PROGRAM FOR ACCELERATION IN CAREERS OF ENGINEERING

Scientific Notation

Definition

- Scientific Notation is a compact way of expressing very large or very small numbers.
- A number in scientific notation has the following format:

$$\pm\ a \times 10^{b}$$

- where b is an integer and

$$1 \leq\ a < 10$$

Examples

$$6.6732 \times 10^{11}$$

$$-8.023 \times 10^{3}$$

$$1.77 \times 10^{-8}$$

$$6.02 \times 10^{26}$$

$$2.997925 \times 10^{8}$$

Not in Scientific Notation

66.732×10^{11}

$.58 \times 10^{-6}$

0.23×10^{3}

$7.93 \times 10^{3/4}$

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Quick Review of Exponents

- A positive exponent denotes how many times a number is multiplied by itself. For example,

$$10^3 = \underbrace{10 \times 10 \times 10}_{3 \text{ times}}$$

- A negative exponent denotes the reciprocal of the quantity with a positive exponent,

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

Converting to Scientific Notation

- We want to represent a decimal number in Scientific Notation
- We don't want to change the value of the number, just how it's represented
- The strategy is to multiply and divide the number we want to convert by the same power of ten
  - The multiplication and division will be done in different ways, but since they will be by the same factor, the value of the quantity will be unchanged

Number Larger Than 10

- If the number is larger than or equal to 10 we want to do the following:
  - Divide by a power of 10 by moving the decimal point to the left
  - Multiply by the same power of 10 by explicitly showing the multiplication operation
- Example
  - Start with 125.43
  - Divide by 10^2 by moving the decimal point to the left two places: 1.2543
  - Multiply by 10^2: 1.2543×10^2

Number Smaller Than 1

- If the number is smaller than 1 we want to do the following:
  - Multiply by a power of 10 by moving the decimal point to the right
  - Divide by the same power of 10 by multiplying by a negative power of 10
- Example
  - Start with 0.95
  - Multiply by 10 by moving the decimal point to the right one place: 9.5
  - Divide by 10 by multiplying by 10^{-1}: 9.5×10^{-1}

More Examples

- 0.0045
  - 4.5×10^{-3}
- 20.07
  - 2.007×10^{1}
- 630
  - 6.3×10^{2}

Test Yourself

- Convert each of the following to Scientific Notation
  - 0.059
  - 970.01
  - 271
- Determine whether each of the following is in Scientific Notation
  - 0.23×10^{3}
  - 3.55×10^{-5}
  - $1.23 \times 10^{3.5}$

Test Answers

- Convert each of the following to Scientific Notation
  - 0.059 5.9×10^{-2}
  - 970.01 9.7001×10^{2}
  - 271 2.71×10^{2}
- Determine whether each of the following is in Scientific Notation
  - 0.23×10^{3} No
  - 3.55×10^{-5} Yes
  - $1.23 \times 10^{3.5}$ No