

Some Solved Examples of  
Laws of thermodynamics & some  
unsolved problems for you.

Q.1. A motor car tyre has a pressure of 2 atmospheres at the room temperature of  $27^\circ\text{C}$ . If the tyre suddenly bursts, find the resulting temperature.

Soln:- Given that  $P_1 = 2$  atmospheres

$$T_1 = 273 + 27 = 300\text{K}$$

$$P_2 = 1 \text{ atmosphere}$$

$$T_2 = ?$$

$$\gamma = 1.4$$

$$\therefore \frac{P_1^{\gamma-1}}{T_1^\gamma} = \frac{P_2^{\gamma-1}}{T_2^\gamma} \quad \text{or} \quad \left(\frac{P_2}{P_1}\right)^{\gamma-1} = \left(\frac{T_2}{T_1}\right)^\gamma$$

$$\Rightarrow \left(\frac{1}{2}\right)^{0.4} = \left(\frac{T_2}{300}\right)^{1.4}$$

$$2.304 \times 0.4 \log_{10}(0.5) = 1.4 [\log_{10} T_2 - \log_{10} 300] \times 2.304$$

$$\Rightarrow -0.1204 = 1.4 \log_{10} T_2 - 3.4680$$

$$\Rightarrow 1.4 \log_{10} T_2 = 3.4680 - 0.1204 = 3.3476$$

$$\Rightarrow \log_{10} T_2 = \frac{3.3476}{1.4} = 2.3911$$

$$\therefore T_2 = \text{Antilog}(2.3911) = 246.1\text{K}$$

$$\text{Hence } T_2 = -26.9^\circ\text{C}$$

Ans.

Do yourself :- Worksheet no. - 1

Q.1. A quantity of air at  $27^{\circ}\text{C}$  and atmospheric pressure is suddenly compressed to half its original volume. Find the final (i) pressure and (ii) temperature. (Given  $\gamma = 1.4$  &  $2^{1.4} = 2.64$ )

Q.2. Calculate the work done when one litre of a mono perfect gas at N.T.P is compressed adiabatically to half its volume  $\gamma = 1.67$ .

Q.3. The initial temperature of a gas is  $27^{\circ}\text{C}$ . Calculate the rise in temperature when the gas is compressed suddenly to 8 times its original pressure ( $\gamma = 1.5$ ).

Q.4. Calculate the rise in temperature of a gas initially at  $27^{\circ}\text{C}$ , if its pressure is suddenly doubled,  $\gamma = 1.4$ .

Q.5. A quantity of air at  $27^{\circ}\text{C}$  is compressed (i) slowly and (ii) suddenly to  $\frac{1}{3}$  of its volume. Find the change in temperature in each case, assuming  $\gamma$  to be 1.4 for dry air. — x —