



PHYSICS

SI Units

OCR Physics A Specification H556

2.1.2 (a) Learners should be able to demonstrate and apply their knowledge and understanding of *Système Internationale (S.I.)* base quantities and their units.

2.1.2 (b) Learners should be able to demonstrate and apply their knowledge and understanding of *derived units of S.I. base units*

Throughout history, different cultures had a range of different units for the same variables e.g. Lengths measured in inches, feet, furlongs, stadia etc...

In 1789, the French started to create a system of universal units based on their metric system that could be used by every scientist and engineer worldwide in agreement without the need for conversion. By 1971, the current "International System" or *System Internationale* of units were agreed, with 7 base units and various derived units, some of which were named after scientists who made significant contributions to that area of Physics.

There are seven base units. For A-Level Physics, we only need six.

Variable	Unit Name	Unit Symbol
Mass	kilogram	kg
Length	metre	m
Time	second	s
Electrical Current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol

However, there are more variables to measure than those listed. There are derived units, which are based on the base units.

Some bases units do not have a special name. For example, the unit for speed is derived from the base units for distance and time.

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

The units are found by dividing the base unit for distance by the base unit of time, given us derived units of ms^{-1} (At A-Level, we use x^{-1} instead of $1/\text{x}$ as you will have done at GCSE).

There are some derived units with names, given in tribute to scientists who made significant contribution in that area of Physics.

The unit for force is known as the newton, N. We derive this unit from base units by using the equation:

$$force = mass \times acceleration$$

The newton, therefore, is expressed in base units as **kg ms⁻²**.

Useful videos

	Physics Online Base Units Link
	Physics Online Derived Units Link

Task

1. **Convert the following into base units using the provided equations:**

- a. The coulomb, C, for charge

$$\text{Charge} = \text{Current} \times \text{Time}$$

- b. The pascal, Pa, for pressure (See previous page)

$$\text{Pressure} = \frac{\text{Force}}{\text{Cross-sectional Area}}$$

- c. The hertz for frequency

$$\text{Frequency} = \frac{1}{\text{Period of Time}}$$

2. **The joule, J, can be expressed in base units as $\text{kg m}^2\text{s}^{-2}$. Use base units to determine if the following can be use in calculations for energy.**

- a. mass $\times$ acceleration

- b. mass $\times$ velocity²

- c. mass $\times$ velocity $\times$ time

- d. force $\times$ velocity