Monday, 20 July 2026

Connect

Title

SI International units of measurement

Today's Target

Learn how and which SI units of measurement are used in engineering

Connect:		
Biomedical	Flammable Warning	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

NCFE Level 1 / 2 Technical Award in Engineering

CA2 - Applied science and mathematics in engineering

2.1.1 SI Units of Measurement
Lesson 1

Today's title: SI units of measurement

Today's Target

Learn about the SI units of measurement used in engineering

Today's Learning:

- Define what SI is.
- Identify the basic units from the SI and their applications
- Differentiate between base and derived units.
- Apply SI units to engineering applications

Prior Learning

CA1 Engineering disciplines

Future Learning

CA3

Reading engineering drawings

Literacy

Systems international, Metric, Imperial, Measurement, Derived unit, Unit conversion

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Today's title: 2.1.1: SI Units of Measurement

Your target	Steps to success	Path to progress
• Introduce and understand the different SI fundamental units of measurement	• List the 7 SI fundamental units • Outline how the SI units could be used in engineering products and projects	• Determine which SI units could be used for a specified engineering product or project and justify the selection

Key terms

International System (SI)

WHY NOW?

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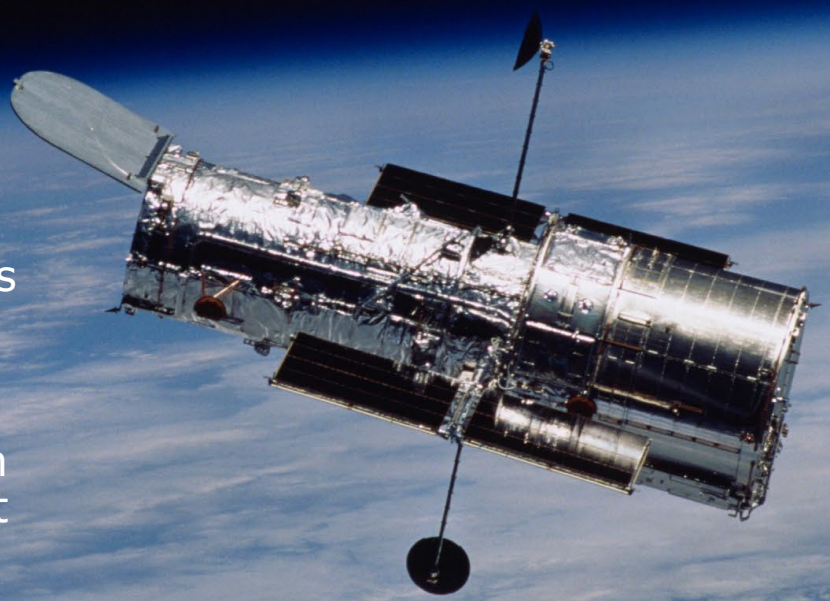
What is this? The Hubble telescope

Its intended launch was in 1983, but the project was beset by technical delays, budget problems, and the 1986 Challenger disaster. Hubble was finally launched in 1990, but its **main mirror** had been ground incorrectly using **mis-calibrated equipment**, resulting in spherical aberration that compromised the telescope's capabilities.

It cost $36 million, but it did not work to begin with. NASA made a mistake with the measurements. Discuss in pairs what the mistake with the measurements was.



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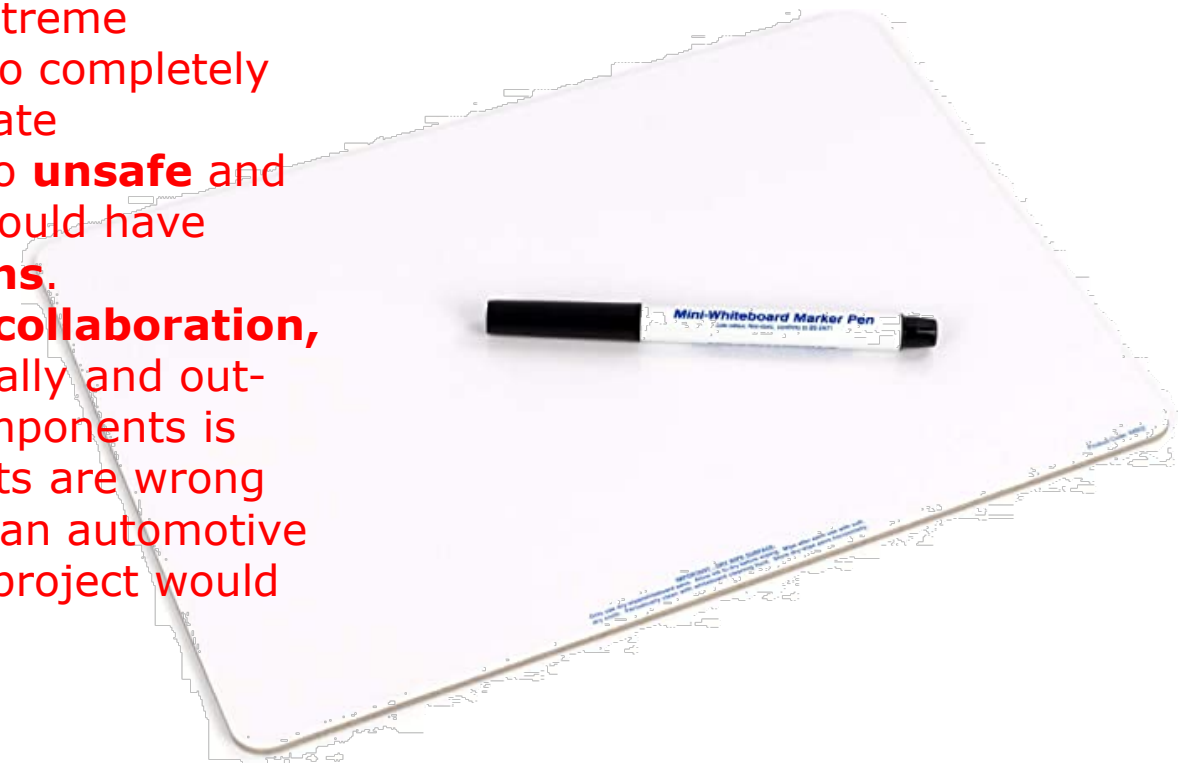
Why are accurate measurements so important in engineering?

Measurement inaccuracies can often result in **rework** or even more extreme measures, such as having to completely **restart a project**. Inaccurate measurements could lead to **unsafe** and **faulty** components and it could have significant **cost implications**.
Engineering often requires **collaboration,** both locally and internationally and out-sourcing of engineering components is often need. If measurements are wrong then parts, for example, in an automotive or mechanical engineering project would be **incompatible**.



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Use your mini whiteboard to list some different units of measurement and what it is used for to measure.

E.g. Seconds - time

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The international System of Units

An SI unit is a fundamental unit. This means that it **cannot be broken down** into other units.

The International System of Units (SI), commonly known as the **metric system**, is the **international standard** for measurement. The International Treaty of the Meter was signed in Paris on 20 May 1875 by **17 countries**.

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Benefits of an international system

Every discipline of engineering involves **taking measurements**, **understanding them** and then **communicating them to others**. Which means, with **global trading**, we all have to **speak the same basic language**, to provide a **consistent way** of **communicating** size, mass, shape, temperature, time, amount, energy, power, and speed. **The SI system is used around the world.**

Copy the bold words into your revision notes.

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The 7 SI Base Units

1. Do you know the units? 2. Do you know the symbols?

Dimension	Unit	Symbol
Mass		
Distance		
Time		
Current		
Amount of Substance		
Temperature		
Light Intensity		

Are you able to spot the error?

Mass = kg Distance = m

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SI Base Units - Powers of Ten

Prefixes can be added to indicate multiples of the basic SI units.

Power	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deca	da

Power	Prefix	Symbol
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

In this context 'Power of' simply means multiply or divide by 10

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Powers of Ten

Examples:

1. 5km = 5 kilometres= 5×10^3m (5000m)

= 5 x 10 x 10 x 10

2. 7ns = 7 nanoseconds = 7×10^{-9}s (0.000000007s)

= 7 ÷ 10 ÷ 10 ÷ 10 ÷ 10 ÷ 10 ÷ 10 ÷ 10

You will often see very large or very small numbers categorised by powers of ten, so it is very important you become familiar with these.

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The 7 units of measurement.
Questions to consider:

- Can you recall what each system is **used**
- **to measure?**
- Are you able to recall the **different symbols** for each system?
- What do you think the **multiples** might be for each unit? E.g. km/m/cm/mm

Can you link each unit to an engineering discipline and/or application?

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Ampere (A)

The ampere (A) is a **measure of the amount of electric charge** passing a point in an electric circuit per unit time.

Ampere units of measurements are:

- micro amps
- milliamps
- amps
- kilo amps

- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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Candela (cd)

The candela (cd) was so named to refer to "candlepower" back in the days when candles were the most common source of illumination. The candela is the **SI unit for luminous intensity (brightness).**

Candela units of measurements are:

- micro Candela
- milli Candela
- candela

- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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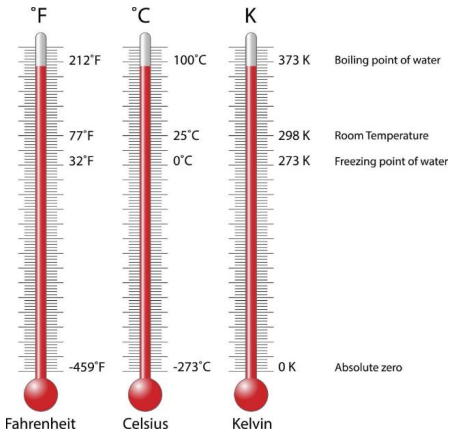
Kelvin (K)

The kelvin (K) is the unit of the thermodynamic (heat) **temperature scale**.

Kelvin units of measurements are:

- kelvin
- degrees celsius (Not a kelvin unit, but accepted for use within the SI)



- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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Kilogram (kg)

The SI unit of mass (equivalent to approximately 2.205 lb), first introduced as a **unit of mass** for the metric system.

Kilogram units of measurements are:

- kilogram
- gram
- milligram

- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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Metre (m)

The SI base **unit of length** (equivalent to approximately 39.37 inches), first introduced as a unit of length in the metric system.

Kilogram units of measurements are:

- micrometre
- millimetre
- centimetre
- metre
- kilometre

- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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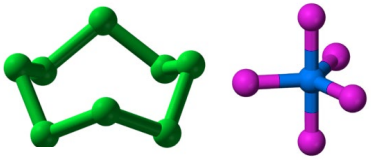
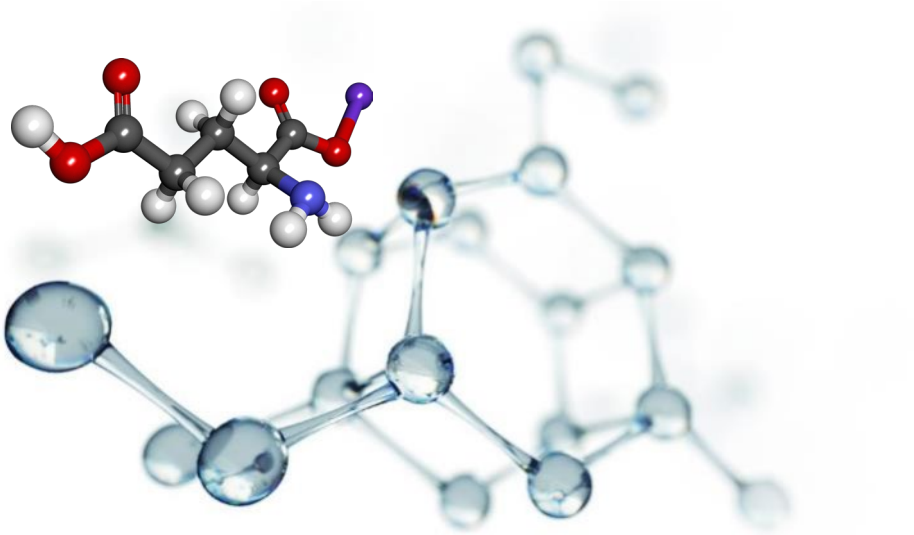
Mole (mol)

The mole (mol) is a quantity which is sometimes referred to as the **SI unit of chemical substance amount.** Atoms and molecules are incredibly small and even the smallest chemical sample will contain an unimaginable number and counting them in a sample is impossible. It is easier to think of a chemical mole by visualising a mole as a pile of atoms and molecules.

Mole units of measurements are:

- **nano mole**
- **micromole**
- **milli mole**
- **mole**





- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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Second (s)

The second is the **base unit of time** in the International System of Units, commonly understood and historically defined as 1/86400 of a day

Units of measurements are:

- **microsecond**
- **milliseconds**
- **seconds**
- **minutes** (Not a second unit, but accepted for use within the SI)
- **Hours** (Not a second unit, but accepted for use within the SI)

- Used to measure?
- Symbol for this system?
- Multiples of this unit?
- Engineering discipline?

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In your table groups, discuss which SI unit might be used for each of these scenarios

Dimension	Unit	Symbol
Mass	Kilogram	m
Distance	metre	kg
Time	Second	s
Current	Ampere	A
Amount of Substance	Mole	K
Temperature	Kelvin	mol
Light Intensity	Candela	cd

Consider if you think there are multiple possibilities for some scenarios? Can you identify which?

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SI Derived Units

Derived units are derived from the seven SI base units. They are formed by combining them mathematically.

To **deduce** the base units that conform a derived unit, it is necessary to use the definition of the quantity.

For example:
Speed = Distance / Time = **m/s (Metres per second)**

Activate

Deduce the base unit

For fun, based on the following definitions, can you deduce the SI units of the physical quantities below? You may have covered this knowledge in your Physics curriculum.

1. Acceleration = change in velocity / time

Answer = Acceleration = m/s (metres / second)

2. Force = mass × acceleration

Answer = Force (N) = kg x m/s (mass x acceleration)

Note: it is unlikely that deducing derived units will feature heavily on the examination paper, due to the level of difficulty.

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Demonstrate

1. Recall the SI units and symbols

Dimension	Unit	Symbol
Mass		
Distance		
Time		
Current		
Amount of Substance		
Temperature		
Light Intensity		

2. List the 5 multiples (prefix) of the base unit for distance (length)

_____ _____ _____ _____ _____

3. Recall the engineering discipline responsible for this product then list and justify the different SI units required.

Engineering discipline

_____

SI Units

_____

_____

Justification

_____

_____

4. Why are standard units of measurement important in all aspects of engineering?

_____

_____

_____

_____

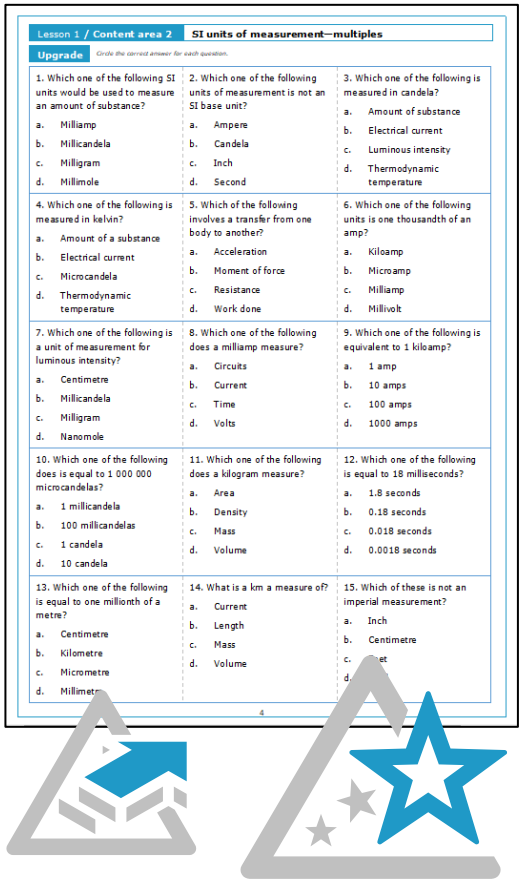
Complete the diagnostic, multiple choice questions of the following page.

Question 4: How to structure your response.

Intro: Rewrite the question
Units of measurement are important in engineering because...

Main: State and give examples
One reason is…
An example of this is...

Conclude: Sum up your answer
To conclude, these examples show that...



Lesson 1 / Content area 2 — SI units of measurement—multiples

Upgrade — Circle the correct answer for each question.

1. Which one of the following SI units would be used to measure an amount of substance? a. Milliamp b. Millicandela c. Milligram d. Millimole	2. Which one of the following units of measurement is not an SI base unit? a. Ampere b. Candela c. Inch d. Second	3. Which one of the following is measured in candela? a. Amount of substance b. Electrical current c. Luminous intensity d. Thermodynamic temperature
4. Which one of the following is measured in kelvin? a. Amount of a substance b. Electrical current c. Microcandela d. Thermodynamic temperature	5. Which of the following involves a transfer from one body to another? a. Acceleration b. Moment of force c. Resistance d. Work done	6. Which one of the following units is one thousandth of an amp? a. Kiloamp b. Microamp c. Milliamp d. Millivolt
7. Which one of the following is a unit of measurement for luminous intensity? a. Centimetre b. Millicandela c. Milligram d. Nanomole	8. Which one of the following does a milliamp measure? a. Circuits b. Current c. Time d. Volts	9. Which one of the following is equivalent to 1 kiloamp? a. 1 amp b. 10 amps c. 100 amps d. 1000 amps
10. Which one of the following does is equal to 1 000 000 microcandelas? a. 1 millicandela b. 100 millicandelas c. 1 candela d. 10 candela	11. Which one of the following does a kilogram measure? a. Area b. Density c. Mass d. Volume	12. Which one of the following is equal to 18 milliseconds? a. 1.8 seconds b. 0.18 seconds c. 0.018 seconds d. 0.0018 seconds
13. Which one of the following is equal to one millionth of a metre? a. Centimetre b. Kilometre c. Micrometre d. Millimetre	14. What is a km a measure of? a. Current b. Length c. Mass d. Volume	15. Which of these is not an imperial measurement? a. Inch b. Centimetre c. [illegible]et d. [illegible]

4

25 minutes!

For the 6 mark question, make sure to make 3 points and justify to achieve full marks

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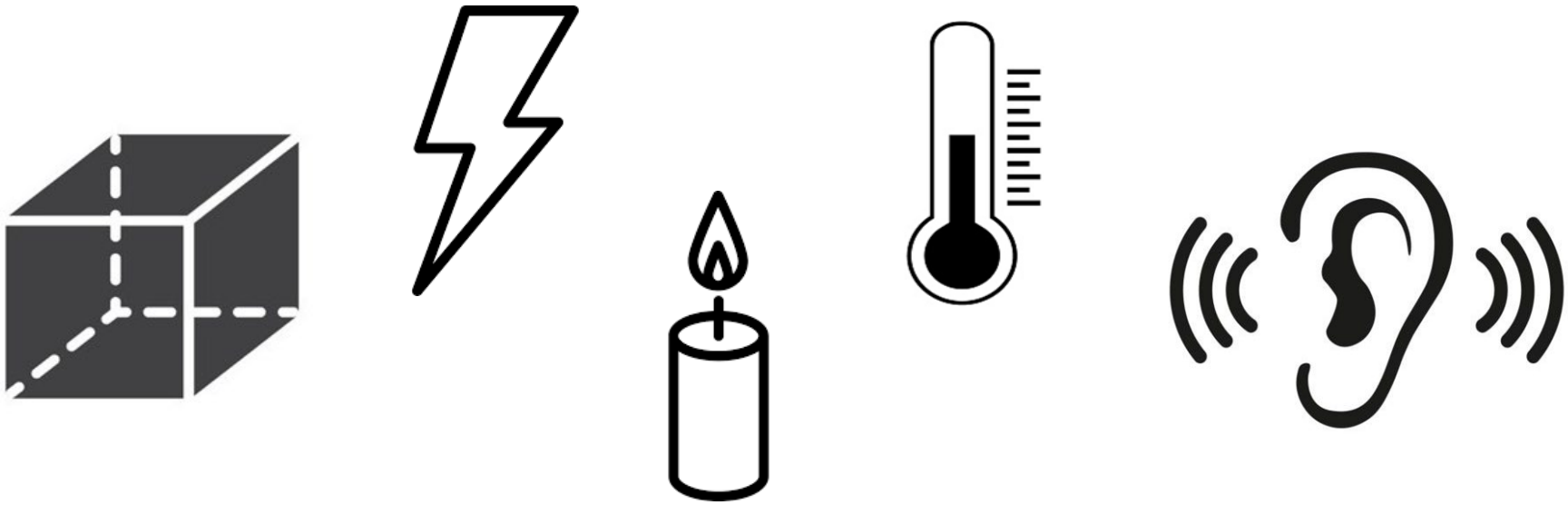
Consolidate

- **Why are accurate measurements so important in engineering?**
- **What is meant by SI Units?**
- **Why is it important that engineers use standardised units?**
- **How do these units help us in everyday life?**



Next lesson…

We will…

…look at the application of basic SI units in projects and products