For N_2 gas molecules in a 10 cm cubic box, the rules of QM dictate the discrete allowed values for:

1. Translational K.E. in one dimension: $\{1 \times 10^{-40}\ \text{J}, 4 \times 10^{-40}\ \text{J}, 9 \times 10^{-40}\ \text{J}, \ldots\}$
2. Rotational K.E.: $\{0\ \text{J}, 0.8 \times 10^{-22}\ \text{J}, 0.8 \times 10^{-22}\ \text{J}, 0.8 \times 10^{-22}\ \text{J}, 2.5 \times 10^{-22}\ \text{J}, \ldots\}$
3. Vibrational energy: $\{2.3 \times 10^{-20}\ \text{J}, 6.9 \times 10^{-20}\ \text{J}, 11.5 \times 10^{-20}\ \text{J}, \ldots\}$

Sketch a graph of $\frac{dU}{dT}$ of 10^{22} molecules of N_2 gas in the temperature range of 70 K (the temperature at which N_2 becomes liquid at 1 atm of pressure) to 5000 K (at which temperature N_2 breaks apart).

(use a logarithmic temperature axis)