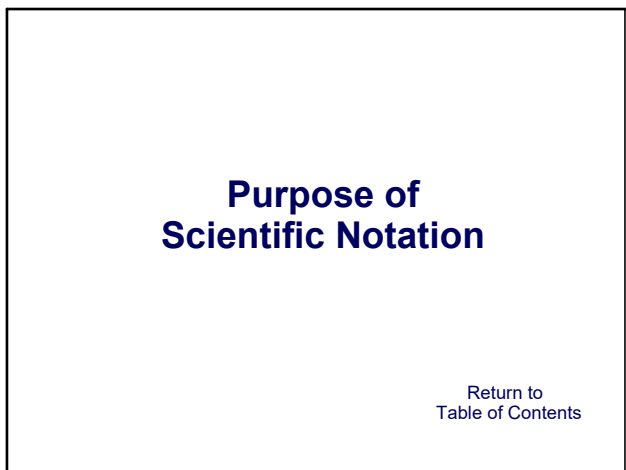


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- Purpose of Scientific Notation
- Writing Numbers in Scientific Notation
- Converting Between Scientific Notation and Standard Form
- Magnitude
- Comparing Numbers in Scientific Notation
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- Addition and Subtraction with Scientific Notation
- Glossary & Standards

Teacher Notes



**Purpose of Scientific Notation**

Scientists are often confronted with numbers that look like this:  
 300,000 kg

Can you guess what weighs this much?

Math Practice

[https://youtu.org/video?v=Dhpl\\_batm-5I](https://youtu.org/video?v=Dhpl_batm-5I)

**Can you match these BIG objects to their weights?**

**300,000,000,000 kg**

**2,000,000,000,000,000,000,000,000,000 kg**

**600,000,000 kg**

**60,000,000,000,000,000,000,000,000 kg**

**180,000 kg**

Math Practice

**Can you match these BIG objects to their weights?**


Click object to reveal answer

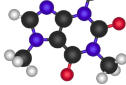
**Can you match these small objects to their weights?**


0.00015 kg

0.000000000000000000000000000030 kg


0.000000000035 kg

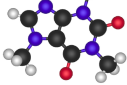
grain of sand 


molecule 

steam 

**Click to reveal the answers.**

grain of sand 

molecule 

steam 

### Scientific Notation

The examples were written in **standard form**, the form we normally use. But the standard form is difficult to work with when a number is **HUGE** or **tiny**, if it has a lot of zeros.

Scientists have come up with a more convenient method to write very **LARGE** and very **small** numbers.

Writing numbers in **scientific notation** doesn't change the value of the number.

### Scientific Notation

Scientific Notation uses **Powers** of 10 to write big or small numbers more conveniently.

Using scientific notation requires us to use the rules of exponents we learned earlier. While we developed those rules for all **bases**, scientific notation only uses base 10.

### Powers of Ten

$10^1 = 10$

$10^2 = 10 \times 10 = 100$

$10^3 = 10 \times 10 \times 10 = 1,000$

$10^4 = 10 \times 10 \times 10 \times 10 = 10,000$

$10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100,000$

[Click here to see a video on powers of ten which puts our universe into perspective!](#)

[Click here to move from the Milky Way through space towards Earth to an oak tree, and then within a cell!](#)

### Powers of Integers

Powers are a quick way to write repeated multiplication, just as multiplication was a quick way to write repeated addition.

These are all equivalent:

$$10^3$$

$$(10)(10)(10)$$

$$1000$$

In this case, the base is 10 and the exponent is 3.

### Review of Exponent Rules

Remember that when multiplying numbers with exponents, if the bases are the same, you write the base and add the exponents.

$$2^5 \times 2^6 = 2^{(5+6)} = 2^{11}$$

$$3^3 \times 3^7 = 3^{(3+7)} = 3^{10}$$

$$10^8 \times 10^{-3} = 10^{(8+(-3))} = 10^5$$

$$4^7 \times 4^{-7} = 4^{(7+(-7))} = 4^0 = 1$$

$$2^3 \times 3^7 = 2 \times 3^{10}$$

1  $10^2 \times 10^4 =$

A  $10^6$

B  $10^8$

C  $10^{10}$

D  $10^{12}$

$$10^2 \times 10^4$$

$$10^{(2+4)}$$

$$10^6$$

Answer



<https://njctl.org/video/?v=arHXqCTQ9BA>

2  $10^{14} \times 10^{-6} =$

A  $10^6$

B  $10^8$

C  $10^{10}$

D  $10^{12}$

Answer



<https://njctl.org/video/?v=Y-8ZsrzoT8>

3  $10^{-4} \times 10^{-6} =$

A  $10^{-6}$

B  $10^{-8}$

C  $10^{-10}$

D  $10^{-12}$

Answer



<https://njctl.org/video/?v=2VYkYDUZ8>

4  $10^4 \times 10^6 =$

A  $10^6$

B  $10^8$

C  $10^{10}$

D  $10^{12}$

Answer



<https://njctl.org/video/?v=EwGD0zQvfw>

## Writing Numbers in Scientific Notation

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### Scientific Notation

Here are some different ways of writing 6,500.

6,500 = 6.5 thousand  
 6.5 thousand =  $6.5 \times 1,000$   
 $6.5 \times 1,000 = 6.5 \times 10^3$

which means that  $6,500 = 6.5 \times 10^3$

6,500 is standard form of the number  
 and  $6.5 \times 10^3$  is scientific notation



These are two ways of writing the same number.

[https://vimeo.com/video/71155R\\_8c8arp3U](https://vimeo.com/video/71155R_8c8arp3U)

### Scientific Notation

$6.5 \times 10^3$  isn't a lot more convenient than 6,500.

But let's do the same thing with 7,400,000,000  
 which is equal to 7.4 billion  
 which is  $7.4 \times 1,000,000,000$   
 which is  $7.4 \times 10^9$

Besides being shorter than 7,400,000,000 it is a lot  
 easier to keep track of the zeros in scientific notation.

And we'll see that the math gets a lot easier as well.

### Scientific Notation

Scientific notation expresses numbers as the product of:

a coefficient and 10 raised to some power.  
 $3.78 \times 10^6$

The **coefficient** is always greater than or equal to one, and less than 10. In this case, the number 3,780,000 is expressed in scientific notation.

### Express 870,000 in Scientific Notation

- Write the number without the comma. 870000
- Place the decimal so that the first number will be less than 10 but greater than or equal to 1.  $8.70000 \times 10$
- Count how many places you had to move the decimal point. This becomes the exponent of 10.  $8.70000 \times 10$   
54321
- Drop the zeros to the right of the right-most non-zero digit.  $8.7 \times 10^5$

### Express 284,000,000 in Scientific Notation

- Write the number without the comma. ~~284000000~~
- Place the decimal so that the first number will be less than 10 but greater than or equal to 1. 2.84
- Count how many places you had to move the decimal point. This becomes the exponent of 10.  $10^8$
- Drop the zeros to the right of the right-most non-zero digit.  $2.84 \times 10^8$

Answer

### Express 536,000 in Scientific Notation

- Write the number without the comma. \_\_\_\_\_
- Place the decimal so that the first number will be less than 10 but greater than or equal to 1. \_\_\_\_\_
- Count how many places you had to move the decimal point. This becomes the exponent of 10. \_\_\_\_\_
- Drop the zeros to the right of the right-most non-zero digit. \_\_\_\_\_

Answer

$5.36 \times 10^5$

5 Which is the correct coefficient of 147,000 when it is written in scientific notation?

- A 147
- B 14.7
- C 1.47
- D .147

Answer



<https://njctl.org/video/?v=xK4O3ngo7F1>

6 Which is the correct coefficient of 23,400,000 when it is written in scientific notation?

- A .234
- B 2.34
- C 234.
- D 23.4



<https://njctl.org/video/?v=KvEayqNZluw>

7 How many places do you need to move the decimal point to change 190,000 to 1.9?

- A 3
- B 4
- C 5
- D 6

Answer



<https://njctl.org/video/?v=TVvwpjxM1jks>

8 How many places do you need to move the decimal point to change 765,200,000,000 to 7.652?

- A 11
- B 10
- C 9
- D 8

Answer



<https://njctl.org/video/?v=Namy-D4HSY>

9 Which of the following is 345,000,000 in scientific notation?

- A  $3.45 \times 10^8$
- B  $3.45 \times 10^6$
- C  $345 \times 10^6$
- D  $.345 \times 10^9$

Answer



<https://njctl.org/video/?v=ua4XkjT5YPU>

### The Mass of the Solar System

300,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 kg

(How do you even say that number?)



<https://njctl.org/video/?v=TYF5de-1D3s>

More Practice

Express 9,040,000,000 in Scientific Notation

1. Write the number without the comma. \_\_\_\_\_
2. Place the decimal so that the first number will be less than 10 but greater than or equal to 1. \_\_\_\_\_
3. Count how many places you had to move the decimal point. This becomes the exponent of 10. \_\_\_\_\_
4. Drop the zeros to the right of the right-most non-zero digit. \_\_\_\_\_

9.04 x 10<sup>10</sup>



<https://njctl.org/video/?v=2uT7Q3-4Lh8>

Express 13,030,000 in Scientific Notation

1. Write the number without the comma. \_\_\_\_\_
2. Place the decimal so that the first number will be less than 10 but greater than or equal to 1. \_\_\_\_\_
3. Count how many places you had to move the decimal point. This becomes the exponent of 10. \_\_\_\_\_
4. Drop the zeros to the right of the right-most non-zero digit. \_\_\_\_\_

Answer

Express 1,000,000,000 in Scientific Notation

1. Write the number without the comma. \_\_\_\_\_
2. Place the decimal so that the first number will be less than 10 but greater than or equal to 1. \_\_\_\_\_
3. Count how many places you had to move the decimal point. This becomes the exponent of 10. \_\_\_\_\_
4. Drop the zeros to the right of the right-most non-zero digit. \_\_\_\_\_

Answer

10 Which of the following is 12,300,000 in scientific notation?

- A .123 x 10<sup>8</sup>
- B 1.23 x 10<sup>5</sup>
- C 123 x 10<sup>5</sup>
- D 1.23 x 10<sup>7</sup>

Answer



<https://njctl.org/video/?v=FqgnzucEKRE>

11 The average distance from Earth to the Moon is approximately 384,400,000 meters. What is the average distance, in kilometers, from Earth to the Moon written in scientific notation?

- A 3.844 x 10<sup>4</sup> kilometers
- B 3.844 x 10<sup>5</sup> kilometers
- C 3.844 x 10<sup>7</sup> kilometers
- D 3.844 x 10<sup>8</sup> kilometers

$m \rightarrow km$   
 $\frac{384,400,000 \text{ m}}{1,000} \times \left[ \frac{1 \text{ km}}{1,000 \text{ m}} \right]$



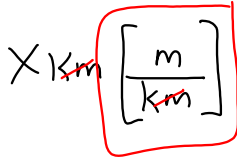
<https://njctl.org/video/?v=egbbA4mLEg>

From PARCC PBA sample test calculator #1

Answer & Math Practice

12 The closest that Venus ever gets to Earth is 38,000,000 km. What is this distance, in meters, from Venus to Earth written in scientific notation?

- A  $3.8 \times 10^9$  meters
- B  $3.8 \times 10^7$  meters
- C  $3.8 \times 10^{10}$  meters
- D  $3.8 \times 10^6$  meters



Answer



<https://njctl.org/video?v=34f9E5NSAx>

### Writing Small Numbers in Scientific Notation

#### Express 0.0043 in Scientific Notation

1. Write the number without the decimal point.  $0043$
2. Place the decimal so that the first number is 1 or more, but less than 10.  $004.3 \times 10^?$
3. Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10.  $004.3 \times 10^?$   
*123*
4. Drop the zeros to the left of the left-most non-zero digit.  $4.3 \times 10^{-3}$



<https://njctl.org/video?v=yjgqYKO254>

#### Express 0.0000832 in scientific notation

1. Write the number without the decimal point. \_\_\_\_\_
2. Place the decimal so that the first number is 1 or more, but less than 10. \_\_\_\_\_
3. Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10. \_\_\_\_\_
4. Drop the zeros to the left of the left-most non-zero digit. \_\_\_\_\_

Answer

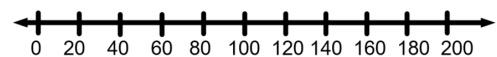
#### Express 0.0073 in scientific notation

1. Write the number without the decimal point. \_\_\_\_\_
2. Place the decimal so that the first number is 1 or more, but less than 10. \_\_\_\_\_
3. Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10. \_\_\_\_\_
4. Drop the zeros to the left of the left-most non-zero digit. \_\_\_\_\_

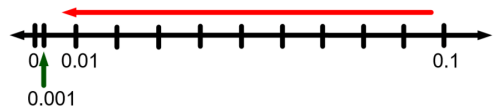
Answer

#### Scientific Notation: The Difference Between Positive & Negative Exponents

As you get further and further down a number line in the positive direction, your numbers are getting bigger. Therefore, really big numbers will have a positive exponent when written in scientific notation.



As you get closer and closer to zero on a number line, your numbers are getting smaller. Therefore, really small numbers will have a negative exponent when written in scientific notation.



13 Which is the correct decimal placement to convert 0.000832 to scientific notation?

- A 832
- B 83.2
- C .832
- D 8.32

Answer



<https://ijcl.org/video?v=vmv59zhuMBQ>

14 Which is the correct decimal placement to convert 0.000000376 to scientific notation?

- A 3.76
- B 0.376
- C 376.
- D 37.6

Answer



<https://ijcl.org/video?v=V5EBB-Xk07Q>

15 How many times do you need to move the decimal point to change 0.00658 to 6.58?

- A 2
- B 3
- C 4
- D 5

Answer



<https://ijcl.org/video?v=GFHK3EY2mc>

16 How many times do you need to move the decimal point to change 0.000003242 to 3.242?

- A 5
- B 6
- C 7
- D 8

Answer



<https://ijcl.org/video?v=ya800INQMk>

17 Write 0.00278 in scientific notation.

- A  $27.8 \times 10^{-4}$
- B  $2.78 \times 10^3$
- C  $2.78 \times 10^{-3}$
- D  $278 \times 10^{-3}$

Answer



<https://ijcl.org/video?v=2qKfnyIE>

18 Which of these numbers, written in scientific notation, is a number greater than one?

- A  $3.4 \times 10^{-6}$
- B  $7.2 \times 10^{-3}$
- C  $8.9 \times 10^4$
- D  $2.2 \times 10^{-1}$
- E  $1.14 \times 10^{-12}$
- F  $4.1 \times 10^{-3}$

Answer




<https://ijcl.org/video?v=80FIC2WYf>




19 Which of these numbers, written in scientific notation, is not a number greater than one?

- A  $3.4 \times 10^8$
- B  $7.2 \times 10^3$
- C  $8.9 \times 10^4$
- D  $2.2 \times 10^{-1}$
- E  $1.4 \times 10^{12}$
- F  $4.1 \times 10^3$



Answer  
Multi Practice

More Practice



**Express 0.001003 in Scientific Notation**

- Write the number without the decimal point. \_\_\_\_\_
- Place the decimal so that the first number is 1 or more, but less than 10. \_\_\_\_\_
- Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10. \_\_\_\_\_
- Drop the zeros to the left of the left-most non-zero digit. \_\_\_\_\_

Answer

**Express 0.000902 in Scientific Notation**

- Write the number without the decimal point. \_\_\_\_\_
- Place the decimal so that the first number is 1 or more, but less than 10. \_\_\_\_\_
- Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10. \_\_\_\_\_
- Drop the zeros to the left of the left-most non-zero digit. \_\_\_\_\_

Answer


**Express 0.000012 in Scientific Notation**

- Write the number without the decimal point. \_\_\_\_\_
- Place the decimal so that the first number is 1 or more, but less than 10. \_\_\_\_\_
- Count how many places you had to move the decimal point. The negative of this number becomes the exponent of 10. \_\_\_\_\_
- Drop the zeros to the left of the left-most non-zero digit. \_\_\_\_\_

Answer

20 Write 0.000847 in scientific notation.

- A  $8.47 \times 10^4$
- B  $847 \times 10^{-4}$
- C  $8.47 \times 10^{-4}$
- D  $84.7 \times 10^5$




Answer

## Converting Between Scientific Notation and Standard Form

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### Express $3.5 \times 10^4$ in Standard Form

1. Write the coefficient.	3.5
2. Add a number of zeros equal to the exponent: to the right for positive exponents and to the left for negative.	3.50000
3. Move the decimal the number of places indicated by the exponent: to the right for positive exponents and to the left for negative.	35000.0
4. Drop unnecessary zeros and add comma, as necessary.	35,000



https://www.khanacademy.org/a/...

### Express $1.02 \times 10^6$ in Standard Form

1. Write the coefficient. \_\_\_\_\_
2. Add a number of zeros equal to the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
3. Move the decimal the number of places indicated by the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
4. Drop unnecessary zeros and add comma, as necessary. \_\_\_\_\_

Answer

### Express $3.42 \times 10^{-3}$ in Standard Form

1. Write the coefficient. \_\_\_\_\_
2. Add a number of zeros equal to the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
3. Move the decimal the number of places indicated by the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
4. Drop unnecessary zeros and add comma, as necessary. \_\_\_\_\_

Answer

### Express $2.95 \times 10^{-4}$ in Standard Form


1. Write the coefficient. \_\_\_\_\_
2. Add a number of zeros equal to the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
3. Move the decimal the number of places indicated by the exponent: to the right for positive exponents and to the left for negative. \_\_\_\_\_
4. Drop unnecessary zeros and add comma, as necessary. \_\_\_\_\_

Answer

21 How many times do you need to move the decimal and which direction to change  $7.41 \times 10^6$  into standard form?

A 6 to the right  
 B 6 to the left  
 C 7 to the right  
 D 7 to the left

Answer



https://www.khanacademy.org/a/...

22 How many times do you need to move the decimal and which direction to change  $4.5 \times 10^{10}$  into standard form?

- A 10 to the right
- B 10 to the left
- C 11 to the right
- D 11 to the left

Answer



<https://vctf.org/video?v=PEqOXysks>

23 Write  $6.46 \times 10^2$  in standard form.

- A 646,000
- B 0.00000646
- C 64,600
- D 0.0000646

Answer



<https://vctf.org/video?v=ASB2G5p2B>

24 Write  $3.4 \times 10^3$  in standard form.

- A 3,400
- B 340
- C 34,000
- D 0.0034

Answer



[https://vctf.org/video?v=0J\\_8E2D9X](https://vctf.org/video?v=0J_8E2D9X)

25 Write  $6.46 \times 10^{-5}$  in standard form.

- A 646,000
- B 0.00000646
- C 0.00646
- D 0.0000646

Answer



<https://vctf.org/video?v=GTCD488PDD>

26 Write  $1.25 \times 10^{-4}$  in standard form.

- A 125
- B 0.000125
- C 0.00000125
- D 4.125

Answer



<https://vctf.org/video?v=vg1003D4uTE>

27 Write  $4.56 \times 10^{-2}$  in standard form.

- A 456
- B 4560
- C 0.00456
- D 0.0456

Answer




<https://vctf.org/video?v=46Pz0z7W8V>

28 Write  $1.01 \times 10^8$  in standard form.

- A 101,000,000,000
- B 1,010,000,000
- C 0.00000000101
- D 0.000000101


Answer



<https://imgpt.org/video?m=KJh0BZw6pu>

### Using a Calculator for Scientific Notation


When entering numbers into a calculator that are in scientific notation, you can use the EE button. It means "x 10 to the power of."



This button eliminates the "x 10" of a number in scientific notation.

So  $9 \times 10^8$  is entered into the calculator using **9 EE 8** and shows up at the top as 9E8.

Math Practice



<https://imgpt.org/video?m=KJh0BZw6pu>


### Using a Calculator for Scientific Notation

Enter the following numbers into the calculator using the "EE" button to determine its value in standard form.

- a)  $4 \times 10^2$
- b)  $5.7 \times 10^{-3}$
- c)  $9.87 \times 10^4$
- d)  $1.43 \times 10^{-1}$

Answer

### Using a Calculator for Scientific Notation



When reading a calculator that has a number in scientific notation, remember that the "E" stands for "x 10 to the power of".


Which number written in standard form represents the number in the calculator to the right?

Answer

### Using a Calculator for Scientific Notation

When reading a calculator that has a number in scientific notation, remember that the "E" stands for "x 10 to the power of".


Which number written in standard form represents the number in the calculator below?




Answer

29 Which number written in standard form represents the number in the calculator below?

- A 0.000000000482
- B 0.0000000000482
- C 4,820,000,000,000
- D 48,200,000,000




Answer




<https://imgpt.org/video?m=KJh0BZw6pu>

30 Which number written in standard form represents the number in the calculator below?

A 0.00000653  
 B 0.0000653  
 C 6,530,000  
 D 653,000,000




Answer




<https://www.njctl.org/video/?v=0-V33M82DPM>

31 Which number written in standard form represents the number in the calculator below?

A 0.000000000974  
 B 0.0000000000974  
 C 9,740,000,000,000  
 D 97,400,000,000




Answer




<https://www.njctl.org/video/?v=Jm4d9p781EDQ>

32 Which number written in standard form represents the number in the calculator below?

A 0.00000407  
 B 0.00000407  
 C 4,070,000  
 D 407,000,000




Answer




<https://www.njctl.org/video/?v=028P9tWtYR>

33 Liz saw this number on her calculator screen. Which number represent the number Liz saw?

A 0.0000006  
 B 0.00000006  
 C -6,000,000  
 D -60,000,000



Answer



<https://www.njctl.org/video/?v=03407560u>

From PARCC EOY sample test calculator #13

## Magnitude

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## Magnitude

Scientific notation always uses decimal notation that is bigger than 1 but smaller than 10. Why?


This is due to magnitude. Magnitude is how we can observe very large or very small numbers and easily compare them.

The magnitude of a number is the exponent when the number is written in scientific notation. Below are a few examples.

$8,304 = 8.304 \times 10^3$  - the order of magnitude is 3

$20,000 = 2 \times 10^4$  - the order of magnitude is 4

$0.000034 = 3.4 \times 10^{-5}$  - the order of magnitude is -5



[https://njctl.org/video/?v=\\_ElyHy6s\\_8](https://njctl.org/video/?v=_ElyHy6s_8)

### Scientific Notation vs. Magnitude

Write each of the following in Scientific Notation first and then indicate the order of magnitude.

	Scientific Notation	Order of Magnitude
6214	_____	_____
472.17	_____	_____
813000000	_____	_____
.000253	_____	_____
.00647	_____	_____
.0000049	_____	_____

### Application

Let J represent the world population in 1950.

$$J = 2,556,000,053.$$

Find the smallest power of 10 that will exceed J.

The number above (J) has 10 digits and is smaller than a whole number with 11 digits.

(10,000,000,000 or  $10^{10}$  therefore  $J < 10^{10}$ )

The answer is 10.

### Application

Let K represent the national debt in 1950.

$$K = 257,357,352,351.$$

Find the smallest power of 10 that will exceed K.

Answer & Math Practice

34 If  $m = 149,162,536,496,481,100$  find the smallest power of 10 that will exceed m.

A 19

B 18

C 17

D 14



<https://njctl.org/video/?v=clmfsByPdk>

(Derived from engage™)

Answer

35 What is the smallest power of 10 that will exceed 5,321?

A 6

B 5

C 4

D 3

Answer



<https://njctl.org/video/?v=B6VR3yqjNA>

(Derived from engage™)

36 If  $m = 628 \frac{437}{562}$  find the smallest power of 10 that will exceed m?

A 6

B 5

C 4

D 3

Answer



<https://njctl.org/video/?v=whf9J6X85e9U>

(Derived from engage™)

37 What would the negative exponent be used to express the number  $\frac{1}{10,000}$  ?

- A -4
- B -5
- C -1000
- D -1

Answer



[https://njctl.org/video/?v=ZEN\\_AIRp28E](https://njctl.org/video/?v=ZEN_AIRp28E)

(derived from engage™)

## Comparing Numbers Written in Scientific Notation



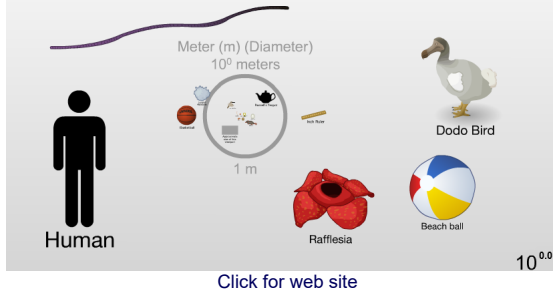
[https://njctl.org/video/?v=6Lk\\_1H-pk](https://njctl.org/video/?v=6Lk_1H-pk)

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### The Scale of the Universe 2

## The Scale of the Universe 2

### Giant Earthworm



### Comparing Numbers in Scientific Notation

First, compare the exponents.  
 If the exponents are different, the coefficients do not matter; they have a smaller effect.  
 Whichever number has the larger exponent is the larger number.

### Comparing Numbers in Scientific Notation

When the exponents are different, just compare the exponents.

- <      =      >
- $9.99 \times 10^3$          $2.17 \times 10^4$
- $1.02 \times 10^2$          $8.54 \times 10^{-3}$
- $6.83 \times 10^{-9}$          $3.93 \times 10^{-2}$

just drag the sign that is correct

Answer & Math Practice

### Comparing Numbers in Scientific Notation

If the exponents are the same, compare the coefficients.

The larger the coefficient, the larger the number (if the exponents are the same).

### Comparing Numbers in Scientific Notation

When the exponents are the same, just compare the coefficients.

$<$	$=$	$>$
$5.67 \times 10^3$	<input type="radio"/>	$4.67 \times 10^3$
$4.32 \times 10^6$	<input type="radio"/>	$4.67 \times 10^6$
$2.32 \times 10^{10}$	<input type="radio"/>	$3.23 \times 10^{10}$

Answer

38 Which is ordered from least to greatest?

- |                  |                        |
|------------------|------------------------|
| A I, II, III, IV | I. $1.0 \times 10^5$   |
| B IV, III, I, II | II. $7.5 \times 10^6$  |
| C I, IV, II, III | III. $8.3 \times 10^4$ |
| D III, I, II, IV | IV. $5.4 \times 10^7$  |



<https://njctl.org/video/?v=F7yugNpc2l>

Answer

39 Which is ordered from least to greatest?

- |                  |                        |
|------------------|------------------------|
| A I, II, III, IV | I. $1.0 \times 10^2$   |
| B IV, III, I, II | II. $7.5 \times 10^6$  |
| C I, IV, II, III | III. $8.3 \times 10^9$ |
| D I, II, IV, III | IV. $5.4 \times 10^7$  |

Answer



<https://njctl.org/video/?v=b44TtYHVG0>

40 Which is ordered from least to greatest?

- |                  |                           |
|------------------|---------------------------|
| A I, II, III, IV | I. $1 \times 10^2$        |
| B IV, III, I, II | II. $7.5 \times 10^3$     |
| C III, IV, II, I | III. $8.3 \times 10^{-2}$ |
| D III, IV, I, II | IV. $5.4 \times 10^3$     |

Answer



[https://njctl.org/video/?v=b8grh2\\_V0](https://njctl.org/video/?v=b8grh2_V0)

41 Which is ordered from least to greatest?

- |                  |                            |
|------------------|----------------------------|
| A II, III, I, IV | I. $1 \times 10^{-2}$      |
| B IV, III, I, II | II. $7.5 \times 10^{-24}$  |
| C III, IV, II, I | III. $8.3 \times 10^{-15}$ |
| D III, IV, I, II | IV. $5.4 \times 10^7$      |

Answer



<https://njctl.org/video/?v=bBulMh5c3k>

42 Which is ordered from least to greatest?

- |                  |                        |
|------------------|------------------------|
| A I, II, III, IV | I. $1.0 \times 10^2$   |
| B IV, III, I, II | II. $7.5 \times 10^2$  |
| C I, IV, II, III | III. $8.3 \times 10^2$ |
| D III, IV, I, II | IV. $5.4 \times 10^7$  |

Answer



<https://njctl.org/video/?v=FV2zhGAFKVE>



43 Which is ordered from least to greatest?

- |   |                |                        |
|---|----------------|------------------------|
| A | I, II, III, IV | I. $1.0 \times 10^6$   |
| B | IV, III, I, II | II. $7.5 \times 10^6$  |
| C | I, IV, II, III | III. $8.3 \times 10^6$ |
| D | III, IV, I, II | IV. $5.4 \times 10^6$  |

Answer



<https://njctl.org/video/?v=WWLcsqgDuw>

44 Which is ordered from least to greatest?

- |   |                |                        |
|---|----------------|------------------------|
| A | I, II, III, IV | I. $1.0 \times 10^3$   |
| B | IV, III, I, II | II. $5.0 \times 10^3$  |
| C | I, IV, II, III | III. $8.3 \times 10^6$ |
| D | III, IV, I, II | IV. $9.5 \times 10^6$  |

Answer



<https://njctl.org/video/?v=H23de8KvH>

45 Which is ordered from least to greatest?

- |   |                |                           |
|---|----------------|---------------------------|
| A | I, II, III, IV | I. $2.5 \times 10^{-3}$   |
| B | IV, III, I, II | II. $5.0 \times 10^{-3}$  |
| C | I, IV, II, III | III. $9.2 \times 10^{-6}$ |
| D | III, IV, I, II | IV. $4.2 \times 10^{-6}$  |

Answer



[https://njctl.org/video/?v=JSD\\_lqgqzqY](https://njctl.org/video/?v=JSD_lqgqzqY)

46 The chance of a shark bite is  $\frac{1}{11,500,000}$  and the chance of a snake bite is  $\frac{1}{50,000,000}$ . Which are you more likely to be bit by?

- A both are the same chance
- B the snake
- C the shark
- D neither

Answer



<https://njctl.org/video/?v=DGOm5-wLwLA>

(Derived from [engage™](#))

## Multiplying Numbers in Scientific Notation

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## Multiplying Numbers in Scientific Notation

Multiplying with scientific notation requires at least three (and sometimes four) steps.

1. Multiply the coefficients
2. Multiply the powers of ten applying the rule of exponents
3. Combine those results
4. Put in proper form



<https://njctl.org/video/?v=ng6S-AzyPUAo>

### Multiplying Numbers in Scientific Notation

Evaluate:  $(6.0 \times 10^4)(2.5 \times 10^2)$

- |  |                           |
|--|---------------------------|
| 1. Multiply the coefficients                                 | $6.0 \times 2.5 = 15$     |
| 2. Multiply the powers of ten applying the rule of exponents | $10^4 \times 10^2 = 10^6$ |
| 3. Combine those results                                     | $15 \times 10^6$          |
| 4. Put in proper form  | $1.5 \times 10^7$         |

Math Practice

### Multiplying Numbers in Scientific Notation

Evaluate:  $(4.80 \times 10^6)(9.0 \times 10^{-8})$

1. Multiply the coefficients \_\_\_\_\_
2. Multiply the powers of ten applying the rule of exponents \_\_\_\_\_
3. Combine those results \_\_\_\_\_
4. Put in proper form \_\_\_\_\_

Answer

47 Evaluate  $(2.0 \times 10^{-4})(4.0 \times 10^7)$ .  
Express the result in scientific notation.

- A  $8.0 \times 10^{11}$
- B  $8.0 \times 10^3$
- C  $5.0 \times 10^3$
- D  $5.0 \times 10^{11}$
- E  $7.68 \times 10^{-28}$
- F  $7.68 \times 10^{-28}$

Answer



48 Evaluate  $(5.0 \times 10^6)(7.0 \times 10^7)$ .  
Express the result in scientific notation.

- A  $3.5 \times 10^{13}$
- B  $3.5 \times 10^{14}$
- C  $3.5 \times 10^1$
- D  $3.5 \times 10^{-1}$
- E  $7.1 \times 10^{13}$
- F  $7.1 \times 10^1$

Answer



49 Evaluate  $(6.0 \times 10^2)(2.0 \times 10^3)$ .  
Express the result in scientific notation.

- A  $1.2 \times 10^6$
- B  $1.2 \times 10^1$
- C  $1.2 \times 10^5$
- D  $3.0 \times 10^{-1}$
- E  $3.0 \times 10^5$
- F  $3.0 \times 10^1$

Answer



50 Evaluate  $(1.2 \times 10^{-6})(2.5 \times 10^3)$ .  
Express the result in scientific notation.

- A  $3 \times 10^3$
- B  $3 \times 10^{-3}$
- C  $30 \times 10^{-3}$
- D  $0.3 \times 10^{-18}$
- E  $30 \times 10^{18}$

Answer



51 Evaluate  $(1.1 \times 10^4)(3.4 \times 10^6)$ .  
Express the result in scientific notation.

- A  $3.74 \times 10^{24}$
- B  $3.74 \times 10^{10}$
- C  $4.5 \times 10^{24}$
- D  $4.5 \times 10^{10}$
- E  $37.4 \times 10^{24}$

Answer



<https://njctl.org/video/?v=vgbaPmWkYs1Y>

52 Evaluate  $(3.3 \times 10^4)(9.6 \times 10^3)$ .  
Express the result in scientific notation.

- A  $31.68 \times 10^7$
- B  $3.168 \times 10^8$
- C  $3.2 \times 10^7$
- D  $32 \times 10^8$
- E  $30 \times 10^7$

Answer



<https://njctl.org/video/?v=nuJkKpFMTM>

53 Evaluate  $(2.2 \times 10^{-5})(4.6 \times 10^{-4})$ .  
Express the result in scientific notation.

- A  $10.12 \times 10^{-20}$
- B  $10.12 \times 10^{-9}$
- C  $1.012 \times 10^{-10}$
- D  $1.012 \times 10^{-9}$
- E  $1.012 \times 10^{-8}$

Answer



<https://njctl.org/video/?v=kbaeTChCdxg>

### Dividing Numbers in Scientific Notation

Dividing with scientific notation follows the same basic rules as multiplying.

1. Divide the coefficients
2. Divide the powers of ten applying the rule of exponents
3. Combine those results
4. Put in proper form



<https://njctl.org/video/?v=M8BEYw0bBA>

### Division with Scientific Notation

Evaluate:  $\frac{5.4 \times 10^6}{9.0 \times 10^2}$

- |  |                         |
|--|-------------------------|
| 1. Divide the coefficients                                 | $5.4 \div 9.0 = 0.6$    |
| 2. Divide the powers of ten applying the rule of exponents | $10^6 \div 10^2 = 10^4$ |
| 3. Combine those results                                   | $0.6 \times 10^4$       |
| 4. Put in proper form                                      | $6.0 \times 10^3$       |

Math Practice

### Division with Scientific Notation

Evaluate:  $\frac{4.4 \times 10^6}{1.1 \times 10^{-3}}$

- |  |       |
|--|-------|
| 1. Divide the coefficients                                 | _____ |
| 2. Divide the powers of ten applying the rule of exponents | _____ |
| 3. Combine those results                                   | _____ |
| 4. Put in proper form                                      | _____ |

Answer

54 Evaluate:  $\frac{4.16 \times 10^{-9}}{5.2 \times 10^{-5}}$

Express the result in scientific notation.

- A  $0.8 \times 10^{-4}$
- B  $0.8 \times 10^{-14}$
- C  $0.8 \times 10^{-5}$
- D  $8 \times 10^{-4}$
- E  $8 \times 10^{-5}$

Answer



<https://njctl.org/video/?v=LHXEBpeGgM>

55 Evaluate:  $\frac{7.6 \times 10^{-2}}{4 \times 10^{-4}}$

Express the result in scientific notation.

- A  $1.9 \times 10^{-2}$
- B  $1.9 \times 10^{-6}$
- C  $1.9 \times 10^2$
- D  $1.9 \times 10^{-8}$
- E  $1.9 \times 10^8$

Answer



<https://njctl.org/video/?v=q2PA8noVgAE>

56 Evaluate:  $\frac{8.2 \times 10^3}{2 \times 10^7}$

Express the result in scientific notation.

- A  $4.1 \times 10^{-10}$
- B  $4.1 \times 10^4$
- C  $4.1 \times 10^{-4}$
- D  $4.1 \times 10^{21}$
- E  $4.1 \times 10^{10}$

Answer



<https://njctl.org/video/?v=4PNUGAsio8s>

57 Evaluate:  $\frac{3.2 \times 10^{-2}}{6.4 \times 10^{-4}}$

Express the result in scientific notation.

- A  $.5 \times 10^{-6}$
- B  $.5 \times 10^{-2}$
- C  $.5 \times 10^2$
- D  $5 \times 10^1$
- E  $5 \times 10^3$

Answer



<https://njctl.org/video/?v=OuSztN0DCpc>

58 The point on a pin has a diameter of approximately  $1 \times 10^{-4}$  meters. If an atom has a diameter of  $2 \times 10^{-10}$  meters, about how many atoms could fit across the diameter of the point of a pin?

- A 50,000
- B 500,000
- C 2,000,000
- D 5,000,000

Answer



<https://njctl.org/video/?v=VAvtGp77Dg>

Question from ADP Algebra 1  
End-of-Course Practice Test

59 The body of a 154 pound person contains approximately  $2 \times 10^{-1}$  milligrams of gold and  $6 \times 10^1$  milligrams of aluminum. Based on this information, the number of milligrams of aluminum in the body is how many times the number of milligrams of gold in the body?

- A  $12.0 \times 10^0$
- B  $1.2 \times 10^1$
- C  $3.0 \times 10^2$
- D  $0.5 \times 10^0$



<https://njctl.org/video/?v=PSbYEWXgPI>

From PARCC EOY sample test non-calculator #5

60 One type of ant weighs about  $3 \times 10^{-3}$  gram. The ant can carry close to  $1.5 \times 10^{-1}$  gram of food on its back. The amount of food, in grams, an ant can carry on its back is approximately how many times its own body weight, in grams? Give your answer in standard form.

- A 45
- B 20
- C 5
- D 50



[https://njctl.org/video?v=H\\_G\\_008sW-8](https://njctl.org/video?v=H_G_008sW-8)

From PARCC PBA sample test non-calculator #8

Answer & Math Practice

This Add - Hd you - W - W - Hd

## Addition and Subtraction with Scientific Notation

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### Addition and Subtraction with Scientific Notation

Numbers in scientific notation can only be added or subtracted if they have the same exponents.

If needed, an intermediary step is to rewrite one of the numbers so it has the same exponent as the other.



<https://njctl.org/video?v=A2py9XSNtyw>

### Addition and Subtraction

This is the simplest example of addition

$$4.0 \times 10^3 + 5.3 \times 10^3 =$$

Since the exponents are the same (3), just add the coefficients.

$$4.0 \times 10^3 + 5.3 \times 10^3 = 9.3 \times 10^3$$

This just says

$$\begin{array}{r} 4.0 \text{ thousand} \\ + 5.3 \text{ thousand} \\ \hline 9.3 \text{ thousand} \end{array}$$

### Addition and Subtraction

This problem is slightly more difficult because you need to add one extra step at the end.

$$8.0 \times 10^3 + 5.3 \times 10^3 =$$

Since the exponents are the same (3), just add the coefficients.

$$8.0 \times 10^3 + 5.3 \times 10^3 = 13.3 \times 10^3$$

But that is not proper form, since  $13.3 > 10$ ; it should be written as  $1.33 \times 10^4$

### Addition and Subtraction

$$8.0 \times 10^4 + 5.3 \times 10^3 =$$

This requires an extra step at the beginning because the exponents are different. We have to either convert the first number to  $80 \times 10^3$  or the second one to  $0.53 \times 10^4$ .

The latter approach saves us a step at the end.

$$8.0 \times 10^4 + 0.53 \times 10^4 = 8.53 \times 10^4$$

Once both numbers had the same exponents, we just add the coefficient. Note that when we made the exponent 1 bigger, that's makes the number 10x bigger; we had to make the coefficient 1/10 as large to keep the number the same.

61 The sum of  $5.6 \times 10^3$  and  $2.4 \times 10^3$  is

- A  $8.0 \times 10^3$
- B  $8.0 \times 10^6$
- C  $8.0 \times 10^{-3}$
- D  $8.53 \times 10^3$

Answer



<https://njctl.org/video/?v=R44PEfPcBP4>

62  $8.0 \times 10^3$  minus  $2.0 \times 10^3$  is

- A  $6.0 \times 10^{-3}$
- B  $6.0 \times 10^0$
- C  $6.0 \times 10^3$
- D  $7.8 \times 10^3$

Answer



<https://njctl.org/video/?v=q1X0X449ZDo>

63  $7.0 \times 10^3$  plus  $2.0 \times 10^2$  is

- A  $9.0 \times 10^3$
- B  $9.0 \times 10^5$
- C  $7.2 \times 10^3$
- D  $7.2 \times 10^2$

Answer



<https://njctl.org/video/?v=U90NatzlEc>

64  $3.5 \times 10^5$  plus  $7.8 \times 10^5$  is

- A  $11.3 \times 10^6$
- B  $1.13 \times 10^4$
- C  $1.13 \times 10^6$
- D  $11.3 \times 10^{10}$

Answer



<https://njctl.org/video/?v=XXBU9KQ-UyA>

## Glossary & Standards

Teacher Notes

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## Base


The number that is going to be raised to a power. It is multiplied the number of times shown in the power.

$18^8$	$2^9$	ten to the power of 3 $10^3 =$ $10 \times 10 \times 10 =$ 1,000	In scientific notation, the base will always = 10
	$7^3$		
$33^5$	$1^{12}$		
	$215^4$		

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## Coefficient

A number used to multiply a variable.  
A factor of a term.

$3y$ $19z$ $6.5 \times 10^3$	$.000000459$  $4.59 \times 10^{-7}$	scientific notation: a coefficient and 10 raised to some power $3.78 \times 10^5$
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## Power

A number that shows you how many times to use the number in a multiplication.  
A quick way to write repeated multiplication.

a.k.a. Exponent or Index	ten to the power of 3 $10^3 =$ $10 \times 10 \times 10 =$ 1,000	scientific notation: a coefficient and 10 raised to some power $3.78 \times 10^5$
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## Scientific Notation

A convenient system scientists developed to rewrite big or small numbers using powers of 10 that does not change the value.

big numbers $180,000 \text{ kg} =$ $1.8 \times 10^5$	small numbers $0.00015 \text{ kg} =$ $1.5 \times 10^{-4}$	a coefficient and 10 raised to some power $3.78 \times 10^5$
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## Standard Form

A number whose scientific form has been expanded. The most familiar form of a number.

$4,500,000$ $0.00000032$ $0.006789$ $120,000$	Standard Form: $6,500$ vs. Scientific Form: $6.5 \times 10^3$	*Note* this is not the "correct" form but the most recognizable form.
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## Standards for Mathematical Practices

- MP1 Make sense of problems and persevere in solving them.
- MP2 Reason abstractly and quantitatively.
- MP3 Construct viable arguments and critique the reasoning of others.
- MP4 Model with mathematics.
- MP5 Use appropriate tools strategically.
- MP6 Attend to precision.
- MP7 Look for and make use of structure.
- MP8 Look for and express regularity in repeated reasoning.

Click on each standard to bring you to an example of how to meet this standard within the unit.



## Attachments

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