AS Level Physics

Chapter 1 – Measurements and their errors

1.1.1 Physical Quantities and Units

Revision Notes

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PHYSICAL QUANTITY

A ***PHYSICAL QUANTITY,*** when used in physics, implies they have a numerical value (the amount) and a unit. For example, a rope is 4 metres long.

SYSTÈME INTERNATIONAL D'UNITES (SI SYSTEM)

- The SI system is made up of 7 base (fundamental) units called the SI units. The 7 base units are shown below:

Base Quantity	Base Unit
mass (m)	kilogram (kg)
length (l)	metre (m)
time (t)	seconds (s)
temperature (T, θ)	Kelvin (K)
electrical current (I)	Ampere (A)
amount of substance (n)	mole (mol)
luminous intensity	candela (cd)

- Tip: When carrying out calculations in physics always convert units into SI units i.e. grams to kilograms and centimetres to meters.

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DERIVED UNITS

- From those seven base units all other quantities and units can be derived.

For example:

Quantity	Unit	Symbol Base Unit	Derived Unit
Velocity	metres per second	$m\,s^{-1}$	$m\,s^{-1}$
Acceleration	metre per second squared	$m\,s^{-2}$	$m\,s^{-2}$
Force	Newton	N	$kg\,m\,s^{-2}$
Work or Energy	Joule	J	$kg\,m^2\,s^{-2}$
Power	Watt	W	$kg\,m^2\,s^{-3}$
Pressure	Pascal	Pa	$kg\,m^{-1}\,s^{-2}$
Frequency	Hertz	Hz	s^{-1}
Charge	Coulomb	C	$A\,s$

- How it works:

$$Force\ (F) = mass\ (m)\ \times acceleration\ (a)$$
$$Newtons = kg\ \times ms^{-2} = kg\,m\,s^{-2}$$
$$N = kg\,m\,s^{-2}$$

Like shown above all other quantites can be derived in the same way.

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PREFIXES

When using SI units you will have to work with very large or very small numbers that could be difficult to write in full. In order to deal with these numbers, you can use ***PREFIXES***. The table below shows the ***STANDARD PREFIXES*** you will use:

Prefix	Symbol	Value	Multiple Size
Tera-	T	10^{12}	1,000,000,000,000
Giga-	G	10^{9}	1,000,000,000
Mega-	M	10^{6}	1,000,000
kilo-	k	10^{3}	1,000
centi-	c	10^{-2}	0.01
milli-	m	10^{-3}	0.001
micro-	μ	10^{-6}	0.000001
nano-	n	10^{-9}	0.000000001
pico	P	10^{12}	0.000000000001

Tip: Look at the table above, the prefix values go up and down in power by multiples of 3 but centi doesn't and has a value of 10^{-2}. So in an exam start with centi and go up and down in multiples of 3. This is a good way to remember the prefixes.

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ESTIMATING

In physics, you will carry out a lot of calculations. To ensure that your answers are reasonable and not crazy you will need to have an idea of some reference points. Below I have put together a table with some sizes of typical objects to guide you:

Mass of a person	70 kilograms
Height of a person	1.70 metres
Weight of an apple	1 Newton
Mass of a car	990 kilograms
Running speed	5 mph
Diameter of a football	22cm
Diameter of the sun	696000 km
UK Mains voltage	230 Volts
Volume of a swimming pool	375 m^3

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Please see the **'1.1.2 Physical Quantities and Units Worked Examples'** pack for **exam style questions.**

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