Math Review for CHEM 3

Chemistry uses mathematics as a language to express quantitative relationships between measurable, physical quantities. The questions below involve prerequisite mathematics that will be necessary to solving common problems encountered in chemistry. **Try your best to work through these problems WITHOUT the use of a calculator. SHOW YOUR WORK.**

Exponents:

Simplify the expressions below.

1) $10^2 \cdot 10^5 =$ $10^{(2+5)} = \boxed{10^7}$

2) $10^{-3} \cdot 10^5 =$ $10^{(-3+5)} = \boxed{10^2}$

3) $10^{-2} \cdot 10^{-4} =$ $10^{(-2+-4)} = 10^{(-2-4)} = \boxed{10^{-6}}$

4) $(10^3)^4 =$ $10^{(3\times4)} = \boxed{10^{12}}$

5) $(10^{-2})^4 =$ $10^{(-2\times4)} = \boxed{10^{-8}}$

6) $\frac{10^3}{10^5} =$ $10^{(3-5)} = \boxed{10^{-2}}$

7) $\frac{10^2}{10^{-8}} =$ $10^{(2-(-8))} = 10^{(2+8)} = \boxed{10^{10}}$

$10^{-8} = \frac{1}{10^8}$

8) $\frac{(10^3)^{-3}}{10^{-6}} =$ $\frac{10^{(3\cdot-3)}}{10^{-6}} = \frac{10^{-9}}{10^{-6}} = 10^{(-9-(-6))} = 10^{(-9+6)} = \boxed{10^{-3}}$

9) ① $\frac{10^9}{10^{-2}\cdot10^5} \cdot \frac{10^{-7}}{(100^3)} = \frac{10^9}{10^{(-2+5)}} \cdot \frac{10^{-7}}{(10^2)^3} = \frac{10^9}{10^3} \cdot \frac{10^{-7}}{10^6}$

② $10^{(9-3)} \cdot 10^{(-7-6)} = 10^6 \cdot 10^{-13} = 10^{(6+-13)} = \boxed{10^{-7}}$

10) $\frac{10^{-3}}{(10^4)^{-2}} \cdot \frac{10^2}{\frac{1}{10^3}} = \frac{10^{-3}}{10^{(4\cdot-2)}} \cdot \frac{10^2 \cdot 10^3}{1}$

$= \frac{10^{-3}}{10^{-8}} \cdot 10^{(2+3)} = \frac{10^{-3}}{10^{-8}} \cdot 10^5$

$= 10^{(-3-(-8))} \cdot 10^5$

$= 10^{(-3+8)} \cdot 10^5$

$= 10^5 \cdot 10^5 = 10^{5+5} = \boxed{10^{10}}$

$10^{-3} = \frac{1}{10^3}$

Scientific Notation:

1) $(5.7 \times 10^{-25}) - (1.3 \times 10^{-25}) =$

2) $(4.0 \times 10^2) + (3.00 \times 10^3) =$

3) $(2.80 \times 10^{-2}) - (1.0 \times 10^{-3}) =$

$\frac{10^2}{\frac{1}{10^3}} = 10^2 \cdot \frac{10^3}{1}$

$= 10^{2+3}$

or $= 10^5$

$\frac{10^2}{10^{-3}} = 10^{(2-(-3))}$

$= 10^{(2+3)}$

Math Review for CHEM 3

Chemistry uses mathematics as a language to express quantitative relationships between measurable, physical quantities. The questions below involve prerequisite mathematics that will be necessary to solving common problems encountered in chemistry. **Try your best to work through these problems WITHOUT the use of a calculator. SHOW YOUR WORK.**

Algebra:

Solve for x.

Hint: Sometimes it may be helpful to express quantities in scientific notation and then simplify.

1) $\frac{50x}{50} = \frac{5000}{50}$ $x = \frac{5000}{50} = \boxed{100}$

2) $3x + 25 = 55$ $3x = 55 - 25$ $\frac{3x}{3} = \frac{30}{3}$ $x = \frac{30}{3} = \boxed{10}$

3) $\frac{3 \times (2x)}{3} = \frac{30}{3}$ $\frac{2x}{2} = \frac{10}{2}$ $x = \boxed{5}$

4) $\frac{4 \times (2x - 100)}{4} = \frac{800}{4}$ $2x - 100 = 200$ $+100 \quad +100$ $2x = 300$ $\frac{2x}{2} = \frac{300}{2}$ $x = \boxed{150}$

5) $\frac{x}{5} = \frac{2500}{25}$ $5 \times \frac{x}{5} = 100 \times 5$ $x = \boxed{500}$

6) $x \cdot 200 = \frac{10}{x} \cdot x$ $\frac{200x}{200} = \frac{10}{200}$ $x = \boxed{\frac{1}{20}}$

7) $\frac{400}{20} = \frac{80}{x}$ $20 = \frac{80}{x}$ $\frac{20x}{20} = \frac{80}{20}$ $x = \boxed{4}$

8) $(x+10) \cdot 10 = \frac{200}{(x+10)} \cdot (x+10)$ $\frac{10(x+10)}{10} = \frac{200}{10}$ $x + 10 = 20$ $-10 \quad -10$ $x = \boxed{10}$

9) $400 = x^2$ $x = \sqrt{400} = x = \boxed{\pm 20}$

10) $1003 = x^3 + 3$ $1000 = x^3$ $x = \sqrt[3]{1000}$ $x = 10$

11) $\frac{(x+3)}{5} = \frac{30}{0.15}$ $\frac{(x+3)}{5} = 200$ $x + 3 = 1000$ $x = \boxed{997}$

12) $\frac{600}{(2x+16)} = \frac{200}{10}$ $\frac{600}{2x+16} = 20$ $\frac{600}{20} = \frac{20(2x+16)}{20}$ $30 = 2x + 16$ $14 = 2x$ $x = \boxed{7}$

$$A^x \cdot A^y = A^{(x+y)}$$

$$A^x \div A^y = \frac{A^x}{A^y} = A^{(x-y)}$$

$$(A^x)^y = A^{(x \cdot y)}$$

$$(A^x)^{\frac{1}{y}} = A^{(\frac{x}{y})}$$

$$\frac{10^9}{10^{-2} \cdot 10^5} \cdot \frac{10^{-7}}{(100^3)} =$$

↑

problem ⇒ needs to be power of 10

? How do I convert this to 10^x ?

$(100)^3 = (10^x)^3$

$(10^1)^3 = (10)^3$

$(10^2)^3 = (100)^3$

$(10^3)^3 = (1000)^3$

Scientific Notation - Used for very large & very small numbers to make the number more manageable

Decimal form

1,067,000. sec

6 place values

Scientific notation

$y.yyy \times 10^{z}$

↑ must be between 1 & 9

Cannot be Zero and Cannot be larger than 9

1.067×10^{6} ← positive = greater than 1

1,067,000 = 1.067×10^{6}

decimal Scientific notation

6.00000937

6 place values to right

9.37×10^{-6} ← negative = less than 1

Scientific Notation:

1) $(5.7 \times 10^{-25}) - (1.3 \times 10^{-25}) =$

$$\begin{array}{r} 5.7 \times 10^{-25} \\ -\ 1.3 \times 10^{-25} \\ \hline 4.4 \times 10^{-25} \end{array} = \boxed{4.4 \times 10^{-25}}$$

2) $(4.0 \times 10^{2}) + (3.00 \times 10^{3}) =$

3) $(2.80 \times 10^{-2}) - (1.0 \times 10^{-3}) =$

Addition & Subtraction

$1032.7 + 1.63 =$

$$\begin{array}{r} 1032.7 \\ +\ 1.63 \\ \hline 1034.33 \end{array}$$

Addition took place by place value

$4.0 \times 10^{2} + 3.00 \times 10^{3} =$

$$\begin{array}{r} 400. \\ 3000. \\ \hline 3400. \end{array}$$

3.4×10^{3}

Plan

move to decimal form
Align decimal
perform operation
Convert back to scientific notation

$2.80 \times 10^{-2} - 1.0 \times 10^{-3} =$

$$\begin{array}{r} 0.0280 \\ -\ 0.0010 \\ \hline 0.0270 \end{array}$$

2.70×10^{-2}

$0.0270 = 2.70 \times 10^{-2}$