POWERS OF 10

Negative powers: $10^{-x} = \dfrac{1}{10^x}$

Multiplication with the same base (of 10): $10^x \cdot 10^y = 10^{x+y}$

Division with the same base (of 10): $\dfrac{10^x}{10^y} = 10^{x-y}$

Nested Exponentials: $(10^x)^y = 10^{x \cdot y}$

Addition and subtraction with numbers including base 10 exponentials (as in scientific notation) requires that the exponent on the power of 10 be identical: $[a \times 10^z] + [b \times 10^z] = [(a+b) \times 10^z]$

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

2) $\dfrac{10^3}{10^7} = \boxed{10^{-4}}$

3) $(5.7 \times 10^{-25}) - (1.3 \times 10^{-25}) = \boxed{4.4 \times 10^{-25}}$

4) $(10^3)^6 = \boxed{10^{18}}$

5) $\dfrac{10^6}{10^{-12} \cdot (10^{-2})^{-2}} = \boxed{10^{14}}$

6) $(3.0 \times 10^5) + (2 \times 10^4) = \boxed{3.2 \times 10^5}$

SCIENTIFIC NOTATION

A numbers written in scientific notation should always **reflect** all of the significant figures in a number.

Express the following numbers in scientific notation with the proper number of significant digits:

7) 0.000 002 158

2.158×10^{-6}

8) 6,024,000

6.024×10^6

9) 500.0

5.000×10^2

10) 0.00120

1.20×10^{-3}

Express the following numbers in long form with the proper number of significant digits:

11) 3.56×10^{-3}

0.00356

12) 6.85×10^5

$685,000$

13) 9.500×10^2

950.0

14) 3.80×10^{-2}

0.0380

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DIMENSIONAL ANALYSIS

15) Calculate the number of moles equal to 1.23×10^{24} molecules of PCl_5.

$$\frac{1.23 \times 10^{24} \text{ molecules}}{} \left| \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \right. = \boxed{2.04 \text{ mol } PCl_5}$$

16) Calculate the ~~number of moles~~ Mass equal to 2.50 mol of Uranium atoms.

$$\frac{2.50 \text{ mol}}{} \left| \frac{238.03 \text{ g } U}{1 \text{ mol}} \right. = \boxed{595 \text{ g}}$$

17) Calculate the number of formula units equivalent to 5.93 g of SiO_2. → 60.09 g/mol

$$\frac{5.93 \text{ g}}{} \left| \frac{1 \text{ mol } SiO_2}{60.09 \text{ g}} \right| \frac{6.022 \times 10^{23} \text{ form.un.}}{1 \text{ mol } SiO_2} = \boxed{5.94 \times 10^{22} \text{ form. units } SiO_2}$$

18) Calculate the number of pg equal to 4.5×10^{-6} cg.

$$\frac{4.5 \times 10^{-6} \text{ cg}}{} \left| \frac{10^{-2} \text{ g}}{1 \text{ cg}} \right| \frac{1 \text{ pg}}{10^{-12} \text{ g}} = \boxed{4.5 \times 10^{4} \text{ pg}}$$

DENSITY

19) Calculate the density of a mineral sample if it causes the level of water in a graduated cylinder to increase from 22.3 mL to 35.6 mL and has a mass of 60.891 g.

$$D = ?$$
$$V = \frac{35.6}{-22.3}$$
$$\overline{13.3 \text{ mL}}$$

$$m = 60.891 \text{ g} \qquad \left(1 \text{ mL} \equiv 1 \text{ cm}^3 \right)$$

$$D = \frac{m}{V} = \frac{60.891 \text{ g}}{13.3 \text{ mL}} = \boxed{4.58 \text{ g/mL} = 4.58 \text{ g/cm}^3}$$

20) Ethylene glycol, used in antifreeze, has a density of 1.11 g/mL. What is the mass in kg of 1.00 gallons of the compound? $\boxed{\text{gal} \rightarrow L \rightarrow g \rightarrow kg}$ general scheme.

$$\frac{1.00 \text{ gal}}{} \left| \frac{4 \text{ qt}}{1 \text{ gal}} \right| \frac{0.9464 \text{ L}}{1 \text{ qt}} \left| \frac{1000 \text{ mL}}{1 \text{ L}} \right| \frac{1.11 \text{ g}}{1 \text{ mL}} \left| \frac{1 \text{ kg}}{1000 \text{ g}} \right. =$$

$$= \boxed{4.20 \text{ kg}}$$