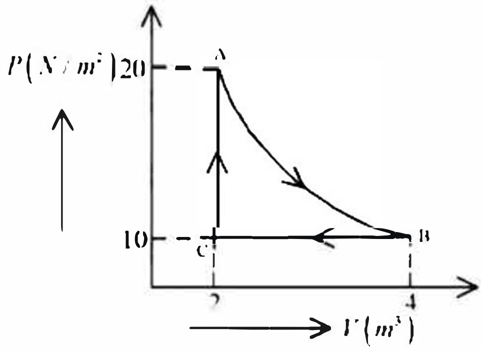
Q1. The volume of an ideal gas ($\gamma = 1.5$) is changed adiabatically from 5 litres to 4 litres. The ratio of initial pressure to final pressure is: ***09 Apr 2024 (M)***

(1) $\frac{16}{25}$
(2) $\frac{4}{5}$
(3) $\frac{8}{5\sqrt{5}}$
(4) $\frac{2}{\sqrt{5}}$

Q2. A sample of 1 mole gas at temperature T is adiabatically expanded to double its volume. If adiabatic constant for the gas is $\gamma = \frac{3}{2}$, then the work done by the gas in the process is: ***09 Apr 2024 (M)***

(1) $\frac{R}{T}[2-\sqrt{2}]$
(2) $\frac{T}{R}[2+\sqrt{2}]$
(3) $\mathrm{RT}[2-\sqrt{2}]$
(4) $\mathrm{RT}[2+\sqrt{2}]$

Q3. A real gas within a closed chamber at $27^{\circ}\mathrm{C}$ undergoes the cyclic process as shown in figure. The gas obeys $PV^3 = RT$ equation for the path A to B. The net work done in the complete cycle is (assuming $R = 8$ J/molK):



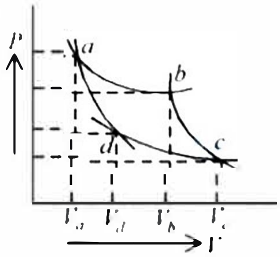
09 Apr 2024 (E)

(1) 20 J
(2) 205 J
(3) -20 J
(4) 225 J

Q4. A diatomic gas ($\gamma = 1.4$) does 100 J of work in an isobaric expansion. The heat given to the gas is : ***08 Apr 2024 (E)***

(1) 250 J
(2) 150 J
(3) 350 J
(4) 490 J

Q5. Two different adiabatic paths for the same gas intersect two isothermal curves as shown in P-V diagram. The relation between the ratio $\frac{V_a}{V_d}$ and the ratio $\frac{V_b}{V_c}$ is:



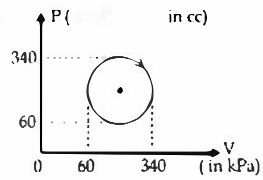
08 Apr 2024 (M)

(1) $\frac{V_a}{V_d} \neq \frac{V_b}{V_c}$
(2) $\frac{V_a}{V_d} = \frac{V_b}{V_c}$
(3) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{-1}$
(4) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{2}$

Q6. A total of 48 J heat is given to one mole of helium kept in a cylinder. The temperature of helium increases by $2^{\circ}\mathrm{C}$. The work done by the gas is:
Given, $\mathrm{R} = 8.3\ \mathrm{J\ K^{-1}\ mol^{-1}}$. ***06 Apr 2024 (E)***

(1) 24.9 J (2) 72.9 J (3) 48 J (4) 23.1 J

Q7. The heat absorbed by a system in going through the given cyclic process is :



05 Apr 2024 (M)

(1) 19.6 J (2) 61.6 J

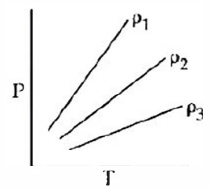
(3) 616 J (4) 431.2 J

Q8. A sample of gas at temperature T is adiabatically expanded to double its volume. Adiabatic constant for the gas is $\gamma = 3/2$. The work done by the gas in the process is:
($\mu = 1$ mole) ***04 Apr 2024 (E)***

(1) $RT[1 - 2\sqrt{2}]$ (2) $RT[\sqrt{2} - 2]$

(3) $RT[2 - \sqrt{2}]$ (4) $RT[2\sqrt{2} - 1]$

Q9. P-T diagram of an ideal gas having three different densities ρ_1, ρ_2, ρ_3 (in three different cases) is shown in the figure. Which of the following is correct :



04 Apr 2024 (M)

(1) $\rho_1 > \rho_2$ (2) $\rho_2 < \rho_3$

(3) $\rho_1 = \rho_2 = \rho_3$ (4) $\rho_1 < \rho_2$

Q10. A diatomic gas ($\gamma = 1.4$) does 200 J of work when it is expanded isobarically. The heat given to the gas in the process is : ***01 Feb 2024 (E)***

(1) 850 J (2) 800 J

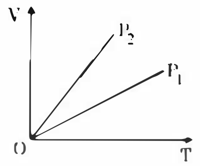
(3) 600 J (4) 700 J

Q11. The pressure and volume of an ideal gas are related as $PV^{\frac{3}{2}} = K$ (Constant). The work done when the gas is taken from state $A(P_1,\ V_1,\ T_1)$ to state $B(P_2,\ V_2,\ T_2)$ is : ***01 Feb 2024 (M)***

(1) $2(P_1V_1 - P_2V_2)$ (2) $2(P_2V_2 - P_1V_1)$

(3) $2(\sqrt{P_1}V_1 - \sqrt{P_2}V_2)$ (4) $2(P_2\sqrt{V_2} - P_1\sqrt{V_1})$

Q12. The given figure represents two isobaric processes for the same mass of an ideal gas, then

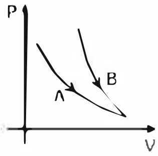


31 Jan 2024 (M)

(1) $P_2 \geq P_1$ (2) $P_2 > P_1$

(3) $P_1 = P_2$ (4) $P_1 > P_2$

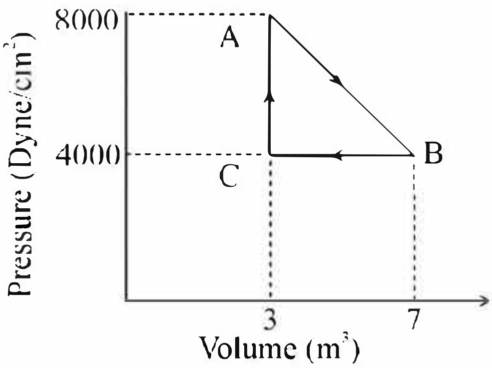
Q13. Choose the correct statement for processes A & B shown in figure.



30 Jan 2024 (E)

(1) $PV^{\gamma} = k$ for process B and $PV = k$ for process A.
(2) $PV = k$ for process B and A.
(3) $\frac{P^{\gamma-1}}{T^{\gamma}} = k$ for process B and $T = k$ for process A.
(4) $\frac{T^{\gamma}}{P^{\gamma-1}} = k$ for process A and $PV = k$ for process B.

Q14. A thermodynamic system is taken from an original state A to an intermediate state B by a linear process as shown in the figure. Its volume is then reduced to the original value from B to C by an isobaric process. The total work done by the gas from A to B and B to C would be :



29 Jan 2024 (M)

(1) 33800 J
(2) 2200 J
(3) 600 J
(4) 800 J

Q15. 0.08 kg air is heated at constant volume through 5°C. The specific heat of air at constant volume is 0.17 kcal kg^{-1} $^{\circ}$C^{-1} and $1\text{ J} = 4.18$ joule cal^{-1}. The change in its internal energy is approximately.

27 Jan 2024 (M)

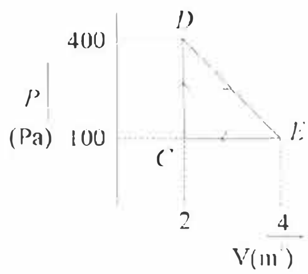
(1) 318 J
(2) 298 J
(3) 284 J
(4) 142 J

Q16. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio of $\frac{C_p}{C_v}$ for the gas is :

27 Jan 2024 (E)

(1) $\frac{5}{3}$
(2) $\frac{3}{2}$
(3) $\frac{7}{5}$
(4) $\frac{9}{7}$

Q17. A thermodynamic system is taken through cyclic process. The total work done in the process is :



15 Apr 2023 (M)

(1) 200 J (2) 300 J
(3) 100 J (4) Zero

Q18. The initial pressure and volume of an ideal gas are P_0 and V_0. The final pressure of the gas when the gas is suddenly compressed to volume $\frac{V_0}{4}$ will be:
(Given γ= ratio of specific heats at constant pressure and at constant volume.)

13 Apr 2023 (E)

(1) $P_0(4)^{\gamma}$ (2) $4P_0$
(3) P_0 (4) $P_0(4)^{\frac{1}{\gamma}}$

Q19*. An engine operating between the boiling and freezing points of water will have
A. Efficiency more than 27%.
B. Efficiency less than the efficiency of a Carnot engine operating between the same two temperatures.
C. Efficiency equal to 27%. D. Efficiency less than 27%.
Choose the correct answer from the options given below

12 Apr 2023 (M)

(1) B, C and D only (2) A and B only (3) B and D only (4) B and C only

Q20. The thermodynamic process, in which internal energy of the system remains constant is *11 Apr 2023 (E)*
(1) Isochoric (2) Adiabatic
(3) Isothermal (4) Isobaric

Q21. A gas is compressed adiabatically, which one of the following statement is NOT true?

10 Apr 2023 (E)

(1) There is no heat supplied to the system (2) There is no change in the internal energy
(3) The temperature of the gas increases (4) The change in the internal energy is equal to the work done on the gas

Q22. Consider two containers A and B containing monoatomic gases at the same Pressure (P), Volume (V) and Temperature (T). The gas in A is compressed isothermally to $\frac{1}{8}$ of its original volume while the gas in B is compressed adiabatically to $\frac{1}{8}$ of its original volume. The ratio of final pressure of gas in B to that of gas in A is *10 Apr 2023 (M)*
(1) 8 (2) 4
(3) $8^{\frac{3}{2}}$ (4) $\frac{1}{8}$

Q23. Given below are two statements:
Statement I: If heat is added to a system, its temperature must increase.
Statement II: If positive work is done by a system in a thermodynamic process, its volume must increase.
In the light of the above statements, choose the correct answer from the options given below

08 Apr 2023 (M)

(1) Statement I is true but Statement II is false (2) Both Statement I and Statement II are false
(3) Both Statement I and Statement II are true (4) Statement I is false but Statement II is true

Q24*. Work done by a Carnot engine operating between temperatures $127^{\circ}\mathrm{C}$ and $27^{\circ}\mathrm{C}$ is $2\ \mathrm{kJ}$. The amount of heat transferred to the engine by the reservoir is: ***08 Apr 2023 (E)***

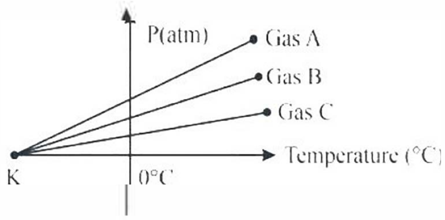
(1) $8\ \mathrm{kJ}$ (2) $2.67\ \mathrm{kJ}$
(3) $2\ \mathrm{kJ}$ (4) $4\ \mathrm{kJ}$

Q25. A source supplies heat to a system at the rate of $1000\ \mathrm{W}$. If the system performs work at a rate of $200\ \mathrm{W}$. The rate at which internal energy of the system increases is

06 Apr 2023 (M)

(1) 600 W (2) 800 W
(3) 500 W (4) 1200 W

Q26. For three low density gases $A,\ B,\ C$ pressure versus temperature graphs are plotted while keeping them at constant volume, as shown in the figure. The temperature corresponding to the point 'K' is:



01 Feb 2023 (E)

(1) $-273^{\circ}\mathrm{C}$ (2) $-100^{\circ}\mathrm{C}$
(3) $-373^{\circ}\mathrm{C}$ (4) $-40^{\circ}\mathrm{C}$

Q27. A sample of gas at temperature T is adiabatically expanded to double its volume. The work done by the gas in the process is given, (given $\gamma = \frac{3}{2}$) : ***01 Feb 2023 (M)***

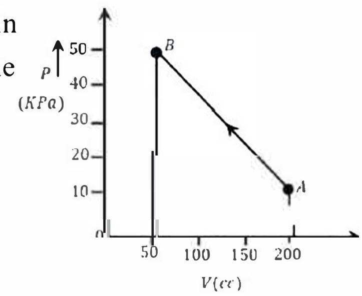
(1) $W = TR\left[\sqrt{2} - 2\right]$ (2) $W = \frac{T}{R}\left[\sqrt{2} - 2\right]$
(3) $W = \frac{R}{T}\left[2 - \sqrt{2}\right]$ (4) $W = RT\left[2 - \sqrt{2}\right]$

Q28*. A Carnot engine operating between two reservoirs has efficiency $\frac{1}{3}$. When the temperature of cold reservoir raised by x, its efficiency decreases to $\frac{1}{6}$. The value of x, if the temperature of hot reservoir is $99^{\circ}\ C$, will be

01 Feb 2023 (E)

(1) $16.5\ K$ (2) $33\ K$
(3) $66\ K$ (4) $62\ K$

Q29. The pressure of a gas changes linearly with volume from A to B as shown in figure. If no heat is supplied to or extracted from the gas then change in the internal energy of the gas will be



31 Jan 2023 (M)

(1) $6\ \mathrm{J}$ (2) Zero
(3) $-4.5\ \mathrm{J}$ (4) $4.5\ \mathrm{J}$

Q30. The correct relation between $\gamma = \frac{C_P}{C_V}$ and temperature T is : ***31 Jan 2023 (M)***

(1) $\gamma \propto \frac{1}{\sqrt{T}}$ (2) $\gamma \propto T^0$
(3) $\gamma \propto \frac{1}{T}$ (4) $\gamma \propto T$

Q31. Heat energy of 735 J is given to a diatomic gas allowing the gas to expand at constant pressure. Each gas molecule rotates around an internal axis but do not oscillate. The increase in the internal energy of the gas will be: ***31 Jan 2023 (E)***

(1) 525 J (2) 441 J
(3) 572 J (4) 735 J

Q32. A hypothetical gas expands adiabatically such that its volume changes from 08 litres to 27 litres. If the ratio of final pressure of the gas to initial pressure of the gas is $\frac{16}{81}$. Then the ratio of $\frac{C_p}{C_v}$ will be. ***31 Jan 2023 (E)***

(1) $\frac{4}{3}$ (2) $\frac{3}{1}$
(3) $\frac{1}{2}$ (4) $\frac{3}{2}$

Q33. Heat is given to an ideal gas in an isothermal process.

A. Internal energy of the gas will decrease.
B. Internal energy of the gas will increase.
C. Internal energy of the gas will not change.
D. The gas will do positive work. E. The gas will do negative work.

Choose the correct answer from the options given below :

30 Jan 2023 (M)

(1) A and E only (2) B and D only
(3) C and E only (4) C and D only

Q34*. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : Efficiency of a reversible heat engine will be highest at $-273\ ^{\circ}\mathrm{C}$ temperature of cold reservoir.

Reason R : The efficiency of Carnot's engine depends not only on temperature of cold reservoir but it depends on the temperature of hot reservoir too and is given as $\eta = \left(1 - \frac{T_2}{T_1}\right)$

In the light of the above statements, choose the correct answer from the options given below :

30 Jan 2023 (E)

(1) A is true but R is false
(2) Both A and R are true but R is NOT the correct explanation of A
(3) A is false but R is true
(4) Both A and R are true and R is the correct explanation of A

Q35. Given below are two statements. One is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : If dQ and dW represent the heat supplied to the system and the work done on the system respectively. Then according to the first law of thermodynamics $dQ = dU - dW$.

Reason R : First law of thermodynamics is based on law of conservation of energy.

In the light of the above statements, choose the correct answer from the option given below :

29 Jan 2023 (M)

(1) A is correct but R is not correct
(2) A is not correct but R is correct
(3) Both A and R are correct and R is the correct explanation of A
(4) Both A and R are correct but R is not the correct explanation of A

Q36. A bicycle tyre is filled with air having pressure of 270 kPa at 27°C. The approximate pressure of the air in the tyre when the temperature increases to 36°C is ***29 Jan 2023 (M)***

(1) 270 kPa (2) 262 kPa
(3) 278 kPa (4) 360 kPa

Q37. Match List I with List II :

	List I		**List II**
A	Isothermal Process	I	Work done by the gas decreases internal energy
B	Adiabatic Process	II	No change in internal energy
C	Isochoric Process	III	The heat absorbed goes partly to increase internal energy and partly to do work
D	Isobaric Process	IV	No work is done on or by the gas

Choose the correct answer from the options given below :

25 Jan 2023 (E)

(1) A-II, B-I, C-III, D-IV (2) A-II, B-I, C-IV, D-III
(3) A-I, B-II, C-IV, D-III (4) A-I, B-II, C-III, D-IV

Q38*. A Carnot engine with efficiency 50% takes heat from a source at 600 K. In order to increase the efficiency to 70%, keeping the temperature of sink same, the new temperature of the source will be: ***25 Jan 2023 (M)***

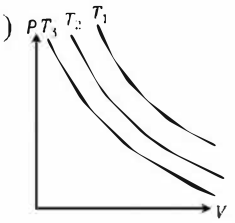
(1) 360 K (2) 1000 K
(3) 900 K (4) 300 K

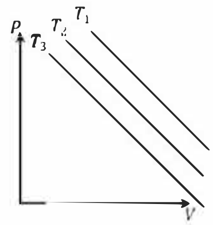
Q39. 1 g of a liquid is converted to vapour at 3×10^5 Pa pressure. If 10% of the heat supplied is used for increasing the volume by 1600 cm^3 during this phase change, then the increase in internal energy in the process will be :

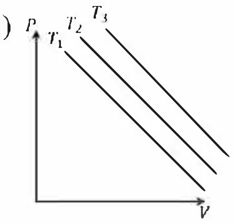
24 Jan 2023 (M)

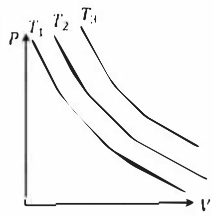
(1) 4320 J (2) 432000 J
(3) 4800 J (4) 4.32×10^8 J

Q40. In an Isothermal change, the change in pressure and volume of a gas can be represented for three different temperature; $T_3 > T_2 > T_1$ as: ***24 Jan 2023 (E)***

(1) 

(2) 

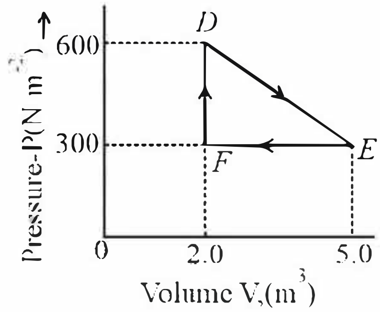
(3) 

(4) 

Q41. The pressure P_1 and density d_1 of diatomic gas $\left(\gamma=\frac{7}{5}\right)$ changes suddenly to $P_2(>P_1)$ and d_2 respectively during an adiabatic process. The temperature of the gas increases and becomes____times of its initial temperature. (given $\frac{d_2}{d_1}=32$)

29 Jul 2022 (M)

Q42. A thermodynamic system is taken from an original state D to an intermediate state E by the linear process shown in the figure. Its volume is then reduced to the original volume from E to F by an isobaric process. The total work done by the gas from D to E to F will be



29 Jul 2022 (E)

(1) -450 J
(2) 450 J
(3) 900 J
(4) 1350 J

Q43. At a certain temperature, the degrees of freedom per molecule for gas is 8. The gas performs 150 J of work when it expands under constant pressure. The amount of heat absorbed by the gas will be _____ J.

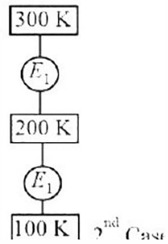
28 Jul 2022 (E)

Q44*. A Carnot engine has efficiency of 50%. If the temperature of sink is reduced by 40°C, its efficiency increases by 30%. The temperature of the source will be :

28 Jul 2022 (M)

(1) 166.7 K
(2) 255.1 K
(3) 266.7 K
(4) 367.7 K

Q45*. In 1st case, Carnot engine operates between temperatures 300 K and 100 K. In 2nd case, as shown in the figure, a combination of two engines is used. The efficiency of this combination (in 2nd case) will be:



27 Jul 2022 (E)

(1) same as the 1^{st} case
(2) always greater than the 1^{st} case
(3) always less than the 1^{st} case
(4) may increase or decrease with respect to the 1^{st} case

Q46*. Read the following statements :

A. When small temperature difference between a liquid and its surrounding is doubled the rate of loss of heat of the liquid becomes twice.

B. Two bodies P and Q having equal surface areas are maintained at temperature $10^{\circ}\mathrm{C}$ and $20^{\circ}\mathrm{C}$. The thermal radiation emitted in a given time by P and Q are in the ratio $1 : 1.15$

C. A carnot Engine working between 100 K and 400 K has an efficiency of 75%

D. When small temperature difference between a liquid and its surrounding is quadrupled, the rate of loss of heat of the liquid becomes twice.

Choose the correct answer from the options given below :

27 Jul 2022 (M)

(1) A, B, C only
(2) A, B only
(3) A, C only
(4) B, C, D only

Q47. 7 mole of certain monoatomic ideal gas undergoes a temperature increase of 40 K at constant pressure. The increase in the internal energy of the gas in this process is (Given $R = 8.3\ \mathrm{J\ K^{-1}\ mol^{-1}}$) ***26 Jul 2022 (M)***

(1) 5810 J
(2) 3486 J
(3) 11620 J
(4) 6972 J

Q48. A monoatomic gas at pressure P and volume V is suddenly compressed to one eighth of its original volume. The final pressure at constant entropy will be ***26 Jul 2022 (M)***

(1) P
(2) $8P$
(3) $32P$
(4) $64P$

Q49*. Let η_1 is the efficiency of an engine at $T_1 = 447^{\circ}\mathrm{C}$ and $T_2 = 147^{\circ}C$ while η_2 is the efficiency at $T_1 = 947^{\circ}\mathrm{C}$ and $T_2 = 47^{\circ}\mathrm{C}$. The ratio $\frac{\eta_1}{\eta_2}$ will be ***25 Jul 2022 (E)***

(1) 0.41
(2) 0.56
(3) 0.73
(4) 0.70

Q50. A certain amount of gas of volume V at $27^{\circ}\mathrm{C}$ temperature and pressure $2 \times 10^{7}\mathrm{N\ m^{-2}}$ expands isothermally until its volume gets doubled. Later it expands adiabatically until its volume gets redoubled. The final pressure of the gas will be (Use $\gamma = 1.5$) ***25 Jul 2022 (M)***

(1) 3.536×10^{5} Pa
(2) 3.536×10^{6} Pa
(3) 1.25×10^{6} Pa
(4) 1.25×10^{5} Pa

Q51. Starting with the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2, if the process is purely adiabatic and W_3 if the process is purely isobaric. Then, choose the correct option ***29 Jun 2022 (E)***

(1) $W_2 < W_1 < W_3$
(2) $W_1 < W_2 < W_3$
(3) $W_2 < W_3 < W_1$
(4) $W_3 < W_1 < W_2$

Q52*. 300 calories of heat is given to a heat engine, and it rejects 225 calories of heat. If source temperature is 227°C, then the temperature of sink will be _____ °C. *29 Jun 2022 (M)*

Q53. The total internal energy of two mole monoatomic ideal gas at temperature $T = 300$ K will be _____ J. (Given $R = 8.31 \text{ J mol}^{-1} \cdot \text{K}$) *28 Jun 2022 (M)*

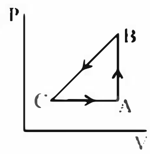
Q54. **Statement - I :** When μ amount of an ideal gas undergoes adiabatic change from state (P_1, V_1, T_1) to state (P_2, V_2, T_2), then work done is $W = \frac{\mu R(T_2 - T_1)}{1-\gamma}$, where $\gamma = \frac{C_P}{C_V}$ and $R =$ universal gas constant.

Statement - II : In the above case, when work is done on the gas, the temperature of the gas would rise.

28 Jun 2022 (M)

(1) Both statement-I and statement-II are true.
(2) Both statement-I and statement-II are false.
(3) Statement-I is true but statement-II is false.
(4) Statement-I is false but statement-II is true.

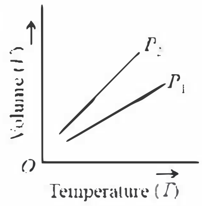
Q55. A sample of an ideal gas is taken through the cyclic process $ABCA$ as shown in figure. It absorbs, 40 J of heat during the part AB, no heat during BC and rejects 60 J of heat during CA. A work of 50 J is done on the gas during the part BC. The internal energy of the gas at A is 1560 J. The work done by the gas during the part CA is



28 Jun 2022 (E)

(1) 20 J
(2) 30 J
(3) -30 J
(4) -60 J

Q56. For a perfect gas, two pressures P_1 and P_2 are shown in figure. The graph shows



27 Jun 2022 (E)

(1) $P_1 > P_2$
(2) $P_1 < P_2$
(3) $P_1 = P_2$
(4) Insufficient data to draw any conclusion

Q57. A diatomic gas $(\gamma = 1.4)$ does 400 J of work when it is expanded isobarically. The heat given to the gas in the process is _____ J. *27 Jun 2022 (E)*

Q58*. In a carnot engine, the temperature of reservoir is 527°C and that of sink is 200 K. If the workdone by the engine when it transfers heat from reservoir to sink is 12000 kJ, the quantity of heat absorbed by the engine from reservoir is _____ $\times 10^6$ J. *27 Jun 2022 (M)*

Q59*. The efficiency of a Carnot's engine, working between steam point and ice point, will be *26 Jun 2022 (M)*

(1) 26.81%
(2) 37.81%
(3) 47.81%
(4) 57.81%

Q60. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats 1.4. Vessel is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surrounding and vessel

temperature of the gas increases by :
($R=$ universal gas constant) *26 Jun 2022 (M)*

(1) $\frac{Mv^2}{7R}$
(2) $\frac{Mv^2}{5R}$
(3) $2\frac{Mv^2}{7R}$
(4) $7\frac{Mv^2}{5R}$

Q61*. A heat engine operates with the cold reservoir at temperature 324 K. The minimum temperature of the hot reservoir, if the heat engine takes 300 J heat from the hot reservoir and delivers 180 J heat to the cold reservoir per cycle, is _____ K.

26 Jun 2022 (E)

Q62*. A Carnot engine whose heat sinks at 27°C, has an efficiency of 25%. By how many degrees should the temperature of the source be changed to increase the efficiency by 100% of the original efficiency ?

24 Jun 2022 (M)

(1) Increases by 18°C
(2) Increases by 200°C
(3) Increases by 120°C
(4) Increases by 73°C

Q63*. A Carnot engine takes 5000 kcal of heat from a reservoir at 727°C and gives heat to a sink at 127°C. The work done by the engine is *24 Jun 2022 (E)*

(1) 3×10^{6}J
(2) Zero
(3) 8.4×10^{6} J
(4) 12.6×10^{6} J

Q64. The temperature of 3.00 mol of an ideal diatomic gas is increased by 40.0°C without changing the pressure of the gas. The molecules in the gas rotate but do not oscillate. If the ratio of change in internal energy of the gas to the amount of workdone by the gas is $\frac{x}{10}$. Then the value of x (round off to the nearest integer) is _________.

(Given$R=8.31$ J mol^{-1} K^{-1})

01 Sep 2021 (E)

Q65. A sample of gas with $\gamma=1.5$ is taken through an adiabatic process in which the volume is compressed from 1200 cm^3 to 300 cm^3. If the initial pressure is 200 kPa. The absolute value of the workdone by the gas in the process = ________ J. *31 Aug 2021 (E)*

Q66*. A reversible engine has an efficiency of $\frac{1}{4}$. If the temperature of the sink is reduced by 58°C, its efficiency becomes double. Calculate the temperature of the sink: *31 Aug 2021 (M)*

(1) 180.4°C
(2) 382°C
(3) 174 K
(4) 280°C

Q67*. A heat engine operates between a cold reservoir at temperature $T_2=400$ K and a hot reservoir at temperature T_1. It takes 300 J of heat from the hot reservoir and delivers 240 J of heat to the cold reservoir in a cycle. The minimum temperature of the hot reservoir has to be *27 Aug 2021 (E)*

Q68. An electric appliance supplies 6000 J min^{-1}, heat to the system. If the system delivers a power of 90 W. How long it would take to increase the internal energy by 2.5×10^{3} J? *26 Aug 2021 (M)*

(1) 2.5×10^{1} s
(2) 2.5×10^{2} s
(3) 2.4×10^{3} s
(4) 4.1×10^{1} s

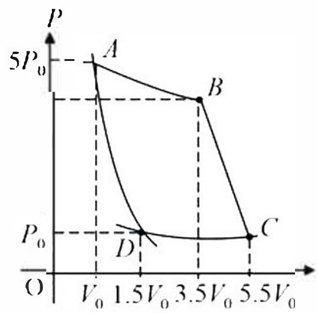
Q69*. A refrigerator consumes an average 35 W power to operate between temperature $-10^{\circ}C$ to $25^{\circ}C$. If there is no loss of energy then how much average heat per second does it transfer? ***26 Aug 2021 (E)***

(1) 350 J s^{-1}
(2) 298 J s^{-1}
(3) 263 J s^{-1}
(4) 35 J s^{-1}

Q70*. Two Carnot engines A and B operate in series such that engine A absorbs heat at T_1 and rejects heat to a sink at temperature T. Engine B absorbs half of the heat rejected by Engine A and rejects heat to the sink at T_3. When workdone in both the cases is equal, to value of T is : ***27 Jul 2021 (E)***

(1) $\frac{2}{3}T_1 + \frac{3}{2}T_3$
(2) $\frac{1}{3}T_1 + \frac{2}{3}T_3$
(3) $\frac{3}{2}T_1 + \frac{1}{3}T_3$
(4) $\frac{2}{3}T_1 + \frac{1}{3}T_3$

Q71. In the reported figure, there is a cyclic process $ABCDA$ on a sample of 1 mol of a diatomic gas. The temperature of the gas during the process $A \rightarrow B$ and $C \rightarrow D$ are T_1 and $T_2(T_1 > T_2)$ respectively. Choose the correct option out of the following for work done if processes BC and DA are adiabatic.



27 Jul 2021 (M)

(1) $W_{AB} = W_{DC}$
(2) $W_{AD} = W_{BC}$
(3) $W_{BC} + W_{DA} > 0$
(4) $W_{AB} < W_{CD}$

Q72. One mole of an ideal gas is taken through an adiabatic process where the temperature rises from $27^{\circ}C$ to $37^{\circ}C$. If the ideal gas is composed of polyatomic molecule that has 4 vibrational modes, which of the following is true? $[R = 8.314 \text{ J mol}^{-1}\text{k}^{-1}]$ ***27 Jul 2021 (E)***

(1) work done by the gas is close to 332 J
(2) work done on the gas is close to 582 J
(3) work done by the gas is close to 582 J
(4) work done on the gas is close to 332 J

Q73. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. If l_1 and l_2 are the lengths of the gas column, before and after the expansion respectively, then the value of $\frac{T_1}{T_2}$ will be: ***25 Jul 2021 (M)***

(1) $\left(\frac{l_1}{l_2}\right)^{\frac{2}{3}}$
(2) $\left(\frac{l_2}{l_1}\right)^{\frac{2}{3}}$
(3) $\left(\frac{l_2}{l_1}\right)$
(4) $\frac{l_1}{l_2}$

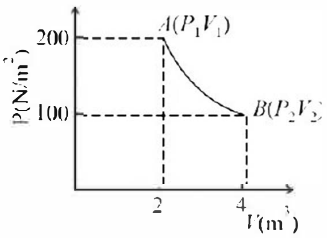
Q74*. A heat engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by $62^{\circ}C$, its efficiency get doubled. The temperature of the source is : ***25 Jul 2021 (E)***

(1) $124^{\circ}C$
(2) $37^{\circ}C$
(3) $62^{\circ}C$
(4) $99^{\circ}C$

Q75. The amount of heat needed to raise the temperature of 4 moles of a rigid diatomic gas from $0\ ^{\circ}C$ to $50\ ^{\circ}C$ when no work is done is (R is the universal gas constant) ***20 Jul 2021 (M)***

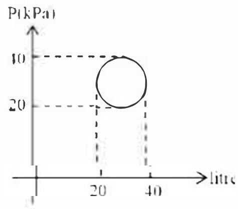
(1) $250R$ (2) $750R$
(3) $175R$ (4) $500R$

Q76. One mole of an ideal gas at $27\ ^{\circ}\mathrm{C}$ is taken from A to B as shown in the given PV indicator diagram. The work done by the system will be _______ $\times 10^{-1}$ J. [Given, $R = 8.3\ \mathrm{J\ mole^{-1}\ K},\ \ln 2 = 0.6931$] (Round off to the nearest integer)



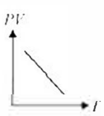
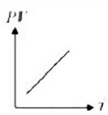
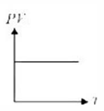
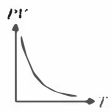
20 Jul 2021 (E)

Q77. In the reported figure, heat energy absorbed by a system in going through a cyclic process is _______πJ.



20 Jul 2021 (M)

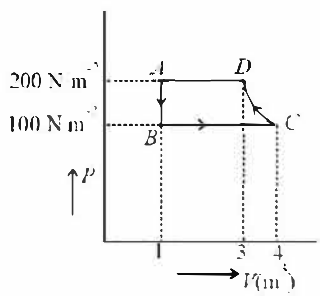
Q78. Which of the following graphs represent the behaviour of an ideal gas? Symbols have their usual meaning.
20 Jul 2021 (E)

(1)  (2)  (3)  (4) 

Q79. The entropy of any system is given by, $\mathrm{S} = \alpha^2\beta \ln\left[\frac{\mu \mathrm{kR}}{\mathrm{J}\beta^2} + 3\right]$ where α and β are the constants. μ, J, k and R are number of moles, mechanical equivalent of heat, Boltzmann's constant and gas constant, respectively. $\left[\text{Take } S = \frac{\mathrm{d}Q}{T}\right]$ Choose the incorrect option from the following: *20 Jul 2021 (M)*

(1) α and J have the same dimensions. (2) S, β, k and μR have the same dimensions.
(3) S and α have different dimensions. (4) α and k have the same dimensions.

Q80. The $P-V$ diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (use $\gamma = 1.4$) :



18 Mar 2021 (M)

(1) –500 J (2) –400 J
(3) 400 J (4) 200 J

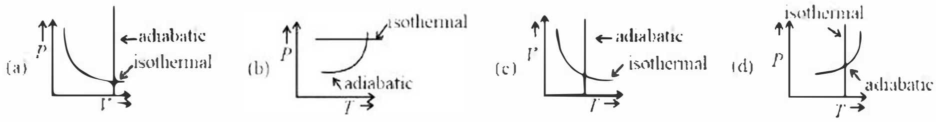
Q81. An ideal gas in a cylinder is separated by a piston in such a way that the entropy of one part is S_1 and that of the other part is S_2. Given that $S_1 > S_2$. If the piston is removed then the total entropy of the system will be:

18 Mar 2021 (E)

(1) $S_1 \times S_2$ (2) $S_1 - S_2$

(3) $\frac{S_1}{S_2}$ (4) $S_1 + S_2$

Q82. Which one is the correct option for the two different thermodynamic processes ? ***17 Mar 2021 (E)***



(1) (c) and (a) (2) (c) and (d)

(3) (a) only (4) (b) and (c)

Q83*. A Carnot's engine working between 400 K and 800 K has a work output of 1200 J per cycle. The amount of heat energy supplied to the engine from the source in each cycle is: ***17 Mar 2021 (M)***

(1) 3200 J (2) 1800 J

(3) 1600 J (4) 2400 J

Q84. In thermodynamics, heat and work are : ***16 Mar 2021 (M)***

(1) Path functions (2) Intensive thermodynamic state variables

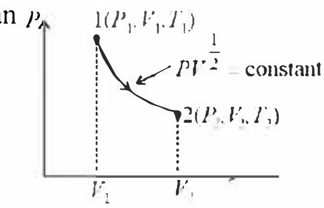
(3) Extensive thermodynamic state variables (4) Point functions

Q85*. For an ideal heat engine, the temperature of the source is 127°C. In order to have 60% efficiency the temperature of the sink should be ____°C. (Round off to the nearest integer) ***16 Mar 2021 (E)***

Q86. 1 mole of rigid diatomic gas performs a work of $\frac{Q}{5}$ when heat Q is supplied to it. The molar heat capacity of the gas during this transformation is $\frac{xR}{8}$. The value of x is [R universal gas constant] ***26 Feb 2021 (E)***

Q87. The volume V of a given mass of monoatomic gas changes with temperature T according to the relation $V = KT^{\frac{2}{3}}$. The workdone when temperature changes by 90 K will be xR. The value of x is [R universal gas constant] ***26 Feb 2021 (E)***

Q88. Thermodynamic process is shown below on a $P - V$ diagram for one mole of an ideal gas. If $V_2 = 2V_1$, then the ratio of temperature $\frac{T_2}{T_1}$ is :



25 Feb 2021 (E)

(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\frac{1}{2}$ (4) 2

Q89*. A reversible heat engine converts one-fourth of the heat input into work. When the temperature of the sink is reduced by 52 K, its efficiency is doubled. The temperature in Kelvin of the source will be ___ .

25 Feb 2021 (E)

Q90. In a certain thermodynamical process, the pressure of a gas depends on its volume as kV^3. The work done when the temperature changes from $100\ ^\circ\mathrm{C}$ to $300\ ^\circ\mathrm{C}$ will be xnR where n denotes number of moles of a gas find x ; ***25 Feb 2021 (M)***

Q91. Match List I with List II.

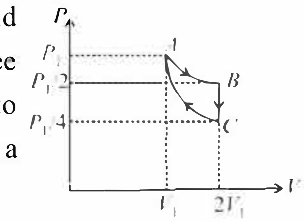
	List I		List II
(a)	Isothermal	(i)	Pressure constant
(b)	Isochoric	(ii)	Temperature constant
(c)	Adiabatic	(iii)	Volume constant
(d)	Isobaric	(iv)	Heat content is constant

Choose the correct answer from the options given below:

24 Feb 2021 (M)

(1) (a) $\rightarrow$ (ii), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (iv), (d) $\rightarrow$ (i)
(2) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (i), (d) $\rightarrow$ (iv)
(3) (a) $\rightarrow$ (i), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (iv)
(4) (a) $\rightarrow$ (ii), (b) $\rightarrow$ (iv), (c) $\rightarrow$ (iii), (d) $\rightarrow$ (i)

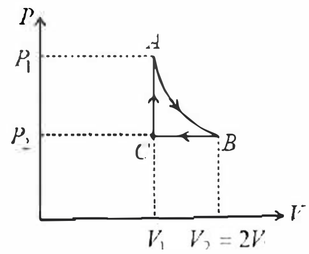
Q92. If one mole of an ideal gas at (P_1, V_1) is allowed to expand reversibly and isothermally (A to B) its pressure is reduced to one-half of the original pressure (see figure). This is followed by a constant volume cooling till its pressure is reduced to one-fourth of the initial value $(B \rightarrow C)$. Then it is restored to its initial state by a reversible adiabatic compression (C to A). The net workdone by the gas is equal to:



24 Feb 2021 (E)

(1) 0
(2) $RT\ln(2)$
(3) $-\frac{RT}{2(\gamma-1)}$
(4) $RT\left[\ln(2)-\frac{1}{2(\gamma-1)}\right]$

Q93. n mole of a perfect gas undergoes a cyclic process $ABCA$ (see figure) consisting of the following processes.



$A \rightarrow B$: Isothermal expansion at temperature T so that the volume is doubled from V_1 to $V_2 = 2V_1$ and pressure changes from P_1 to P_2
$B \rightarrow C$: Isobaric compression at pressure P_2 to initial volume V_1.
$C \rightarrow A$: Isochoric change leading to change of pressure from P_2 to P_1
Total work done in the complete cycle $ABCA$ is:

24 Feb 2021 (M)

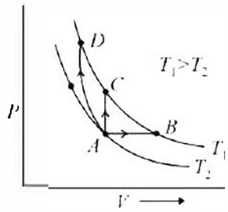
(1) $nRT\left(\ln 2 - \frac{1}{2}\right)$
(2) $nRT \ln 2$
(3) $nRT\left(\ln 2 + \frac{1}{2}\right)$
(4) 0

Q94. Initially a gas of diatomic molecules is contained in a cylinder of volume V_1 at a pressure P_1 and temperature 250 K. Assuming that 25% of the molecules get dissociated causing a change in number of moles. The pressure of the resulting gas at temperature 2000 K, when contained in a volume $2V_1$ is given by P_2. The ratio P_2/P_1 is - ***06 Sep 2020 (M)***

Q95*. An engine operates by taking a monatomic ideal gas through the cycle shown in the figure. The percentage efficiency of the engine is close to

06 Sep 2020 (E)

Q96. Three different processes that can occur in an ideal monoatomic gas are shown in the P vs V diagram. The paths are labelled as $A \rightarrow B, A \rightarrow C$ and $A \rightarrow D$. The change in internal energies during these process are taken as E_{AB}, E_{AC} and E_{AD} and the work done as W_{AB}, W_{AC} and W_{AD}. The correct relation between these parameters are:



05 Sep 2020 (M)

(1) $E_{AB} = E_{AC} < E_{AD}, W_{AB} > 0, W_{AC} = 0, W_{AD} < 0$
(2) $E_{AB} = E_{AC} = E_{AD}, W_{AB} > 0, W_{AC} = 0, W_{AD} < 0$
(3) $E_{AB} < E_{AC} < E_{AD}, W_{AB} > 0, W_{AC} > W_{AD}$
(4) $E_{AB} > E_{AC} > E_{AD}, W_{AB} < W_{AC} < W_{AD}$

Q97. In an adiabatic process, the density of a diatomic gas becomes $32n$ times its initial value. The final pressure of the gas is found to be n times the initial pressure. The value of n is: ***05 Sep 2020 (E)***

(1) 32
(2) 326
(3) 128
(4) $\frac{1}{32}$

Q98. Match the thermodynamics processes taking place in a system with the correct conditions. In the table : ΔQ is the heat supplied, ΔW is the work done and ΔU is change in internal energy of the system.

	Process		Condition
(I)	Adiabatic	(A)	$\Delta W = 0$
(II)	Isothermal	(B)	$\Delta Q = 0$
(III)	Isochoric	(C)	$\Delta U \neq 0, \Delta W \neq 0, \Delta Q \neq 0$
(IV)	Isobaric	(D)	$\Delta U = 0$

04 Sep 2020 (E)

(1) (I) - (A), (II) - (B), (III) - (D), (IV) - (D)
(2) (I) - (B), (II) - (A), (III) - (D), (IV) - (C)
(3) (I) - (A), (II) - (A), (III) - (B), (IV) - (C)
(4) (I) - (B), (II) - (D), (III) - (A), (IV) - (C)

Q99. The change in the magnitude of the volume of an ideal gas when a small additional pressure $\Delta \mathrm{P}$ is applied at a constant temperature, is the same as the change when the temperature is reduced by a small quantity $\Delta \mathrm{T}$ at constant pressure. The initial temperature and pressure of the gas were 300 K and 2 atm respectively. If $|\Delta \mathrm{T}| = \mathrm{C}|\Delta \mathrm{P}|$ then value of C in (K/ atm) is ***04 Sep 2020 (E)***

Q100. A balloon filled with helium (32°C and 1 .7 atm) bursts. Immediately after wards the expansion of helium can be considered as : ***03 Sep 2020 (M)***

(1) irreversible isothermal
(2) irreversible adiabatic
(3) reversible adiabatic
(4) reversible isothermal

Q101*. If minimum possible work is done by a refrigerator in converting 100 grams of water at $0\ ^{\circ}\mathrm{C}$ to ice, how much heat (in calories) is released to the surroundings at temperature $27\ ^{\circ}\mathrm{C}$ (Latent heat of ice $= 80\ \mathrm{Cal} / \mathrm{gram}$) to the nearest integer? ***03 Sep 2020 (E)***

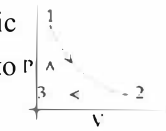
Q102*. A heat engine is involved with exchange of heat of 1915 J, −40 J, + 125 J and $-Q$ J, during one cycle achieving and efficiency of 50.0%. The value of Q is: ***02 Sep 2020 (E)***

(1) 640 J
(2) 40 J
(3) 980 J
(4) 400 J

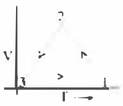
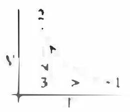
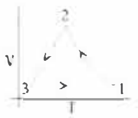
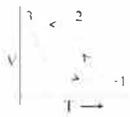
Q103. An engine takes in 5 moles of air at $20\ ^{\circ}\mathrm{C}$ and $1\ \mathrm{atm}$, and compresses it adiabatically to $1/10^{\mathrm{th}}$ of the original volume. Assuming air to be a diatomic ideal gas made up of rigid molecules, the change in its internal energy during this process comes out to be $\mathrm{X kJ}$. The value of X to the nearest integer is:

02 Sep 2020 (M)

Q104. Which of the following is an equivalent cyclic process corresponding to the thermodynamic cyclic given in the figure? Where, $1 \rightarrow 2$ is adiabatic. (Graphs are schematic and are not to scale)



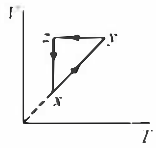
09 Jan 2020 (M)

(1) 
(2) 
(3) 
(4) 

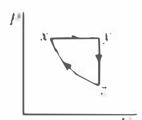
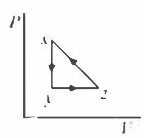
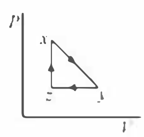
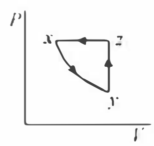
Q105. Starting at temperature $300K$, one mole of an ideal diatomic gas ($\gamma = 1.4$) is first compressed adiabatically from volume V_1 to $V_2 = \frac{V_1}{16}$. It is then allowed to expand isobarically to volume $2V_2$. If all the processes are the quasi-static then the final temperature of the gas (in ${}^{o}K$) is (to the nearest integer) ___________.

09 Jan 2020 (E)

Q106. A thermodynamic cycle $xyzx$ is shown on a V - T diagram. The P - V diagram that best describes this cycle is: (Diagrams are schematic and not to scale)



08 Jan 2020 (M)

(1) 
(2) 
(3) 
(4) 

Q107*. A Carnot engine having an efficiency of $\frac{1}{10}$ is being used as a refrigerator. If the work done on the refrigerator is 10 J, the amount of heat absorbed from the reservoir at a lower temperature is

08 Jan 2020 (E)

(1) 99 J
(2) 100 J
(3) 1 J
(4) 90 J

Q108*. A Carnot engine operates between two reservoirs of temperatures 900K and 300K. The engine performs 1200J of work per cycle. The heat energy (in J) delivered by the engine to the low temperature reservoir, in a cycle, is ______________ ***07 Jan 2020 (M)***

Q109. A litre of dry air at STP expands adiabatically to a volume of 3 litres. If $\gamma = 1.40$, the work done by air is: $\left(3^{1.4} = 4.6555\right)$ [Take air to be an ideal gas] ***07 Jan 2020 (M)***

(1) $60.7J$
(2) 90.5J
(3) 100.8J
(4) 48J

Q110. Under an adiabatic process, the volume of an ideal gas gets doubled. Consequently, the mean collision time between the gas molecule changes from τ_1 to τ_2. If $\frac{C_P}{C_v} = \gamma$ for this gas then a good estimate for $\frac{\tau_2}{\tau_1}$ is given by ***07 Jan 2020 (E)***

(1) 2
(2) $\frac{1}{2}$
(3) $\left(\frac{1}{2}\right)^{\gamma}$
(4) $\left(\frac{1}{2}\right)^{\frac{\gamma+1}{2}}$

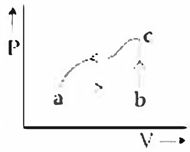
Q111*. Two ideal Carnot engines operate in cascade (all heat given up by one engine is used by the other engine to produce work) between temperatures, T_1 and T_2. The temperature of the hot reservoir of the first engine is T_1 and the temperature of the cold reservoir of the second engine is T_2. T is temperature of the sink of first engine which is also the source for the second engine. How is T related to T_1 and T_2, if both the engines perform equal amount of work? ***07 Jan 2020 (E)***

(1) $T = \frac{2T_1T_2}{T_1+T_2}$
(2) $T = \frac{T_1+T_2}{2}$
(3) $T = \sqrt{T_1T_2}$
(4) $T = 0$

Q112*. A Carnot engine has an efficiency of $\frac{1}{6}$. When the temperature of the sink is reduced by 62 °C, its efficiency is doubled. The temperatures of the source and the sink are, respectively, ***12 Apr 2019 (E)***

(1) 124 °C, 62 °C
(2) 37 °C, 99 °C
(3) 99 °C, 37 °C
(4) 62 °C, 124 °C

Q113. A sample of an ideal gas is taken through the cyclic process abca as shown in the figure. The change in the internal energy of the gas along the path ca is -180 J. The gas absorbs 250 J of heat along the path ab and 60 J along the path bc. The work done by the gas along the path abc is:



12 Apr 2019 (M)

(1) 130 J
(2) 100 J
(3) 120 J
(4) 140 J

Q114. A cylinder with fixed capacity of 67.2 litre contains helium gas at STP. The amount of heat needed to raise the temperature of the gas by $20^{\circ}C$ is: [Given that $R = 8.31\ J\ mol^{-1}\ K^{-1}$] ***10 Apr 2019 (M)***

(1) 748 J (2) 700 J (3) 350 J (4) 374 J

Q115. n moles of an ideal gas with constant volume heat capacity C_v undergo an isobaric expansion by certain volume. The ratio of the work done in the process, to the heat supplied is: ***10 Apr 2019 (M)***

(1) $\frac{4nR}{C_v+nR}$ (2) $\frac{4nR}{C_v-nR}$

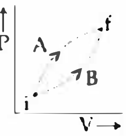
(3) $\frac{nR}{C_v+nR}$ (4) $\frac{nR}{C_v-nR}$

Q116. One mole of an ideal gas passes through a process where pressure and volume obey the relation $P = P_o\left[1 - \frac{1}{2}\left(\frac{V_o}{V}\right)^2\right]$. Here P_o and V_o are constants. Calculate the change in the temperature of the gas if its volume changes from V_o to $2V_o$. ***10 Apr 2019 (E)***

(1) $\frac{1}{4}\frac{P_0V_0}{R}$ (2) $\frac{5}{4}\frac{P_0V_0}{R}$

(3) $\frac{1}{2}\frac{P_0V_0}{R}$ (4) $\frac{3}{4}\frac{P_0V_0}{R}$

Q117. Following figure shows two processes A and B for a gas. If ΔQ_A and ΔQ_B are the amount of heat absorbed by the system in two cases, and ΔU_A and ΔU_B are changes in internal energies, respectively, then:

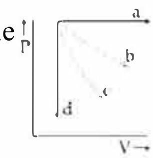


09 Apr 2019 (M)

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

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

Q118. The given diagram shows four processes i.e., isochoric, isobaric, isothermal and adiabatic. The correct assignment of the processes, in the same order is given by:

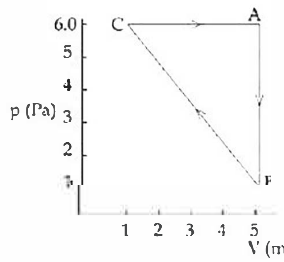


08 Apr 2019 (E)

(1) a d b c (2) d a b c

(3) a d c b (4) d a c b

Q119. For the given cyclic process CAB as shown for a gas, the work done is:



12 Jan 2019 (M)

(1) 10 J (2) 5 J

(3) 1 J (4) 30 J

Q120. A vertical closed cylinder is separated into two parts by a frictionless piston of mass m and of negligible thickness. The piston is free to move along the length of the cylinder. The length of the cylinder above piston is l_1, and that below the piston is l_2, such that $l_1 > l_2$. Each part of the cylinder contains n moles of an ideal gas at equal temperature T. If the piston is stationary, its mass m will be given by: (R is universal gas constant and g is the acceleration due to gravity) ***12 Jan 2019 (E)***

(1) $\frac{RT}{ng}\left[\frac{l_1-3l_2}{l_1l_2}\right]$ (2) $\frac{nRT}{g}\left[\frac{l_1-l_2}{l_1l_2}\right]$

(3) $\frac{\mathrm{nRT}}{\mathrm{g}}\left[\frac{1}{\mathrm{I}_2}+\frac{1}{\mathrm{I}_1}\right]$ (4) $\frac{RT}{gl}\left[\frac{2l_1+l_2}{l_1l_2}\right]$

Q121. A rigid diatomic ideal gas undergoes an adiabatic process at room temperature. The relation between temperature and volume for this process is $\mathrm{TV}^{\mathrm{x}}=$ constant, then x is: ***11 Jan 2019 (M)***

(1) $\frac{3}{5}$ (2) $\frac{2}{5}$

(3) $\frac{2}{3}$ (4) $\frac{5}{3}$

Q122. In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation $\mathrm{VT}=\mathrm{K}$, where K is a constant. In this process the temperature of the gas is increased by $\Delta\mathrm{T}$. The amount of heat absorbed by gas is (R is gas constant): ***11 Jan 2019 (E)***

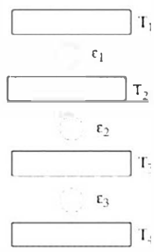
(1) $\frac{1}{2}\mathrm{R}\Delta\mathrm{T}$ (2) $\frac{1}{2}\mathrm{KR}\Delta\mathrm{T}$

(3) $\frac{3}{2}\mathrm{R}\Delta\mathrm{T}$ (4) $\frac{2\mathrm{K}}{3}\Delta\mathrm{T}$

Q123. Half mole of an ideal monoatomic gas is heated at a constant pressure of 1 atm from 20° C to 90° C. Work done by the gas is(Gas constant, $R=8.21\ \mathrm{J\ mol^{-1}\ K^{-1}}$) ***10 Jan 2019 (E)***

(1) 73 J (2) 581 J (3) 291 J (4) 146 J

Q124*. Three Carnot engines operate in series between a heat source at a temperature T_1 and a heat sink at temperature T_4 (see figure). There are two other reservoirs at temperature T_2 and T_3, as shown, with $T_1>T_2>T_3>T_4$. The three engines are equally efficient if:

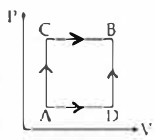


10 Jan 2019 (M)

(1) $T_2=\left(T_1T_4^2\right)^{\frac{1}{3}};T_3=\left(T_1^2T_4\right)^{\frac{1}{3}}$ (2) $T_2=\left(T_1T_4\right)^{\frac{1}{2}};T_3=\left(T_1^2T_4\right)^{\frac{1}{3}}$

(3) $T_2=\left(T_1^2T_4\right)^{\frac{1}{3}};T_3=\left(T_1T_4^2\right)^{\frac{1}{3}}$ (4) $T_2=\left(T_1^3T_4\right)^{\frac{1}{4}};T_3=\left(T_1T_4^3\right)^{\frac{1}{3}}$

Q125. A gas can be taken from A to B via two different processes ACB and ADB. When path ACB is used 60 J of heat flows into the system and 30 J of work is done by the system. If the path ADB is used then work done by the system is 10 J, the heat flows into the system in the path ADB is:



09 Jan 2019 (M)

(1) 100 J (2) 20 J

(3) 40 J (4) 80 J

Q126*. Two carnot engines A and B are operated in series. The first one, A, receives heat at $T_1(=600K)$ and rejects to a reservoir at temperature T_2. The second engine B receives heat rejected by the first engine and, in turn, rejects to a heat reservoir at $T_3(=400K)$. Calculate the temperature T_2 if the work outputs of the two engines are equal: ***09 Jan 2019 (E)***

(1) 500 K (2) 400 K

(3) 300 K (4) 600 K

ANSWER KEYS

1. (3)	**2.** (3)	**3.** (2)	**4.** (3)	**5.** (2)	**6.** (4)	**7.** (2)	**8.** (3)
9. (1)	**10.** (4)	**11.** (1)	**12.** (4)	**13.** (1)	**14.** (4)	**15.** (3)	**16.** (2)
17. (2)	**18.** (1)	**19.** (3)	**20.** (3)	**21.** (2)	**22.** (2)	**23.** (4)	**24.** (1)
25. (2)	**26.** (1)	**27.** (4)	**28.** (4)	**29.** (4)	**30.** (2)	**31.** (1)	**32.** (1)
33. (4)	**34.** (4)	**35.** (3)	**36.** (3)	**37.** (2)	**38.** (2)	**39.** (1)	**40.** (4)
41. (4)	**42.** (2)	**43.** (750)	**44.** (3)	**45.** (1)	**46.** (1)	**47.** (2)	**48.** (3)
49. (2)	**50.** (2)	**51.** (1)	**52.** (102)	**53.** (7479)	**54.** (1)	**55.** (2)	**56.** (1)
57. (1400)	**58.** (16)	**59.** (1)	**60.** (2)	**61.** (540)	**62.** (2)	**63.** (4)	**64.** (25)
65. (480)	**66.** (3)	**67.** (500)	**68.** (2)	**69.** (3)	**70.** (4)	**71.** (2)	**72.** (2)
73. (2)	**74.** (4)	**75.** (4)	**76.** (17258)	**77.** (100)	**78.** (2)	**79.** (4)	**80.** (1)
81. (4)	**82.** (2)	**83.** (4)	**84.** (1)	**85.** (-113)	**86.** (25)	**87.** (60)	**88.** (1)
89. (208)	**90.** (50)	**91.** (1)	**92.** (4)	**93.** (1)	**94.** (5)	**95.** (19)	**96.** (2)
97. (3)	**98.** (4)	**99.** (150)	**100.** (2)	**101.** (8791)	**102.** (3)	**103.** (46)	**104.** (3)
105. (1819)	**106.** (1)	**107.** (4)	**108.** (600)	**109.** (2)	**110.** (4)	**111.** (2)	**112.** (2)
113. (1)	**114.** (1)	**115.** (3)	**116.** (2)	**117.** (3)	**118.** (2)	**119.** (1)	**120.** (2)
121. (2)	**122.** (1)	**123.** (3)	**124.** (3)	**125.** (3)	**126.** (1)		