

Two moles of an ideal monatomic gas occupies a volume V at $27^\circ C$. The gas expands adiabatically to a volume $2V$. Calculate (a) the final temperature of the gas and (b) change in its internal energy.

- (1) (a) 189 K (b) 2.7 kJ
- (2) (a) 195 K (b) -2.7 kJ
- (3) (a) 189 K (b) -2.7 kJ
- (4) (a) 195 K (b) 2.7 kJ

Based on JEE Main 2018 - [123IITJEE](#)

For adiabatic process, $TV^{\gamma-1} = \text{constant}$

$$\therefore 300 \times V^{5/3-1} = T \times (2V)^{5/3-1}$$

$$\therefore T = \frac{300}{2^{2/3}} = 189K$$

$$\Delta U = nC_v \Delta T$$

Note: Since, $\Delta T < 0$ the only correct option possible is option (3) which can be further confirmed by putting the values.

$$\Delta U = 2 \times \frac{3}{2} \times 8.314 \times (189 - 300)$$

Ans: Option (3).