

Preparations for A-Level Physics

Sanjin Zhao

1th Sep 2022

Learning Outcome

I highly recommend you to finish this checklist to determine whether you've achieved the learning objectives.

- Understand that all physical quantities consist of a numerical magnitude and a unit.
- Recall the following SI **base quantities** and their units:
- Recall and use **prefixes** and their symbols
- Make reasonable estimates of physical quantities included within the syllabus
- Express **derived units** as products or quotients of the SI base units
- Use SI base units to check the *homogeneity*¹

¹ def:

Leadin

Watch the [videos](#) and try to answer the following questions:

Task

1. what is the meaning of unifying the measuring system?
2. any revolution happens when defining the base units? If so, what is the change?



Figure 1: SI logo

SI system

Base Unit

BIPM has established the decimal as the common system and defined the original three *base units* in 1875. And with the development of science and technology, 4 more base units are included into the system and finally become the *Le Système international d'unités*². What are they?

² from French

Task

Finish the 7 base units in the following, stating what they measures and the units.

Extended Questions:

Why using constants rather than realistic items to define 1 base unit?

Prefix of SI

However, one base unit may not always suitable to measure tiny or larger objects. For example, 1 metre may not be appropriate to measure the distance a train travels, and neither suitable for the length of a bacterium.

Base Quantity		Base Unit	
name	symbol	name	unit
	<i>t</i>		
		meter	
Mass	<i>m</i>		
	<i>I,i</i>		
	<i>T</i>		
	<i>n</i>		
Luminous intensity	<i>I_v</i>		

there are several prefix either enlarge or minimize the base unit, most common among which are kilo and centi. You have to memorize the conversion factor and symbol of them.

Derived Units

Apparently, 7 base unit would not be enough to measuring every quantities in the physics world. Other units are also important, for example, newton³

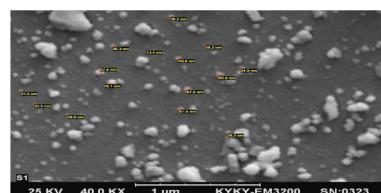


Figure 2: Electroscope of bacteria

³ not CAPITALIZE, to show that it is a unit not a person

is the most common units when measuring forces. So why only the 7 units are called ‘*BASE UNIT*’, it is because that all other units can be **derived** from them. Such units are called derived units.

The principle that the derived units can be deduced is that:

Find formula of common derived units:

Conversion and Dimension Analysis

What if I want to change the distance that a Tesla Model 3 can travel from *Metric System*⁴ into the *Imperial System*?

⁴ def:

Factor	Name	Symbol	Factor	Name	Symbol
10^0		T	10^0	deci	
10^1		G	10^1	centi	
10^{-3}		M	10^{-3}	milli	m
10^{-6}		k	10^{-6}		μ
10^{-9}		h	10^{-9}	nano	n
10^{-12}		da	10^{-12}		p

Quantity	name	unit	dimension	formula
Force	newton	N	kg m s^{-2}	$F = ma$
Pressure				
Energy				
Frequency				
Power				
Momentum				
Impulse				
Torque				

A common way to convert is using fraction multiplication.

Approximate values of common objects

Try to finish the following tables to memorize the common estimated physical quantities.



Figure 3: Lying Travel Distance

Mass of a person	_____
Height of a person	_____
Walking speed	_____
Speed of a car on the motorway	_____
Volume of a can of a drink	_____
Density of water	_____
Density of air	_____
Mass of an apple	_____
e.m.f of a car battery	_____
e.m.f of a AA battery	_____
Current in a domestic appliance	_____
Hearing range	_____
Young's Modulus of a material	_____