7. a) State and explain first law of thermodynamics.
   b) Obtain the relation between the heat capacities of an ideal gas. **(2+6)**

8. a) State Clausius and Kelvin's statements of second law of thermodynamics.
   b) Calculate the change in entropy during reversible and irreversible process. **(2+6)**

PART – B

Solve **any five** of the following problems. **Each** problem carries **four** marks. **(5×4=20)**

9. A 10 kg block is placed on a horizontal table and is attached to a 5 kg block with the help of a string passing through a frictionless and mass less pulley. Calculate the acceleration produced. Given, kinetic friction between 10 kg block and the table is 0.2.

10. Calculate the orbital velocity of a earth's geostationary satellite. Given, mass of earth = 5.98×10^{24} kg and gravitational constant = 6.67×10^{-11} Nm^2kg^{-2}.

11. A neutron moving with a velocity of 10^6 m/sec, collides with a deuteron at rest. After collision, the combined mass (titron) moves with a certain velocity. Calculate the velocity, if the mass of neutron is 1.67×10^{-27} kg and mass of the deuteron is 3.34×10^{-27} kg.

12. If the average energy radiated per unit area of the surface of the sun is 7.452×10^7 watt. Estimate the surface temperature of the sun by assuming it as a perfect black body. Given, $\sigma = 5.67 \times 10^{-8}$ $wm^{-2}K^{-4}$.

13. If the rms velocity of hydrogen molecule is 1.84 km/sec at NTP, then calculate the rms velocity of oxygen molecule at NTP. Given, molecular weights of hydrogen and oxygen are 2 and 32 respectively.

14. Find the co-efficient of viscosity of a nitrogen gas at NTP from the following data. Density of nitrogen = 1.25 kgm^{-3}, mean velocity = 454.4 $msec^{-1}$, mean free path of nitrogen gas = 9.44×10^{-8} m.

15. At 27°C two moles of an ideal monoatomic gas occupies a volume V and the gas expands adiabatically to a volume 2V. Find the temperature of the gas and work done by the gas during the process. Given that $\gamma = \frac{5}{3}$.

16. In a Carnot engine the temperature of source and sink are 500 K and 375 K respectively. If engine consumes 25×10^5 joule per cycle, then find the efficiency of the engine and work done per cycle.