

Unit 1 *Scientific Notation*

Introduction

Learning objectives

This unit is focused on one main concept, that of expressing and using numbers in *standard form* (or *scientific notation*). After completing this unit, you should be able to

- express any number in standard form
- convert any number in standard form into decimal form
- undertake calculations with numbers in standard form.

Notes

Scientific notation, or *standard form*, as it is often referred to, is a very convenient way of writing both very large and very small numbers. It was not created, as such, but developed from the use of indices in the form 10^n (n positive integer). For example, you can write

$$30\,000 = 3 \times 10^4$$

This is not much of a gain, but consider

$$1\,000\,000\,000 = 1 \times 10^9$$

and

$$0.0000001 = 1 \times 10^{-7}$$

where the scientific notation is much more concise than the alternative form.

Another example of the efficiency of this notation becomes obvious writing down the mass of the Earth, which is

$$593360000000000000000000 \text{ kg} = 5.9336 \times 10^{24} \text{ kg}$$

Key points

- In standard form, the number is expressed as $a \times 10^n$ where $1 \leq a < 10$ and n is an integer.
- Any number can be written in standard form, and it is unique.

Facts to remember

- $10^0 = 1$
- $10^{-n} = \frac{1}{10^n}$, for example, $10^{-1} = \frac{1}{10}$, etc.
- In standard form, the number is written as

$$a \times 10^n$$

where $1 \leq a < 10$ and n is an integer.

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Glossary of terms

Standard form

Any number can be written uniquely in standard form (scientific notation) as

$$a \times 10^n$$

where $1 \leq a < 10$ and n is an integer.

For example, $4763 = 4.763 \times 10^3$ ($a = 4.763$, $n = 3$)

$$0.037 = 3.7 \times 10^{-2} \quad (a = 3.7, \quad n = -2)$$