

NCFE Level 1 / 2 Technical Award in Engineering

CA2 - Applied science and mathematics in engineering

2.2.1 SI Units of Measurement - equations

Mass

Lesson 5

Connect

Title

SI Units – Mass equations



Today's Targets

Identify equations for mass
Select which equations from a given list v
specified engineering product o

Connect:

692.5 Km/h or
692.5

$P = F/A$
Pressure =
Force / Area

In aeronautical engineering weight is one of the four forces of flight. Weight is the force that pulls an airplane back towards the Earth, due to the mass of the aircraft and the gravitational pull. The weight must be overcome by lift to achieve flight. The lift must be greater than the weight of an airplane for the airplane to climb.



Monday, 20 July 2026

Today's title: SI Units – Mass equations



Prior Learning

CA1 Engineering disciplines



Today's Targets

Identify equations for mass

Select which equations from a given list

Today's Learning:

You must be able to:

Define mass and weight.

Explain the difference between mass and weight.

Define density.

You may also be able to:

Identify the SI units for weight and density.

Apply the formula for weight and density to solve engineering problems.



Future Learning

CA3

Reading engineering drawings



Literacy

International System (SI)	Equation	
Mass	Weight	Density

Today's title: 2.2: Mass equations



Your target

- Identify equations for Mass
- Select which equations from a given list would be used for a specified engineering product or project



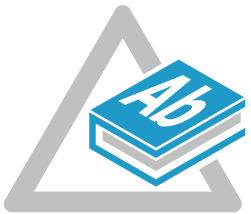
Steps to success

- Apply data to a selected equation to complete a calculation for a specified engineering product or project



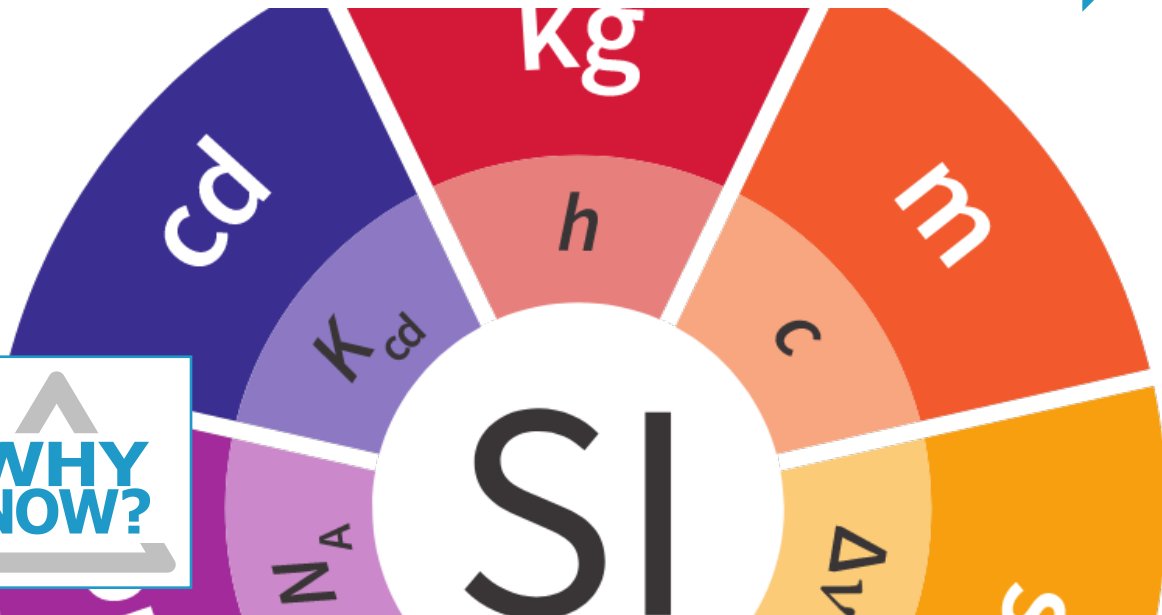
Path to progress

- Justify the selection of the equation
- Assess whether the correct calculation has been used



Key terms

International System (SI)
Equation
Mass and Weight
Density



Activate

Introduction

It is important to understand how mathematical and scientific equations are used in engineering disciplines to calculate the properties of:

- Mass and weight

In the development of products and projects.

The equations provided are not exhaustive, however, they are the ones most relevant to this level of study.

Activate

Quick question:

A sponge and a block of wood have the same dimensions.

Why is the sponge lighter?

**The sponge
is less dense**



Activate

Mass and weight

Mass is the measure of the amount of matter in an object.

Weight

The effect of a gravitational field on a mass. Since it is a force on an object due to the pull of gravity, it is measured in newtons (N).

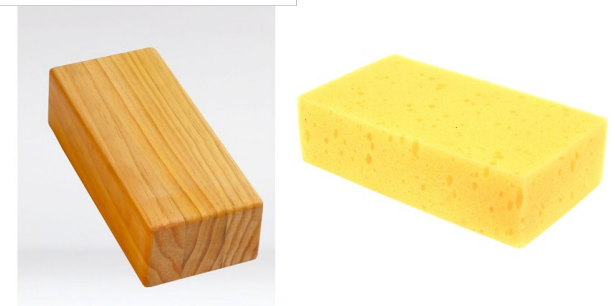
$$W \text{ (N)} = \text{mass (kg)} \times \text{gravity (ms}^{-2}\text{)}$$

Activate

Density

Density

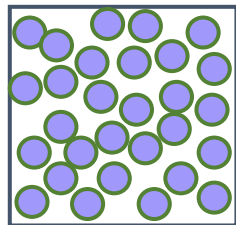
Mass per unit volume of an object.



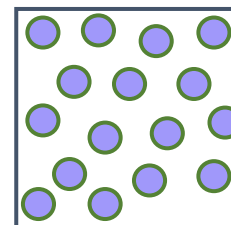
The units of density depend on the units used for mass and volume:

- If the mass is measured in *g* and volume in **cm³**, then the density will be in **g / cm³**
- If the mass is measured in *kg* and volume in **m³**, then the density will be in **kg / m³**

$$d = \frac{\text{mass}}{\text{volume}}$$



More
dense



Less
dense

Activate

Solve the problems



In your pairs, can you solve the following problems:

1. A paving slab has a mass of 73kg and dimensions 40mm × 500mm × 850mm. Calculate the **density** (in kg m^{-3}) of the material from which the paving slab is made.

mass:

- weight
- density

$$w = m \times g$$
$$d = m \div v$$

weight = mass x gravity
density = mass ÷ volume



Activate

Solve the problems - *answers*



In your pairs, can you solve the following problems:

1. Density = $73 \div ((40 \times 500 \times 850) \div 100) = 4.3 \text{ kg m}^{-3}$

mass:

- weight
- density

$$w = m \times g$$
$$d = m \div v$$

weight = mass x gravity
density = mass ÷ volume



Demonstrate

1. State two SI units for the measurement of mass. 1. _____ 2. _____

2. A disc sander has a mass of 15 290 grams.

Calculate the disc sander's **weight** to the nearest whole number. Gravity = 9.81 ms^2

2. A paving slab has a mass of 73kg and dimensions $40\text{mm} \times 500\text{mm} \times 850\text{mm}$.

Calculate the **density** (in kg m^{-3}) of the material from which the paving slab is made.

Show your working. [2 marks]

3. Calculate the **density** of a metal if its mass is 15kg and volume is 0.25m^3

Show your working. [2 marks]

4. Figure 2 shows an aluminium component.

Calculate the total **volume** and **density** of the aluminium component with the cylindrical hole cut through it.

Mass of the product = 247.37g

Value of $n = 3.14$

All dimensions are in mm. Show your working. [5 marks]

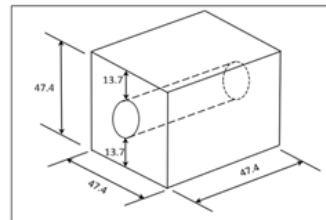


Figure 2



Which one of the following does a kilogram measure? A. Area B. Density C. Mass D. Volume

mass:

- ☐ weight
- ☐ density

$$w = m \times g$$
$$d = m \div v$$

weight = mass x gravity

density = mass ÷ volume

25
minutes!



Consolidate

Progress check

Complete this short quiz:

1. Density can be measured in:

- g / cm³
- kg / m³
- All of the above

2. True or false? $W \text{ (N)} = \text{mass (kg)} \times \text{gravity (ms}^{-2}\text{)}$ is the correct formula for weight.

3. Density is:

- a. Mass per unit dimension of an object
- b. Weight per unit volume of an object
- c. Mass per unit volume of an object

Consolidate

Can you now?

- Define mass and weight?
- Explain the difference between mass and weight?
- Define density?
- Identify the SI units for weight and density?
- Apply the formula for weight and density to solve engineering problems?

Next lesson...

We will learn about...

...how science and mathematics is applied in engineering and the equations which are used to describe and calculate electricity.