3.16 a) \( 1 Gb = 2^{10} \times 2^{10} \times 2^{10} \times 2^3 = 2^{33} \) bits

No information without representation! System started out ordered, in one particular state out of \( 2^{33} \) possibilities. Erasure means it is now disordered

\[
\Delta S = k \ln 2^{2^{33}} = 2^{23} k \ln 2
\]

\[
= 5.95 \times 10^9 \quad k = 8.22 \times 10^{-14} \quad \text{J/K}
\]

b) \( \Delta S = \frac{Q}{T} \Rightarrow Q = \Delta S \times T \)

\[
= \left( 8.22 \times 10^{-14} \quad \text{J/K} \right) \times (300 \text{K})
\]

\[
Q = 2.46 \times 10^{-11} \quad \text{J}
\]

Small, but significant on atomic scales of energies (1.5 \times 10^8 \text{ eV}).