centimeters</i>	<i>thick.</i>
<i>The river</i>	<i>is</i>	<i>50 meters</i>	<i>broad.</i>

You will meet two possible spellings of words like *meter* and *centimeter*. The *-er* spelling (which is American) is used here rather than the *-re* spelling (which is British). The *-er* spelling is easier and more logical.

Wide and *broad* usually mean the same thing and can be used one instead of the other. This can be seen in the two statements about the river.

Tall and *high* also mean the same thing, but they cannot usually be used one instead of the other.

Tall is used of physical objects which are much longer in height than in width.

High is used of rounder or squarer objects. Therefore we say *a tall tower* but *a high dam*.

Also notice that only *high* can be used when describing things which are not physical objects: *a high speed, high pressure* etc.

- **Exercise 1** Complete these sentences using a suitable adjective. The first one has already been done.

- 1 The mountain is 2,150 meters
- 2 The carpet is 3 meters
- 3 The carpet is 1½ centimeters
- 4 The chimney is 15 meters
- 5 The telephone wires are 6 meters
- 6 The telephone poles are 6.5 meters
- 7 That tree is 20 meters
- 8 The box is 0.50 meters
- 9 Women are usually about 1.50 meters
- 10 The door is 7 feet, 2½ feet, and 2½ inches

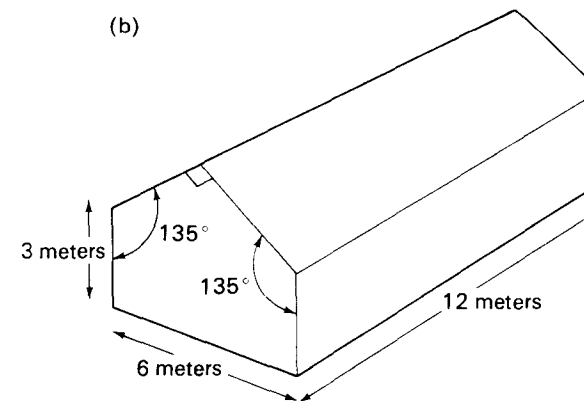
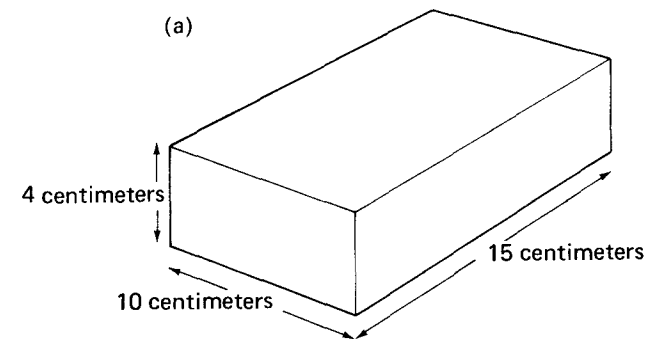
- **Exercise 2** Here are some 'notes.' Write them out in full using structure 1. Here is an example:

this table—2 meters

This table is 2 meters long.

- 1 this ruler—30 centimeters
- 2 this ruler—3 centimeters
- 3 this ruler—0.3 centimeters
- 4 standard writing paper—0.1 millimeters
- 5 this river—15 meters
- 6 the river—2 meters—in the middle
- 7 the lake—7 kilometers—and 14 kilometers
- 8 size 16 nails—2 centimeters—and 0.2 centimeters
- 9 telephone poles—usually 7 meters—and 20 centimeters
- 10 recent types of transistor—only 0.4 centimeters
- 11 the pages of this book
- 12 the opposite wall
- 13 the nearest window
- 14 Mount Everest
- 15 the local railway track

- △ **Exercise 3** Write two short passages, one giving the dimensions of the box, the other the dimensions of the building. Continue to use structure 1. (Diagrams on the next page)



The other main way of giving dimensions uses the verb *have*. We will call it structure 2. Here are some examples:

	<i>have</i>	<i>noun</i>	
<i>x</i>	<i>has</i>	<i>a length</i>	<i>of 3 centimeters.</i>
<i>The mountain</i>	<i>has</i>	<i>a height</i>	<i>of 2,150 meters.</i>
<i>The river</i>	<i>has</i>	<i>a width</i>	<i>of 50 meters.</i>
<i>The well</i>	<i>has</i>	<i>a depth</i>	<i>of 45 meters.</i>
<i>The pipes</i>	<i>have</i>	<i>a thickness</i>	<i>of 20 centimeters.</i>

Notice these points:

- (a) The indefinite article is used with the noun of dimension.
 (b) The noun from *tall* (*tallness*) is never used in this structure.
 Therefore, the two correct sentences are:

This man is 1.75 meters tall.
This man has a height of 1.75 meters.

- (c) With structure 2 it is now possible to make statements about how heavy something is:

This stone has a weight of 85 grams.
This type of car has a weight of 950 kilograms.

- **Exercise 4** Complete these sentences. Use structure 2. Here is an example:

This pen 11 centimeters.
This pen has a length of 11 centimeters.

- 1 The road outside 6 meters.
- 2 The tallest building in the street 12 meters.
- 3 This pen 0.8 centimeters.
- 4 The contents of the test-tube 250 grams.
- 5 The top-soil in this area 15 centimeters.
- 6 The sample 9 kilos.
- 7 The walls of the glass container 15 millimeters.
- 8 This room 7 meters and 4 meters.
- 9 3 liters of water
- 10 1 liter of petrol

These 'dimension' nouns are difficult to spell. Look at the following list, cover *A* and choose one of the five spellings in *B* for each of the nouns. Then check them against the correct spellings in *A*. If you make a mistake write the word out correctly at least three times.

A	B				
<i>length</i>	length	length	length	lenght	lenegth
<i>height</i>	height	hight	heigth	hieght	heihgt
<i>width</i>	width	weidth	width	widht	wiedth
<i>depth</i>	depeth	deephth	debth	depth	depght
<i>weight</i>	wieght	wieght	wieght	weght	waight

Study these abbreviations (short forms):

<i>fig.</i>	= <i>figure</i>	<i>kg</i>	= <i>kilogram(s)</i>
<i>km</i>	= <i>kilometer(s)</i>	<i>gm</i>	= <i>gram(s)</i>
<i>m</i>	= <i>meter(s)</i>	<i>mg</i>	= <i>milligram(s)</i>
<i>cm</i>	= <i>centimeter(s)</i>	<i>hr</i>	= <i>hour(s)</i>
<i>mm</i>	= <i>millimeter(s)</i>	<i>min.</i>	= <i>minute(s)</i>
<i>approx.</i>	= <i>approximately</i>	<i>sec.</i>	= <i>second(s)</i>

Notice that the same abbreviation is used for singular and plural. But remember that a plural form such as *3 cm* must be pronounced as *3 centimeters*.

Finally, there are a few other nouns of dimension that have not been mentioned so far. The most common ones are:

radius, diameter, area, volume, circumference

- **Exercise 5** Complete these sentences using the information given:

Circle A has a radius of 3 cm.

- 1 Circle A 6 cm.
- 2 Circle A 18.84 cm.
- 3 Circle A 28.26 cm².

Box B: length = 3m; height = 1.5 m; width = 2 m.

- 4 Box B 9 m³.
- 5 Box B 27 m².

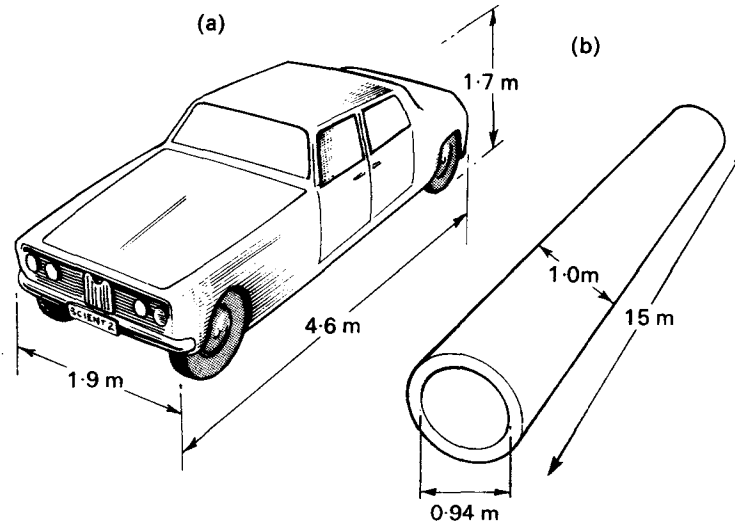
Sphere C has a diameter of 10 cm.

- 6 Sphere C 5 cm.
- 7 Sphere C 31.4 cm.
- 8 Sphere C 528 cm³.

Cylinder D has a cross-sectional area of 28.26 cm² and a height of 12 cm.

- 9 Cylinder D
- 10 Cylinder D

- △ **Exercise 6** Describe the dimensions of the car and the steel pipe. Write a short passage on each. In (b) include a statement about the amount of steel used in the pipe. (In order to avoid repeating the same structure all the time it is a good idea to use both structures 1 and 2.) (Diagrams on the next page)



Properties

We have already seen that *have* can be used to make statements of length, height and weight etc. *Have* is also commonly used in referring to many other properties.

○ **Exercise 7** Here are ten mixed-up sentences. Study them and write out the ten correct sentences.

Aluminium	has	a speed of	15 years.
Water	has	an average life of	0.000026 per °C.
Glass	has	a range of	100° C.
Sound	have	a resistance of	more than 5,000 km.
Cows	has	a coefficient of expansion of	2.8.
Some modern planes	has	a specific gravity of	-114° C.
Alcohol	has	a capacity of	760 mph at sea level.
The storage tank	have	a boiling point of	2,500 ohms per 100 cm.
This wire	has	a freezing point of	5,000 liters.

These *have* sentences have one thing in common; they all describe properties. Consider this pair of sentences:

Water boils at 100° C.
Water has a boiling point of 100° C.

The first sentence states that some action (boiling) takes place at a certain temperature. However, it may be more scientific not to think of water actually doing something (in this case, boiling), but of having certain properties such that certain things occur at a certain temperature. This is why the second sentence may be preferred even though it is longer.

△ **Exercise 8** Complete ten of the following, using sentences of your own:

- 1 ... (*have*) a boiling point of
- 2 a freezing point of
- 3 ... a density of
- 4 ... a velocity of
- 5 ... a mass of
- 6 ... a voltage of
- 7 ... a breaking strain of
- 8 ... an average life of
- 9 ... an average temperature of
- 10 ... a resistance of
- 11 ... a diameter of
- 12 ... a force of
- 13 ... a cost of
- 14 ... a thermal conductivity of
- 15 ... the property of

There are several possible ways of putting structure 2 statements in the negative. Look at the following:

Common in spoken British English

Pure water hasn't got a smell.
Pure water hasn't got any smell.

Common in spoken American English

Pure water doesn't have a smell.
Pure water doesn't have any smell.

Common in written scientific English

Pure water has no smell.

A point has no dimensions.

- **Exercise 9** Look at the table below. You will see that it is not complete, but you probably know some of the missing information. Write as much as you can about each of the six substances. (Notice that you cannot use *have* when describing the form.) Join some of the statements together. Here is an example:

Aluminium is a metal which has a melting point of 660° C.

It is silver in colour and it has a specific gravity of 2.8.

It has no smell.

Substance	Form	Colour	Smell	Melting Point	Boiling Point	Density
chlorine	gas					0.0032
oxygen		none	none	-218	-183	0.0014
ethyl-alcohol			characteristic		78.5	
water						
iron				1535	2800	
sulphur	solid	yellow		113	445	2.07

'Fronted' statements

Look at these examples of 'fronted' statements (structure 3):

<i>noun</i>		<i>be</i>
<i>The length</i>	<i>of x</i>	<i>is 3 cm.</i>
<i>The width</i>	<i>of this river</i>	<i>is 50 m.</i>
<i>The height</i>	<i>of the hill</i>	<i>is 750 m.</i>
<i>The depth</i>	<i>of this well</i>	<i>is 45 m.</i>
<i>The thickness</i>	<i>of this tree</i>	<i>is 1½ m.</i>

Notice the difference between structure 2 and structure 3 (the subjects have been underlined):

structure 2 The well has a depth of 45 meters.

structure 3 The depth of the well is 45 meters.

In structure 3 more information is put into the subject. This way of building up the subject is common in scientific and technical writing. It can be called 'fronting' because more words are put in front of the main verb. Here are some more examples:

The specific gravity of benzene is 0.78.

The distance between the two contacts is 2.5 mm.

The coefficient of expansion of brass is 0.000026 per ° C.

The diameter of the cheaper kinds of household electric wire is approximately 1.3 mm.

- △ **Exercise 10** Rewrite these sentences using structure 3. Here is an example:

This pen is 11 cm long.

The length of this pen is 11 cm.

- The bottle weighs 160 gm.
- Water freezes at 0° C.
- The water-towers have a height of 35 m.
- Sound has a speed of 333 m per sec.
- The water-tower has a capacity of 50,000 gallons.
- The sea 100 m from the shore has an average depth of 15 m.
- The cheaper kinds of household electric wire are 1.3 mm across.
- The two cylinders of oxygen are 38 kg and 41 kg in weight.
- The temperature in the furnace averages 900° C.
- Under these circumstances, gravity has no effect.

Summary of structures for stating dimensions and properties

structure 1: *x is 3 cm long.*

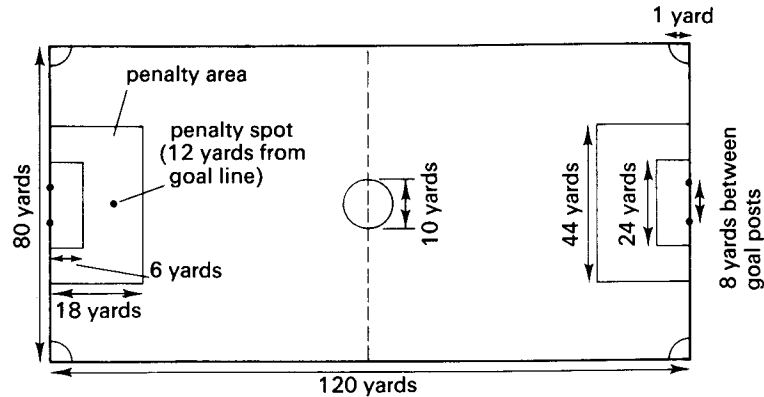
structure 2: *x has a length of 3 cm.*

structure 3: *The length of x is 3 cm.*

It is also possible to describe dimensions using a variation of structure 1:

structure 1(a): *x is 3 cm in length.*

- **Exercise 11** Write a passage describing the lay-out of a football field. (Be careful not to confuse the three structures.) (Diagram on the next page)



Qualified statements of dimensions

If a dimension is not given exactly, the fact that it is not exact should be made clear. In non-scientific English we usually use the word *about*:

x is about 3 centimeters long.

In more technical writing *approximately* may be used instead:

x is approximately 3 cm long.

x is approximately 3 cm in length.

Here are some other typical qualifying words and phrases:

- (a) $x = 3\text{ cm}$ *x is 3 cm long.*
- (b) $x = 3.00\text{ cm}$ *x is exactly 3 cm long.*
- (c) $x = \pm 3\text{ cm}$ *x is about 3 cm long.*
 x is approximately 3 cm long.
- (d) $\left. \begin{matrix} x_1 = 3\text{ cm} \\ x_2 = 3\text{ cm} \\ x_3 = 2.8\text{ cm} \\ x_4 = 3.2\text{ cm} \end{matrix} \right\}$ *x is 3 cm long on average*
- (e) $x = 3.3\text{ cm}$ *x is over 3 cm long.*
- (f) $x = 2.7\text{ cm}$ *x is under 3 cm long.*
- (g) $x = 3.1\text{ cm}$ *x is slightly over 3 cm long.*
 x is just over 3 cm long.
 x is a little over 3 cm long.
- (h) $x = 2.9\text{ cm}$ *x is just under 3 cm long.*
 x is a little under 3 cm long.
 x is slightly under 3 cm long.

What structure was used in the examples you have just read?

Of course the above examples are only approximate. It is not possible to say exactly when these qualifying words or phrases are to be used.

- **Exercise 12** Write ten sentences as indicated below. Here is an example:

The length of AB = 9.03 cm (just over) AB is just over 9 cm long.

- 1 $x = 3.07\text{ cm}$ long
 - (a) (exactly)
 - (b) (approximately)
- 2 The value of $\pi = 3.14159$
 - (a) (approximately)
 - (b) (slightly under)
 - (c) (to two decimal places)
- 3 The width of the pipe = 0.216 meters
 - (a) (under)
 - (b) (just over)
 - (c) (exactly)
- 4 The speed of the plane = 523 kph
 - (a) (very approximately)
 - (b) (a little over)

The qualifying phrases *under, over, just under, a little over*, etc. can be used in the same way with structures 2 and 3:

structure 2 *x has a length of over 3 cm.*
 x has a length of slightly under 3 cm.
 x has a length of a little over 3 cm.

structure 3 *The length of x is over 3 cm.*
 The length of x is slightly under 3 cm.
 The length of x is a little over 3 cm.

However, there are two possible forms with other qualifications:

structure 2 *x has an approximate length of 3 cm.*
 x has a length of approximately 3 cm.

structure 3 *The approximate length of x is 3 cm.*
 The length of x is approximately 3 cm.
 The average length of x is 3 cm.

....
The exact length of x is 3 cm.

△ **Exercise 13** Rewrite these sentences qualifying them.

- 1 The mountain is 2045 m high.
- 2 The height of the mountain is 2045 m.
- 3 The foundations of the building are 3.9 m deep.
- 4 The samples have weights of 18.6, 21.1, and 19.5 kilograms.
- 5 The nerve is 0.009 mm in breadth.
- 6 Diamond has an index of refraction of 2.47.
- 7 The moon has a radius of 1736 km.
- 8 Light has a speed through water of 224 million meters per second.
- 9 Under stated conditions atmospheric pressure equals 14.72 psi.
- 10 The escape velocity of the moon is 2.38 km per sec. and for the earth 11.2 km per sec.

□ **Exercise 14** Describe the dimensions of this syringe. Include a statement about the approximate amount of liquid the syringe can contain.

Scale 1 : 3

