

Key

Quick Introduction to Scientific Notation

What is it?

Scientific notation is a quick way to write really big numbers by expressing them as the product of a small number and a power of 10. For example: 1,473,000,000,000,000 can be written as 1.473×10^{15} . Scientific notation is used frequently in science, especially in chemistry.

Converting numbers to scientific notation.

To convert a large number to scientific notation, first move the decimal so that there is only one number to the left of it. Let n = the number of spaces that you moved the decimal. Multiply your new number by 10^n if you moved the decimal to the left, or 10^{-n} if you had to move the decimal to the right.

Examples:

$$1,254,300 = 1.2543 \times 10^6$$

$$0.0000000029 = 2.9 \times 10^{-9}$$

Practice Problems:

$$34,294 = \underline{3.4294 \times 10^4}$$

$$0.0000284 = \underline{2.84 \times 10^{-5}}$$

$$944 = \underline{9.44 \times 10^2}$$

$$0.000000000000734 = \underline{7.34 \times 10^{-12}}$$

Converting numbers in scientific notation back to standard notation.

To convert a number in scientific notation back to standard notation, move the decimal the correct number of spaces indicated by the exponent. If the exponent is positive, move the decimal to the right. If the exponent is negative, move the decimal to the left.

Examples:

$$2.387 \times 10^7 = 23,870,000$$

$$6.5 \times 10^{-4} = 0.00065$$

Practice Problems:

$$4.3 \times 10^6 = \underline{4,300,000}$$

$$3.29 \times 10^{-5} = \underline{0.0000329}$$

Multiplication with scientific notation.

To multiply numbers written in scientific notation, follow these steps.

1. Multiply the numerals.
2. Add the exponents on the tens.
3. Multiply the product from step 1 by 10^n , where n is the sum from step 2.
4. Rewrite the answer in correct scientific notation form.

$$\text{Example: } 5.6 \times 10^{11} \times 3.2 \times 10^5 = (5.6 \times 3.2) \times 10^{16} = 17.92 \times 10^{16} = 1.792 \times 10^{17}$$

Practice Problems:

$$3.56 \times 10^4 \times 4.8 \times 10^3 = \underline{(3.56 \times 4.8) \times 10^{(4+3)} = 17.088 \times 10^7 = 1.7088 \times 10^8}$$

$$1.547 \times 10^3 \times 2 \times 10^{12} = \underline{(1.547 \times 2) \times 10^{(3+12)} = 3.094 \times 10^{15}}$$

Division with scientific notation.

To divide numbers written in scientific notation, follow these steps.

1. Rewrite the division problem in fraction form (if it isn't already).
2. Divide the numerals.
3. Subtract the exponent on the denominator from the exponent on the numerator.
4. Multiply the quotient from step 2 by 10^n , where n is the difference from step 3.
5. Rewrite the answer in correct scientific notation form.

$$\text{Example: } \frac{4.589 \times 10^9}{3.74 \times 10^3} = (4.589/3.74) \times 10^6 = 1.227 \times 10^6$$

Practice Problems:

$$\frac{1.23 \times 10^8}{3.5 \times 10^4} = \left(\frac{1.23}{3.5} \right) \times 10^{(8-4)}$$

$$\frac{4.29 \times 10^4}{2.4 \times 10^{11}}$$

$$\left(\frac{4.29}{2.4} \right) \times 10^{(4-11)}$$

$$0.35 \times 10^4 = 3.5 \times 10^3$$

$$1.8 \times 10^{-7}$$

Key: Earth Science

Name: Key Period: _____

The Metric System: Friend of the Scientist

kilo	hecto	deka	unit	deci	centi	milli	x	x	micro
kilometer (km)	hectometer (hm)	dekameter (dam)	meter* (m)	decimeter (dm)	centimeter (cm)	millimeter (mm)			micrometer (μ m)
1000 m	100 m	10 m	1 m	0.1 m	0.01 m	0.001 m			0.000001m

*Meters are used to measure length. When measuring volume, use liters (l). When measuring mass, use grams (g).

- 1.) 1 m = 1000000 micrometers 1,000,000
- 2.) 1 m = 0.001 kilometers .001
- 3.) 24.6 mm = 2.46 centimeters 24.6
- 4.) 43.68 cm = 436.8 millimeters 43.68
- 5.) 13.45 μ m = 0.01345 millimeters 13.45
- 6.) 0.75 km = 750 meters .750
- 7.) 0.25 dam = 250 centimeters .250
- 8.) 0.40 cm = 4.0 millimeters 0.40
- 9.) 0.40 cm = 0.004 meters 20.40
- 10.) 700 μ m = 0.007 decimeters 20.700
- 11.) 5,788 cm = 0.5788 hectometers 5.788
- 12.) 1000 m = 1.0 kilometers 1000
- 13.) 7000 m = 7.0 kilometers 7000
- 14.) 5 km = 50000 decimeters 50000
- 15.) 55.77 cm = 0.5577 meters 55.77
- 16.) 100 cm = 1.0 meters 100
- 17.) 250 cm = 2.5 meters 250
- 18.) 900 dam = 9.0 kilometers 900
- 19.) 44.88 mm = 4.488 centimeters 44.88
- 20.) 40 hm = 400 dekameters 40.0
- 21.) 0.77 μ m = 0.0000077 decimeters 0.0000077
- 22.) 398.4 mm = 398400 micrometers 398.400
- 23.) 99 dm = 9.9 meters 99
- 24.) 0.23984 cm = 2.3984 millimeters 0.23984
- 25.) 0.000005374 km = 0.5374 centimeters 0.000005374
- 26.) 1.59 m = 15.9 decimeters 1.59

1) $1 \mu\text{m} \left(\frac{1 \mu\text{m}}{0.000001 \text{ m}} \right) = 1,000,000 \mu\text{m} = 1 \times 10^6 \mu\text{m}$

2) $1 \text{ km} \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) = 0.001 \text{ km} = 1 \times 10^{-3} \text{ km}$

3) $24.6 \text{ mm} \left(\frac{1 \text{ mm}}{0.001 \text{ cm}} \right) \left(\frac{1 \text{ cm}}{1 \text{ cm}} \right) = 2.46 \text{ cm} = 2.46 \times 10^0 \text{ cm}$

4) $43.68 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) \left(\frac{1 \text{ mm}}{0.001 \text{ m}} \right) = 436.8 \text{ mm} = 4.368 \times 10^2 \text{ mm}$

5) $13.45 \text{ km} \left(\frac{1 \text{ km}}{0.000001 \text{ m}} \right) \left(\frac{1 \text{ mm}}{0.001 \text{ m}} \right) = 0.01345 \text{ mm} = 1.345 \times 10^{-2} \text{ mm}$

6) $0.75 \text{ km} \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) = 750 \text{ m} = 7.5 \times 10^2 \text{ m}$

7) $0.25 \text{ km} \left(\frac{1 \text{ km}}{10 \text{ m}} \right) \left(\frac{1 \text{ cm}}{0.01 \text{ m}} \right) = 250 \text{ cm} = 2.5 \times 10^2 \text{ cm}$

8) $0.40 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) \left(\frac{1 \text{ m}}{0.01 \text{ m}} \right) = 0.004 \text{ m} = 4.0 \times 10^{-3} \text{ m}$

9) $0.40 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) \left(\frac{1 \text{ mm}}{0.001 \text{ m}} \right) = 4.0 \text{ mm} = 4.0 \times 10^0 \text{ mm}$

10) $700 \text{ km} \left(\frac{0.000001 \text{ m}}{1 \text{ dm}} \right) \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) = 0.007 \text{ dm} = 7.0 \times 10^{-3} \text{ dm}$

11) $5788 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ km}} \right) \left(\frac{1 \text{ km}}{100 \text{ m}} \right) = 0.5788 \text{ km} = 5.788 \times 10^{-1} \text{ km}$

12) $1000 \text{ m} \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) = 1.0 \text{ km} = 1.0 \times 10^0 \text{ km}$

13) $7000 \text{ m} \left(\frac{1 \text{ km}}{1000 \text{ m}} \right) = 7.0 \text{ km} = 7.0 \times 10^0 \text{ km}$

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$$14) 5 \text{ Km} \left(\frac{1000 \text{ m}}{1 \text{ Km}} \right) \left(\frac{1 \text{ dm}}{0.1 \text{ m}} \right) = \boxed{50000 \text{ dm} = 5.0 \times 10^4 \text{ dm}}$$

$$15) 55.77 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) = \boxed{0.5577 \text{ m} = 5.577 \times 10^{-1} \text{ m}}$$

$$16) 100 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) = \boxed{1.0 \text{ m} = 1.0 \times 10^0 \text{ m}}$$

$$17) 250 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) = \boxed{2.5 \text{ m} = 2.5 \times 10^0 \text{ m}}$$

$$18) 900 \text{ dam} \left(\frac{10 \text{ m}}{1 \text{ dam}} \right) \left(\frac{1 \text{ Km}}{1000 \text{ m}} \right) = \boxed{9.0 \text{ Km} = 9.0 \times 10^0 \text{ Km}}$$

$$19) 44.488 \text{ mm} \left(\frac{0.001 \text{ m}}{1 \text{ mm}} \right) \left(\frac{1 \text{ cm}}{0.01 \text{ m}} \right) = \boxed{4.4888 \text{ cm} = 4.4888 \times 10^0 \text{ cm}}$$

$$20) 40 \text{ hkm} \left(\frac{100 \text{ m}}{1 \text{ hkm}} \right) \left(\frac{1 \text{ dam}}{10 \text{ m}} \right) = \boxed{400 \text{ dam} = 4.0 \times 10^2 \text{ dam}}$$

$$21) 0.77 \text{ } \mu\text{m} \left(\frac{0.000001 \text{ m}}{1 \text{ } \mu\text{m}} \right) \left(\frac{1 \text{ dm}}{0.1 \text{ m}} \right) = \boxed{0.0000077 \text{ dm} = 7.7 \times 10^{-6} \text{ dm}}$$

$$22) 398.4 \text{ mm} \left(\frac{0.001 \text{ m}}{1 \text{ mm}} \right) \left(\frac{1 \text{ } \mu\text{m}}{0.000001 \text{ m}} \right) = \boxed{398400 \text{ } \mu\text{m} = 3.984 \times 10^5}$$

$$23) 99 \text{ dam} \left(\frac{0.1 \text{ m}}{1 \text{ dam}} \right) = \boxed{9.9 \text{ m} = 9.9 \times 10^0 \text{ m}}$$

$$24) 0.23984 \text{ cm} \left(\frac{0.01 \text{ m}}{1 \text{ cm}} \right) \left(\frac{1 \text{ mm}}{0.001 \text{ m}} \right) = \boxed{2.3984 \text{ mm} = 2.3984 \times 10^0 \text{ mm}}$$

$$25) 0.000005374 \text{ Km} \left(\frac{1000 \text{ m}}{1 \text{ Km}} \right) \left(\frac{1 \text{ cm}}{0.01 \text{ m}} \right) = \boxed{0.5374 \text{ cm} = 5.374 \times 10^{-1} \text{ cm}}$$

$$26) 1.59 \text{ m} \left(\frac{1 \text{ dm}}{0.1 \text{ m}} \right) = \boxed{15.9 \text{ dm} = 1.59 \times 10^1 \text{ dm}}$$