1. The first law of thermodynamics is based on :–

(1) Law of conservation of energy

(2) Law of conservation of mechanical energy

(3) Law of conservation of gravitational P.E.

(4) None of the above

2. In a process, 500 calories of heat is given to a system and at the same time 100 joules of work is done on the system. The increase in the internal energy of the system is :-

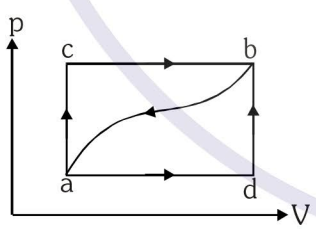
(1) 40 calories (2) 1993 joules

(3) 2193 joules (4) 82 calories

3. In a thermodynamic process pressure of a fixed mass of a gas is changed in such a manner that the gas releases 20 joules of heat and 8 joules of work was done on the gas. If the initial internal energy of the gas was 30 joules, then the final internal energy will be:-

(1) 2 J (2) 42 J (3) 18 J (4) 58 J

4. When a system is taken from state 'a' to state 'b' along the path 'acb', it is found that a quantity of heat Q = 200 J is absorbed by the system and a work W = 80J is done by it. Along the path 'adb', Q = 144J. The work done along the path 'adb' is



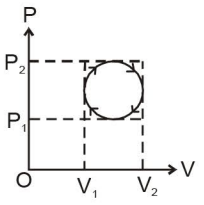
(1) 6J (2) 12 J

(3) 18 J (4) 24 J

5. 1 kg of a gas does 20 kJ of work and receives 16 kJ of heat when it is expanded between two states. A second kind of expansion can be found between the same initial and final state which requires a heat input of 9 kJ. The work done by the gas in the second expansion is :

(1) 32 kJ (2) 5 kJ (3) –4 kJ (4) 13 kJ

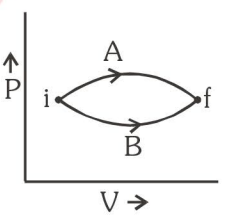
6. In a cyclic process shown on the P – V diagram, the magnitude of the work done is :



(1) $\pi\left(\frac{P_2 - P_1}{2}\right)^2$ (2) $\pi\left(\frac{V_2 - V_1}{2}\right)^2$

(3) $\frac{\pi}{4}(P_2 - P_1)(V_2 - V_1)$ (4) $\pi(P_2V_2 - P_1V_1)$

7. A system is taken along the paths A and B as shown. If the amounts of heat given in these processes are ΔQ_A and ΔQ_B and change in internal energy are ΔU_A and ΔU_B respectively then :-



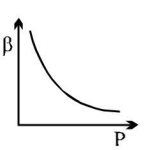
(1) $\Delta Q_A = \Delta Q_B$; $\Delta U_A < \Delta U_B$

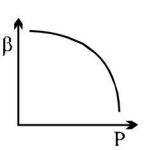
(2) $\Delta Q_A \geq \Delta Q_B$; $\Delta U_A = \Delta U_B$

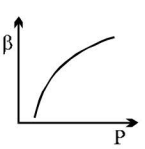
(3) $\Delta Q_A < \Delta Q_B$; $\Delta U_A > \Delta U_B$

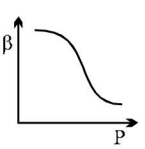
(4) $\Delta Q_A > \Delta Q_B$; $\Delta U_A = \Delta U_B$

8. Which of the following graphs correctly represents the variation of $\beta = -(dV/dP)/V$ with P for an ideal gas at constant temperature?

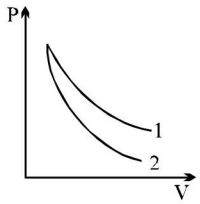
(1) 

(2) 

(3) 

(4) 

9. P-V plots for two gases during adiabatic processes are shown in the figure. Plots 1 and 2 should correspond respectively to



(1) He and O_2 (2) O_2 and He
(3) He and Ar (4) O_2 and N_2

10. For an adiabatic expansion of a perfect gas, the value of $\Delta P/P$ is equal to:-

(1) $-\sqrt{\gamma}\ \Delta V/V$ (2) $-\Delta V/V$
(3) $-\gamma\ \Delta V/V$ (4) $-\gamma^2\ \Delta V/V$

11. A gas for which $\gamma = 5/3$ is heated at constant pressure. The percentage of total heat given that will be used for external work is :

(1) 40% (2) 30% (3) 60% (4) 20%

12. One mole of an ideal gas at temperature T_1 expends according to the law $\frac{P}{V^2}$ = a (constant). The work done by the gas till temperature of gas becomes T_2 is :

(1) $\frac{1}{2}R(T_2 - T_1)$ (2) $\frac{1}{3}R(T_2 - T_1)$

(3) $\frac{1}{4}R(T_2 - T_1)$ (4) $\frac{1}{5}R(T_2 - T_1)$

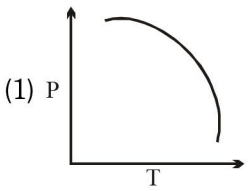
13. A quantity of air ($\gamma = 1.4$) at 27°C is compressed suddenly, the temperature of the air system will :

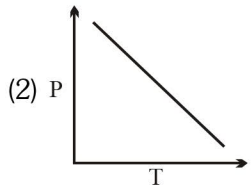
(1) Fall (2) Rise
(3) Remain unchanged (4) First rise and then fall

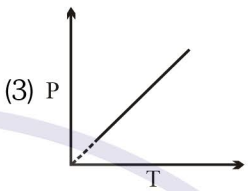
14. The volume of a poly-atomic gas $\left(\gamma = \frac{4}{3}\right)$ compressed adiabatically to $\frac{1}{8^{th}}$ of the original volume. If the original pressure of the gas is P_0 the new pressure will be :

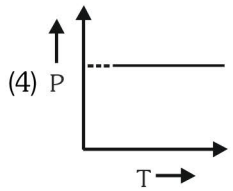
(1) 8 P_0 (2) 16 P_0 (3) 6 P_0 (4) 2 P_0

15. Graph of isometric process is :-

(1) 

(2) 

(3) 

(4) 

16. According to the second law of thermodynamics :

(1) heat energy cannot be completely converted to work

(2) work cannot be completely converted to heat energy

(3) for all cyclic processes we have $dQ/T < 0$

(4) the reason all heat engine efficiencies are less than 100% is friction, which is unavoidable

17. A reversible refrigerator operates between a low temperature reservoir at T_C and a high temperature reservoir at T_H. Its coefficient of performance is given by :

(1) $(T_H - T_C)/T_C$ (2) $T_C/(T_H - T_C)$
(3) $(T_H - T_C)/T_H$ (4) $T_H/(T_H - T_C)$

18. The efficiency of carnot engine is 50% and temperature of sink is 500K. If temperature of source is kept constant and its efficiency raised to 60%, then the required temperature of the sink will be :-

(1) 100 K (2) 600 K (3) 400 K (4) 500 K

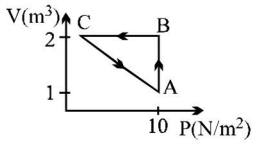
19. A refrigerator works between temperature −10°C and 27°C, the coefficient of performance is :

(1) 7.1 (2) 1 (3) 8.1 (4) 15.47

20. An ideal gas expands isothermally from a volume V_1 to V_2 and then compressed to original volume V_1 adiabatically. Initial pressure is P_1 and final pressure is P_3. The total work done is W. Then

(1) $P_3 > P_1$, $W > 0$ (2) $P_3 < P_1$, $W < 0$
(3) $P_3 > P_1$, $W < 0$ (4) $P_3 = P_1$, $W = 0$

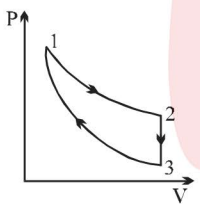
21. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure. If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process $C \to A$ is



(1) –5J (2) –10 J

(3) –15 J (4) –20 J

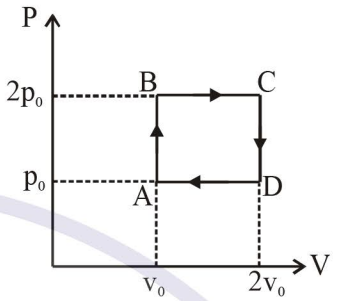
22. Three processes form a thermodynamic cycle as shown on P-V diagram for an ideal gas. Process $1 \to 2$ takes place at constant temperature (300K). Process $2 \to 3$ takes place at constant volume. During this process 40J of heat leaves the system. Process $3 \to 1$ is adiabatic and temperature T_3 is 275K. Work done by the gas during the process $3 \to 1$ is



(1) -40J (2) -20J

(3) +40J (4) +20J

23. The above P-V diagram represents the thermodynamic cycle of an engine, operating with an ideal monoatomic gas. The amount of heat, extracted from the source in a single cycle is :



(1) p_0v_0 (2) $\left(\frac{13}{2}\right)p_0v_0$

(3) $\left(\frac{11}{2}\right)p_0v_0$ (4) $4p_0v_0$

24. In the above question efficiency of cycle ABCDA is nearly :

(1) 12.5% (2) 15.4%

(3) 9.1% (4) 10.5%

ANSWER KEY										Exercise-I
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**1**	**3**	**3**	**4**	**4**	**3**	**4**	**1**	**2**	**3**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**1**	**2**	**2**	**2**	**3**	**1**	**2**	**3**	**1**	**3**
Que.	21	22	23	24						
Ans.	**1**	**1**	**2**	**2**						