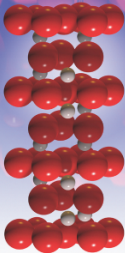


# FUNDAMENTALS

OF MATERIALS SCIENCE AND ENGINEERING  
AN INTEGRATED APPROACH

FIFTH EDITION



WILLIAM D. CALLISTER, JR. • DAVID G. RETHWISCH

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## Characteristics of Selected Elements

| <i>Element</i> | <i>Symbol</i> | <i>Atomic Number</i> | <i>Atomic Weight (amu)</i> | <i>Density Solid, 20°C (g/cm<sup>3</sup>)</i> |
|----------------|---------------|----------------------|----------------------------|---|
| Aluminum       | Al            | 13                   | 26.98                      | 2.71  |
| Argon          | Ar            | 18                   | 39.95                      | —   |
| Barium         | Ba            | 56                   | 137.33                     | 3.5   |
| Beryllium      | Be            | 4                    | 9.012                      | 1.85  |
| Boron          | B             | 5                    | 10.81                      | 2.34  |
| Bromine        | Br            | 35                   | 79.90                      | —   |
| Cadmium        | Cd            | 48                   | 112.41                     | 8.65  |
| Calcium        | Ca            | 20                   | 40.08                      | 1.55  |
| Carbon         | C             | 6                    | 12.011                     | 2.25  |
| Cesium         | Cs            | 55                   | 132.91                     | 1.87  |
| Chlorine       | Cl            | 17                   | 35.45                      | —   |
| Chromium       | Cr            | 24                   | 52.00                      | 7.19  |
| Cobalt         | Co            | 27                   | 58.93                      | 8.9   |
| Copper         | Cu            | 29                   | 63.55                      | 8.94  |
| Fluorine       | F             | 9                    | 19.00                      | —   |
| Gallium        | Ga            | 31                   | 69.72                      | 5.90  |
| Germanium      | Ge            | 32                   | 72.64                      | 5.32  |
| Gold           | Au            | 79                   | 196.97                     | 19.32   |

### Values of Selected Physical Constants

| <i>Quantity</i>               | <i>Symbol</i> |
|-------------------------------|---------------|
| Avogadro's number             | $N_A$         |
| Boltzmann's constant          | $k$           |
| Bohr magneton                 | $\mu_B$       |
| Electron charge               | $e$           |
| Electron mass                 | —             |
| Gas constant                  | $R$           |
| Permeability of a vacuum      | $\mu_0$       |
| Permittivity of a vacuum      | $\epsilon_0$  |
| Planck's constant             | $h$           |
| Velocity of light in a vacuum | $c$           |

<sup>a</sup> In cgs-emu units.

<sup>b</sup> In cgs-esu units.



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**Front Cover:** Depiction of a unit cell for  $\alpha$ -aluminum oxide (left) and  $\beta$ -aluminum oxide (right), respectively.

**Back Cover:** (Top) Representation of a unit cell for iron sulfide, showing iron (red) and sulfur (blue) atoms. (Bottom) Depiction of a unit cell for wurtzite, which is a form of zinc sulfide, where zinc (red) and sulfur (blue) atoms are represented by yellow and blue spheres, respectively.

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