3. The surface area of a sphere is $4\pi R^2$, and we find the radius of Earth in Appendix C ($R_E = 6.37\times10^6$ m $= 6.37 \times 10^8$ cm). Therefore, the number of square "patches" (with one centimeter side length) needed to cover Earth is

$$A = 4\pi \left(6.37 \times 10^8\right)^2 = 5.1 \times 10^{18} \ .$$

The number of molecules that we want to distribute as evenly as possible among all those patches is (using Eqs. 20-2, 20-3, with $M = 18$ g/mol)

$$N = N_{\rm A}\,\frac{M_{\rm sam}}{M} = \left(6.02 \times 10^{23}\right)\frac{1.00\,{\rm g}}{18\,{\rm g/mol}} = 3.3 \times 10^{22} \ .$$

Therefore, we have $N/A = 6.56 \times 10^3$ molecules in each patch. Note: students are encouraged to figure $M = 18$ g/mol (for water) based on what they have learned in their chemistry courses, but it should be mentioned that this can also be gleaned from Table 20-1.