# Scientific notation	Season	01
	Episode	AP05
	Time frame	1 period

Prerequisites :
- Positive and negative powers of ten.

Objectives :
- Discover the scientific notation, the E notation used by the calculators and the engineering notation.
- Switch from one notation to another.

Materials :
- *Fact sheets about the three notations (36 copies).*
- *Test paper with 16numbers (36 copies).*
- *Matching cards with different notations of the same numbers (20 cards).*

1 – Matching game — 10 mins

Students are handed out cards with numbers written in ordinary decimal notation, scientific notation, E notation or engineering notation. They commit their numbers to memory and mingle to find the students with equal numbers.

2 – Team work — 20 mins

Working in the same teams as in the first part on a lesson handed-out by the teacher, students have to undersand the three notations and how to switch from one to another.

3 – Test — Remaining time

Still working in teams, students have to convert numbers from one notation to the others, including the ordinary notation.

Scientific notation

Season	01
Episode	AP05
Document	Lesson

Definition 1 : Scientific notation

A decimal number x is said to be in scientific notation if there exist two numbers k and n such as

$$x = a \times 10^n,$$

where a is a decimal number such that $1 \leqslant |a| < 10$, and n is an integer (positive or negative).

Examples :

- 158 ; -45.8 and 3.7 are not in scientific notation.
- -2.58749×10^5 is in scientific notation, as $1 \leqslant 2.58749 < 10$ and 5 is an integer.
- 7.451×10^{-4} is the scientific notation of the number 0.0007451.
- 12×10^{-8} is not a scientific notation because 12 is greater than 10.
- 0.587×10^2 is not a scientific notation because 0.587 is lower than 1.

Definition 2 : E notation

An alternative notation used by calculators is the "E" notation. It's basically the scientific notation, with the letter E standing for $\times 10\hat{}$.

Examples :

- The E notation of the number -2.58749×10^5 is $-2.58749\text{E}5$.
- The E notation of the number 0.0007451 is $7.451\text{E} - 4$.

Definition 3 : Engineering notation

Engineering notation differs from normalized scientific notation in that the exponent n is restricted to multiples of 3. Consequently, the absolute value of a is in the range $1 \leqslant |a| < 1000$, rather than $1 \leqslant |a| < 10$.

Examples :

- The engineering notation of the number -2.58749×10^5 is -258.749×10^3.
- The engineering notation of the number 0.0007451 is 745.1×10^{-6}.

Scientific notation

Season	01
Episode	AP05
Document	Test

	Ordinary	Scientific	Calculator	Engineering
1	45			
2		-3.8405×10^{5}		
3			1.15E − 2	
4				458.7×10^{0}
5	−4879			
6		7.7484×10^{-4}		
7			2.951E0	
8				55.0002×10^{-3}
9	0.258			
10		-3.7×10^{-4}		
11			2.3548792E7	
12				-80×10^{-6}
13	100000			
14		1×10^{-5}		
15			4.01E4	
16				510×10^{-6}

Scientific notation

Season	01
Episode	AP05
Document	Correction

	Ordinary	Scientific	Calculator	Engineering
1	45	4.5×10^{1}	4.5E1	45×10^{0}
2	-384050	-3.8405×10^{5}	-3.8405E5	-384.05×10^{3}
3	0.0115	1.15×10^{-2}	$1.15\text{E}-2$	11.5×10^{-3}
4	458.7	4.587×10^{2}	4.587E2	$458.7(\times 10^{0})$
5	-4879	-4.879×10^{3}	-4.879E3	-4.879×10^{3}
6	0.00077484	7.7484×10^{-4}	$7.7484\text{E}-4$	774.84×10^{-6}
7	2.951	2.951×10^{0}	2.951E0	2.951×10^{0}
8	0.0550002	5.50002×10^{-2}	$5.50002\text{E}-2$	55.0002×10^{-3}
9	0.258	2.58×10^{-1}	$2.58\text{E}-1$	258×10^{-3}
10	-0.00037	-3.7×10^{-4}	$-3.7\text{E}-4$	-370×10^{-6}
11	23548792	2.3548792×10^{7}	2.3548792E7	23.548792×10^{6}
12	-0.00008	-8×10^{-5}	$-8\text{E}-5$	-80×10^{-6}
13	100000	$(1\times)10^{5}$	1E5	100×10^{3}
14	0.00001	1×10^{-5}	$1\text{E}-5$	10×10^{-6}
15	40100	4.01×10^{4}	4.01E4	40.1×10^{3}
16	0.00051	5.1×10^{-4}	$5.1\text{E}-4$	510×10^{-6}

Document 1 Matching cards with various notations of the same numbers

120	1.2×10^{2}	1.2E2	120×10^{0}
12000	1.2×10^{4}	1.2E4	12×10^{3}
12	1.2×10^{1}	1.2E1	12×10^{0}
0.12	1.2×10^{-1}	1.2E−1	120×10^{-3}
0.0012	1.2×10^{-3}	1.2E−3	1.2×10^{-3}