

Lesson 10: Operations with Numbers in Scientific Notation

Classwork

Exercise 1

The speed of light is 300,000,000 meters per second. The sun is approximately 1.5×10^{11} meters from Earth. How many seconds does it take for sunlight to reach Earth?

Exercise 2

The mass of the moon is about 7.3×10^{22} kg. It would take approximately 26,000,000 moons to equal the mass of the sun. Determine the mass of the sun.

Exercise 3

The mass of Earth is 5.9×10^{24} kg. The mass of Pluto is $13,000,000,000,000,000,000,000$ kg. Compared to Pluto, how much greater is Earth's mass?

$$\begin{array}{r}
 5.9 \times 10^{24} \\
 - 1.3 \times 10^{22} \\
 \hline
 5.9 \times 10^{24} - 0.013 \times 10^{24} = 5.887 \times 10^{24}
 \end{array}$$

Exercise 4

Using the information in Exercises 2 and 3, find the combined mass of the moon, Earth, and Pluto.

$$\begin{array}{l}
 \text{moon: } 7.3 \times 10^{22} \text{ kg} \\
 \text{Earth: } 5.9 \times 10^{24} \text{ kg} \\
 \text{Pluto: } 1.3 \times 10^{22} \text{ kg}
 \end{array}$$

$$\begin{array}{r}
 + \\
 (7.3 \times 10^{22}) + (5.9 \times 10^{24}) + (1.3 \times 10^{22}) \\
 \hline
 0.073 \times 10^{24} + 5.9 \times 10^{24} + 0.013 \times 10^{24} \\
 \hline
 = 5.986 \times 10^{24} \text{ kg}
 \end{array}$$

Exercise 5

How many combined moon, Earth, and Pluto masses (i.e., the answer to Exercise 4) are needed to equal the mass of the sun (i.e., the answer to Exercise 2)?

$$\begin{array}{r}
 \text{Sun} \\
 \hline
 \text{combined mass}
 \end{array}
 = \frac{1.898 \times 10^{30}}{5.986 \times 10^{24}} = 0.32 \times 10^6 = 3.2 \times 10^5$$

= 320,000 combined masses to equal the sun

Problem Set

1. The sun produces 3.8×10^{27} joules of energy per second. How much energy is produced in a year? (Note: a year is approximately 31,000,000 seconds).
2. On average, Mercury is about 57,000,000 km from the sun, whereas Neptune is about 4.5×10^9 km from the sun. What is the difference between Mercury's and Neptune's distances from the sun?
3. The mass of Earth is approximately 5.9×10^{24} kg, and the mass of Venus is approximately 4.9×10^{24} kg.
 - a. Find their combined mass.
 - b. Given that the mass of the sun is approximately 1.9×10^{30} kg, how many Venuses and Earths would it take to equal the mass of the sun?