

Questions

1. Write down the rules of exponents.
2. Simplify $(2x^{-3})^{-3}$.
3. Simplify $(4x^{-4})^{-2}$.
4. Simplify $\frac{x^{-2}y^{-3}}{x^4y^{-2}}$.
5. Simplify $\frac{a^{-6}b^3}{a^{-2}b^{-5}}$.
6. Write 8.137×10^7 in decimal notation.
7. Write 4.7×10^{-4} in decimal notation.
8. The tip of a $1/3$ -inch long hour hand on a watch travels at a speed of 0.000 00275 miles per hour. how far has it traveled in a day?
9. Avogadro's number says there are approximately 6.02×10^{23} molecules/mole. How many molecules can one expect in 0.00483 moles?

Solutions

1. The rules of exponents are:

- $x^0 = 1$ if $x \neq 0$ (0^0 is indeterminate and is dealt with in calculus).
- Product Rule: $x^a \cdot x^b = x^{a+b}$.
- Quotient Rule: $\frac{x^a}{x^b} = x^{a-b}$.
- Power Rule: $(x^a)^b = x^{ab}$.
- Product Raised to Power Rule: $(xy)^a = x^a y^a$.
- Quotient Raised to a Power Rule: $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$ if $y \neq 0$.
- Negative Exponent: $x^{-n} = \frac{1}{x^n}$, if $x \neq 0$.

2. $(2x^{-3})^{-3} = 2^{-3} x^{(-3)(-3)} = \frac{1}{2^3} x^9 = \frac{1}{8} x^9 = \frac{x^9}{8}$

3. $(4x^{-4})^{-2} = 4^{-2} x^{(-4)(-2)} = \frac{1}{4^2} x^8 = \frac{1}{16} x^8 = \frac{x^8}{16}$

4. $\frac{x^{-2} y^{-3}}{x^4 y^{-2}} = x^{-2-4} y^{-3+2} = x^{-6} y^{-1} = \frac{1}{x^6 y}$

5. $\frac{a^{-6} b^3}{a^{-2} b^{-5}} = a^{-6+2} b^{3+5} = a^{-4} b^8 = \frac{b^8}{a^4}$

6. $8.137 \times 10^7 = 81\,370\,000$. move decimal 7 places to the right.

7. $4.7 \times 10^{-4} = 0.000\,47$ move decimal 4 places to the left.

8.

$$\begin{aligned} (24 \cancel{\text{hours}}) (0.000\,00275 \frac{\text{miles}}{\cancel{\text{hour}}}) &= (24)(2.75 \times 10^{-6}) \text{ miles} \\ &= 66 \times 10^{-6} \text{ miles} \\ &= 6.6 \times 10^{-5} \text{ miles} \end{aligned}$$

9.

$$\begin{aligned} \text{Number of Molecules in } 0.00483 \text{ moles} &= (0.00483 \cancel{\text{moles}}) (6.02 \times 10^{23} \frac{\text{molecules}}{\cancel{\text{moles}}}) \\ &= (0.00483)(6.02 \times 10^{23}) \text{ molecules} \\ &= 0.0290766 \times 10^{23} \text{ molecules} \\ &= 2.90766 \times 10^{21} \text{ molecules} \\ &= 2.91 \times 10^{21} \text{ molecules} \end{aligned}$$

In the last step we rounded based on Avogadro's number having three significant digits. In your science courses you should determine what the conventions are for rounding answers. In general, round at the end of your calculation.