PHYSICS

NCERT - NCERT PHYSICS(GUJRATI)

THERMODYNAMICS

Exercises

1. A geyser heats water flowing at the rate of 3.0 litres per minute from 27° C to 77° C. If the geyser operates on a gas burner, what is the

rate of consumption of the fuel if its heat of combustion is 4.0×10^4 J/g ?

2. What amount of heat must be supplied to 2.0×10^{-2} Kg of nitrogen (at room temperature) to raise its temperature by $45°C$ at constant pressure ? (Molecular mass of N_2=28 , $R = 8.3 \mathrm{J\,mol}^{-1}K^{-1}$)

3. Explain why

(a) Two bodies at different temperatures T_1 and T_2 if brought in thermal contact do not necessarily settle to the mean temperature $(T_1 + T_2)/2$.

(b) The coolant in a chemical or a nuclear plant (i.e., the liquid used to prevent the different parts of a plant from getting too hot) should have high specific heat.

(c) Air pressure in a car tyre increases during driving.

(d) The climate of a harbour town is more

temperate than that of a town in a desert at the same latitude.

4. A cylinder with a movable piston contains 3 moles of hydrogen at standard temperature and pressure. The walls of the cylinder are made of a heat insulator, and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas

increase if the gas is compressed to half its original volume ?

5. In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35

cal,how much is the net work done by the system in the latter case ? (Take 1 cal = 4.19 J)

6. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following:

(a) What is the final pressure of the gas in A

and B ?

(b) What is the change in internal energy of the gas ?

(c) What is the change in the temperature of the gas ?

(d) Do the intermediate states of the system (before settling to the final equilibrium state) lie on its P-V-T surface ?

▶ Watch Video Solution

7. A steam engine delivers 5.4×10^8 J of work per minute and services 3.6×10^9 J of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute ?

> ▶ **Watch Video Solution**

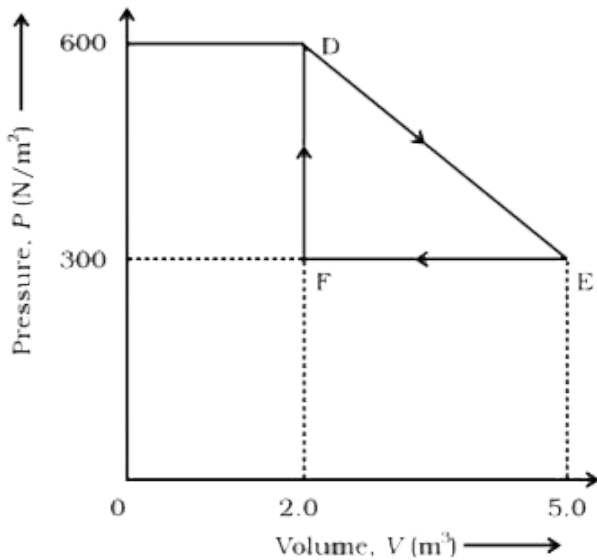**8.** An electric heater supplies heat to a system at a rate of 100 W. If system performs work at

a rate of 75 joules per second. At what rate is the internal energy increasing ?

9. A thermodynamic system is taken from an original state to an intermediate state by the linear process shown in Fig. (12.13)

Its volume is then reduced to the original

value from E to F by an isobaric process.

Calculate the total work done by the gas from

D to E to F

10. A refrigerator is to maintain eatables kept inside at $9°C$. If room temperature is $36°C$, calculate the coefficient of performance.