

Scientific Notation

KEY IDEAS

Scientific notation writes a number as $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

Big numbers (10 or more) have a **positive** exponent: $52\,000 = 5.2 \times 10^4$ (decimal moves 4 places left).

Small numbers (less than 1) have a **negative** exponent: $0.003 = 3 \times 10^{-3}$ (decimal moves 3 places right).

Multiply: multiply the coefficients, **add** the exponents. **Divide:** divide the coefficients, **subtract** the exponents.

A Large numbers to scientific notation

4 marks

1. $5\,600\,000 =$ _____

2. $480\,000\,000 =$ _____

3. $72\,000 =$ _____

4. $3\,090\,000\,000 =$ _____

B Small numbers to scientific notation

4 marks

5. $0.0045 =$ _____

6. $0.000\,07 =$ _____

7. $0.000\,000\,312 =$ _____

8. $0.062 =$ _____

C Scientific notation to standard form

4 marks

9. $3.2 \times 10^5 =$ _____

10. $9.04 \times 10^7 =$ _____

11. $6.1 \times 10^{-4} =$ _____

12. $2 \times 10^{-6} =$ _____

D Is it in scientific notation?

2 marks

Remember: the first number must be at least 1 and less than 10. $\frac{1}{2}$ mark each.

	Number	Scientific notation? (Yes / No)	If not, rewrite it correctly
13.	45×10^3		
14.	7.02×10^{-5}		
15.	0.8×10^6		
16.	10×10^2		

E Compare and order

4 marks

2 marks each.

17. Write these numbers in order from **least to greatest**: 4.2×10^5 , 9.8×10^4 , 1.5×10^6 , 3.7×10^5 .

18. Which number is smaller, 7.2×10^{-3} or 9.1×10^{-4} ? Explain how you know.

F Multiply and divide

4 marks

Give each answer in scientific notation. Show your work in the box.

19. $(2 \times 10^3) \times (4 \times 10^5)$

20. $(3 \times 10^4) \times (5 \times 10^6)$

21. $(8.4 \times 10^9) \div (2 \times 10^3)$

22. $(9 \times 10^8) \div (3 \times 10^5)$

G Real-world problems

6 marks

Show your work and give units. 2 marks each.

23. Light travels about 3×10^8 metres every second. Sunlight takes about 500 seconds to reach Earth. Write 500 in scientific notation, then find the distance from the Sun to Earth in metres.

24. A bacterium is 0.000 002 m long. A grain of sand is 0.0005 m wide. Write both lengths in scientific notation. How many bacteria, lined up end to end, would stretch across the grain of sand?

25. Jupiter is about 1.43×10^5 km across. Earth is about 1.27×10^4 km across. About how many Earths would fit side by side across Jupiter? Round to the nearest whole number.

H Spot the mistake

2 marks

26. A student writes 0.000 56 as 5.6×10^4 . Explain the error and write the correct answer.

27. A student writes $(4 \times 10^3)(6 \times 10^5) = 24 \times 10^{15}$. Explain the error and write the correct answer.

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ANSWER KEY

KEY IDEAS

Scientific notation writes a number as $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

Big numbers (10 or more) have a **positive** exponent: $52\,000 = 5.2 \times 10^4$ (decimal moves 4 places left).

Small numbers (less than 1) have a **negative** exponent: $0.003 = 3 \times 10^{-3}$ (decimal moves 3 places right).

Multiply: multiply the coefficients, **add** the exponents. **Divide:** divide the coefficients, **subtract** the exponents.

A Large numbers to scientific notation

4 marks

1. $5\,600\,000 = 5.6 \times 10^6$

2. $480\,000\,000 = 4.8 \times 10^8$

3. $72\,000 = 7.2 \times 10^4$

4. $3\,090\,000\,000 = 3.09 \times 10^9$

B Small numbers to scientific notation

4 marks

5. $0.0045 = 4.5 \times 10^{-3}$

6. $0.000\,07 = 7 \times 10^{-5}$

7. $0.000\,000\,312 = 3.12 \times 10^{-7}$

8. $0.062 = 6.2 \times 10^{-2}$

C Scientific notation to standard form

4 marks

9. $3.2 \times 10^5 = 320\,000$

10. $9.04 \times 10^7 = 90\,400\,000$

11. $6.1 \times 10^{-4} = 0.000\,61$

12. $2 \times 10^{-6} = 0.000\,002$

D Is it in scientific notation?

2 marks

Remember: the first number must be at least 1 and less than 10. $\frac{1}{2}$ mark each.

	Number	Scientific notation? (Yes / No)	If not, rewrite it correctly
13.	45×10^3	No	4.5×10^4
14.	7.02×10^{-5}	Yes	Already correct
15.	0.8×10^6	No	8×10^5
16.	10×10^2	No	1×10^3

E Compare and order

4 marks

2 marks each.

17. Write these numbers in order from **least to greatest**: 4.2×10^5 , 9.8×10^4 , 1.5×10^6 , 3.7×10^5 .

9.8×10^4 , 3.7×10^5 , 4.2×10^5 , 1.5×10^6

Compare exponents first; when exponents match (10^5), compare the coefficients.

18. Which number is smaller, 7.2×10^{-3} or 9.1×10^{-4} ? Explain how you know.

9.1×10^{-4} is smaller. Its exponent (-4) is more negative, so it is $0.000\,91$, compared with 0.0072 .

F Multiply and divide

4 marks

Give each answer in scientific notation. Show your work in the box.

19. $(2 \times 10^3) \times (4 \times 10^5)$
 $(2 \times 4) \times 10^{3+5} = 8 \times 10^8$

20. $(3 \times 10^4) \times (5 \times 10^6)$
 $(3 \times 5) \times 10^{4+6} = 15 \times 10^{10}$
 $= 1.5 \times 10^{11}$

21. $(8.4 \times 10^9) \div (2 \times 10^3)$
 $(8.4 \div 2) \times 10^{9-3} = 4.2 \times 10^6$

22. $(9 \times 10^8) \div (3 \times 10^5)$
 $(9 \div 3) \times 10^{8-5} = 3 \times 10^3$

G Real-world problems

6 marks

Show your work and give units. 2 marks each.

23. Light travels about 3×10^8 metres every second. Sunlight takes about 500 seconds to reach Earth. Write 500 in scientific notation, then find the distance from the Sun to Earth in metres.

$500 = 5 \times 10^2$. $(3 \times 10^8)(5 \times 10^2) = 15 \times 10^{10} = 1.5 \times 10^{11} \text{ m}$ (150 000 000 km)

24. A bacterium is 0.000 002 m long. A grain of sand is 0.0005 m wide. Write both lengths in scientific notation. How many bacteria, lined up end to end, would stretch across the grain of sand?

$2 \times 10^{-6} \text{ m}$ and $5 \times 10^{-4} \text{ m}$. $(5 \times 10^{-4}) \div (2 \times 10^{-6}) = 2.5 \times 10^2 = 250 \text{ bacteria}$

25. Jupiter is about 1.43×10^5 km across. Earth is about 1.27×10^4 km across. About how many Earths would fit side by side across Jupiter? Round to the nearest whole number.

$(1.43 \div 1.27) \times 10^{5-4} \approx 1.13 \times 10^1 = 11.3$, so about **11 Earths**

H Spot the mistake

2 marks

26. A student writes 0.000 56 as 5.6×10^4 . Explain the error and write the correct answer.

Numbers less than 1 have a **negative** exponent. The decimal moves 4 places right, so $0.000\ 56 = 5.6 \times 10^{-4}$.

27. A student writes $(4 \times 10^3)(6 \times 10^5) = 24 \times 10^{15}$. Explain the error and write the correct answer.

When multiplying, **add** the exponents ($3 + 5 = 8$), not multiply them. Also 24 is not between 1 and 10: $24 \times 10^8 = 2.4 \times 10^9$.