

Scientific Notation – Large Numbers

Exercise Set I

1. How many zeros follow the 1 if the number ten billion is written the long way?
2. Write a googol, using the exponential form.
3. What does 10^0 mean?
4. Our solar system is part of the Milky Way galaxy, which is estimated to contain more than one hundred billion stars. Write this number in two different ways.
5. Suppose only one star out of every million was the sun of a planet with intelligent life on it. Approximately how many planets with intelligent life would there be in the Milky Way?
6. Water molecules are so small that if you could pour a *million* of them into a quart bottle every second and never stop until the bottle was full, it would take more than 10^8 years. If you poured at the rate of a *billion* per second instead, how long would it take? (Since you are pouring at a faster rate, of course it would take less time.)
7. How long at the rate of a *trillion* per second?

Exercise Set II

1. Write these numbers in scientific notation.
a) 34 000 000 b) 421 400 c) 7 300 000 000
2. Write these as ordinary numbers.
a) 4.5×10^5 b) 6×10^7 c) 4.543×10^3
3. It would take 3,000,000,000,000,000,000,000,000 candles to give as much light as the sun. Write this number in scientific notation.
4. The weight of the water in all of the oceans of the world is 1,580,000,000,000,000,000 tons. Write this number in scientific notation.
5. The number of different hands which it is possible for you to be dealt in a game of bridge is about 6.35×10^{11} . Write this number in the long form and then name it in words.

Problem Solving

6. Proxima Centauri, the nearest star beyond the sun, is 40 trillion kilometres away. One way of writing this distance is 40×10^{12} miles, but this number is not in scientific notation. Why not? Rewrite it in scientific notation. (Hint: $40=4 \times 10$; $10 \times 10^{12}=?$)
7. Inflation of the value of money is a serious economic problem. In 1946, inflation of the currency was so bad in Hungary that the gold pengo was worth 130 quintillion paper pengos. Write this number in scientific notation. (The pengo was replaced that year by another unit of money.)

Exercise Set III

1. Write the results in each of the following problems in scientific notation.
a. $(8 \times 10^2) \times (5 \times 10^6)$ b. $(3 \times 10^{11}) \times (7 \times 10^5)$
c. $(9 \times 10^3) \times (1.5 \times 10^{10})$ d. $(6 \times 10^{11}) \times (8.5 \times 10^5)$
2. The earth travels about 5.8×10^8 miles in its trip around the sun each year. What distance does it travel around the sun in 1,000 years?
3. Our solar system is about 3×10^4 light-years from the center of the Milky Way galaxy. Assuming a light-year to be approximately 6×10^{12} miles, how far are we in miles from the center of the Milky Way?

Problem Solving

- Every minute more than 8.4×10^{11} drops of water flow over Niagara Falls. Each drop contains 1.7×10^{21} molecules. How many molecules of water pass over Niagara Falls in one minute?

Exercise Set IV

In one of their ads, the Volkswagen Company claims that "*exactly* 1,612,462 beans" can be put into a Volkswagen station wagon.

- Write this number in scientific notation.
- Is this way of writing the number more compact than writing it in the long form?

Suppose we round off the number of beans and say that a V.W. wagon will hold *about* 1,600,000 beans.

- How does this number look in scientific notation?
- Is this way of writing the number any shorter than writing it in the long form?
- When a scientist deals with large numbers, do you think they are *exact* or *approximate*?
- For which kind of numbers is scientific notation more appropriate: exact numbers or approximate numbers?

Exercise Set V

- The distance from the earth to the sun is about 140 000 000 km.
 - Express this in scientific notation on your calculator.
 - Convert it to centimetres.
 - A \$20 note is 14.7 cm long. How many \$20 notes would fit in a straight line between the earth and the sun?
- The distance light travels in a year is about 9 000 000 000 000 km. (This distance is called a light year.)
 - Express this in scientific notation on your calculator screen.
 - Alpha Centuri is 4 light years from Earth. What is this distance in kilometres?
 - If you drove at 120 km/hr how many hours would it take you to drive to Alpha Centauri?
 - If you flew a jet plane at 2000 km/hr, how many hours would it take you to fly to Alpha Centauri?
 - How many years is this (Use $365\frac{1}{4}$ days a year)?
- Rubik's cube was a popular puzzle some years ago. The cube could be rotated and twisted in many different orientations - about 4.3×10^{19} different orientations in fact.

If you could rotate the cube to a different orientation each second, without duplication, how long would it take you to get every possible orientation of the cube ...

a) in hours?	b) in days?
c) in months?	d) in years?
e) in generations (1 generation = 35 years)?	f) in millenia (1 millenia = 1 000 years)?