Defining and calculating dimensions

Starter

1. A car of mass 950 kg moves along a horizontal road with its engine working at a constant rate of 25 kW. The car accelerates from 14 m/s to 18 m/s. Assuming there is no resistance to motion, calculate the time taken.

Notes

In mechanics, the dimensions of quantities can be expressed in terms of **M** for mass, **L** for length and **T** for time.

Use ***square brackets*** to abbreviate the phrase '***the dimension of***' i.e. $[v]$ means the dimension of velocity.

When working out the dimensions of a quantity, it is useful to ***consider the units*** used.

E.g. 1 Find the dimensions of velocity.

Working: Possible units for velocity are m/s so $[v] = \mathrm{LT}^{-1}$

The dimensions of scalar quantities are the same as their vector equivalents so, for example, velocity and speed have the same dimensions.

N.B. Numbers, including irrational numbers such as π, are dimensionless.

When it is not entirely obvious what the dimensions of a unit are, write down a formula for the quantity.

E.g. 2 By considering the formula $s = r\theta$, where s is the arc length of a sector and r is its radius, decide what the dimensions of angles are.

E.g. 3 Find the dimensions of force.

E.g. 4 Find the dimensions of: (a) kinetic energy (b) power.

Video: Dimensions of quantities and units
Video: Dimension anaylsis example A
Video: Dimension anaylsis example B

Solutions to Starter and E.g.s

Exercise

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Summary

Dimensions of quantities can be expressed in terms of M for mass, L for length and T for time.
Notation: $[v]$ means the dimension of velocity.
When working out the dimensions of a quantity, it is useful to consider the units used or to write down a formula for the quantity.
The dimensions of scalar quantities are the same as their vector equivalents.