Lesson 5: Scientific Notation

Scan this lesson and see if you can find 2 real-world scenarios in which you would use scientific notation:

1) electronics

2) population problems

Vocabulary: scientific notation CCLS: 8.EE.4

Real-World Link: ELECTRONICS A single sided, single layer DVD has a storage capacity of 4.7 gigabytes. One gigabyte is equal to 10^9 bytes. 1) Write a multiplication expression that represents how many bytes can be stored on the DVD:

4.7×10^9

2) Complete the table below

Expression	Product	Expression	Product
4.7×10^1	47	4.7×10^{-1}	0.47
4.7×10^2	470	4.7×10^{-2}	0.047
4.7×10^3	4700	4.7×10^{-3}	.0047
4.7×10^4	47,000	4.7×10^{-4}	.00047

3) If 4.7 is multiplied by a positive power of 10, what relationship exists between the decimal point's new position and the exponent?

Rt.

4) When 4.7 is multiplied by a negative power of 10, how does the new position of the decimal point relate to the negative exponent?

Left

$541.23 =$

$500 + 40 + 1 + 0.2 + 0.03$

4.7
47.0
470.0
4700.0

0.47
0.047
0.0047

8724.12×10^2

87,241,200

SCIENTIFIC NOTATION: when a number is written as the product of a factor and an integer power of 10. The factor must be greater than or equal to 1 and less than 10.

$a \times 10^n$, where $1 \le a \le 10$, and n is an integer

425,000,000 = 4.25×10^8

4.25×10^6

Use these rules to express a number in scientific notation: the power of 10 is positive if the number is ≥ 1; the power of 10 is negative if the number is between 0 and 1.

EXAMPLES: Write each number in standard form

1) 5.34×10^4 2) 3.27×10^{-3}

Don't just count the zeros

a) 7.42×10^5 b) 6.1×10^{-2} c) 3.714×10^2

742,000 .061 371.4

Write in scientific notation:

3) 3,725,000 3.725×10^{6}

4) 0.000316 3.16×10^{-4}

Got It?! Try these...

d) 14,140,000 1.414×10^{7}

e) 0.00876 8.76×10^{-3}

f) 0.114 1.14×10^{-1}

Example 5: Refer to the table at the right. Order the countries according to the amount of money visitors spent in the United States from greatest to least.

Dollars Spent by International Visitors to the U.S.:

COUNTRY:	DOLLARS SPENT:
Canada	1.03×10^{7}
India	1.83×10^{6}
Mexico	7.15×10^{6}
United Kingdom	1.06×10^{7}

Got It? Try this...: Some of the top U.S. cities visited by overseas travelers are shown in the table. Order the cities according to # of visitors from greatest to least:

U. S. CITY:	Number of Visitors:
Boston	7.21×10^{5}
Las Vegas	1.3×10^{6}
Los Angeles	2.2×10^{6}
Metro D.C. Area	9.01×10^{5}

13×10^{5}

22×10^{5}

Example 6 (STEM): If you could walk at a rate of 2 meters per second, it would take you 1.92×10^8 seconds to walk to the moon. Is it more appropriate to report this time as 1.92×10^8 seconds or 6.09 years? Explain your reasoning.

Got It? Great, let's try this one...: In an ocean, the sea floor moved 475 kilometers over 65 million years. Is it more appropriate to report this rate as 7.31 centimeters per year or 7.31×10^{-5} kilometers per year? Explain your reasoning.

Guided Practice:

Write each number in standard form:

1) 9.931×10^5 =

2) 6.02×10^{-4} =

Write in scientific notation:

3) 8,785,000,000 =

4) 0.524 =

List the years from least to greatest dollar amount (the table lists total value of music shipments for 4 years):

Year:	Music Shipments:
1	1.22×10^{10}
2	1.12×10^{10}
3	7.15×10^6
4	1.06×10^7

6) STEM A plant cell has a diameter of 1.3×10^{-8} kilometer. Is it more appropriate to report the diameter of a plant cell as 1.3×10^{-8} kilometer or 1.3×10^{-2} millimeter? Explain your reasoning.

7) Building on the EQ: How is scientific notation useful in the real world?

Independent Practice:

Write in standard form: 1) 3.16×10^{3} 2) 1.1×10^{-4} 3) 2.52×10^{-5}

Write in scientific notation: 4) 43,000 5) 0.0072 6) 0.0000901

The areas of the world's oceans are listed in the table. Order the oceans according to their area from least to greatest:

OCEAN	AREA (square miles)
Atlantic	2.96×10^{7}
Arctic	5.43×10^{6}
Indian	2.65×10^{7}
Pacific	6×10^{7}
Southern	7.85×10^{6}

8) The space shuttle can travel about $8x10^5$ cm/s. Is it more appropriate to report this as $8x10^5$ cm/s or 8 kilometers per second? Explain.

9) The inside diameter of a certain size of ring is 1.732×10^{-2} meter. Is it more appropriate to report the ring diameter as 1.732×10^{-2} meter or 17.32 millimeters? Explain.

Fill in each blank to make the statement true with <,>, or =

10) 678,000 __ 6.78×10^6 11) 6.25×10^3 __ 6.3×10^3

12) Jacob is 1.7 m tall. Sarah is 1.52 meters tall. If it takes 1,000,000,000 nanometers to make 1 meter, how tall are Jacob and Sarah in nanonmeters?

Write their heights using scientific notation:

Give an example of something that would be appropriately measured by nanonmeters:

H.O.T. Problems: 1 million = 1×10^6

13) Justify Conclusions: Determine which is closer to 1 million: 1.2×10^{-4} or 1.2×10^6? Explain.

$1.2 \times 10^6 = 1.2$ million v. 0.12×10^6

14) Persevere with Problems: Compute and express each value in scientific notation-

a) (130,000)(0.0057) / 0.0004

b) (90,000)(0.0016) / (200,000)(30,000)(0.00012)

15) The average width of a strand of a spider web is 7×10^{-6} meter. What is this length expressed in standard form?

EXTRA PRACTICE:

Write in standard form:

16) 7.113×10^7

18) 2.08×10^2

19) 7.8×10^{-3}

20) 8.73×10^{-4}

Write in scientific notation:

17) 0.00000707

21) 6,700

22) 52,300,000

23) 0.037

24) STEM The table sows the mass in grams of one atom of each of several elements. List the elements in order from the least mass to greatest mass per atom:

ELEMENT:	MASS PER ATOM:
Carbon	1.995×10^{-23} g
Gold	3.272×10^{-22} g
Hydrogen	1.674×10^{-24} g
Oxygen	2.658×10^{-23} g
Silver	1.792×10^{-22} g