Molar gas constant

CH102 General Chemistry, Summer 1 2012, Boston University

Student: "Which value of the gas constant should I use?"
Teacher: "Use R = 8.31446 J/(mol K) and then convert units as needed."

The currently accepted SI value of the molar gas constant is given at http://physics.nist.gov/cgi-bin/cuu/Value?r as

$$R = 8.31446 \ \text{J}/(\text{mol K})$$

The gas constant can be expressed in terms of the SI unit of pressure bar using

1 J = 1 L kPa = 0.01 L bar,

since 1 bar = 100 kPa, and it can be expressed in terms of the historical but now non-standard unit of pressure atm using

1 J = 0.01 L atm/1.01325,

since 1 atm is defined as *exactly* 1.01325 bar. With these conversions, the molar gas constant can be expressed alternatively as the three different numerical values

$$\begin{aligned} R &= 8.31446 \ \text{J}/(\text{mol K}) \\ &= 0.0831446 \ \text{L bar}/(\text{mol K}) \\ &= 0.0820573 \ \text{L atm}/(\text{mol K}) \end{aligned}$$

Rather than memorize these three different values of R, it is recommended instead to remember just the single SI value $R = 8.31446 \ \text{J}/(\text{mol K})$, and then to use the conversions 1 J = 1 L kPa = 0.01 L bar and 1 atm = 1.01325 bar as needed.