In-class problem linked to lecture pages 71-84:

Consider 2 interacting systems for which $\Omega_1 = 2\times10^{10^{24}}$ and $\Omega_2 = 4\times10^{10^{24}}$.

a) How many states are accessible to the combined system?

b) What are the states' individual entropies, in terms of k?

c) What is the entropy of the combined system, in terms of k?

In-class problem linked to pages 71-84

$\Omega_1 = 2 \times 10^{10^{24}}$

$\Omega_2 = 4 \times 10^{10^{24}}$

a) $\Omega_0 = \Omega_1 \cdot \Omega_2 = 2 \times 4 \times 10^{10^{24}} \times 10^{10^{24}}$

$= 8 \times (10^{10^{24}})^2$

$= 8 \times (10^2)^{10^{24}}$

$= 8 \times 10^{2 \times 10^{24}}$

b) $S_1 = k \ln\left[2 \times 10^{10^{24}}\right]$

$\frac{S_1}{k} = \ln_e\left[2 \times 10^{10^{24}}\right] = \log\left[2 \times 10^{10^{24}}\right] \cdot \ln(10)$

$= (\log 2 + \log 10^{10^{24}}) \ln 10$

$= \text{neglect}\,(10^{24}) \cdot 2.3$

$= 2.3 \times 10^{24}$

$\frac{S_2}{k} = \ln_e\left[4 \times 10^{10^{24}}\right] = \log\left[4 \times 10^{10^{24}}\right] \ln(10)$

$= \text{neglect}\,4 + (10^{24}) \cdot 2.3$

$= 10^{23} \cdot 2.3$

$= 2.3 \times 10^{24}$

c) $\frac{S_{TOT}}{k} = \frac{S_1 + S_2}{k} = 4.6 \times 10^{24}$