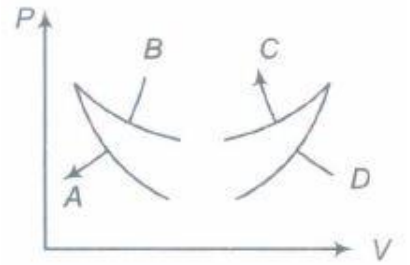
NEET PHYSICS PRACITCE PAPER

Time : 60 Mins **8 THERMODYNAMICS 1** **Marks : 200**

1. The temperature of sink of Carnot engine is 27°C. Efficiency of engine is 25%. Then temperature of source is:
   a) 227°C b) 327°C c) 127°C d) 27°C
2. At constant volume temperature is increased, then
   a) collision on walls will be less b) number of collisions per unit time will increase
   c) collisions will be in straight lines d) collisions will not change
3. Internal energy of an ideal gas depends upon
   a) temperature only b) volume only c) both volume and temperature d) neither volume nor temperature
4. Match the column I with column II

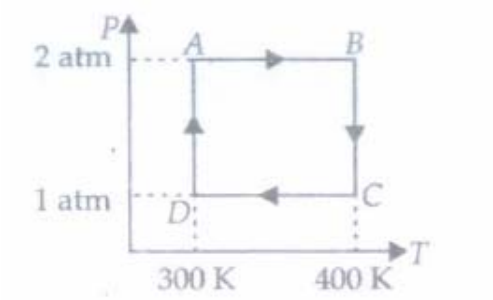
Type of processes	Feature
(A) Isothermal	(p) $\triangle Q = 0$
(B) Isobaric	(q) Volume constant
(C) Isochoric	(r) Pressure constant
(D) Adiabatic	(s) Temperature constant

   a) (A) - (s), (B) - (r), (C) - (q), (D) - (p) b) (A) - (p), (B) - (s), (C) - (r), (D) - (q)
   c) (A) - (q), (B) - (r), (C) - (p), (D) - (s) d) (A) - (r), (B) - (p), (C) - (q), (D) - (s)
5. Two Carnot engines A and B are operated in series. The engine A receives heat from the source at temperature T_1 and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and, rejects to its sink at temperature T_2. For what value of T the efficiencies of the two engines are equal?
   a) $\frac{T_1+T_2}{2}$ b) $\frac{T_1-T_2}{2}$ c) T_1T_2 d) $\sqrt{T_1T_2}$
6. Four curves A, B, C and D are drawn in the adjoining figure for a given amount of gas. The curves which represent adiabatic and isothermal changes are:



   a) C and D respectively b) D and C respectively c) A and B respectively d) B and A respectively
7. If γ denotes the ratio of the two specific heats of a gas, the ratio of the slopes of adiabatic and isothermal curves at their point of intersection is:
   a) $(1/\gamma)$ b) γ c) γ-1 d) γ+1
8. In which of the following thermodynamic process of the gas, the work done is maximum?
   a) Isothermal b) Isobaric c) Adiabatic d) Isochoric
9. First law of thermodynamics concerns conservation of:
   a) heat b) work c) momentum d) energy

10. Two moles of helium gas undergo a cyclic process as shown in figure. Assuming the gas to be ideal, the net work done by the gas is



a) 200Rln2 b) 100Rln2 c) 300Rln2 d) 400Rln2

11. The temperature of the system decreases in the process of:
a) free expansion b) adiabatic expansion c) isothermal expansion d) isothermal compression

12. If the energy input to a Carnot engine is thrice the work it performs then, the fraction of energy rejected to the sink is:
a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{2}{5}$ d) $\frac{2}{3}$ e) $\frac{3}{4}$

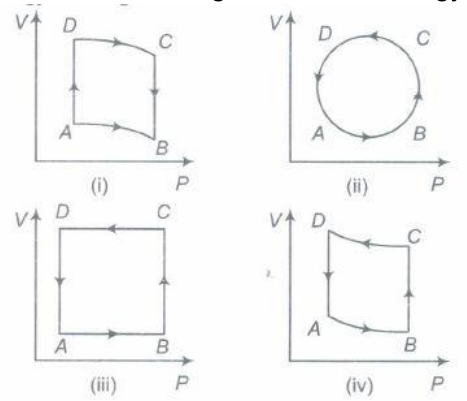
13. A body cools from 50^{o}C to 49.9^{o}C in 5s. How long will it take to cool from 40^{o}C to 39 .9^{o}C? (Assume the temperature of surroundings to be 30.0^{o}C and Newton's law of cooling to be valid)
a) 2.5s b) 10s c) 20s d) 5s

14. A diatomic ideal gas is used in a car engine as the working substance. If during the adiabatic expansion part of the cycle, volume of the gas increases from V to 32 V, the efficiency of the engine is:
a) 0.5 b) 0.75 c) 0.99 d) 0.25

15. In a thermodynamic process, pressure of a fixed mass of a gas is changed in such a manner that the gas releases 20 J of heat and 8 J of work is done on the gas. If initial internal energy of the gas was 30 J, what will be the final internal energy?
a) 42 J b) 12 J c) 10 J d) 18 J

16. Find the amount of work done to increase the temperature of one mole of ideal gas by 30°C, if it is expanding under the condition $V \propto T^{2/3}$: (R = 8.31 J/mol-K)
a) 16.62 J b) 166.2 J c) 1662 J d) 1.662 J

17. In the diagrams (i) to (iv) of variation of volume with changing pressure is shown. A gas is taken along the path ABCD. The change in internal energy of the gas will be :



a) Positive in all cases (i) to (iv) b) Positive in cases (i), (ii) and (iii) but zero in (iv) case
c) Negative in cases (i), (ii) and (iii) but zero in (iv) case d) Zero in all four cases

18. Two Carnot engines A and B have their sources at 1000 K and 1100 Kand their sinks at 400 K and 500 K respectively. If ηA and ηB be their efficiencies, then which of the following statement about their efficiencies is true?

a) ηA=ηB b) ηA<ηB c) ηA>ηB d) The data is not sufficient to make the above prediction

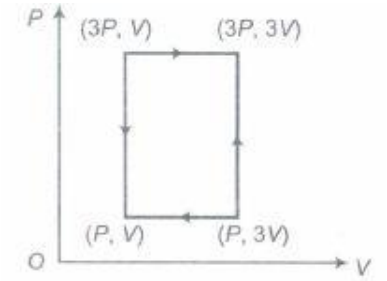
19. For a certain gas the ratio of specific heats is given to be g = 1.5, for this gas:
    a) $C_v = \frac{3R}{J}$ b) $C_p = \frac{3R}{J}$ c) $C_p = \frac{5R}{J}$ d) $C_v = \frac{5R}{J}$
20. In which of the following processes, heat is neither absorbed nor released by a system?
    a) Adiabatic b) Isobaric c) Isochoric d) Isothermal
21. An insulated container of gas has two chambers separated by an insulating partition. One of the chambers has volume V_1 and contains ideal gas at pressure P_1 and temperature T_1. The other chamber has volume V_2 and contains ideal gas at pressure P_2 and temperature T_2. If the partition is removed without doing any work on the gas, the final equilibrium temperature of the gas in the container will be:
    a) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_1}$ b) $\frac{P_1V_1T_1+P_2V_2T_2}{P_1V_1+P_2V_2}$ c) $\frac{P_1V_1T_2+P_2V_2T_1}{P_1V_1+P_2V_2}$ d) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_1+P_2V_2T_2}$
22. One of the most efficient engines ever developed operates between 2100 K and 700 K. Its actual efficiency is 40%. What percentage of its maximum possible efficiency is this?
    a) 40% b) 60% c) 66.67% d) 33.37%
23. A Camet's cycle operating between T_1 = 600 K and T_2 = 300 K producing 1.5 kJ of mechanical work per cycle, The heat transferred to the engine by the reservoirs is
    a) 2.5 kJ b) 3 kJ c) 3.5 kJ d) 4 kJ
24. If one mole of a monoatomic gas γ =5/3 is mixed with one mole ofa diatomic gas γ =7/5, what is the value ofy for the mixture?
    a) 1.5 b) 1.53 c) 1.60 d) 1.52
25. **Assertion:** In an isothermal expansion, the gas absorbs heat and does work while in an isothermal compression, work is done on the gas by the environment and heat is released.
    Reason: In an isothermal process, there is no change in internal energy of an ideal gas.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b) If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false
26. An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas?
    a) Isothermal b) Adiabatic c) Isobaric d) Isochoric
27. If for a gas R/C_v = 0.67, this gas is made up of molecules which are:
    a) monoatomic b) diatomic c) polyatomic d) mixture of diatomic and polyatomic molecules
28. The internal energy of a gas during isothermal expansion:
    a) increases b) decreases c) remains constant d) becomes zero
29. The specific heats of argon at constant pressure and constant volume are 525 J/kg and 315 J/kg respectively. Its density at NTP will be:
    a) 1.77 kg/m^3 b) 0.77 kg/m^3 c) 1.77 gm/m^3 d) 0.77 gm/m^3
30. 50 g of oxygen at NTP is compressed adiabatically to a pressure of 5 atmosphere. The work done on the gas, ify = 1.4 and R = 8.31 J mol^{-1} K^{-1} is
    a) - 5173 J b) 1131 J c) - 1364 J d) 5673
31. A thermodynamical system goes from state
    (i) P_1,V to $2P_1$V (ii) P_1,V to P_1, 2V then the work done in the two cases is:
    a) (i) zero (ii) zero b) (i) zero (ii) P_1V c) (i) P_1V (ii) zero d) (i) P_1V (ii) P_1V

32. A gaseous mixture enclosed in a vessel of volume V consists of one mole of a gas A with γ = 5/3 and another gas B with γ = 7/5 at a certain temperature T. The molar masses of the gases A and B are 4 and 32, respectively. The gases A and B do not react with each other and are assumed to be ideal. The gaseous mixture follows the equation $PV^{19/13}$ = constant, in adiabatic processes. The number of moles of the gas B in the gaseous mixture.
a) 2 b) 3 c) 4 d) 5

33. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while box B contains one mole of helium at temperature (7/3)T_0. The boxes are then put into thermal contact with each other and heat flows between them until the gases reach a common final temperature (Ignore the heat capacity of.boxes). Then, the final temperature of the gases T_f in terms of T_0 is:
a) $T_f=\frac{5}{2}T_0$ b) $T_f=\frac{3}{7}T_0$ c) $T_f=\frac{7}{3}T_0$ d) $T_f=\frac{3}{2}T_0$

34. A box (thermally insulated) has two chambers separated by a membrane. One of volume V contains an ideal gas at temperature T. The other of volume $\left(\frac{1}{2}V\right)$ is evacuated. If the membrane breaks down, the gas temperature will be:
a) $\frac{3}{2}$T b) $\frac{2T}{3}$ c) T d) none of these

35. An ideal monoatomic gas is taken round the cycle ABCDA as shown in following P-V diagram. The work done during the cycle is :



a) PV b) 2 PV c) 4 PV d) Zero

36. If 2 moles of an ideal monatomic gas at temperature T_0 is mixed with 4 moles of another idea! monoatomic gas at temperature $2T_0$, then the temperature of the mixture is:
a) $\frac{5}{3}T_0$ b) $\frac{3}{2}T_0$ c) $\frac{4}{3}T_0$ d) $\frac{5}{4}T_0$

37. Two moles of oxygen is mixed with eight moles of helium. The effective specific heat of the mixture at constant volume is
a) l.3R b) 1.4R c) 1.7R d) 1.9R

38. The thermodynamic process in which no work is done on or by the gas is:
a) isothermal process b) adiabatic process c) cyclic process d) isobaric process e) isochoric process

39. A Carnot engine uses first an ideal monoatomic gas (γ = 5/3) and then an ideal diatomic gas (γ = 7/ 5) as its working substance. The source and sink temperatures are 411°C and 69°C respectively and the engine extracts 1000 J of heat from the source in each cycle. Then:
a) the efficiencies of the engine in the two cases are in the ratio 21 : 25
b) the area enclosed by the P- V diagram in the first case only is 500 J
c) the area enclosed by the P-V diagram in both cases is 500 J
d) the heat energy rejected by the engine in the first case is 600 J while that in the second case is 714.3 J

40. Which of the following is not a thermodynamic coordinate?
a) Gas constant (R) b) Volume (V) c) Pressure (P) d) Temperature (T)

41. If 150 J of heat is added to a system and the work done by the system is 110 kJ, then change in internal energy will be:
a) 260 J b) 150 J c) 110 J d) 40 J

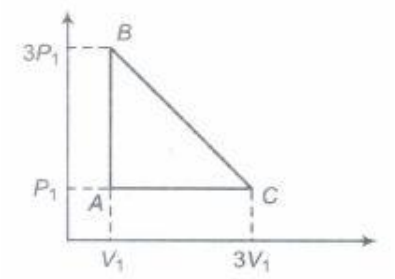
42. The internal energy of an ideal gas depends upon:
    a) Specific volume b) Pressure c) Temperature d) Density

43. A gas undergoes a process in which its pressure P and volume V are related as VP^n= constant. The bulk modulus of the gas in this process is:
    a) nP b) $P^{1/n}$ c) P/n d) P^n

44. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of I gm/sec. The calorific value of fuel is 2 kcal/gm. This claim is:
    a) valid b) invalid c) dependent on engine design d) dependent on load

45. The equation of state, corresponding to 8 kg of O_2 is:
    a) PV=RT b) PV=8RT c) PV=$\frac{RT}{2}$ d) PV=$\frac{RT}{4}$

46. An ideal gas is taken around the cycle ABCA as shown in the P-V diagram. The net work done by the gas during the cycle is equal to :



    a) $12P_1V_1$ b) $6P_1V_1$ c) $3P_1V_1$ d) $2P_1V_1$

47. A Carnot engine whose sink is at 300 K has an efficiency of 40%. By how much should the temperature of source be increased so as to increase, its efficiency by 50% of original efficiency?
    a) 325K b) 250K c) 380K d) 275K

48. A monoatomic gas supplied the heat Q very slowly keeping the pressure constant. The work done by the gas will be:
    a) $\frac{2}{3}$Q b) $\frac{3}{5}$Q c) $\frac{2}{5}$Q d) $\frac{1}{5}$Q

49. (A) When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.
    (R) Adiabatic expansion of the gas causes lowering of temperature which start condensation of water vapours.
    a) If both assertion and reason are true and reason is the correct explanation of assertion
    b) If both assertion and reason are true but reason is not the correct explanation of assertion
    c) If assertion is true but reason is false d) If both assertion and reason are false
    e) If assertion is false but reason is true

50. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16V. The final pressure of the gas is: (take g = $\frac{5}{3}$)
    a) 64 P b) 32 P c) $\frac{p}{64}$ d) 16 P