

4. Which of the processes described below are irreversible?

- a. The increase in temperature of an iron rod by hammering it.
- b. A gas in a small container at a temperature T_1 is brought in contact with a big reservoir at a higher temperature T_2 which increases the temperature of the gas.
- c. A quasi-static isothermal expansion of an ideal gas in a cylinder fitted with a frictionless piston.
- d. An ideal gas is enclosed in a piston-cylinder arrangement with adiabatic walls. A weight W is added to the piston, resulting in compression of the gas.

Sol. We know that in thermodynamics, a reversible process is a process whose direction can be reversed by including infinitesimal changes to the property of the system through its surroundings.

Now,

case(a) in which the internal energy of the rod is increased through external work done, this process is irreversible.

case(b) heat is transferred from one container to another, the process is irreversible.

case (c) process is reversible because the cylinder is fitted with a frictionless piston.

case(d) process is irreversible as weight is added to the cylinder arrangement in form of external pressure.

option (a, b, d) is correct.