38.26. Solve: The Bohr radius is defined as

$$a_B = \frac{4\pi\varepsilon_0\hbar^2}{me^2} = \frac{4\pi\left(8.85\times10^{-12}\ \mathrm{C^2/N\,m^2}\right)\left(1.05\times10^{-34}\ \mathrm{J\,s}\right)^2}{\left(9.11\times10^{-31}\ \mathrm{kg}\right)\left(1.60\times10^{-19}\ \mathrm{C}\right)^2} = 5.26\times10^{-11}\ \mathrm{m} = 0.0526\ \mathrm{nm}$$

This differs slightly from the accepted value of 0.0529 nm because of rounding error due to using constants accurate to only 3 significant figures. From Equation 38.29, the ground state energy level of hydrogen is

$$E_1 = \frac{-e^2}{4\pi\varepsilon_0(2a_B)} = \frac{-\left(9\times10^{9}\ \mathrm{N^2\,m/C^2}\right)\left(1.60\times10^{-19}\ \mathrm{C}\right)^2}{2\left(5.29\times10^{-11}\ \mathrm{m}\right)} = -2.18\times10^{-18}\ \mathrm{J} = -13.61\ \mathrm{eV}$$

The slight difference from the accepted −13.60 eV is due to rounding error.