LESSON 7-2

Practice A

Powers of 10 and Scientific Notation

Find the value of each power of 10.

1. 10^{-2} 0.01
2. 10^{3} 1000
3. 10^{0} 1
4. 10^{-5} 0.00001
5. 10^{-1} 0.1
6. 10^{7} 10,000,000

Complete each statement to write each number as a power of 10.

7. 100,000
   The decimal point is 5 places to the right of 1, so $100{,}000 = 10^{5}$.
8. 0.0001
   The decimal point is 4 places to the left of 1, so $0.0001 = 10^{-4}$.
9. 0.001
   The decimal point is 3 places to the left of 1, so $0.001 = 10^{-3}$.

Find the value of each expression.

10. 22.6×10^{4} 226,000
11. 5.28×10^{-3} 0.00528
12. 476.283×10^{-4} 0.0476283
13. 0.482×10^{6} 482,000
14. 0.29×10^{-1} 0.029
15. 6×10^{4} 60,000

Write each number in scientific notation.

16. 4500 4.5×10^{3}
17. 6,560,000 6.56×10^{6}
18. 0.00002 2×10^{-5}
19. 0.00203 2.03×10^{-3}

Order each list of numbers from least to greatest.

20. 2.4×10^{4}, 9.1×10^{-3}, 4.7×10^{3}, 6.13×10^{4}, 7.2×10^{-3}, 9.2×10^{3}
    7.2×10^{-3}; 9.1×10^{-3}; 4.7×10^{3}; 9.2×10^{3}; 2.4×10^{4}; 6.13×10^{4}
21. 4.5×10^{8}, 1.1×10^{-3}, 4.1×10^{-2}, 5.6×10^{-2}, 9.2×10^{8}, 4.2×10^{8}
    1.1×10^{-3}; 4.1×10^{-2}; 5.6×10^{-2}; 4.2×10^{8}; 4.5×10^{8}; 9.2×10^{8}

22. In 2003, the population of Virginia was about 7,390,000. Write the population in scientific notation. 7.39×10^{6}
23. The land area of Virginia is about 4×10^{4} square miles. Write the area in standard form. 40,000 sq mi
24. In 2003, the population of the United States was about 2.9×10^{8}. Write the population in standard form. 290,000,000
25. The land area of the United States is about 5.98×10^{6} square miles. Write the area in standard form. 5,980,000 sq mi

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Practice B

Powers of 10 and Scientific Notation

Find the value of each power of 10.

1. 10^{-3} 0.001
2. 10^{5} 100,000
3. 10^{-4} 0.0001
4. 10^{0} 1
5. 10^{7} 10,000,000
6. 10^{1} 10

Write each number as a power of 10.

7. 1,000,000 10^{6}
8. 0.001 10^{-3}
9. 0.000001 10^{-6}
10. 0.00001 10^{-5}
11. 0.1 10^{-1}
12. 0.00000001 10^{-8}

Find the value of each expression.

13. 5.02×10^{3} 5020
14. 603×10^{-4} 0.0603
15. 52.8×10^{6} 52,800,000
16. 5.41×10^{-3} 0.00541
17. 0.03×10^{-2} 0.0003
18. 22.81×10^{-6} 0.00002281

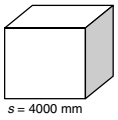
Write each number in scientific notation.

19. 4500 4.5×10^{3}
20. 6,560,000 6.56×10^{6}
21. 0.00002 2×10^{-5}
22. 0.00203 2.03×10^{-3}

Order the list of numbers from least to greatest.

23. 3×10^{2}; 4.54×10^{-3}; 6.75×10^{2}; 8.2×10^{-4}; 9×10^{-1}; 6.18×10^{-4}
    6.18×10^{-4}; 8.2×10^{-4}; 4.54×10^{-3}; 9×10^{-1}; 3×10^{2}; 6.75×10^{2}
24. 5.4×10^{-3}; 6.2×10^{-1}; 7.25×10^{3}; 6.87×10^{3}; 2.24×10^{-1}; 6.6×10^{-3}
    5.4×10^{-3}; 6.6×10^{-3}; 2.24×10^{-1}; 6.2×10^{-1}; 6.87×10^{3}; 7.25×10^{3}

25. In 1970, the number of televisions sold in the United States was about 1.2×10^{7}. Write this number in standard form. 12,000,000
26. In 1950, about 3,880,000 households in the United States had televisions. Write this number in scientific notation. 3.88×10^{6}
27. Find the volume of the cube shown at right. Write the answer in both standard form and in scientific notation. 64,000,000,000 mm^3; 6.4×10^{10} mm^3



Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Practice C

Powers of 10 and Scientific Notation

Find the value of each power of 10.

1. 10^{4} 10,000
2. 10^{0} 1
3. 10^{-2} 0.01
4. 10^{1} 10
5. 10^{-6} 0.000001
6. 10^{-1} 0.1

Write each number as a power of 10.

7. 1000 = 10^{3}
8. 0.00001 = 10^{-5}
9. 0.01 = 10^{-2}
10. 10,000 = 10^{4}
11. 0.001 = 10^{-3}
12. 10,000,000 = 10^{7}

Find the value of each expression.

13. 1×10^{4} = 10,000
14. 2×10^{4} = 20,000
15. 5.2×10^{-4} = 0.00052
16. 6.2×10^{7} = 62,000,000
17. 27.9×10^{5} = 2,790,000
18. 14.87×10^{0} = 14.87
19. 0.2×10^{-6} = 0.0000002
20. 3.25×10^{2} = 325
21. 14.15×10^{4} = 141,500
22. 3.287×10^{-6} = 0.000003287

State whether each number is written in scientific notation. If not, explain why not.

23. 45×10^{-2} no; the first number is not between 1 and 10.
24. 2.6×5^{4} no; the second number is not a power of 10.
25. 1.41×10^{8} yes

Order the list of numbers from least to greatest.

26. 2.5×10^{-1}; 2.4×10^{-6}; 5×10^{3}; 1.23×10^{-1}; 2.5×10^{-5}; 3.56×10^{3}
    2.4×10^{-6}; 2.5×10^{-5}; 1.23×10^{-1}; 2.5×10^{-1}; 3.56×10^{3}; 5×10^{3}
27. 4.5×10^{1}; 2.9×10^{-3}; 1.24×10^{0}; 3.58×10^{-6}; 5.5×10^{-3}; 2.19×10^{-6}
    2.19×10^{-6}; 3.58×10^{-6}; 2.9×10^{-3}; 5.5×10^{-3}; 1.24×10^{0}; 4.5×10^{1}

28. The space telescope Hubble orbits the Earth every 97 minutes, and travels more than 1.50×10^{8} miles every year. Write the distance traveled in standard notation. 150,000,000 mi
29. Hubble has taken many photographs of the planet Pluto. Pluto's mass is about 14,000,000,000,000,000,000,000 kg. Write Pluto's mass in scientific notation. 1.4×10^{22} kg
30. Write Pluto's mass in terms of grams. (Hint: 1 kg = 1,000 g) 1.4×10^{25} g

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Reteach

Powers of 10 and Scientific Notation

Powers of 10 are used to write large numbers in a simple way.

The exponent will tell you how many places to move the decimal when finding the value of a power of 10.

Find the value of 10^{5}.

Step 1: Start with the number 1.

1.0

Step 2: The exponent is **positive** 5. Move the decimal 5 spaces to the **right.**

1.0 0 0 0 0 = 100,000

Write 100,000,000 as a power of 10.

100000000.

The decimal point is 8 places to the right of the 1. The exponent is 8.

$100{,}000{,}000 = 10^{8}$

Numbers greater than 1 will have a positive exponent.

Find the value of 10^{-4}.

Step 1: Start with the number 1.

1.0

Step 2: The exponent is **negative** 4. Move the decimal 4 spaces to the **left.**

0 . 0 0 0 1 = 0.0001

Write 0.00001 as a power of 10.

0 . 0 0 0 0 1

The decimal point is 5 places to the left of the one. The exponent is −5.

$0.00001 = 10^{-5}$

Numbers less than 1 will have a negative exponent.

First determine whether the decimal point will move to the right or to the left. Then find the value of each power of 10.

1. 10^{6} right 1,000,000
2. 10^{-2} left 0.01
3. 10^{4} right 10,000

First determine whether the exponent will be positive or negative when each number is written as a power of 10. Then write each number as a power of 10.

4. 1000 positive 10^{3}
5. 0.0001 negative 10^{-4}
6. 10,000,000 positive 10^{7}

Copyright © by Holt, Rinehart and Winston. All rights reserved.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Reteach

Powers of 10 and Scientific Notation (continued)

Scientific notation is used for writing very large or very small numbers.

3.2×10^5 — The first factor must be between 1 and 10. The second factor must be a power of 10.

Write 7,230,000,000 in scientific notation.

Step 1: Write the first factor. 7.23

Step 2: Count the number of places you need to move the decimal point to make the given value. 7 ,2 ,3 ,0 ,0 ,0 ,0 ,0 ,0 ,0

Step 3: Because you moved to the right, the exponent will be positive. 7.23×10^9

Write 0.00062 in scientific notation.

Step 1: Write the first factor. 6.2

Step 2: Count the number of places you need to move the decimal point to make the given value. 0 ,0 ,0 ,0 ,6 ,2

Step 3: Because you moved to the left, the exponent will be negative. 6.2×10^{-4}

Write 8.24×10^{-6} in standard notation.

Step 1: Write the first factor. 8.24

Step 2: Because the exponent is -6, move the decimal point 6 places to the left. 0 ,0 ,0 ,0 ,0 ,8 ,2 4

Step 3: Write the number. 0.00000824

First determine whether the exponent will be positive or negative when each number is written in scientific notation. Then write the number in scientific notation.

7. 61,200,000 — positive — 6.12×10^7

8. 0.00045 — negative — 4.5×10^{-4}

9. 4,670,000 — positive — 4.67×10^6

Write each number in standard notation.

10. 7.451×10^3 — 7451

11. 4.231×10^{-5} — 0.00004231

12. 2.93×10^8 — 293,000,000

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Challenge

Using Scientific Notation to Make Comparisons

The average distance between Earth and the sun is 93,000,000 miles.
The average distance between Jupiter and the sun is 484,000,000 miles.
Using scientific notation, you can answer questions like the one below.

How many times farther from the sun is Jupiter than Earth?

Answer the following questions.

1. a. Write the distance between Earth and the sun in scientific notation. 9.3×10^7 miles

b. Write the distance between Jupiter and the sun in scientific notation. 4.84×10^8 miles

c. How many times farther from the Sun is Jupiter than Earth? about 5.2 times

2. The average distance between Pluto and the sun is 3,675,000,000 miles.

a. How many times farther from the sun is Pluto than Earth? about 39.5 times

b. How many times farther from the sun is Pluto than Jupiter? about 7.6 times

3. The star closest to the sun is 25,000,000,000,000 miles from the sun. How many times farther is it from the sun to the nearest star as it is from Earth to the sun? about 269,000 times

One light-year is the distance light travels in one year. Light travels 186,282 miles in 1 second.

4. How many miles does light travel in a year? Give your answer in scientific notation rounded to the nearest tenth. 5.9×10^{12}

5. a. One galaxy is 200,000 light-years from the sun. How many miles from the sun is the galaxy? about 1.17×10^{18}

b. How many times farther is this galaxy from the sun than Earth is from the sun? about 1.3×10^{10} times

You can use scientifc notation to compare masses of large objects with masses of small objects.

Mass of hydrogen atom:	1.67×10^{-24} grams
Jerry's mass:	6.35×10^1 kilograms
Mass of Earth:	5.97×10^{24} kilograms

6. Write a ratio to compare Jerry's mass with that of a hydrogen atom. about 3.8×10^{28} to 1.

7. Write a ratio to compare the mass of Earth with that of a hydrogen atom. about 3.6×10^{48} to 1.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Problem Solving

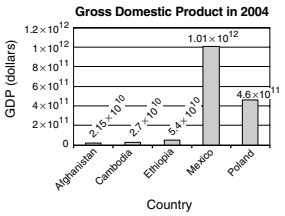
Powers of 10 and Scientific Notation

Write the correct answer.

1. Insects can multiply rapidly during the summer. A pair of houseflies could potentially grow to a population of 1.91×10^{20}. If all the descendants of a female cabbage aphid lived, the population could increase to 1.56×10^{24}. Which population would be larger?

cabbage aphid

2. The graph shows the gross domestic product (GDP) for several countries around the world. Identify the country whose GDP is twice that of another country. Write the GDPs of both countries in standard form.



3. The 2005 population estimates of five countries are listed below.

Brazil	1.86×10^8
India	1.08×10^9
Kenya	3.38×10^7
Philippines	8.79×10^7
United Kingdom	6.04×10^7

List the countries in order of population size from least to greatest.

Kenya, UK, Philippines, Brazil, India

Ethiopia: $54,000,000,000; Cambodia: $27,000,000,000

The table shows astronomical data about several planets. Use the table to answer questions 4–7. Select the best answer.

4. An AU is an astronomical unit. One AU equals 150,000,000 km. What is that measure in scientific notation?

(A) 1.50×10^8 km C 1.50×10^{10} km
B 1.50×10^9 km D 1.50×10^{11} km

5. Suppose the mass of Mars were written in standard form. How many digits would be to the *left* of the decimal?

F 23 H 25
(G) 24 J 26

6. Which of these is the distance from the Sun to Mercury expressed in scientific notation?

A 0.38 AU (C) 3.8×10^{-1} AU
B 3.8×10^1 AU D 38×10^{-2} AU

7. What is the diameter of the Earth in scientific notation?

F 1.28×10^2 km (H) 1.28×10^4 km
G 1.28×10^3 km J 1.28×10^5 km

Astronomical Data for the First Five Planets

Planet	Avg. Distance from Sun (AU)	Diameter (km)	Mass (kg)
Mercury	0.38	4,880	3.20×10^{23}
Venus	0.72	12,100	4.87×10^{24}
Earth	1	12,800	5.97×10^{24}
Mars	1.52	6,790	6.42×10^{23}
Jupiter	5.20	143,000	1.90×10^{27}

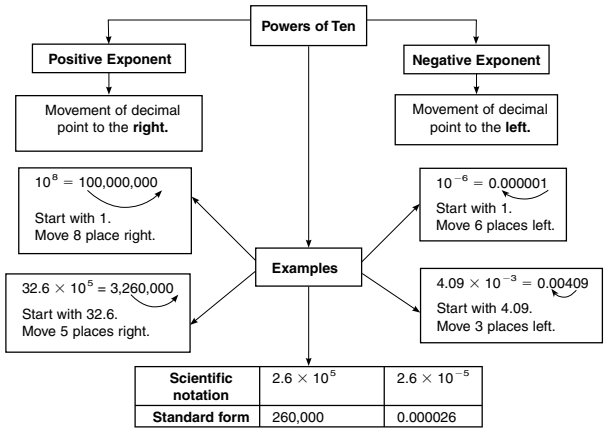
Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 7-2

Reading Strategies

Use a Graphic Aid

The graphic aid below summarizes how to work with powers of 10.



Scientific notation	2.6×10^5	2.6×10^{-5}
Standard form	260,000	0.000026

Complete each of the following.

1. Which represents a very large number: 4×10^9 or 4×10^{-9}? 4×10^9

2. Write 9.7×10^{-3} in standard form. 0.0097

3. Write 419,000,000,000 in scientific notation. 4.19×10^{11}

Match each number with its equivalent power of 10.

A. 10^4 B. 10^{-5} C. 10^5 D. 10^{-4}

4. 0.00001 — B

5. 10,000 — A

6. 100,000 — C

7. 0.0001 — D

Find the value of each expression.

8. 56×10^6 — 56,000,000

9. 87.5×10^4 — 875,000

Copyright © by Holt, Rinehart and Winston. All rights reserved.

Copyright © by Holt, Rinehart and Winston. All rights reserved.