Name _____ Date_____

Operations with Numbers in Scientific Notation

1. The speed of light is 3×10^8 meters per second. The sun is approximately $230{,}000{,}000{,}000$ meters from Mars. How many seconds does it take for sunlight to reach Mars?

2. If the sun is approximately 1.5×10^{11} meters from Earth, what is the approximate distance from Earth to Mars?

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?

1. **The speed of light is 3×10^8 meters per second. The sun is approximately $230,000,000,000$ meters from Mars. How many seconds does it take for sunlight to reach Mars?**

$$230,000,000,000 = 2.3 \times 10^{11}$$

$$\frac{2.3 \times 10^{11}}{3 \times 10^8} = \frac{2.3}{3} \times \frac{10^{11}}{10^8}$$

$$= 0.76\ldots \times 10^3$$

$$\approx 0.76 \times 10 \times 10^2$$

$$\approx 7.6 \times 10^2$$

It takes approximately 760 seconds for sunlight to reach Mars.

2. **If the sun is approximately 1.5×10^{11} meters from Earth, what is the approximate distance from Earth to Mars?**

$$2.3 \times 10^{11} - 1.5 \times 10^{11} = (2.3 - 1.5) \times 10^{11}$$

$$= 0.8 \times 10^{11}$$

$$= 0.8 \times 10 \times 10^{10}$$

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

The distance from Earth to Mars is 8×10^{10} meters.

Students practice operations with numbers written in scientific notation and standard notation.

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).**

$$31,000,000 = 3.1 \times 10^7$$

$$(3.8 \times 10^{27})(3.1 \times 10^7) = (3.8 \times 3.1)(10^{27} \times 10^7)$$

$$= 11.78 \times 10^{34}$$

$$= 1.178 \times 10 \times 10^{34}$$

$$= 1.178 \times 10^{35}$$

The sun produces 1.178×10^{35} joules of energy in a year.

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?

$$57,000,000 = 5.7 \times 10^7$$

$$\begin{aligned} 4.5 \times 10^9 - 5.7 \times 10^7 &= 4.5 \times 10^2 \times 10^7 - 5.7 \times 10^7 \\ &= 450 \times 10^7 - 5.7 \times 10^7 \\ &= 450 - 5.7 \times 10^7 \\ &= 444.3 \times 10^7 \\ &= 4.443 \times 10^2 \times 10^7 \\ &= 4.443 \times 10^9 \end{aligned}$$

The difference in the distance of Mercury and Neptune from the sun is 4.443×10^9 km.

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.

$$\begin{aligned} 5.9 \times 10^{24} + 4.9 \times 10^{24} &= 5.9 + 4.9 \times 10^{24} \\ &= 10.8 \times 10^{24} \\ &= 1.08 \times 10 \times 10^{24} \\ &= 1.08 \times 10^{25} \end{aligned}$$

The combined mass of Earth and Venus is 1.08×10^{25} kg.

   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?

$$\begin{aligned} \frac{1.9 \times 10^{30}}{1.08 \times 10^{25}} &= \frac{1.9}{1.08} \times \frac{10^{30}}{10^{25}} \\ &= 1.75925 \ldots \times 10^5 \\ &\approx 1.8 \times 10^5 \end{aligned}$$

It would take approximately 1.8×10^5 Venuses and Earths to equal the mass of the sun.