Laws of thermodynamics - CSIR NET Physics PYQs

Thermodynamics . All PYQs (2015-2025) with answer key

10 questions . Answer key included

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Q1. [June 2016] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2016 June	3.5M

When an ideal monatomic gas is expanded adiabatically from an initial volume V_0 to $3V_0$, its temperature changes from T_0 to T. Then the ratio T/T_0 is

1. $\frac{1}{3}$

2. $\left(\frac{1}{3}\right)^{2/3}$

3. $\left(\frac{1}{3}\right)^{1/3}$

4. 3

Q2. [June 2017] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2017 June	3.5M

A box, separated by a movable wall, has two compartments filled by a monoatomic gas of $\frac{C_P}{C_V} = \gamma$. Initially the volumes of the two compartments are equal, but the pressures are $3P_0$ and P_0 respectively. When the wall is allowed to move, the final pressures in the two compartments become equal. The final pressure is

1. $\left(\frac{2}{3}\right)^{\gamma} P_0$
2. $3\left(\frac{2}{3}\right)^{\gamma} P_0$
3. $\frac{1}{2}\left(1 + 3^{1/\gamma}\right)^{\gamma} P_0$
4. $\left(\frac{3^{1/\gamma}}{1+3^{1/\gamma}}\right)^{\gamma} P_0$

Q3. [June 2018] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2018 June	3.5M

The van der Waals equation for one mole of a gas is $\left(p+\frac{a}{V^2}\right)(V-b)=RT$. The corresponding equation of state for n moles of this gas at pressure P, volume V and temperature T, is

1. $\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$

2. $\left(P+\frac{a}{V^2}\right)(V-nb)=nRT$

3. $\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$

4. $\left(P+\frac{a}{V^2}\right)(V-nb)=nRT$

Q4. [June 2018] . 5.0 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2018 June	5M

A thermally insulated chamber of dimensions ($L, L, 2L$) is partitioned in the middle. One side of the chamber is filled with n moles of an ideal gas at a pressure P and temperature T, while the other side is empty. At $t = 0$, the partition is removed and the gas is allowed to expand freely. The time to reach equilibrium varies as

1. $n^{1/3}L^{-1}T^{1/2}$
2. $n^{2/3}LT^{-1/2}$
3. $n^{0}LT^{-1/2}$
4. $nL^{-1}T^{1/2}$

Q5. [Dec 2019] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2019 Dec	3.5M

A mole of gas at initial temperature T_i comes into contact with a heat reservoir at temperature T_f and the system is allowed to reach equilibrium at constant volume. If the specific heat of the gas is $C_V = \alpha T$, where α is a constant, the total change in entropy is

1. zero
2. $\alpha(T_f - T_i) + \frac{\alpha}{2T_f}(T_f - T_i)^2$
3. $\alpha(T_f - T_i)$
4. $\alpha(T_f - T_i) + \frac{\alpha}{2T_f}(T_f^2 - T_i^2)$

Q6. [June 2020] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2020 June	3.5M

Two ideal gases in a box are initially separated by a partition. Let N_1, V_1 and N_2, V_2 be the numbers of particles and volume occupied by the two systems. When the partition is removed, the pressure of the mixture at an equilibrium temperature T, is

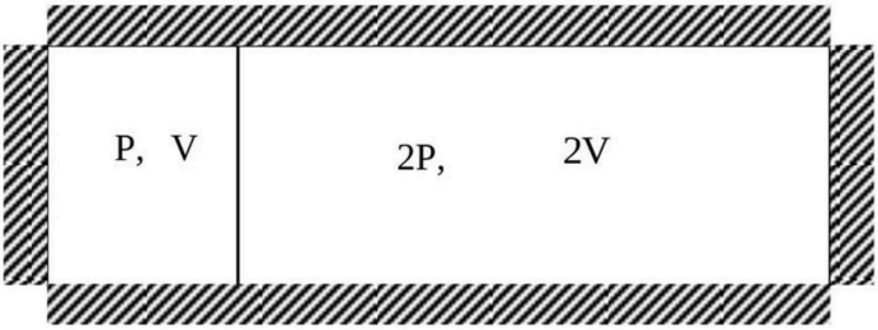
1. $k_B T\left(\frac{N_1+N_2}{2(V_1+V_2)}\right)$
2. $k_B T\left(\frac{N_1+N_2}{V_1+V_2}\right)$
3. $k_B T\left(\frac{N_1}{V_1}+\frac{N_2}{V_2}\right)$
4. $\frac{1}{2}k_B T\left(\frac{N_1}{V_1}+\frac{N_2}{V_2}\right)$

Q7. [June 2022] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2022 June	3.5M

A thermally isolated container, filled with an ideal gas at temperature T, is divided by a partition, which is clamped initially, as shown in the figure below.



The partition does not allow the gas in the two parts to mix. It is subsequently released and allowed to move freely with negligible friction. The final pressure at equilibrium is

1. $5P/3$
2. $5P/4$
3. $3P/5$
4. $4P/5$

Q8. [Dec 2023] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2023 Dec	3.5 M

A classical ideal gas is subjected to a reversible process in which its molar specific heat changes with temperature T as $C(T) = C_V + R\frac{T}{T_0}$. If the initial temperature and volume are T_0 and V_0 respectively, and the final volume is $2V_0$, then the final temperature is

1. $T_0/\ln 2$
2. $2T_0$
3. $T_0/[1-\ln 2]$
4. $T_0[1+\ln 2]$

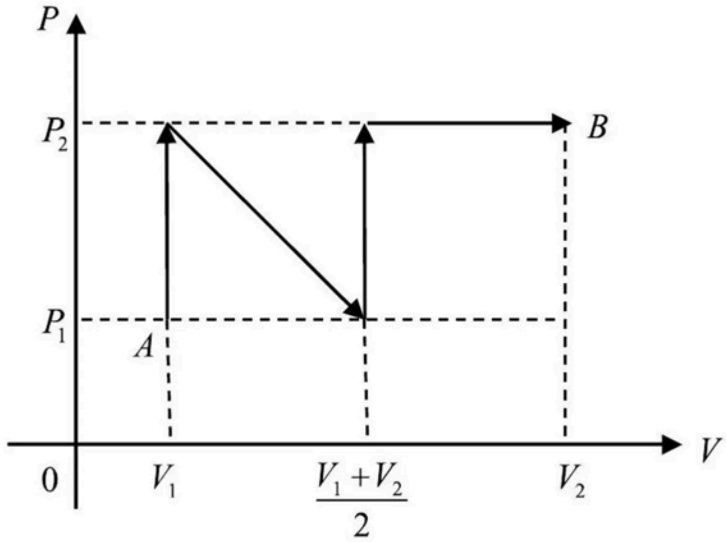
Q9. [June 2024] . 3.5 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2024 June	3.5M

The following $P - V$ diagram shows a process, where an ideal gas is taken quasi-statically from A to B along the path as shown in the figure. The work done W in this process is

1. $\frac{1}{4}(V_2 - V_1)(3P_2 + P_1)$
2. $\frac{1}{4}(V_2 - V_1)(3P_2 - P_1)$
3. $\frac{1}{2}(V_2 - V_1)(P_1 + P_2)$
4. $\frac{1}{2}(V_2 + V_1)(P_2 - P_1)$



Q10. [Dec 2025] . 5.0 marks

Thermodynamics > Laws of thermodynamics

CSIR NET	2025 Dec	5M	Thermal

A spherical gaseous ball of radius 15 m was formed with a temperature $T = 3 \times 10^5$ K. The gas expands adiabatically and its temperature drops to 5×10^3 K. Given $\gamma = \frac{5}{3}$ for this gas, the radius of the ball becomes approximately

1. 212 m
2. 86 m
3. 137 m
4. 116 m

Answer Key

10 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Thermodynamics	Laws of thermodynamics	**2**
Q2	Thermodynamics	Laws of thermodynamics	**None**
Q3	Thermodynamics	Laws of thermodynamics	**1**
Q4	Thermodynamics	Laws of thermodynamics	**3**
Q5	Thermodynamics	Laws of thermodynamics	**4**
Q6	Thermodynamics	Laws of thermodynamics	**2**
Q7	Thermodynamics	Laws of thermodynamics	**1**
Q8	Thermodynamics	Laws of thermodynamics	**4**
Q9	Thermodynamics	Laws of thermodynamics	**1**
Q10	Thermodynamics	Laws of thermodynamics	**4**

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