Last lesson

What is the difference between weight and mass?

Last term

If an object has unbalanced forces acting on it, what will the affect be on the object's motion?

Last topic

Name 3 vectors and 3 scalars?

Even earlier

Name the 4 energy transfers.

10 minutes!

End

Last lesson

Weight is a force (measured in Newtons), and mass is the amount of atoms/matter in an object (kilograms)

Last term

The object accelerates in the direction of the larger force.

Last topic

Vectors: velocity, displacement, acceleration, force, momentum, etc…
Scalars: speed, distance, time, temperature, energy…

Even earlier

Mechanically
Electricity
Heating
Radiation

Standard Form and Prefixes

Date: 20-May-20

Objectives

AO1 – Understand standard form notation.

AO2 – Be able to convert numbers into standard form and back again.

AO3 – Use prefixes to notate standard form and convert numbers between prefixes.

Lesson Sequence

CP2

Newton's 1st Law
F = ma
Weight
Throwback: Prefixes and SF
CPAC: F = ma
Newton's 3rd law
Reaction time
Stopping distance
CP2 Test

CP4

Wave properties
Wave equation
Wave behaviours
CPAC: Measuring waves in liquids and solids
End of Topic Test

Starter:

1. 10^2 = **10 x 10 = 100**

2. 10^3 = **10 x 10 x 10 = 1000**

3. How many 10s in 1000? **1000 ÷ 10 = 3**

4. What is 4 x 1000? **4 x 1000 = 4000**

5. What is 4 x 10^3? **4 x 10 x 10 x 10 = 4000**

6. How many 10s in 100,000? **100,000 ÷ 10 = 5**

1.

We use Standard Form to represent REALLY big or REALLY small numbers…

The rules of Standard Form are:

$$n \times 10^{m}$$

‘n’ MUST be a number between 1 and 10 (**not including 10**)

‘m’ represents the number of times 10 has been multiplied by itself.

2.

For example:

‘n’ MUST be a number between 1 and 10 (not including 10)

‘m’ represents the number of times 10 has been multiplied by itself.

$n \times 10^m$

This represents 4000, because it is saying ‘4 x 10 x 10 x 10’.

Are these following the rules…?

1:

X

Yes!

2:

X

Nope! 0.6 isn’t between 1 and 10!

3:

X

Nope! It must be multiplied by a factor of 10!

4:

X

Yes!

5:

X

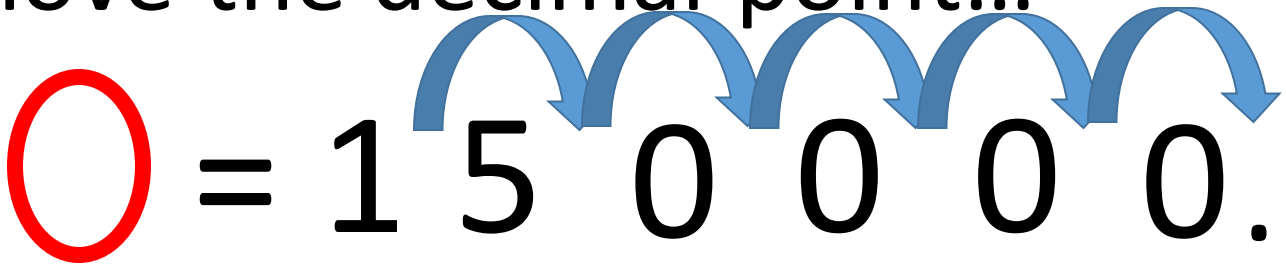
Nope! 10.5 isn’t between 1 and 10!

How to use them…

x = 1.5 x 10 x 10 x 10 x 10 x 10

= 150,000

You can also just move the decimal point…

x  = 1 5 0 0 0 0.

Now you have a go…

1) 5.2×10^2 **= 520**

2) 3.7×10^7 **= 37,000,000**

3) 4.7×10^3 **= 4700**

4) 9.2×10^5 **= 920,000**

5) 2.32×10^5 **= 232,000**

6) 4.36×10^3 **= 4360**

But what about smaller numbers?

Sometimes, we use negative powers of 10 for exactly that! Use your calculators to find these:

1) 10^{-2} **= 0.1**

2) 10^{-5} **= 0.0001**

3) 10^{-7} **= 0.000001**

The only difference when using these is we either divide by 10 that many times…

x ◯ = 1.5 ÷ 10 ÷ 10 ÷ 10

= 0.015

Or you can just move the decimal point the other way…

x ◯ = 0.0015

Now you have a go…

1) 5.2×10^{-5} **= 0.000052**

2) 3.7×10^{-3} **= 0.0037**

3) 4.7×10^{-6} **= 0.0000047**

4) 9.2×10^{-4} **= 0.00092**

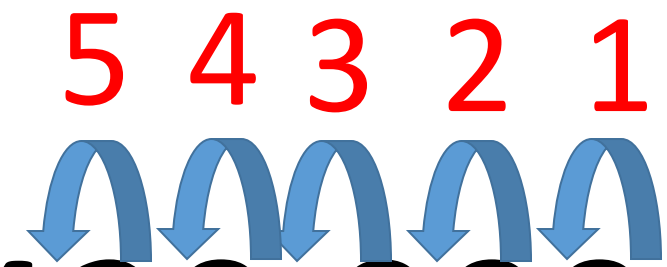
5) 2.32×10^{-5} **= 0.0000232**

6) 4.36×10^{-2} **= 0.0436**

Complete worksheet 1

So how might we convert numbers back to Standard Form?

You need to count how many times the decimal place needs to move to get a number between 1 and 10 (not including 10)…

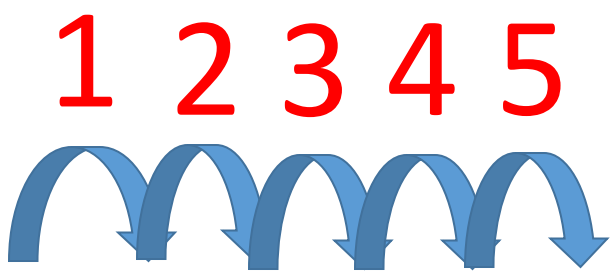


So we write this as…

x

We know this is positive because if we expand it back out, the number gets bigger.

Another example…



So we write this as…

x

We know this is negative because if we expand it back out, the number gets smaller.

Now you have a go…

1)750,000 **= 7.5×10^{5}**

2)0.00000369 **= 3.69×10^{-6}**

3)25000 **= 2.5×10^{4}**

4)0.00259 **= 2.59×10^{-3}**

5)6900 **= 6.9×10^{3}**

6)0.00008 **= 8.0×10^{-5}**

Complete worksheet 2

Prefixes:

- Prefixes and units are NOT the same thing!
- **Units tell us what a quantity is measured in**. e.g. speed is measured in metres per second, so this is the unit for speed (m/s)
- **Prefixes are letters that represent different powers of 10**. We use them to help us write large/tiny values more easily.
- We write prefixes just before the unit.
- For example, 4.2 kg = 4.2 kilo-grams = 4.2 x 10^3 grams = 4200 grams = 4200 g
- **This means 'k' (kilo) represents '10^3'.**

Name	Symbol	Factor of 10
Giga	G	10^{9}
Mega	M	10^{6}
Kilo	k	10^{3}
Hecto (rarely used)	h	10^{2}
Deka (rarely used)	da	10^{1}
Deci (rarely used)	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	μ	10^{-6}
Nano	n	10^{-9}

Examples:

1) 5.6 Gm (Giga-metres)

$5.6 \times 10^9 = 5{,}600{,}000{,}000\text{m}$

2) 6.3 Mg (Mega-grams)

$6.3 \times 10^6 = 6{,}300{,}000\text{g}$

3) 4.1 km (kilo-metres)

$4.1 \times 10^3 = 4100\text{m}$

4) 6.8 mm (milli-metres)

$6.8 \times 10^{-3} = 0.0068m$

5)5.8 µJ (micro-Joules)

$5.8 \times 10^{-6} = 0.0000058J$

6)2.2 nW (nano-Watts)

$2.2 \times 10^{-9} = 0.0000000022W$

Questions

1. If I have 2.5 Gm (Giga-metres) of rope, how many metres is that?
   2,500,000,000 metres
2. There are 4.2 mJ (milli-Joules) of energy in a grape. How many Joules is this?
   0.0042 Joules
3. An atom is 1.3 nm (nano-metres) wide. How many metres is this?
   0.0000000013 metres
4. The moon is 3.8 Gm (Giga-metres) away, how many metres is this?
   3,800,000,000 metres
5. There are 2.5 Ml (Mega-litres) in an Olympic swimming pool. How many litres is this?
   2,500,000 litres

Questions: Write the following with prefixes…

1. 3,000,000 J (Joules) **3 MJ (Mega-Joules)**
2. 0.1 m (metres) **1.0 dm (deci-metres)**
3. 320 l (litres) **3.2 hl (hecto-litres)**
4. 0.0000000065 m (metres) **6.5 nm (nano-metres)**
5. 0.0048 l (litres) **4.8 ml (milli-litres)**