Scientific Notation I

Astronomers rely on scientific notation in order to work with 'big' things in the universe. The rules for using this notation are pretty straight-forward, and are commonly taught in most 7th-grade math classes as part of the National Education Standards for Mathematics.

The following problems involve the conversion of decimal numbers into SN form, and are taken from common astronomical applications and quantities.

1) Length of a year. 31,560,000.0 seconds

2) Speed of light: 299,792.4 kilometers/sec

3) Mass of the sun: 1,989,000,000,000,000,000,000,000,000,000,000 grams

4) Mass of Earth: 5,974,000,000,000,000,000,000,000 kilograms

5) One light-year : 9,460,500,000,000 kilometers

6) Power output of sun : 382,700,000,000,000,000,000,000,000 watts

7) Mass of an electron: 0.00000000000000000000000000000091096 kilograms

8) Energy equivalent of one electron-Volt : 0.000000000000000000016022 joules

9) Ratio of proton to electron mass: 1,836.2

10) Planck's Constant: 0.000000000000000000000000006626068 ergs seconds

11) Radius of hydrogen atom : 0.00000000529177 centimeters

12) Radius of Earth's orbit: 14,959,789,200,000 centimeters

13) Smallest unit of physical distance: 0.000000000000000000000000000000016 centimeters

14) Diameter of Visible Universe: 26,000,000,000,000,000,000,000,000,000 centimeters

Answer Key:

1) Length of a year. 31,560,000.0 seconds
Answer: 3.156×10^{7} seconds

2) Speed of light: 299,792.4 kilometers/sec
Answer: 2.997924×10^{5} km/sec

3) Mass of the sun: 1,989,000,000,000,000,000,000,000,000,000,000 grams
Answer: 1.989×10^{33} grams

4) Mass of Earth: 5,974,000,000,000,000,000,000,000 kilograms
Answer: 5.974×10^{24} kg

5) One light-year : 9,460,500,000,000 kilometers
Answer: 9.4605×10^{12} km

6) Power output of sun : 382,700,000,000,000,000,000,000,000 watts
Answer: 3.827×10^{26} watts

7) Mass of an electron: 0.000000000000000000000000000000091096 kilograms
Answer: 9.1096×10^{-31} kg

8) Energy equivalent of one electron-Volt : 0.000000000000000000016022 joules
Answer: 1.6022×10^{-19} Joules

9) Ratio of proton to electron mass: 1,836.2
Answer; 1.8362×10^{3}

10) Planck's Constant: 0.000000000000000000000000006626068 ergs seconds
Answer: 6.626068×10^{-27} ergs seconds

11) Radius of hydrogen atom : 0.00000000529177 centimeters
Answer: 5.29177×10^{-9} cm

12) Radius of Earth's orbit: 14,959,789,200,000 centimeters
Answer: $1.49597892 \times 10^{13}$ cm

13) Smallest unit of physical distance: 0.000000000000000000000000000000016 centimeters
Answer: 1.6×10^{-33} cm

14) Diameter of Visible Universe: 26,000,000,000,000,000,000,000,000,000 centimeters
Answer; 2.6×10^{28} cm