

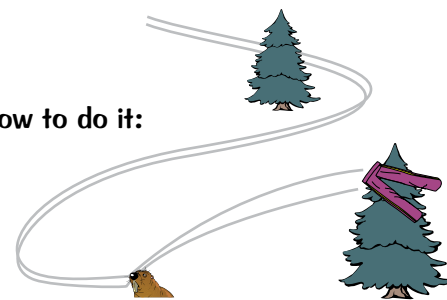
# Standard Form

Standard form (or 'standard index form') is useful for writing **VERY BIG** or **VERY SMALL** numbers in a more convenient way, e.g.

56 000 000 000 would be  $5.6 \times 10^{10}$  in standard form.

0.000 000 003 45 would be  $3.45 \times 10^{-9}$  in standard form.

But **ANY NUMBER** can be written in standard form and you need to know how to do it:



## What it Actually is:



A number written in standard form must **always** be in **exactly** this form:

This **number** must **always** be **between 1 and 10**.

$$A \times 10^n$$

This number is just the **number of places** the **decimal point** moves.

(The fancy way of saying this is  $1 \leq A < 10$ )

## Learn the Three Rules:

- 1) The **front number** must always be **between 1 and 10**.
- 2) The power of 10,  $n$ , is **how far the decimal point moves**.
- 3)  $n$  is **positive** for **BIG** numbers,  $n$  is **negative** for **SMALL** numbers.  
(This is much better than rules based on which way the decimal point moves.)

## Four Important Examples:



**1** Express 35 600 in standard form.

- 1) **Move the decimal point** until 35 600 becomes 3.56 ( $1 \leq A < 10$ )
- 2) The decimal point has moved **4 places** so  $n = 4$ , giving:  $10^4$
- 3) 35 600 is a **big number** so  $n$  is +4, not -4

$$\begin{array}{ccccccc} & \curvearrowright & \curvearrowright & \curvearrowright & & & \\ & 3 & . & 5 & 6 & 0 & 0 \\ = & 3.56 & \times & 10^4 \end{array}$$

**2** Express 0.0000623 in standard form.

- 1) The decimal point must move **5 places** to give 6.23 ( $1 \leq A < 10$ ).  
So the power of 10 is 5.
- 2) Since 0.0000623 is a **small number** it must be  $10^{-5}$  not  $10^{+5}$

$$\begin{array}{ccccccccccc} & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & & & & & \\ & 0 & . & 0 & 0 & 0 & 0 & 6 & 2 & 3 \\ = & 6.23 & \times & 10^{-5} \end{array}$$

**3** Express  $4.95 \times 10^{-3}$  as an ordinary number.

- 1) The power of 10 is **negative**, so it's a **small number** — the answer will be less than 1.
- 2) The power is -3, so the decimal point moves **3 places**.

$$\begin{array}{ccccccc} & \curvearrowright & \curvearrowright & \curvearrowright & & & \\ & 0 & 0 & 0 & 4 & . & 95 \\ = & 0.00495 \end{array} \times 10^{-3}$$

**4** What is 1463 million in standard form?

Too many people get this type of question **wrong**.  
Just take your time and do it in **two stages**:

The two favourite **wrong answers** for this are:

- $146.3 \times 10^6$  — which is kind of right but it's not in **standard form** because 146.3 is not between 1 and 10
- $1.463 \times 10^6$  — this one **is** in standard form but it's **not big enough**

$$\begin{array}{l} 146.3 \text{ million} \\ = 146300000 \\ = 1.463 \times 10^8 \end{array}$$