

2. ATOMS: *The Nature of Things*

Answers to conceptual exercises

4. $6 \times 12 = 72$ (carbon), and $6 \times 16 = 96$ (oxygen), so the weight ratio is 72 parts carbon to 12 parts hydrogen to 96 parts oxygen, in other words 6 to 1 to 8.
6. $2 + 5 + 1 + 1 = 9$.
16. Assume that coal is pure carbon (C). When coal burns, each C atom attaches to two O atoms to make CO_2 . If we assume, for simplicity, that C and O atoms have the same weight, then a CO_2 molecule would weigh three times as much as a single C atom. So a ton of coal makes three tons of carbon dioxide gas. The more precise answer, based on the weight ratio of 3 to 4 given in exercise 2, is that a ton of coal makes $1\frac{1}{3}$ (or 3.67) tons of carbon dioxide gas.
21. $400 \text{ billion} = 4 \times 10^{11}$, $0.0005 = 5 \times 10^{-4}$. Multiplying them, we get 20×10^7 , or 2×10^8 , in other words 200 million.
31. With more air, the air molecules will hit the inside of the tire more often. With hotter air, the air molecules will hit the inside of the tire harder.
32. Weigh two identical rigid containers, one containing air and one that has had some of its air removed. If air has weight, the air-filled container should weigh a little more.
37. How many times does 10^{-10} m go into 0.1 mm? Since $0.1 \text{ mm} = 10^{-4}$ m, the answer is $10^{-4} / 10^{-10} = 10^{-4+10} = 10^6$ atoms, or one million atoms thick.