Units

IB PHYSICS | MOTION

Two Types of Observations

Provide some examples of each





How can you **quantify** a measurement?

Systems and Units

Fundamental S.I. Units:

Length	
Mass	
Time	
Electric Current	
Temperature	
Amount of Substance	
Luminous Intensity	

Units are Arbitrary



What's 'the standard'?

All of our base SI units are grounded in some "standard" that helps maintain consistency.

Some of these units even reference each other...

Definition of the Second



The "second" is defined as the interval required for 9,192,631,770 vibrations of the cesium-133 atom measured via an atomic beam clock

Primary and Secondary Colors

Primary Colors

Secondary Colors

Fundamental vs Derived

Fundamental S.I. Units

Length	m
Mass	kg
Time	S

Derived Units

Velocity:

Acceleration:

Force:

Welcome to IB Land!

Since this course is *International* all of the units must be in the "European" format rather than the "American" format This means that instead of writing units with a fraction slash, we must use negative exponents

7 m/s	$6.67 \frac{\mathrm{Nm^2}}{\mathrm{kg^2}}$
9.81 m/s ²	$2.2 \frac{J}{\kappa}$
87 g/cm ³	$8.31 \frac{J}{K \times mol}$

ب	Prefix	Abbreviation	Value
okle	peta	Р	1015
BO	tera	Т	1012
ata	giga	G	10^{9}
S	mega	М	106
iysio	kilo	k	10 ³
8 Ph	hecto	h	10 ²
e E	deca	da	101
n th	deci	d	10-1
fror	centi	с	10-2
:tly	milli	m	10-3
irec	micro	μ	10-6
n d	nano	n	10-9
ake	pico	р	10-12
► *	femto	f	10-15



Prefix	Abbreviation	Value
peta	Р	1015
tera	Т	1012
giga	G	10 ⁹
mega	М	106
kilo	k	10 ³
hecto	h	10 ²
deca	da	101
deci	d	10-1
centi	с	10-2
milli	m	10-3
micro	μ	10-6
nano	n	10-9
pico	р	10-12
femto	f	10-15

The value given is the number of places the decimal moves

Please make sure that you go in the correct direction!

900 nm = 900,000,000,000 m or 900 nm = 0.0000009 m



Prefix	Abbreviation	Value
peta	Р	1015
tera	Т	1012
giga	G	109
mega	М	106
kilo	k	10 ³
hecto	h	10 ²
deca	da	101
deci	d	10-1
centi	с	10-2
milli	m	10-3
micro	μ	10-6
nano	n	10-9
pico	р	10-12
femto	f	10-15

900 nm → _____ m

Prefix	Abbreviation	Power
giga-	G	10 ⁹
mega-	М	10 ⁶
kilo-	К	10 ³
hecto-	h	10 ²
deca-	da	10 ¹
	Base	
deci-	d	10-1
centi-	С	10-2
milli-	m	10 ⁻³
micro-	μ	10 ⁻⁶
nano-	n	10 ⁻⁹

Con	vers	sior	ns:

0.00325 kg = μg

54 mm = km

The Metric System | Try These

Prefix	Abbreviation	Power
giga-	G	10 ⁹
mega-	М	10 ⁶
kilo-	К	10 ³
hecto-	h	10 ²
deca-	da	10 ¹
	Base	
deci-	d	10-1
centi-	С	10-2
milli-	m	10-3
micro-	μ	10 ⁻⁶
nano-	n	10 ⁻⁹

SI prefixes

1000 ⁿ	10 ⁿ	Prefix	Symbol	Short scale	Long scale	Decimal equivalent in SI writing style
10008	1024	yotta-	Y	Septillion	Quadrillion	1 000 000 000 000 000 000 000 000
10007	1021	zetta-	z	Sextillion	Trilliard (thousand trillion)	1 000 000 000 000 000 000 000
1000 ⁶	10 ¹⁸	еха-	E	Quintillion	Trillion	1 000 000 000 000 000 000
1000 ⁶	10 ¹⁵	peta-	P	Quadrillion	Billiard (thousand billion)	1 000 000 000 000 000
10004	10 ¹²	tera-	T	Trillion	Billion	1 000 000 000 000
1000 ³	10 ⁹	giga-	G	Billion	Milliard (thousand million)	1 000 000 000
1000 ²	10 ⁶	mega-	м		Million	1 000 000
10001	10 ³	kilo-	k		Thousand	1 000
10002/3	10 ²	hecto-	h		Hundred	100
10001/3	10 ¹	deca-	da	Ten		10
1000 ⁰	10 ⁰	(none)	(none)	One		1
1000-1/3	10-1	deci-	d	Tenth		0.1
1000 ^{-2/3}	10-2	centi-	c	Hundredth		0.01
1000-1	10-3	milli-	m	Thousandth		0.001
1000-2	10-6	micro-	μ	Millionth		0.000 001
1000-3	10-9	nano-	n	Billionth	Milliardth	0.000 000 001
1000-4	10-12	pico-	р	Trillionth	Billionth	0.000 000 000 001
1000-5	10-15	femto-	f	Quadrillionth	Billiardth	0.000 000 000 000 001
1000-6	10-18	atto-	а	Quintillionth	Trillionth	0.000 000 000 000 000 001
1000-7	10-21	zepto-	z	Sextillionth	Trilliardth	0.000 000 000 000 000 000 001
1000-8	10-24	yocto-	у	Septillionth	Quadrillionth	0.000 000 000 000 000 000 000 001

There's more...



"What about Instagram?"

Lesson Takeaways

- □ I can describe the difference between quantitative and qualitative observations
- □ I can identify the 7 Fundamental SI units
- □ I can define and give an example of a derived unit
- □ I can represent fractional units with negative exponents
- □ I can convert metric units between prefixes