You will need Evernote today; no clickers.

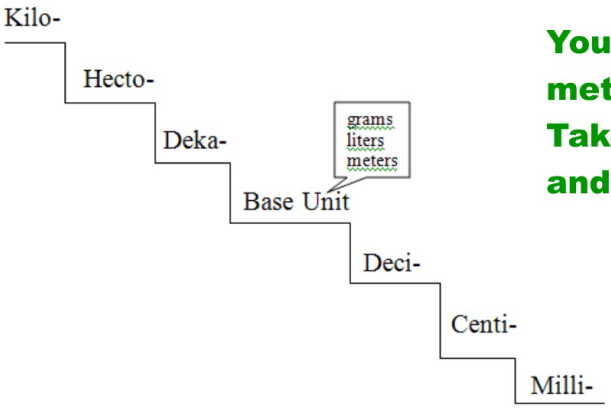
Algebra

6-3 Multiplying with Scientific Notation

CONTENT STANDARDS
8.EE.4

What You'll Learn

To multiply numbers written in scientific notation and choose appropriate units of measure



You will need to remember your metric conversions for this lesson. Take a snapshot with your webcam and save it to Evernote.

Staircase method instructions-Look at the prefix you have and count how many steps you need to get to the prefix you want.

Then move the decimal that many steps and in the same direction to convert the number to the new unit.

Example 52 mm to km

starting at milli- it is 6 steps to the left to get to kilo

move the decimal six places to the left

so 52 becomes 0.000052km

Why Learn This?

Astronomers use scientific notation when they work with very large numbers. To calculate using scientific notation, you must know how to multiply with exponents.

The rule for multiplying powers with the same base applies to multiplying numbers in scientific notation.

EXAMPLE 1 Multiplying With Scientific Notation

Multiply $(5 \times 10^6)(9 \times 10^3)$. Write the product in scientific notation.

$$(5 \times 10^6)(9 \times 10^3) = (5 \times 9) \times (10^6 \times 10^3) \quad \leftarrow \text{Use the associative and commutative properties.}$$

$$= 45 \times (10^6 \times 10^3) \quad \leftarrow \text{Multiply 5 and 9.}$$

$$= 45 \times 10^9 \quad \leftarrow \text{Add the exponents of the powers of 10.}$$

$$= 4.5 \times 10^1 \times 10^9 \quad \leftarrow \text{Write 45 in scientific notation.}$$

$$= 4.5 \times 10^{10} \quad \leftarrow \text{Add the exponents.}$$

Example

❶ **Multiplying With Scientific Notation** Multiply $(3 \times 10^3)(7 \times 10^5)$. Write the product in scientific notation.

$(3 \times 10^3)(7 \times 10^5) = (\square \times \square) \times (10^{\square} \times 10^{\square})$ ← Use the ☐ and ☐ properties.

$= \square \times (10^{\square} \times 10^{\square})$ ← Multiply ☐ and ☐.

$= \square \times 10^{\square}$ ← Add the exponents for the powers of 10.

$= \square \times 10^{\square} \times 10^{\square}$ ← Write ☐ in scientific notation.

$= \square \times 10^{\square}$ ← Add the exponents.

Quick Check

1. Multiply. Write each product in scientific notation.

a. $(2 \times 10^6)(4 \times 10^3)$

b. $(3 \times 10^5)(2 \times 10^8)$

c. $12(8 \times 10^{20})$

EXAMPLE 2 Application: Science

Multiple Choice A light-year, the distance light travels in one Earth year, is about 5.9×10^{12} miles. A mile is 5.28×10^3 feet. How many feet are in a light-year?

(A) 31.2×10^{15} (C) 3.12×10^{15}

(B) 31.2×10^{16} (D) 3.12×10^{16}

$(5.9 \times 10^{12})(5.28 \times 10^3)$ ← Multiply by the conversion factor.

$(5.9 \times 5.28) \times (10^{12} \times 10^3)$ ← Associative and Commutative properties

$31.2 \times (10^{12} \times 10^3)$ ← Multiply 5.9 and 5.28. Round to the nearest tenth.

31.2×10^{15} ← Add the exponents of the powers of 10.

$(3.12 \times 10^1) \times 10^{15}$ ← Write 31.2 in scientific notation.

3.12×10^{16} ← Add the exponents.

There are 3.12×10^{16} feet in a light-year. The correct answer is choice D.

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2 **Multiple choice** A light-year is about 5.9×10^{12} miles. A mile is about 1.609×10^3 meters. How many meters are in a light-year? Write your answer in scientific notation.

A. 9.5×10^{15} **B.** 9.5×10^{16} **C.** 9.5×10^{36} **D.** 9.5×10^{37}

$(5.9 \times 10^{12})(1.609 \times 10^3)$ ← Multiply by conversion factor.

$= (\boxed{5.9} \times \boxed{1.609}) \times (10^{\boxed{12}} \times 10^{\boxed{3}})$ ← Use the **Associative** and **Commutative** properties.

$\approx \boxed{9.5} \times (10^{\boxed{12}} \times 10^{\boxed{3}})$ ← Multiply **5.9** and **1.609**. Round to the nearest tenth.

$= \boxed{9.5} \times 10^{\boxed{15}}$ ← Add the exponents.

There are about $\boxed{9.5 \times 10^{15}}$ meters in a light-year. The correct answer is choice **A**.

Often the size of the unit is close to the measurement of the object. You can also choose units that are much greater or smaller by multiplying with scientific notation.

EXAMPLE 3 Choosing Units with Scientific Notation

Choose the most reasonable unit to describe the quantity. Then use scientific notation to describe the quantity using the other unit.

a. The mass of a nickel is 5 _____. (g, mg) 5 g

$$5\text{ g} \times \left(\frac{10^3\text{ mg}}{1\text{ g}}\right) = 5 \times 10^3\text{ mg} \quad \leftarrow \text{Multiply by a conversion factor.}$$

b. The length of a football field is about 91 _____. (km, m) 91 m

$$91\text{ m} \times \left(\frac{10^{-3}\text{ km}}{1\text{ m}}\right) = 91 \times 10^{-3}\text{ km} \quad \leftarrow \text{Multiply by a conversion factor.}$$

$$= 9.1 \times 10^{-2}\text{ km} \quad \leftarrow \text{Simplify.}$$

3 Choosing Units with Scientific Notation Choose the most reasonable unit to describe the quantity. Then use scientific notation to describe the quantity using the other unit.

a. The length of a school bus is 9 [m]. (m, km)

$$9\text{ [m]} \times \frac{\text{[10}^{-3}\text{]\ km}}{1\text{ m}} = 9 \times \text{[10}^{-3}\text{]\ km} \quad \leftarrow \text{Multiply by a conversion factor.}$$

b. The mass of a horse is about 500 [kg]. (g, kg)

$$500\text{ [kg]} \times \frac{\text{[10}^{3}\text{]\ g}}{1\text{ kg}} = 500 \times 10^3\text{ g} \quad \leftarrow \text{Multiply by a conversion factor.}$$

$$= 5 \times \text{[10}^{5}\text{]\ g} \quad \leftarrow \text{Simplify.}$$

Quick Check

2. Astronomy The speed of light is about 3.0×10^5 kilometers/second. Use the formula $d = r \cdot t$ to find the distance light travels in an hour, which is 3.6×10^3 seconds.

3. Choose the most reasonable unit to describe the quantity. Then use scientific notation to describe the quantity using the other unit.

A pencil is 7 _____ long. (cm, m)

For Exercises 1–4, fill in the blank.

1. $(3 \times 10^4)(6 \times 10^{12}) = 1.8 \times 10^{\blacksquare}$

2. $7(1.8 \times 10^7) = \blacksquare \times 10^8$

3. $(1.9 \times 10^5)(6.4 \times 10^3) = 1.216 \times \blacksquare^9$

4. $5(3.2 \times 10^7) = 1.6 \times 10^{\blacksquare}$

5. The speed of light is about 3.00×10^5 km/s. A kilometer is about 0.621 mi. Written in scientific notation, what is the speed of light in miles per second?

6. Reasoning Choose the most reasonable unit to complete each of the following sentences. Then use scientific notation to describe each quantity using another unit.

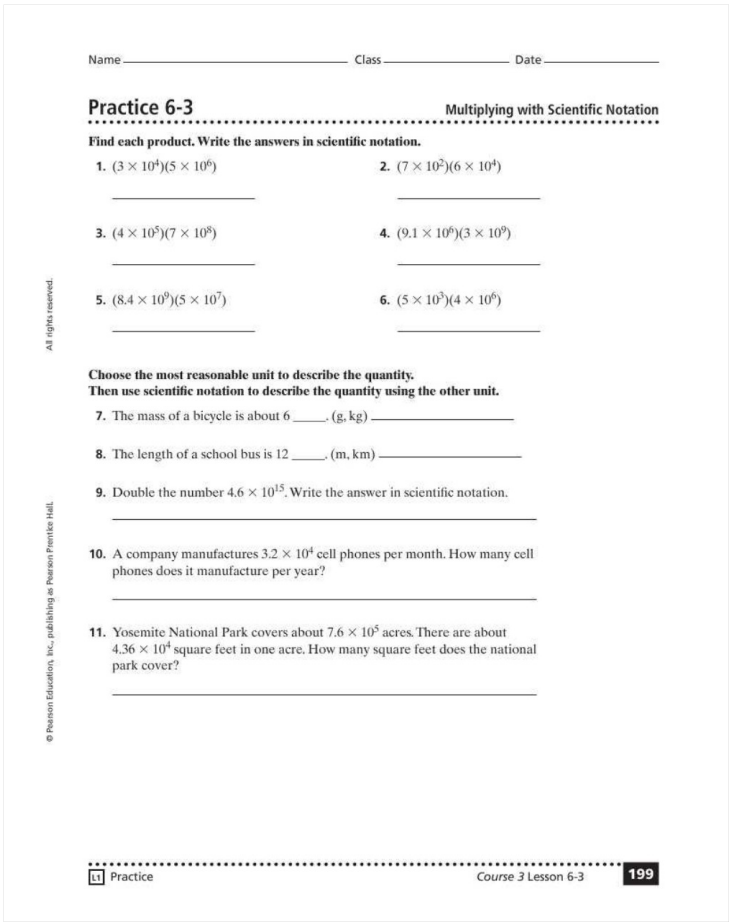
a. The distance between two cities is 36 _____. (m, km)

b. The mass of a teaspoon of salt is 6 _____. (g, kg)

6.

b.

You have an assignment worksheet, and time to begin working on it now.



Name _____ Class _____ Date _____

Practice 6-3

Multiplying with Scientific Notation

Find each product. Write the answers in scientific notation.

1. $(3 \times 10^4)(5 \times 10^6)$ _____

2. $(7 \times 10^2)(6 \times 10^4)$ _____

3. $(4 \times 10^5)(7 \times 10^8)$ _____

4. $(9.1 \times 10^6)(3 \times 10^9)$ _____

5. $(8.4 \times 10^9)(5 \times 10^7)$ _____

6. $(5 \times 10^3)(4 \times 10^6)$ _____

Choose the most reasonable unit to describe the quantity.
Then use scientific notation to describe the quantity using the other unit.

7. The mass of a bicycle is about 6 _____. (g, kg) _____

8. The length of a school bus is 12 _____. (m, km) _____

9. Double the number 4.6×10^{15}. Write the answer in scientific notation.
_____

10. A company manufactures 3.2×10^4 cell phones per month. How many cell phones does it manufacture per year?
_____

11. Yosemite National Park covers about 7.6×10^5 acres. There are about 4.36×10^4 square feet in one acre. How many square feet does the national park cover?
_____