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Subject : Physics	Topic :Thermodynamics and Kinetic theory	Worksheet No. 12
Resource Person : Mrs. Jayalakshmi Ratish		Date : _____
Name of the Student :_____	Class & Division : XI A/B	Roll Number : __

1   Calculate the total number of degrees of freedom for a mole of diatomic gas at NTP.

2   If on giving 40 J of heat to a system, work done on the system is 10 J. What will be the change in internal energy of the system?

3   A mixture of 0.1 mol of hydrogen and 0.2 mol of helium is contained in a vessel of volume 2×10^{-3} m³. What is the pressure due to the component gases and mixture? Given temperature of mixture = 300 K and R = 8.31 J/mol/K.

4   Air is filled at 60°C in a vessel of open mouth. Upto what temperature should the vessel be heated so that $\frac{1}{4}$ th part of air may escape?

5   A balloon hydrogen is filled with hydrogen at a given pressure at 20°C. What fraction of gas will escape out of the balloon if the temperature rises to 40°C at constant pressure?

6   Calculate the kinetic energy of one gram of nitrogen at 77°C. Given that R=8.31 Jmol⁻¹K⁻¹.

7   The density of neon gas at a temperature of 273 K and a pressure of 1.02×10^5 Ps is 0.9 kg/m³. Neon maybe assumed as an ideal gas. Calculate the root mean square speed of neon atoms at –

(i) 273 K

(ii) 546 K

8   Calculate the mean free path and the collision frequency of air molecules, if the number of molecules per cm³ is 3×10^{19}, the diameter of the molecule is 2×10^{-8} cm and the average molecular speed is 1 km/s.

9   What amount of heat must be supplied to 2×10^{-2} kg of nitrogen (at room temperature) to raise its temperature by 45°C at constant pressure?

(molecular mass of nitrogen =28, R = 8.3 Jmol⁻¹K⁻¹)

10   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)

11   An electric heater supplies heat to a system at a rate of 100 W. If system performs work at a rate of 75 J/s, at what rate is the internal energy increasing?

12   A heat engine is having a source at temperature 527°C and sinks at temperature 127°C. If the useful work is required to be done by the engine at the rate of 750 watt, then find the amount of heat absorbed by the engine per second from the source. Also find the efficiency of heat engine.

13   Following figure represents the graph of thermodynamic processes occurring in a system. The internal energy of the system in state D is 100 J. Calculate –
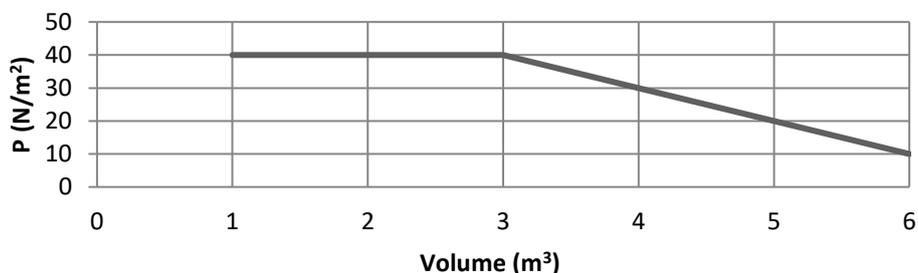
(a) the internal energy of system in state A, if 10 J heat is given from state D to state A.
(b) net work done by the system in the cyclic process ABCDA

14   5 mole of oxygen is heated at constant volume from 10°C to 20°C. What will be the change in the internal energy of the gas? The gram-molecular specific heat of oxygen at constant pressure, C_p = 8 cal/mol/°C and R = 8.36 J/mol/°C.

15   A Carnot engine absorbs 1000J of heat from a reservoir at 127°C and rejects 600 J of heat during each cycle. Calculate –
(a) the efficiency of the engine,
(b) the temperature of the sink,
(c) the amount of the useful work done during each cycle.