8. (a) The total surface area bounding the bathroom is

$$A = 2\,(2.5 \times 3.0) + 2\,(3.0 \times 2.0) + 2\,(2.0 \times 2.5) = 37 \text{ m}^2 \ .$$

The absolute value of the total electric flux, with the assumptions stated in the problem, is $|\Phi| = |\sum \vec{E} \cdot \vec{A}| = |\vec{E}|\,A = (600)(37) = 22 \times 10^3$ N·m^2/C. By Gauss' law, we conclude that the enclosed charge (in absolute value) is $|q_{\text{enc}}| = \varepsilon_0\,|\Phi| = 2.0 \times 10^{-7}$ C. Therefore, with volume $V = 15$ m^3, and recognizing that we are dealing with negative charges (see problem), we find the charge density is $q_{\text{enc}}/V = -1.3 \times 10^{-8}$ C/m^3.

(b) We find $(|q_{\text{enc}}|/e)/V = (2.0 \times 10^{-7}/1.6 \times 10^{-19})/15 = 8.2 \times 10^{10}$ excess electrons per cubic meter.