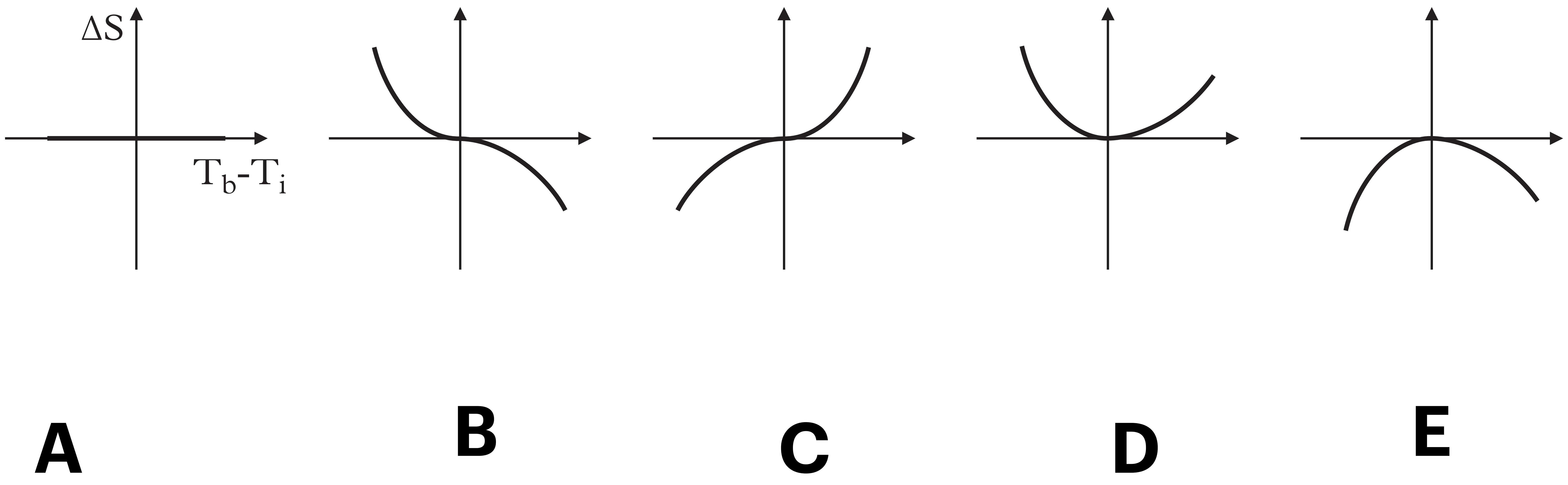
שיעור חזרה - עבודה עצמית

https://padlet.com/gmisha59/9zfecor4qzefj79r

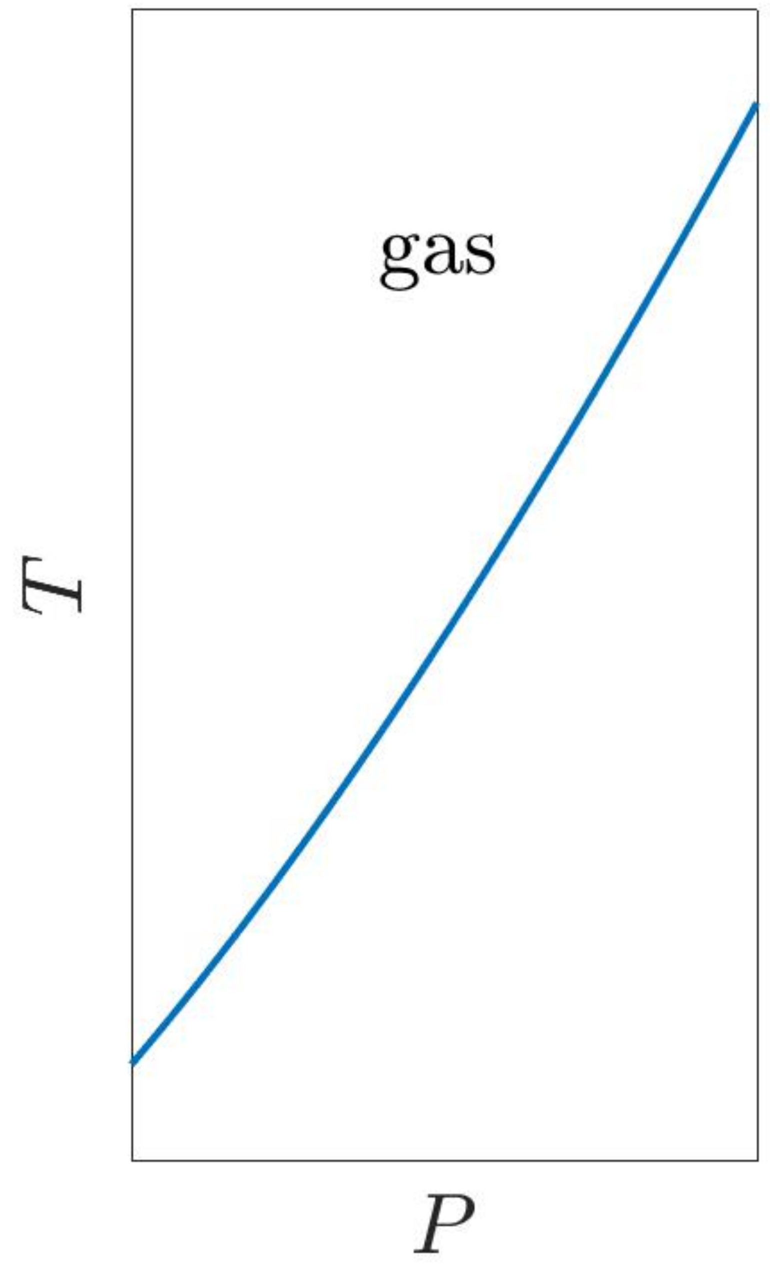
A solid of fixed volume, initially at a temperature T_i, is suddenly immersed in a bath of fluid at temperature T_b. Eventually the solid comes to thermal equilibrium with the bath at some intermediate temperature. No work is done during this process, and the solid plus bath are isolated from the rest of the world. Let ΔS denote the difference between final and initial entropy of the total system (solid plus bath). Which of the graphs shown in Fig. 3.4 could represent the dependence of this entropy change on the temperature difference $(T_b - T_i)$? Explain.



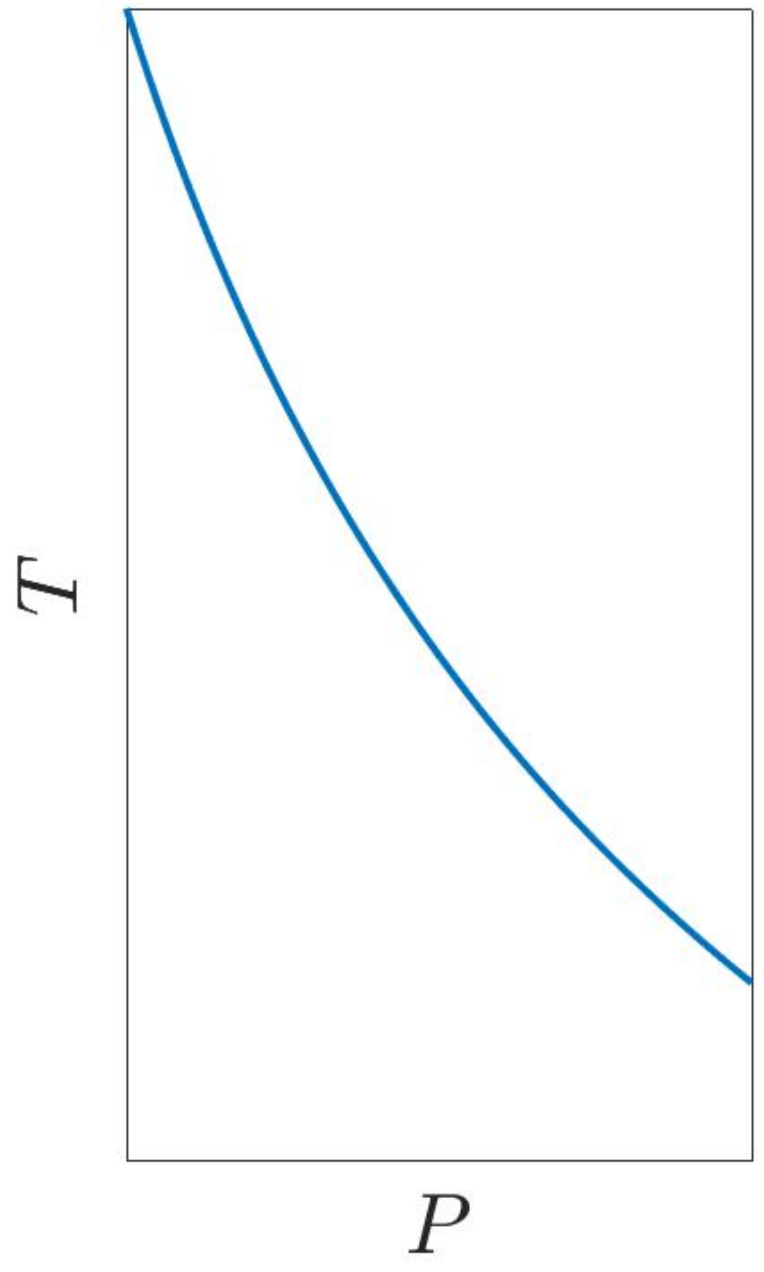
A system is brought from state A to state B. What process results in the largest entropy increase ?

A. Reversible
B. Irreversible
C. Quasistatic
D. Does not matter
E. Not enough information

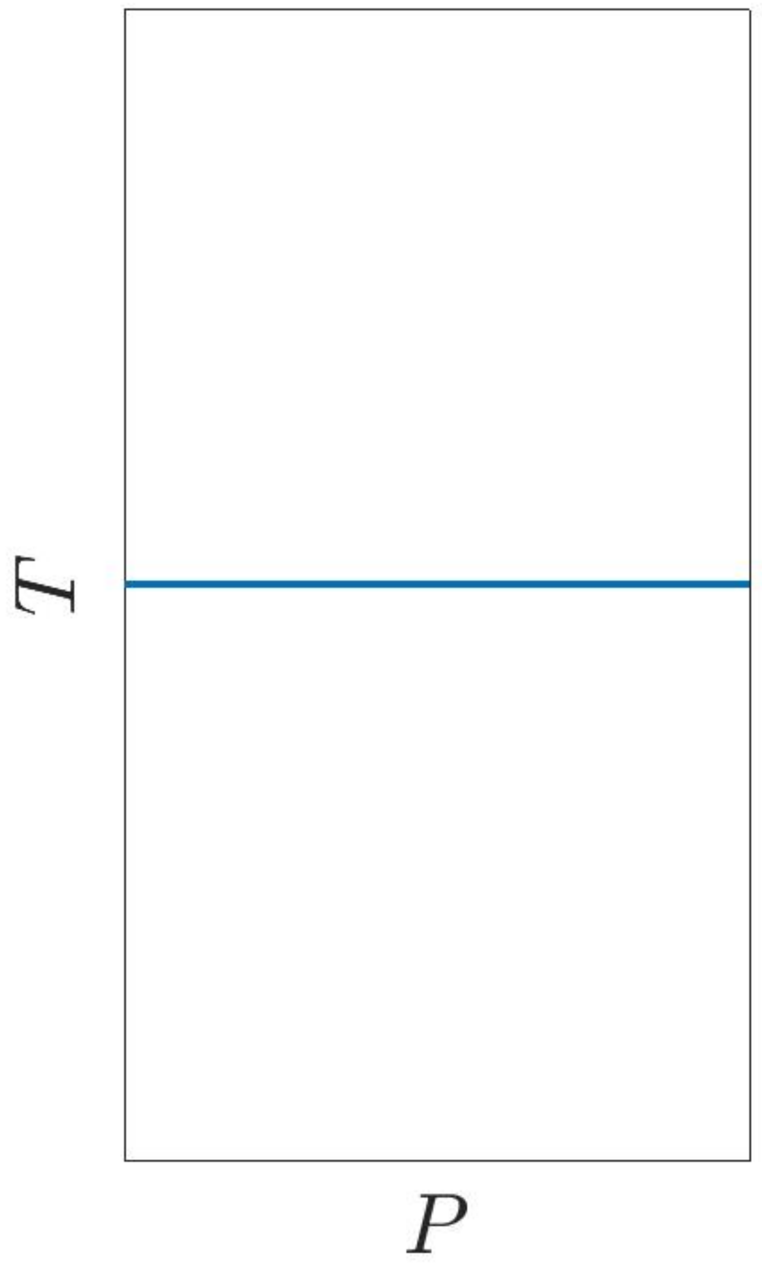
Each figure shows a part of the coexistence curve of the liquid and gas phases of some substance. Which curves are valid ?



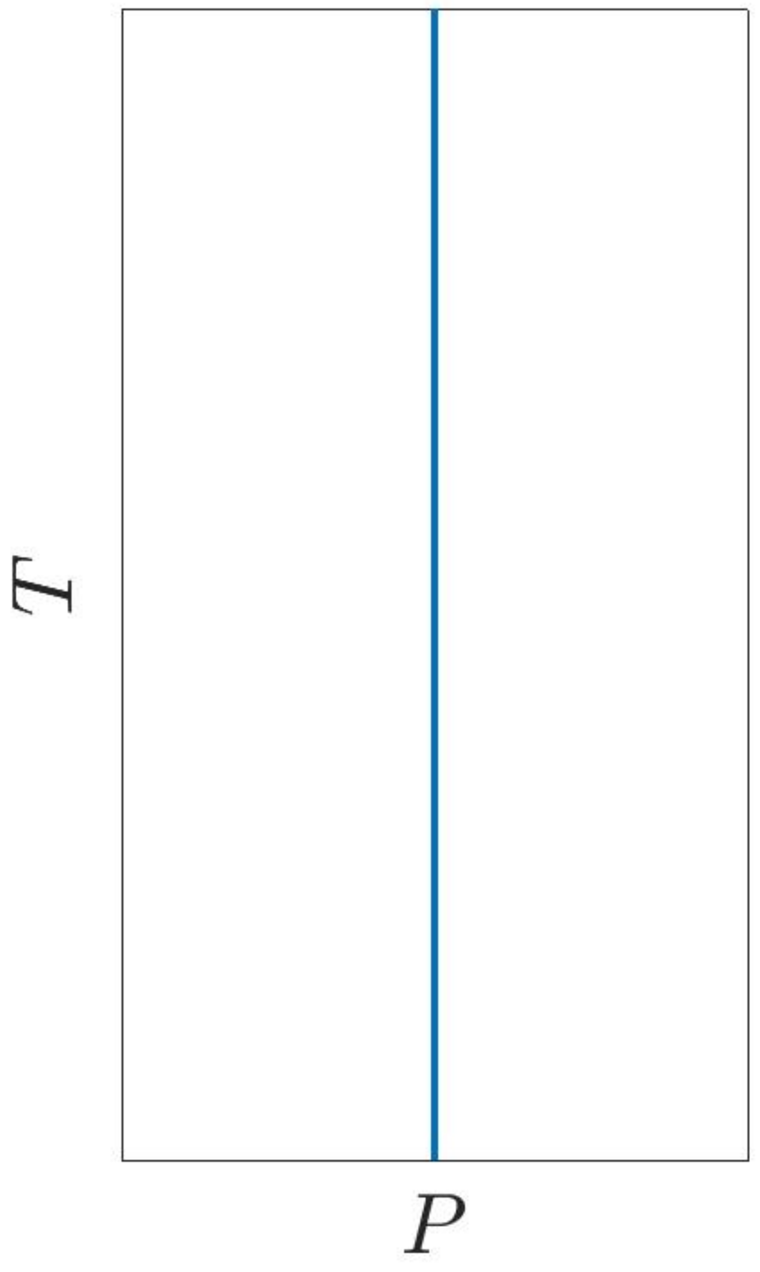
A



B



C



D

All

E

1 g of sugar $C_{12}H_{22}O_{11}$ or salt $NaCl$ are added to the same amount of water in the same conditions. In which case the osmotic pressure is higher ?

A. Salt

B. Sugar

C. They will be the same

D. Not enough information

E. There will be no osmotic pressure

A system is in Internal Thermal Equilibrium. We know that

$$S = S(\frac{U}{2},\frac{V}{2},\frac{N}{2}) + S(\frac{U}{2},\frac{V}{2},\frac{N}{2})$$

Let

$$\tilde{S} = S(\frac{U}{2}+\frac{U}{100},\frac{V}{2}+\frac{V}{100},\frac{N}{2}+\frac{N}{100}) + S(\frac{U}{2}-\frac{U}{100},\frac{V}{2}-\frac{V}{100},\frac{N}{2}-\frac{N}{100})$$

Which relation is correct ?

A. $\tilde{S} > S$

B. $\tilde{S} < S$

C. $\tilde{S} = S$

D. any relation is possible

E. not enough information

A solid at temperature $T_1 > 0$ is brought in thermal contact with a systems of spins at $T_2 < 0$. What would be the temperature when the two systems arrive at mutual thermal equilibrium ?

A. > 0

B. < 0

C. $= 0$

D. $= \infty$

E. not enough information

A system consists of several subsystems. A spontaneous process occurs in the composite system. Can it cause entropy decrease of one or more subsystems.

A. No
B. One only
C. In all of them
D. At most in all but one.
E. Not enough information

A system consists of a number of chemicals and is maintained at constant temperature and pressure. Can a chemical reaction occur if in this reaction

$\Delta G > 0$ **?**

A. Never

B. Always

C. Only non-spontaneous

D. Depends on ΔS

E. Depends on ΔU

A system can take on unlimited energy E. The size and number of particles are fixed. Which dependence of the system multiplicity on energy is viable when $E \to \infty$?

A. $\Gamma \propto E^n$

B. $\Gamma \propto e^{aE}, \quad a = \text{const}$

C. $\Gamma \to \text{const}$

D. $\Gamma \to 0$

E. all of the above

A system can take on unlimited energy E. The size and number of particles are fixed. Which dependence of the system temperature on energy is viable when $E \to \infty$?

A. $T \propto E$

B. $T \to \text{const} > 0$

C. $T \to \text{const} < 0$

D. $T \propto e^{aE}, \quad a = \text{const}$

E. none of the above

A system consists of non-interacting bosons. The first three single-particle states have energies $\varepsilon_0 = 0, \quad \varepsilon_1, \quad \varepsilon_2 \gg \varepsilon_1$. The system is at temperature $\varepsilon_1 \ll T \ll \varepsilon_2$. What is the mean energy per particle ?

A. $\approx \varepsilon_0 = 0$

B. $\approx \varepsilon_1$

C. $\approx \frac{1}{2}(\varepsilon_0 + \varepsilon_1)$

D. $\approx \frac{1}{2}(\varepsilon_1 + \varepsilon_2)$

E. T

A “new-Fermi” (NF) statistics allows at most 4 particles in one single-particle state. Compare the pressure of the degenerate, $T = 0,$ Fermi gas (F) with the pressure of the degenerate NF gas of the same particle density. Which one is higher ?

A. $P_{NF} > P_F$

B. $P_F > P_{NF}$

C. $P_F = P_{NF} > 0$

D. $P_F = P_{NF} = 0$

E. not enough information

A Fermi gas is degenerate at $T = 0$ and then $\mu > 0$. The same gas becomes classical at high temperatures and then $\mu < 0$. The transition from positive to negative μ occurs at some temperature T_c. What is the dependence of this temperature on the gas density n, which is kept constant ?

A. $T_c \propto n$

B. $T_c \propto n^{2/3}$

C. $T_c \propto n^{3/2}$

D. $T_c \propto 1/n$

E. T_c does not depend on n

The second law of thermodynamics does not allow a process in which

A. all work is converted to heat
B. all heat is converted to work
C. the only result is conversion of all work to heat
D. the only result is conversion of all heat to work
E. heat is used to produce work

A system is in thermal contact with a reservoir at some temperature. Let $P(E)$ be the probability that the measured energy of the system is E. Which statement is correct ?

A. $P(E)$ monotonically decreases with energy

B. $P(E)$ monotonically increases with energy

C. $P(E)$ is maximum at some energy

D. $P(E)$ does not depend on energy

E. depends on the specific system

A system is in thermal and diffusive equilibrium with a reservoir. The temperature and the chemical potential of the reservoir change very slowly. Which statement is correct ?

A. Energies of single-particle states of the system change slowly.
B. Mean occupation numbers change slowly.
C. Number of available single-particle states changes slowly.
D. Statistics of particles changes at some critical values of temperature and/or chemical potential.
E. Nothing changes within the system.

An absorbing system can accommodate unlimited number of molecules, each of which will have energy $\varepsilon_0 < 0$ when absorbed. The system is in thermal and diffusive equilibrium with a classical ideal gas at chemical potential μ. Which statement is correct ?

A. $\varepsilon_0 = \mu$

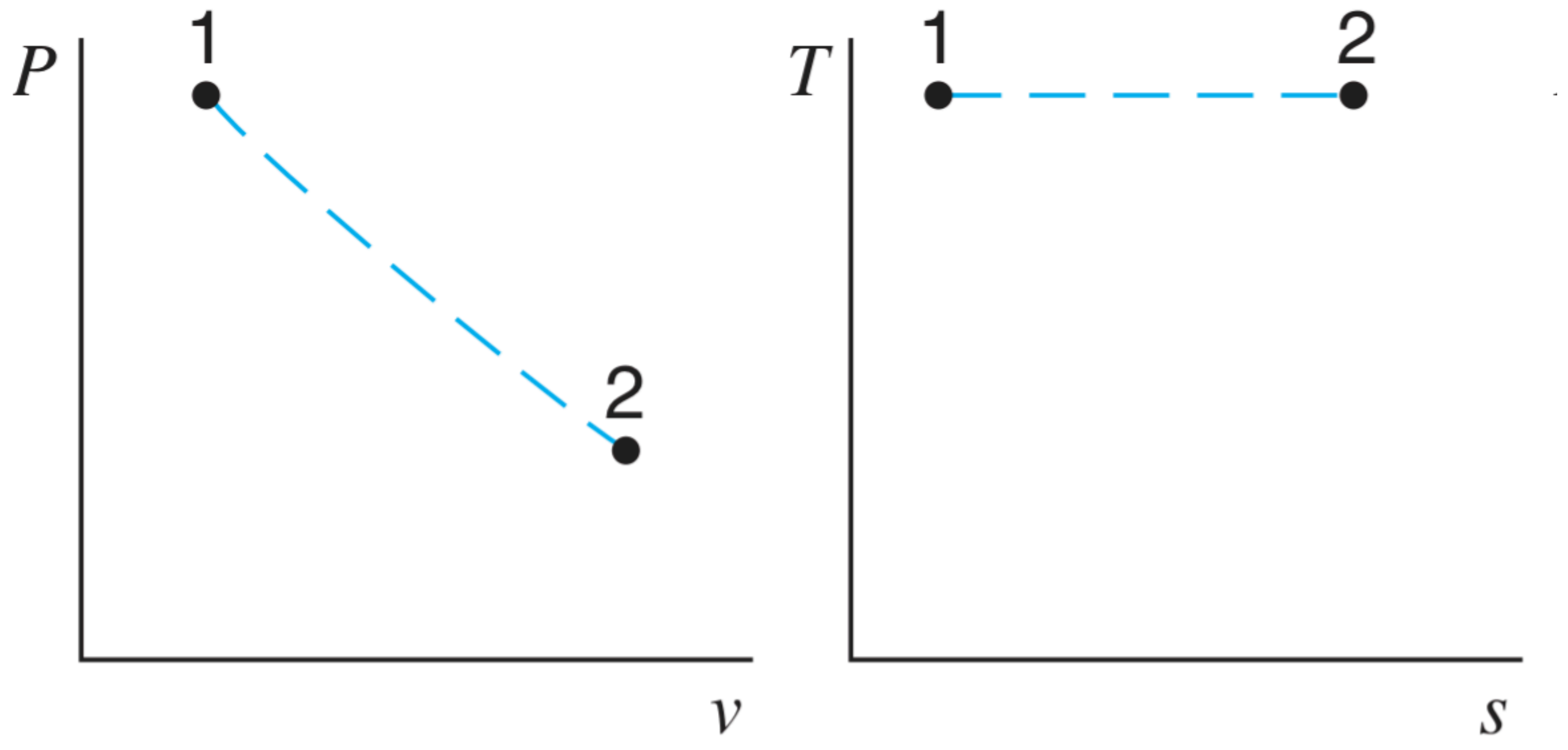
B. $\varepsilon_0 < \mu$

C. $\varepsilon_0 > \mu$

D. any relation is possible

E. the situation is impossible

An ideal gas undergoes a non-quasistatic process bringing it from state 1 to state 2, as shown in the $P-V$ and $T-S$ diagrams. What work W is done by the gas and what heat Q is transferred to the gas ?



A. $W = \dfrac{(P_1 + P_2)(V_2 - V_1)}{2}, \quad Q = T(S_2 - S_1)$

B. $W = 0, \quad Q = T(S_2 - S_1)$

C. $W = \dfrac{(P_1 + P_2)(V_2 - V_1)}{2}, \quad Q = 0$

D. $W = 0, \quad Q = 0$

E. Not enough information