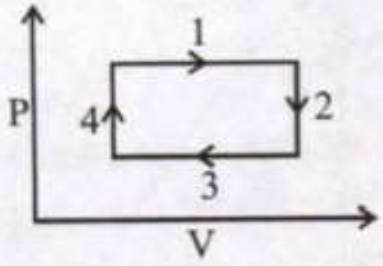
1. An ideal gas undergoes a four step cycle as shown in the P - V diagram below. During this cycle, heat is absorbed by the gas in [Adv. 2021]



(a) steps 1 and 2 (b) steps 1 and 3

(c) steps 1 and 4 (d) steps 2 and 4

---

1. **(c)** From P-V diagram,

Process 1:

P = constant, Volume (V) increases and temperature (T) also increases.

Work done, $W = \int p\,dV$ = positive,

$$\Delta U = \frac{f}{2} nR\Delta T \text{ = positive}$$

Therefore heat is absorbed by the gas

$\because \Delta Q = \Delta U + \Delta W$

Process -2:

Volume V = constant, Pressure (P) decreases.

$\therefore$ Temperature (T) decreases.

$\because P \propto T$

$\therefore W = \int p\,dV = 0$

ΔT is negative and $\Delta U = \frac{f}{2} nR\Delta T$

$\therefore \Delta U$ in negative.

$\Delta Q = \Delta U + W$ (Negative)

$\therefore$ Heat is rejected by the gas.

Process 3:

P = constant, Volume (V) decreases.

$\therefore$ Temperature (T) also decreases.

$W = P\Delta V$ = negative

$$\Delta U = \frac{f}{2} nR\Delta T \text{ = negative}$$

$\therefore \Delta Q = W + \Delta U$ = negative

$\therefore$ Heat is rejected by the gas.

Process 4:

V = constant, Pressure (P) increases.

$\therefore W = \int p\,dV = 0$

$PV = nRT \Rightarrow$ Temperature increases

$\therefore \Delta U = \frac{f}{2} nR\Delta T$ is positive

$\therefore \Delta Q = \Delta U + W$ = positive

Therefore heat is absorbed by the gas.