

① Match the Thermodynamic Variable with the correct relation to the partition function  $Q$

\_\_\_\_\_  $-\frac{1}{Q} \frac{\partial Q}{\partial \beta}$   $\{A, P, S, U\}$

\_\_\_\_\_  $-k\beta \frac{\partial \ln Q}{\partial \beta} + k \ln Q$

\_\_\_\_\_  $\frac{1}{\beta} \frac{\partial \ln Q}{\partial V}$

\_\_\_\_\_  $-\frac{1}{\beta} \ln Q$

\_\_\_\_\_  $-\frac{\partial \ln Q}{\partial \beta}$

\_\_\_\_\_  $\frac{1}{\beta Q} \frac{\partial Q}{\partial V}$

② Briefly list the characteristics of the following types of system

(a) Isolated system:

(b) Open system:

(c) Adiabatic system:

(d) Closed system:

③  $n$  moles of ideal gas expands irreversibly under constant pressure ( $P = 1 \text{ atm}$ ) from 20 L to 30 L. How much work is done? ( $T = 300 \text{ K}$ )

④ A mole of ideal gas expands reversibly from 20 L to 30 L. How much work is done? ( $T = 300 \text{ K}$ )

