

Unit 3B

Putting Numbers in Perspective

Scientific Notation

Scientific notation is a format in which a number is expressed as a number *between* 1 and 10 multiplied by a power of 10.

Examples:

6,700,000,000 in scientific notation is 6.7×10^9

0.00000000000000002 is 2.0×10^{-15}

Giving Meaning to Numbers

Perspective through estimation

An **order of magnitude** estimate specifies a broad range of values.

Example: Is the total annual ice cream spending in the United States measured in thousands of dollars, millions of dollars, or billions of dollars?

$$\begin{aligned} \text{spending} &= 50 \frac{\text{servings}}{\text{person} \times \text{yr}} \times \frac{\$1}{\text{serving}} \times (3 \times 10^8) \text{ people} \\ &= \frac{1.5 \times 10^{10}}{1 \text{ yr}} \approx \$15 \text{ billion per year} \end{aligned}$$

Giving Meaning to Numbers

Perspective through comparisons

TABLE 3.1 Selected Energy Comparisons

Item	Energy (joules)
Energy released by metabolism of 1 average candy bar	1×10^6
Energy needed for 1 hour of running (adult)	4×10^6
Energy released by burning 1 liter of oil	1.2×10^7
Electrical energy used in an average home daily	5×10^7
Energy released by burning 1 kilogram of coal	1.6×10^9
Energy released by fission of 1 kilogram of uranium-235	5.6×10^{13}
Energy released by fusion of hydrogen in 1 liter of water	7×10^{13}
U.S. annual energy consumption	1×10^{20}
World annual energy consumption	5×10^{20}
Annual energy generation of Sun	1×10^{34}

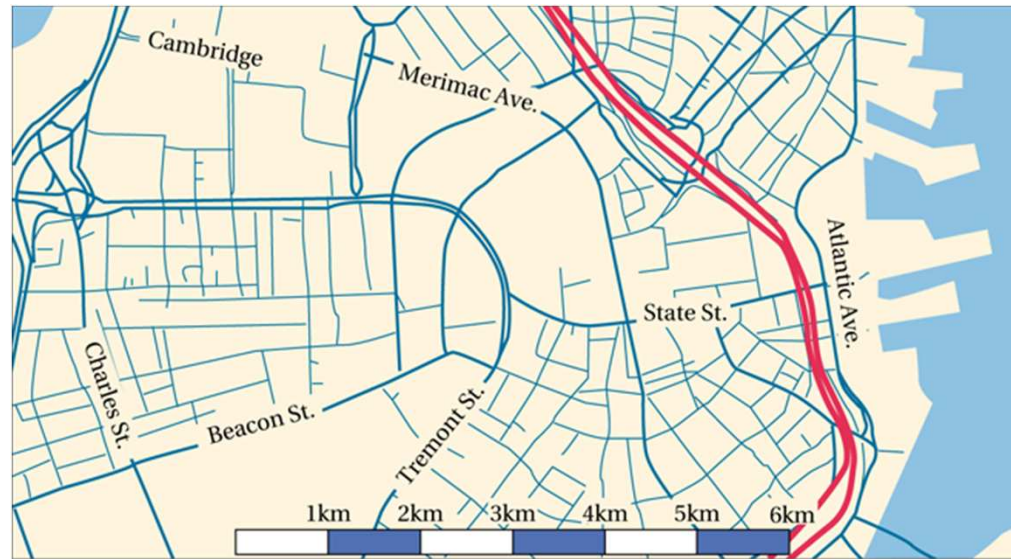
Note: Consumption data (2009) from the U.S. Energy Information Administration.

Giving Meaning to Numbers

Perspective through scaling

Verbally: “1 cm = 1 km”

Graphically:



As a ratio: 1 cm = 1 km means a scale ratio of
1 to 100,000