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PHYSICS · JEE MAIN

Thermodynamics

Previous Year Questions with answers

221 questions · **170** papers · **2002–2026** · newest paper first

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What is in this PDF: every Thermodynamics question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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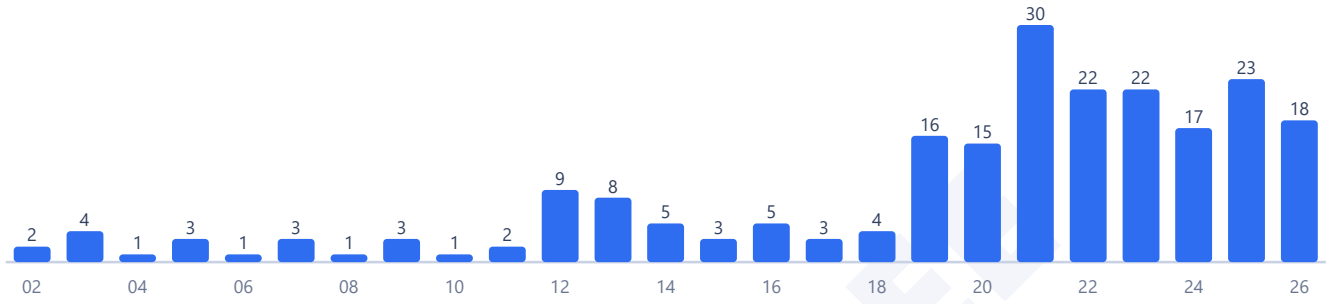
Chapter at a glance

3.6%	221	134 of 162	189 / 32
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Steady: 1 questions per paper in 2024–2026 against 1 in 2019–2023.

Questions per year



Counts are the questions we hold: 221 in 170 papers. 2 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Thermodynamics provides one of the most reliable and conceptual question sets in JEE Main Physics. Across the papers we hold from 2019 to 2026, the chapter delivered **163 questions in 162 papers**, which translates to exactly **1.0 questions per paper**, and was present in 134 of those 162 papers. This record places it at **12th of 29 Physics chapters** by question share, contributing 3.6% of all Physics questions.

The chapter's share has fallen since the AIEEE years. In the 2002 to 2018 era, it accounted for 4.3% of the Physics section; in the last three exam years (2024 to 2026), it declined to 3.7%, yielding 58 questions across 58 papers. Its most concentrated appearance in our collection occurred in 2021, when papers logged 30 questions across 26 papers, followed by 2025 with 23 questions across 19 papers. Every single testing year since 2019 has included questions from this chapter, appearing in 134 of the 162 papers we hold.

The syllabus designates this material as Unit 8: Thermodynamics in Class 11. It pairs naturally with the Kinetic Theory of Gases, which supplies the microscopic molecular picture for the macroscopic state variables analyzed here.

Most-asked topics

Between 2019 and 2026, the chapter's questions sorted across three main topics:

- **First Law & Processes**: 124 questions. More than three-quarters of the entire chapter, covering isothermal, adiabatic, isobaric, and isochoric paths, cyclic work areas on P-V indicator diagrams, and internal energy changes.
- **Second Law & Engines**: 36 questions. Carnot engine efficiency, coefficient of performance of refrigerators, heat pump cycles, and entropy definitions.
- **Basics & Zeroth Law**: 3 questions. Thermal equilibrium, zeroth law, and classification of thermodynamic variables into intensive and extensive parameters.

First law processes and basic state definitions were tested actively in 2026, while second law engine problems appeared regularly through 2025.

What the questions look like

First law problems routinely test energy partitioning during quasi-static expansions. A popular pattern asks for the total heat supplied to an ideal diatomic gas when it expands isobarically and does a specified amount of work, such as 100 J. Because work at constant pressure equals nRΔT and change in internal energy equals nCvΔT, students use the molar heat capacity ratio Cp/R to determine the heat input immediately. In isochoric processes, all supplied heat directly increments internal energy according to nCvΔT.

Adiabatic transformations test the Poisson relations. Given that a gas undergoes reversible adiabatic expansion where volume increases eightfold while absolute temperature drops to one-fourth, students solve T V^(γ - 1) = constant to determine the heat capacity ratio γ and infer whether the gas is monatomic, diatomic, or polyatomic. Indicator diagrams evaluate cyclic work: clockwise cycles enclose positive net work output, whereas counter-clockwise refrigeration cycles require net work input.

Carnot and second law problems calculate theoretical engine efficiencies. Questions frequently specify sink and source temperatures, asking for work output given a heat input, or ask for the entropy change when a substance warms reversibly from one temperature to another.

A significant share requires exact numerical computation: 32 of the 163 questions from 2019 to 2026 had no answer choices, demanding precise algebra with the universal gas constant.

How to practise it

Master the first law equation ΔQ = ΔU + W, fixing your sign conventions early. In physics, work W is defined as positive when the gas expands against external pressure (W = ∫P dV), so work done by the system reduces its internal energy unless heat is added. Verify whether a given problem uses physics or chemistry sign conventions to avoid algebraic errors.

Remember that internal energy U for an ideal gas is strictly a state function of temperature alone: ΔU = n Cv ΔT for any process, whether isobaric, isothermal, adiabatic, or arbitrary. For an isothermal process on an ideal gas, ΔU is always zero regardless of pressure shifts.

For adiabatic processes, write the governing relationships in terms of whichever pair of variables is provided: P V^γ = constant, T V^(γ - 1) = constant, or P^(1 - γ) T^γ = constant. Memorize the degrees of freedom and resulting values of Cv, Cp, and γ for monatomic gases (3 degrees of freedom) and diatomic gases (5 degrees of freedom at ordinary temperatures).

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

One mole of diatomic gas having rotational modes only is kept in a cylinder with a piston system. The cross-section area of the cylinder is 4 cm^2. The gas is heated slowly to raise the temperature by 1.2 °C during which the piston moves by 25 mm. The amount of heat supplied to the gas is _____ J. (Atmospheric pressure = 100 kPa, $R = 8.3$ J/mol. K) (Neglect mass of the piston)

(A) 24.8
(B) 25
(C) 15.04
(D) 29.98

Options (1) or (2) were accepted. More than one answer was accepted. · Official NTA final key

Q2 JEE Main 2026 · 8 Apr · Shift 2 MCQ

Initial pressure and volume of a monoatomic ideal gas are P and V. The change in internal energy of this gas in adiabatic expansion to volume $V_{final} = 27\,V$ is _____ J.

(A) $-2\,PV\left(3\sqrt{3}-1\right)$
(B) $\frac{4}{3}PV$
(C) $-\frac{4}{3}PV$
(D) $\frac{3}{4}PV$

Answer: (C) $-\frac{4}{3}PV$ · Official NTA final key

Q3 JEE Main 2026 · 6 Apr · Shift 1 Numerical

A certain gas is isothermally compressed to $\left(\frac{1}{3}\right)^{rd}$ of its initial volume ($V_o = 3$ litre) by applying required pressure. If the bulk modulus of the gas is 3×10^5 N/m^2, the magnitude of work done on the gas is _____ J.

Numerical value type: the answer is a number.

Answer: 600. · Official NTA final key

Q4 JEE Main 2026 · 6 Apr · Shift 2 MCQ

A cylinder with adiabatic walls is closed at both ends and is divided into two compartments by a frictionless adiabatic piston. Ideal gas is filled in both (left and right) the compartments at same P, V, T. Heating is started from left side until pressure changes to $27P/8$. If initial volume of each compartment was 9 litres then the final volume in right-hand side compartment is _____ litres. (for this ideal gas $C_P/C_V = 1.5$)

(A) 3
(B) 4
(C) 14
(D) 9

Answer: (B) 4 · Official NTA final key

Q5 JEE Main 2026 · 5 Apr · Shift 1 MCQ

Consider the following statements:

A. Zeroth law of thermodynamics gives concept of temperature

B. First law of thermodynamics gives concept of internal energy

C. In isothermal expansion of ideal gas, $\Delta Q \neq \Delta W$

D. Product of intensive and extensive variables is extensive

E. The ratio of any extensive variable to mass will be an extensive variable

Choose the correct combination of statements from the options given below:

(A) C, D and E Only
(B) A, B and C Only
(C) A, B and D Only
(D) B, C and D Only

Answer: (C) A, B and D Only · Official NTA final key

Q6 JEE Main 2026 · 2 Apr · Shift 1 MCQ

Heat is supplied to a diatomic gas at constant pressure. Then the ratio of $\Delta Q : \Delta U : \Delta W$ is _____.

(A) $2 : 3 : 5$
(B) $5 : 3 : 2$
(C) $2 : 5 : 7$
(D) $7 : 5 : 2$

Answer: (D) $7 : 5 : 2$ · Official NTA final key

Q7 JEE Main 2026 · 2 Apr · Shift 1 Numerical

A vessel contains 0.15 m^3 of a gas at pressure 8 bar and temperature 140 °C with $c_p = 3R$ and $c_v = 2R$. It is expanded adiabatically till pressure falls to 1 bar. The work done during this process is _____ k J. (R is gas constant)

Numerical value type: the answer is a number.

Answer: 120. · Official NTA final key

Q8 JEE Main 2026 · 2 Apr · Shift 2 Numerical

5 moles of unknown gas is heated at constant volume from 10 °C to 20 °C. The molar specific heat of this gas at constant pressure $c_p = 8$ cal/mol. °C and $R = 8.36$ J/mol.°C. The change in the internal energy of the gas is _____ calorie.

Numerical value type: the answer is a number.

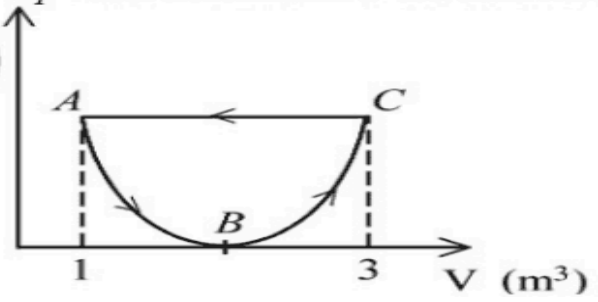
Answer: 300. · Official NTA final key

Q9 JEE Main 2026 · 28 Jan · Shift 1 MCQ

In the following p-V diagram the equation of state along the curved path is given by $(V-2)^2 = 4ap$ where a is a constant. The total work done in the closed path is

(see the figure above)

Q.41 In the following p-V diagram the equation of state along the curved path is given by $(V-2)^2 = 4ap$ where a is a constant. The total work done in the closed path is



Options

1. $-\frac{1}{3a}$
2. $+\frac{1}{3a}$
3. $\frac{1}{2a}$
4. $-\frac{1}{a}$

(A) $-\frac{1}{3a}$
(B) $+\frac{1}{3a}$
(C) $\frac{1}{2a}$
(D) $-\frac{1}{a}$

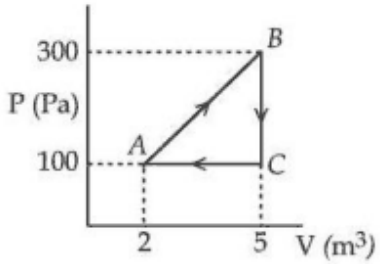
Answer: (A) $-\frac{1}{3a}$ · Official NTA final key

Q10 JEE Main 2026 · 28 Jan · Shift 2 Numerical

A thermodynamic system is taken through the cyclic process ABC as shown in the figure. The total work done by the system during the cycle ABC is _____ J.

(see the figure above)

Q.50 A thermodynamic system is taken through the cyclic process ABC as shown in the figure. The total work done by the system during the cycle ABC is _____ J.



Numerical value type: the answer is a number.

Answer: 300. · Official NTA final key

Q11 JEE Main 2026 · 24 Jan · Shift 1 MCQ

Density of water at 4 °C and 20 °C are 1000 kg/m^3 and 998 kg/m^3 respectively. The increase in internal energy of 4 kg of water when it is heated from 4 °C to 20 °C is _____ J.

(specific heat capacity of water $= 4.2$ J / kg. and 1 atmospheric pressure $= 10^5$ Pa)

(A) 315826.2
(B) 258700.8
(C) 234699.2
(D) 268799.2

Answer: (D) 268799.2 · Official NTA final key

Q12 JEE Main 2026 · 24 Jan · Shift 2 MCQ

10 mole of an ideal gas is undergoing the process shown in the figure. The heat involved in the process from P_1 to P_2 is α Joule ($P_1 = 21.7$ Pa and $P_2 = 30$ Pa, $C_v = 21$ J/K.mol, $R = 8.3$ J/mol.K). The value of α is _____.

(see the figure above)

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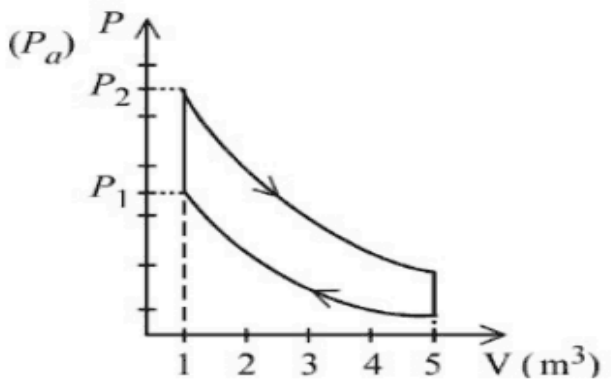
Q.34 10 mole of an ideal gas is undergoing the process shown in the figure. The heat involved in the process from P_1 to P_2 is α Joule ($P_1 = 21.7$ Pa and $P_2 = 30$ Pa, $C_v = 21$ J/K.mol, $R = 8.3$ J/mol.K). The value of α is _____.



Options 1. 15
2. 21
3. 28
4. 24

(A) 15
(B) 21
(C) 28
(D) 24

Answer: (B) 21 · Official NTA final key

Q13 JEE Main 2026 · 24 Jan · Shift 2 Numerical

When 300 J of heat given to an ideal gas with $C_p = \frac{7}{2}R$ its temperature raises from 20 °C to 50 °C keeping its volume constant. The mass of the gas is (approximately) _____ g. (R = 8.314 J/mol.K)

Numerical value type: the answer is a number.

Dropped by NTA. Full marks to everyone. · Official NTA final key

Q14 JEE Main 2026 · 23 Jan · Shift 2 MCQ

The internal energy of a monoatomic gas is $3nRT$. One mole of helium is kept in a cylinder having internal cross section area of 17 cm^2 and fitted with a light movable frictionless piston. The gas is heated slowly by suppling 126 J heat. If the temperature rises by 4 °C, then the piston will move _____ cm.

(atmospheric pressure $= 10^5$ Pa)

(A) 15.5
(B) 1.55
(C) 1.45
(D) 14.5

Answer: (A) 15.5 · Official NTA final key

Q15 JEE Main 2026 · 23 Jan · Shift 2 MCQ

One mole of an ideal diatomic gas expands from volume V to $2V$ isothermally at temperature 27 °C and does W joule of work. If the gas undergoes same magnitude of expansion adiabatically from 27 °C doing the same amount of work W, then its final temperature will be (close to) _____ °C.

$(\log_e 2 = 0.693)$

(A) -56
(B) -30
(C) -189
(D) -117

Answer: (A) -56 · Official NTA final key

Q16 JEE Main 2026 · 22 Jan · Shift 1 MCQ

The volume of an ideal gas increases 8 times and temperature becomes $(1/4)^{\text{th}}$ of initial temperature during a reversible change. If there is no exchange of heat in this process ($\Delta Q = 0$) then identify the gas from the following options (Assuming the gases given in the options are ideal gases):

(A) He
(B) O_2
(C) CO_2
(D) NH_3

Answer: (A) He · Official NTA final key

Q17 JEE Main 2026 · 21 Jan · Shift 1 Numerical

10 mole of oxygen is heated at constant volume from 30 °C to 40 °C. The change in the internal energy of the gas is _____ cal. (The molecular specific heat of oxygen at constant pressure, $C_p = 7$ cal/mol.°C and R = 2 cal./mol.°C.)

Numerical value type: the answer is a number.

Answer: 500. · Official NTA final key

Q18 JEE Main 2026 · 21 Jan · Shift 2 Numerical

A diatomic gas ($\gamma = 1.4$) does 100 J of work when it is expanded isobarically. Then the heat given to the gas _____ J.

Numerical value type: the answer is a number.

Answer: 350. · Official NTA final key

Q19 JEE Main 2025 · 8 Apr · Shift 2 MCQ

A monoatomic gas having $\gamma = \frac{5}{3}$ is stored in a thermally insulated container and the gas is suddenly compressed to $\left(\frac{1}{8}\right)^{th}$ of its initial volume. The ratio of final pressure and initial pressure is: (γ is the ratio of specific heats of the gas at constant pressure and at constant volume)

(A) 32
(B) 40
(C) 16
(D) 28

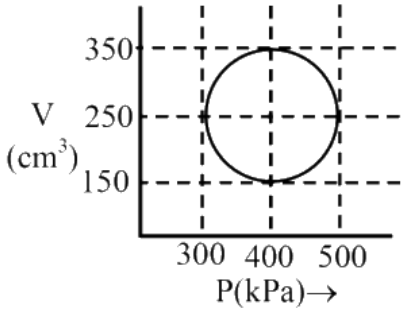
Answer: (A) 32 · Key from source paper

Q20 JEE Main 2025 · 7 Apr · Shift 1 Numerical

An ideal gas has undergone through the cyclic process as shown in the figure. Work done by the gas in the entire cycle is _____ $\times 10^{-1}$ J. (Take $\pi = 3.14$)

(see the figure above)

23. An ideal gas has undergone through the cyclic process as shown in the figure. Work done by the gas in the entire cycle is _____ $\times 10^{-1}$ J. (Take $\pi = 3.14$)



Numerical value type: the answer is a number.

Answer: 314. · Key from source paper

Q21 JEE Main 2025 · 7 Apr · Shift 2 MCQ

Match List - I with List - II.

List - I	List - II
(A) Isothermal	(I) ΔW (work done) = 0
(B) Adiabatic	(II) ΔQ(supplied heat) = 0
(C) Isobaric	(III) ΔU (change in internal energy) $\neq 0$
(D) Isochoric	(IV) $\Delta U = 0$

Choose the correct answer from the options given below :

A (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

B (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

C (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

D (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

Answer: (B) (A)-(IV), (B)-(II), (C)-(III), (D)-(I) · Key from source paper

Q22 JEE Main 2025 · 4 Apr · Shift 2 MCQ

Match List - I with List - II.

List - I		List - II
(A) Isobaric	(I)	$\Delta Q = \Delta W$
(B) Isochoric	(II)	$\Delta Q = \Delta U$
(C) Adiabatic	(III)	$\Delta Q =$ zero
(D) Isothermal	(IV)	$\Delta Q = \Delta U + P\Delta V$

$\Delta Q =$ Heat supplied

$\Delta W =$ Work done by the system

$\Delta U =$ Change in internal energy

$P =$ Pressure of the system

$\Delta V =$ Change in volume of the system

Choose the correct answer from the options given below :

A (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

B (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

C (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

D (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

Answer: (C) (A)-(IV), (B)-(II), (C)-(III), (D)-(I) · Key from source paper

Q23 JEE Main 2025 · 3 Apr · Shift 1 MCQ

During the melting of a slab of ice at 273 K at atmospheric pressure:

A Internal energy of ice-water system remains unchanged.

B Internal energy of the ice-water system decreases.

C Positive work is done by the ice-water system on the atmosphere.

D Positive work is done on the ice-water system by the atmosphere.

Answer: (D) Positive work is done on the ice-water system by the atmosphere. · Key from source paper

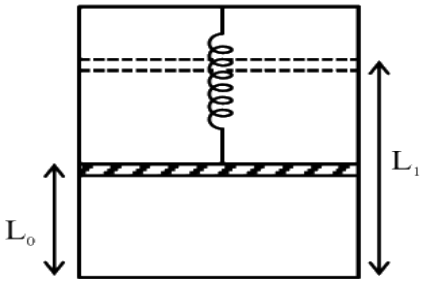
Q24 JEE Main 2025 · 3 Apr · Shift 1 MCQ

A piston of mass M is hung from a massless spring whose restoring force law goes as $F = -kx^3$, where k is the spring constant of appropriate dimension. The piston separates the vertical chamber

into two parts, where the bottom part is filled with 'n' moles of an ideal gas. An external work is done on the gas isothermally (at a constant temperature T) with the help of a heating filament (with negligible volume) mounted in lower part of the chamber, so that the piston goes up from a height L_0 to L_1, the total energy delivered by the filament is :(Assume spring to be in its natural length before heating)

(see the figure above)

5. A piston of mass M is hung from a massless spring whose restoring force law goes as $F = -kx^3$, where k is the spring constant of appropriate dimension. The piston separates the vertical chamber into two parts, where the bottom part is filled with 'n' moles of an ideal gas. An external work is done on the gas isothermally (at a constant temperature T) with the help of a heating filament (with negligible volume) mounted in lower part of the chamber, so that the piston goes up from a height L_0 to L_1, the total energy delivered by the filament is :(Assume spring to be in its natural length before heating)



(1) $nRT\ln\left(\frac{L_1}{L_0}\right)+Mg\left(L_1-L_0\right)+\frac{k}{4}\left(L_1^4-L_0^4\right)$ (2) $nRT\ln\left(\frac{L_1^2}{L_0^2}\right)+\frac{Mg}{2}\left(L_1-L_0\right)+\frac{k}{4}\left(L_1^4-L_0^4\right)$

(3) $nRT\ln\left(\frac{L_1}{L_0}\right)+Mg\left(L_1-L_0\right)+\frac{3k}{4}\left(L_1^4-L_0^4\right)$ (4) $3nRT\ln\left(\frac{L_1}{L_0}\right)+2Mg\left(L_1-L_0\right)+\frac{k}{3}\left(L_1^3-L_0^3\right)$

(A) $nRT\ln\left(\frac{L_1}{L_0}\right)+Mg(L_1-L_0)+\frac{k}{4}\left(L_1^4-L_0^4\right)$

(B) $nRT\ln\left(\frac{L_1^2}{L_0^2}\right)+\frac{Mg}{2}(L_1-L_0)+\frac{k}{4}\left(L_1^4-L_0^4\right)$

(C) $nRT\ln\left(\frac{L_1}{L_0}\right)+Mg(L_1-L_0)+\frac{3k}{4}\left(L_1^4-L_0^4\right)$

(D) $3nRT\ln\left(\frac{L_1}{L_0}\right)+2Mg(L_1-L_0)+\frac{k}{3}\left(L_1^3-L_0^3\right)$

Answer: (A) $nRT\ln\left(\frac{L_1}{L_0}\right)+Mg(L_1-L_0)+\frac{k}{4}\left(L_1^4-L_0^4\right)$ · Key from source paper

Q25 JEE Main 2025 · 3 Apr · Shift 1 MCQ

A gas is kept in a container having walls which are thermally non-conducting. Initially the gas has a volume of $800cm^3$ and temperature 27^oC. The change in temperature when the gas is adiabatically compressed to $200cm^3$ is:

(Take $\gamma = 1.5$; γ is the ratio of specific heats at constant pressure and at constant volume)

(A) 600 K

(B) 522 K

(C) 300 K

(D) 327 K

Answer: (C) 300 K · Key from source paper

Q26 JEE Main 2025 · 3 Apr · Shift 2 MCQ

An ideal gas exists in a state with pressure P_0, volume V_0. It is isothermally expanded to 4 times of its initial volume (V_0), then isobarically compressed to its original volume. Finally the system is heated isochorically to bring it to its initial state. The amount of heat exchanged in this process is

(A) $P_0V_0(2\ln 2 - 0.75)$
(B) $P_0V_0(\ln 2 - 0.75)$
(C) $P_0V_0(\ln 2 - 0.25)$
(D) $P_0V_0(2\ln 2 - 0.25)$

Answer: (A) $P_0V_0(2\ln 2 - 0.75)$ · Key from source paper

Q27 JEE Main 2025 · 2 Apr · Shift 1 MCQ

In an adiabatic process, which of the following statements is true?

(A) The molar heat capacity is infinite
(B) Work done by the gas equals the increase in internal energy
(C) The internal energy of the gas decreases as the temperature increases
(D) The molar heat capacity is zero

Answer: (D) The molar heat capacity is zero · Key from source paper

Q28 JEE Main 2025 · 2 Apr · Shift 2 MCQ

Identify the characteristics of an adiabatic process in a monoatomic gas.

(A) Internal energy is constant.

(B) Work done in the process is equal to the change in internal energy.

(C) The product of temperature and volume is a constant.

(D) The product of pressure and volume is a constant.

(E) The work done to change the temperature from T_1 to T_2 is proportional to $(T_2 - T_1)$.

Choose the correct answer from the options given below :

(A) (B), (D) only
(B) (A), (C), (E) only
(C) (B), (E) only
(D) (A), (C), (D) only

Answer: (C) (B), (E) only · Key from source paper

Q29 JEE Main 2025 · 29 Jan · Shift 1 MCQ

The workdone in an adiabatic change in an ideal gas depends upon only :

(A) change in its temperature
(B) change in its volume
(C) change in its pressure
(D) change in its specific heat

Answer: (A) change in its temperature · Key from source paper

Q30 JEE Main 2025 · 29 Jan · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : With the increase in the pressure of an ideal gas, the volume falls off more rapidly in an isothermal process in comparison to the adiabatic process. Reason (R) : In isothermal process, PV = constant, while in adiabatic process PV^{γ} = constant. Here γ is the ratio of specific heats, P is the pressure and V is the volume of the ideal gas. In the light of the above statements, choose the correct answer from the options given below :

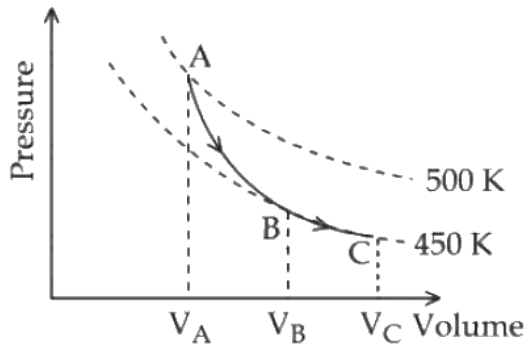
(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(C) (A) is true but (R) is false
(D) (A) is false but (R) is true

Answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A) · Key from source paper

Q31 JEE Main 2025 · 29 Jan · Shift 2 MCQ

see figure

Q42.



A poly-atomic molecule ($C_V = 3R, C_P = 4R$, where R is gas constant) goes from phase space point A $\left(P_A = 10^5\ Pa,\ V_A = 4 \times 10^{-6}\ m^3\right)$ to point B $\left(P_B = 5 \times 10^4\ Pa,\ V_B = 6 \times 10^{-6}\ m^3\right)$ to point

C $\left(P_C = 10^4\ Pa, V_C = 8 \times 10^{-6}\ m^3\right)$. A to B is an adiabatic path and B to C is an isothermal path. The net heat absorbed per unit mole by the system is :

(1) $500R(\ln 3 + \ln 4)$
(2) $450R(\ln 4 - \ln 3)$
(3) $500R \ln 2$
(4) $400R \ln 4$

(A) $500R(\ln 3 + \ln 4)$
(B) $450R(\ln 4 - \ln 3)$
(C) $500R \ln 2$
(D) $400R \ln 4$

Answer: (B) $450R(\ln 4 - \ln 3)$ · Key from source paper

Q32 JEE Main 2025 · 28 Jan · Shift 1 MCQ

A Carnot engine (E) is working between two temperatures 473 K and 273 K . In a new system two engines - engine E_1 works between 473 K to 373 K and engine E_2 works between 373 K to 273 K . If η_{12}, η_1 and η_2 are the efficiencies of the engines E, E_1 and E_2, respectively, then

(A) $\eta_{12} = \eta_1\eta_2$
(B) $\eta_{12} \geq \eta_1 + \eta_2$
(C) $\eta_{12} = \eta_1 + \eta_2$
(D) $\eta_{12} < \eta_1 + \eta_2$

Answer: (D) $\eta_{12} < \eta_1 + \eta_2$ · Key from source paper

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Q33 JEE Main 2025 · 24 Jan · Shift 1 MCQ

An ideal gas goes from an initial state to final state. During the process, the pressure of gas increases linearly with temperature. A. The work done by gas during the process is zero. B. The heat added to gas is different from change in its internal energy. C. The volume of the gas is increased. D. The internal energy of the gas is increased. E. The process is isochoric (constant volume process) Choose the correct answer from the options given below:

(A) E Only
(B) A, B, C, D Only
(C) A, D, E Only
(D) A, C Only

Answer: (C) A, D, E Only · Key from source paper

Q34 JEE Main 2025 · 24 Jan · Shift 1 Numerical

The temperature of 1 mole of an ideal monoatomic gas is increased by 50°C at constant pressure. The total heat added and change in internal energy are E_1 and E_2, respectively. If $\frac{E_1}{E_2} = \frac{x}{9}$ then the value of x is _____ .

Numerical value type: the answer is a number.

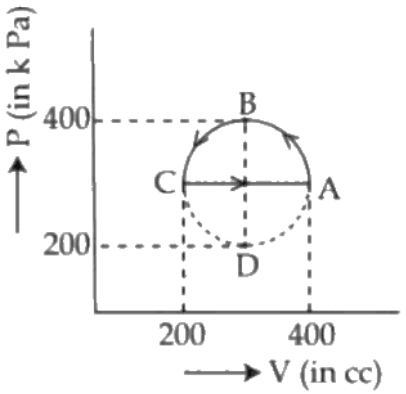
Answer: 15. · Key from source paper

Q35 JEE Main 2025 · 24 Jan · Shift 2 MCQ

The magnitude of heat exchanged by a system for the given cyclic process ABCA (as shown in figure) is (in SI unit) :

(see the figure above)

Q30. The magnitude of heat exchanged by a system for the given cyclic process ABCA (as shown in figure) is (in SI



unit) :

(1) 5π
(2) 40π
(3) 10π
(4) zero

(A) 5π
(B) 40π
(C) 10π
(D) zero

Answer: (A) 5π · Key from source paper

Q36 JEE Main 2025 · 24 Jan · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : In an insulated container, a gas is adiabatically shrunk to half of its initial volume. The temperature of the gas decreases. Reason (R): Free expansion of an ideal gas is an irreversible and an adiabatic process. In the light of the above statements, choose the correct answer from the options given below :

(A) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(B) (A) is false but (R) is true
(C) (A) is true but (R) is false
(D) Both (A) and (R) are true and (R) is the correct explanation of (A)

Answer: (B) (A) is false but (R) is true · Key from source paper

Q37 JEE Main 2025 · 23 Jan · Shift 1 MCQ

LIST-I	LIST-II
A. Pressure varies inversely with volume of an ideal gas.	I. Adiabatic process

B. Heat absorbed goes partly to increase internal energy and partly to do work.	II. Isochoric process
C. Heat is neither absorbed nor released by a system.	III. Isothermal process
D. No work is done on or by a gas.	IV. Isobaric process

(A) A-III, B-IV, C-I, D-II
(B) A-I, B-IV, C-II, D-III
(C) A-III, B-I, C-IV, D-II
(D) A-I, B-III, C-II, D-IV

Answer: (A) A-III, B-IV, C-I, D-II · Key from source paper

Q38 JEE Main 2025 · 23 Jan · Shift 1 Numerical

An ideal gas initially at 0°C temperature, is compressed suddenly to one fourth of its volume. If the ratio of specific heat at constant pressure to that at constant volume is $3/2$, the change in temperature due to the thermodynamic process is _____ K.

Numerical value type: the answer is a number.

Answer: 273. · Key from source paper

Q39 JEE Main 2025 · 23 Jan · Shift 2 MCQ

Water of mass m gram is slowly heated to increase the temperature from T_1 to T_z The change in entropy of the water, given specific heat of water is $1 \mathrm{Jkg}^{-1}\ \mathrm{K}^{-1}$, is :

(A) $m \ln\left(\frac{T_2}{T_1}\right)$
(B) zero
(C) $m \ln\left(\frac{T_1}{T_2}\right)$
(D) $m\left(\mathrm{T}_2-\mathrm{T}_1\right)$

Answer: (A) $m \ln\left(\frac{T_2}{T_1}\right)$ · Key from source paper

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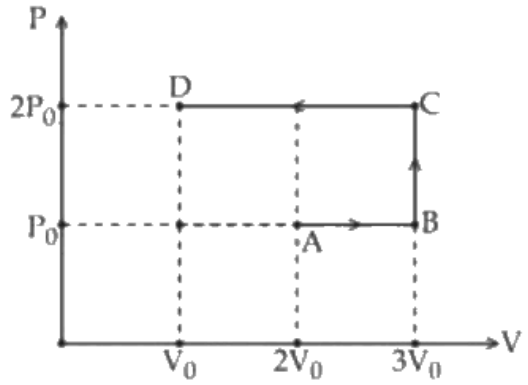
Q40 JEE Main 2025 · 23 Jan · Shift 2 MCQ

Using the given $\mathrm{P}-\mathrm{V}$ diagram, the work done by an ideal gas along the path ABCD is :

(see the figure above)

Q37.



Using the given $P - V$ diagram, the work done by an ideal gas along the path ABCD is :

(1) $3P_0\ V_0$ (2) $-4P_0\ V_0$

(3) $-3P_0\ V_0$ (4) $4P_0\ V_0$

(A) $3P_0\ V_0$

(B) $-4P_0\ V_0$

(C) $-3P_0\ V_0$

(D) $4P_0\ V_0$

Answer: (C) $-3P_0\ V_0$ · Key from source paper

Q41 JEE Main 2025 · 22 Jan · Shift 2 MCQ

Given are statements for certain thermodynamic variables, (A) Internal energy, volume (V) and mass (M) are extensive variables. (B) Pressure (P), temperature (T) and density (ρ) are intensive variables. (C) Volume (V), temperature (T) and density (ρ) are intensive variables. (D) Mass (M), temperature (T) and internal energy are extensive variables. Choose the correct answer from the options given below :

(A) (B) and (C) Only

(B) (C) and (D) Only

(C) (D) and (A) Only

(D) (A) and (B) Only

Answer: (D) (A) and (B) Only · Key from source paper

Q42 JEE Main 2024 · 9 Apr · Shift 1 MCQ

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:

(A) $\frac{R}{T}\left[2-\sqrt{2}\right]$

(B) $\frac{T}{R}\left[2+\sqrt{2}\right]$

(C) RT $\left[2-\sqrt{2}\right]$

(D) RT $\left[2+\sqrt{2}\right]$

Answer: (C) RT $\left[2-\sqrt{2}\right]$ · Key from source paper

Q43 JEE Main 2024 · 9 Apr · Shift 1 MCQ

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:

(A) $\frac{16}{25}$
(B) $\frac{4}{5}$
(C) $\frac{8}{5\sqrt{5}}$
(D) $\frac{2}{\sqrt{5}}$

Answer: (C) $\frac{8}{5\sqrt{5}}$ · Key from source paper

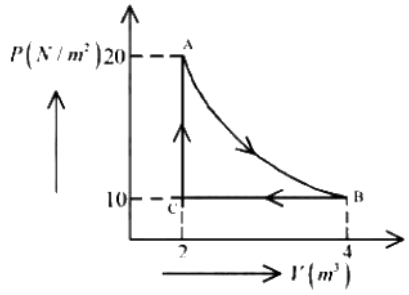
Q44 JEE Main 2024 · 9 Apr · Shift 2 MCQ

A real gas within a closed chamber at 27°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

(see the figure above)

):

Q7. A real gas within a closed chamber at 27°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 $R = 8\ \text{J/molK}$



):

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

(A) 20 J
(B) 205 J
(C) -20 J
(D) 225 J

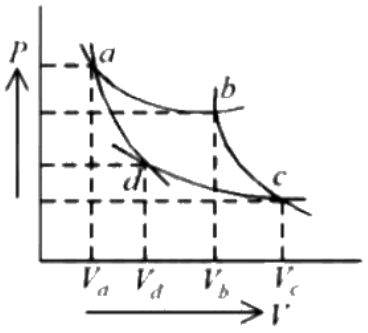
Answer: (B) 205 J · Key from source paper

Q45 JEE Main 2024 · 8 Apr · Shift 1 MCQ

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:

(see the figure above)

Q9. 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:

(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) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{2}$

(A) $\frac{V_a}{V_d} \neq \frac{V_b}{V_c}$
(B) $\frac{V_a}{V_d} = \frac{V_b}{V_c}$
(C) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{-1}$
(D) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{2}$

Answer: (B) $\frac{V_a}{V_d} = \frac{V_b}{V_c}$ · Key from source paper

Q46 JEE Main 2024 · 8 Apr · Shift 2 MCQ

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

(A) 250 J
(B) 150 J
(C) 350 J
(D) 490 J

Answer: (C) 350 J · Key from source paper

Q47 JEE Main 2024 · 6 Apr · Shift 1 MCQ

The specific heat at constant pressure of a real gas obeying $PV^2 = RT$ equation is:

(A) $\frac{R}{3} + C_V$
(B) $C_V + R$
(C) $C_V + \frac{R}{2V}$
(D) R

Answer: (C) $C_V + \frac{R}{2V}$ · Key from source paper

Q48 JEE Main 2024 · 6 Apr · Shift 2 MCQ

A total of 48 J heat is given to one mole of helium kept in a cylinder. The temperature of helium increases by 2°C. The work done by the gas is: Given, R = 8.3 J K^{-1} mol^{-1}.

(A) 24.9 J
(B) 72.9 J
(C) 48 J
(D) 23.1 J

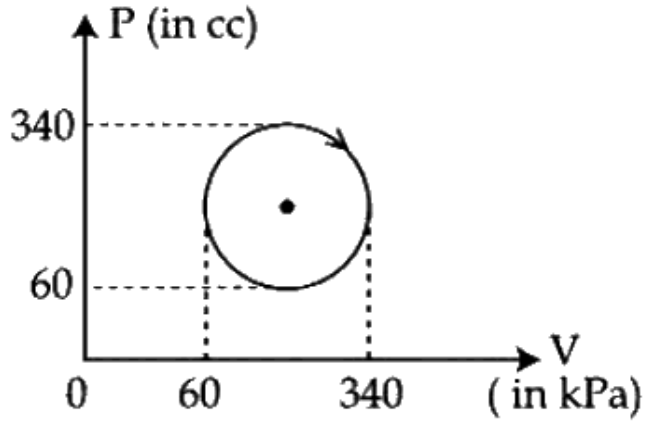
Answer: (D) 23.1 J · Key from source paper

Q49 JEE Main 2024 · 5 Apr · Shift 1 MCQ

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

(see the figure above)

Q11. The heat absorbed by a system in going through the given cyclic process is :



(1) 19.6 J
(2) 61.6 J
(3) 616 J
(4) 431.2 J

(A) 19.6 J
(B) 61.6 J
(C) 616 J
(D) 431.2 J

Answer: (B) 61.6 J · Key from source paper

Q50 JEE Main 2024 · 5 Apr · Shift 2 MCQ

During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_P}{C_V}$ for the gas is :

(A) $\frac{5}{3}$
(B) $\frac{9}{7}$
(C) $\frac{3}{2}$
(D) $\frac{7}{5}$

Answer: (C) $\frac{3}{2}$ · Key from source paper

Q51 JEE Main 2024 · 4 Apr · Shift 2 MCQ

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)

(A) $RT[1 - 2\sqrt{2}]$
(B) $RT[\sqrt{2} - 2]$
(C) $RT[2 - \sqrt{2}]$
(D) $RT[2\sqrt{2} - 1]$

Answer: (C) $RT[2 - \sqrt{2}]$ · Key from source paper

Q52 JEE Main 2024 · 1 Feb · Shift 1 MCQ

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 AP_1, V_1, T_1 to state BP_2, V_2, T_2 is :

(A) $2\left(P_1V_1 - P_2V_2\right)$
(B) $2\left(P_2V_2 - P_1V_1\right)$
(C) $2\sqrt{P_1}V_1 - \sqrt{P_2}V_2$
(D) $2P_2\sqrt{V_2} - P_1\sqrt{V_1}$

Answer: (A) $2\left(P_1V_1 - P_2V_2\right)$ · Key from source paper

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Q53 JEE Main 2024 · 1 Feb · Shift 2 MCQ

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 :

(A) 850 J
(B) 800 J
(C) 600 J
(D) 700 J

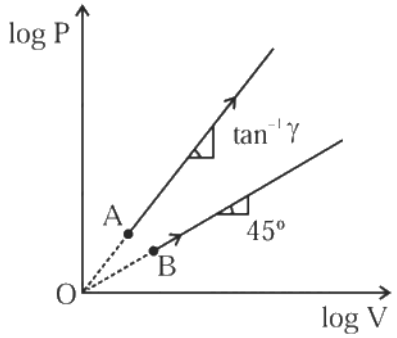
Answer: (D) 700 J · Key from source paper

Q54 JEE Main 2024 · 30 Jan · Shift 1 MCQ

Two thermodynamical process are shown in the figure. The molar heat capacity for process A and B are C_A and C_B. The molar heat capacity at constant pressure and constant volume are represented by C_P and C_V, respectively. Choose the correct statement.

(see the figure above)

Q9. Two thermodynamical process are shown in the figure. The molar heat capacity for process A and B are C_A and C_B. The molar heat capacity at constant pressure and constant volume are represented by C_P and C_V, respectively. Choose the correct statement.



(1) $C_P > C_B > C_V$ (2) $C_A = 0$ and $C_B = \infty$
(3) $C_P > C_V > C_A = C_B$ (4) $C_A > C_P > C_V$

(A) $C_P > C_B > C_V$
(B) $C_A = 0$ and $C_B = \infty$
(C) $C_P > C_V > C_A = C_B$
(D) $C_A > C_P > C_V$

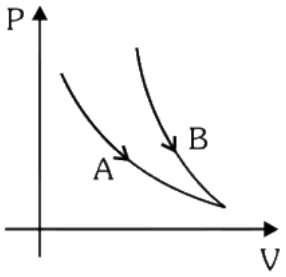
Answer: (A) $C_P > C_B > C_V$ · Key from source paper

Q55 JEE Main 2024 · 30 Jan · Shift 2 MCQ

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

(see the figure above)

Q8. Choose the correct statement for processes A & B shown in figure.



(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.

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

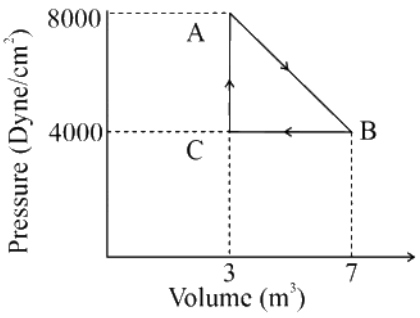
Answer: (A) $PV^{\gamma} = k$ **for process** B **and** $PV = k$ **for process** A. · Key from source paper

Q56 JEE Main 2024 · 29 Jan · Shift 1 MCQ

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 :

(see the figure above)

Q8. 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 :



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

(A) 33800 J
(B) 2200 J
(C) 600 J
(D) 800 J

Answer: (D) 800 J · Key from source paper

Q57 JEE Main 2024 · 27 Jan · Shift 1 MCQ

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 J = 4.18 joule cal^{-1}. The change in its internal energy is approximately.

(A) 318 J
(B) 298 J
(C) 284 J
(D) 142 J

Answer: (C) 284 J · Key from source paper

Q58 JEE Main 2024 · 27 Jan · Shift 2 MCQ

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 :

(A) $\frac{5}{3}$
(B) $\frac{3}{2}$
(C) $\frac{7}{5}$
(D) $\frac{9}{7}$

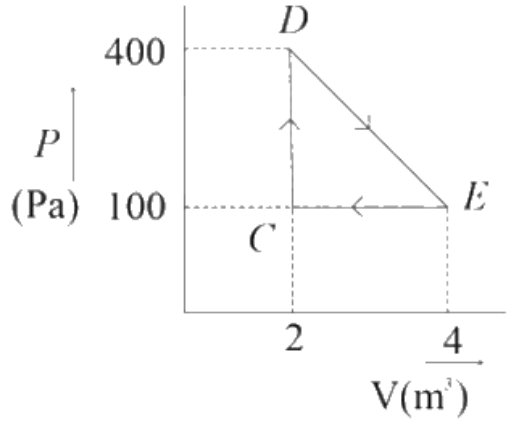
Answer: (B) $\frac{3}{2}$ · Key from source paper

Q59 JEE Main 2023 · 15 Apr · Shift 1 MCQ

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

(see the figure above)

Q8. A thermodynamic system is taken through cyclic process. The total work done in the process is :



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

(A) 200 J
(B) 300 J
(C) 100 J
(D) Zero

Answer: (B) 300 J · Key from source paper

Q60 JEE Main 2023 · 13 Apr · Shift 2 MCQ

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.)

(A) $P_0(4)^{\gamma}$
(B) $4P_0$
(C) P_0
(D) $P_0(4)^{\frac{1}{\gamma}}$

Answer: (A) $P_0(4)^{\gamma}$ · Key from source paper

Q61 JEE Main 2023 · 12 Apr · Shift 1 MCQ

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

(A) B, C and D only
(B) A and B only
(C) B and D only
(D) B and C only

Answer: (C) B and D only · Key from source paper

Q62 JEE Main 2023 · 11 Apr · Shift 1 MCQ

1 kg of water at 100°C is converted into steam at 100°C by boiling at atmospheric pressure. The volume of water changes from $1.00 \times 10^{-3}\ \mathrm{m}^3$ as a liquid to $1.671\ \mathrm{m}^3$ as steam. The change in internal energy of the system during the process will be (Given latent heat of vaporisation $= 2257\ \mathrm{kJ/kg}$, Atmospheric pressure $= 1 \times 10^5$ Pa)

(A) -2426 kJ
(B) +2090 kJ
(C) -2090 kJ
(D) +2476 kJ

Answer: (B) +2090 kJ · Key from source paper

Q63 JEE Main 2023 · 11 Apr · Shift 2 MCQ

The thermodynamic process, in which internal energy of the system remains constant is

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(A) Isochoric
(B) Adiabatic
(C) Isothermal
(D) Isobaric

Answer: (C) Isothermal · Key from source paper

Q64 JEE Main 2023 · 10 Apr · Shift 1 MCQ

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

(A) 8
(B) 4
(C) $8^{\frac{3}{2}}$
(D) $\frac{1}{8}$

Answer: (B) 4 · Key from source paper

Q65 JEE Main 2023 · 10 Apr · Shift 2 MCQ

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

(A) There is no heat supplied to the system
(B) There is no change in the internal energy
(C) The temperature of the gas increases
(D) The change in the internal energy is equal to the work done on the gas

Answer: (B) There is no change in the internal energy · Key from source paper

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Q66 JEE Main 2023 · 8 Apr · Shift 1 MCQ

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

(A) Statement I is true but Statement II is false
(B) Both Statement I and Statement II are false
(C) Both Statement I and Statement II are true
(D) Statement I is false but Statement II is true

Answer: (D) Statement I is false but Statement II is true · Key from source paper

Q67 JEE Main 2023 · 8 Apr · Shift 2 MCQ

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:

(A) $8\ \mathrm{kJ}$
(B) $2.67\ \mathrm{kJ}$
(C) $2\ \mathrm{kJ}$
(D) $4\ \mathrm{kJ}$

Answer: (A) $8\ \mathrm{kJ}$ · Key from source paper

Q68 JEE Main 2023 · 6 Apr · Shift 1 MCQ

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

(A) $600\ \mathrm{W}$
(B) $800\ \mathrm{W}$
(C) $500\ \mathrm{W}$
(D) $1200\ \mathrm{W}$

Answer: (B) $800\ \mathrm{W}$ · Key from source paper

Q69 JEE Main 2023 · 1 Feb · Shift 1 MCQ

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 $\gamma = \frac{3}{2}$) :

(A) $W = TR\sqrt{2} - 2$
(B) $W = \frac{T}{R}\sqrt{2} - 2$
(C) $W = \frac{R}{T}2 - \sqrt{2}$
(D) $W = RT2 - \sqrt{2}$

Answer: (D) $W = RT2 - \sqrt{2}$ · Key from source paper

Q70 JEE Main 2023 · 1 Feb · Shift 2 MCQ

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° C, will be

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(A) 16.5 K
(B) 33 K
(C) 66 K
(D) 62 K

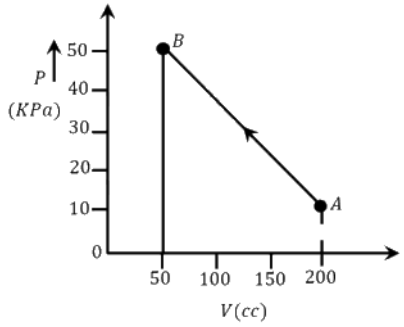
Answer: (D) 62 K · Key from source paper

Q71 JEE Main 2023 · 31 Jan · Shift 1 MCQ

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

(see the figure above)

Q8. 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



(1) 6 J
(2) Zero
(3) -4.5 J
(4) 4.5 J

(A) 6 J
(B) Zero
(C) -4.5 J
(D) 4.5 J

Answer: (D) 4.5 J · Key from source paper

Q72 JEE Main 2023 · 31 Jan · Shift 2 MCQ

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:

(A) 525 J
(B) 441 J
(C) 572 J
(D) 735 J

Answer: (A) 525 J · Key from source paper

Q73 JEE Main 2023 · 31 Jan · Shift 2 MCQ

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.

(A) $\frac{4}{3}$
(B) $\frac{3}{1}$
(C) $\frac{1}{2}$
(D) $\frac{3}{2}$

Answer: (A) $\frac{4}{3}$ · Key from source paper

Q74 JEE Main 2023 · 30 Jan · Shift 1 MCQ

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 :

(A) A and E only
(B) B and D only
(C) C and E only
(D) C and D only

Answer: (D) C and D only · Key from source paper

Q75 JEE Main 2023 · 30 Jan · Shift 2 MCQ

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 °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 :

(A) A is true but R is false
(B) Both A and R are true but R is NOT the correct explanation of A
(C) A is false but R is true
(D) Both A and R are true and R is the correct explanation of A

Answer: (D) Both A and R are true and R is the correct explanation of A · Key from source paper

Q76 JEE Main 2023 · 29 Jan · Shift 1 MCQ

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 :

(A) A is correct but R is not correct
(B) A is not correct but R is correct
(C) Both A and R are correct and R is the correct explanation of A
(D) Both A and R are correct but R is not the correct explanation of A

Answer: (C) Both A and R are correct and R is the correct explanation of A · Key from source paper

Q77 JEE Main 2023 · 25 Jan · Shift 1 MCQ

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 the sink same, the new temperature of the source will be:

(A) 360 K
(B) 1000 K
(C) 900 K
(D) 300 K

Answer: (B) 1000 K · Key from source paper

Q78 JEE Main 2023 · 25 Jan · Shift 2 MCQ

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 :

(A) A-II, B-I, C-III, D-IV
(B) A-II, B-I, C-IV, D-III
(C) A-I, B-II, C-IV, D-III
(D) A-I, B-II, C-III, D-IV

Answer: (B) A-II, B-I, C-IV, D-III · Key from source paper

Q79 JEE Main 2023 · 24 Jan · Shift 1 MCQ

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 $1600\ \mathrm{cm}^3$ during this phase change, then the increase in internal energy in the process will be :

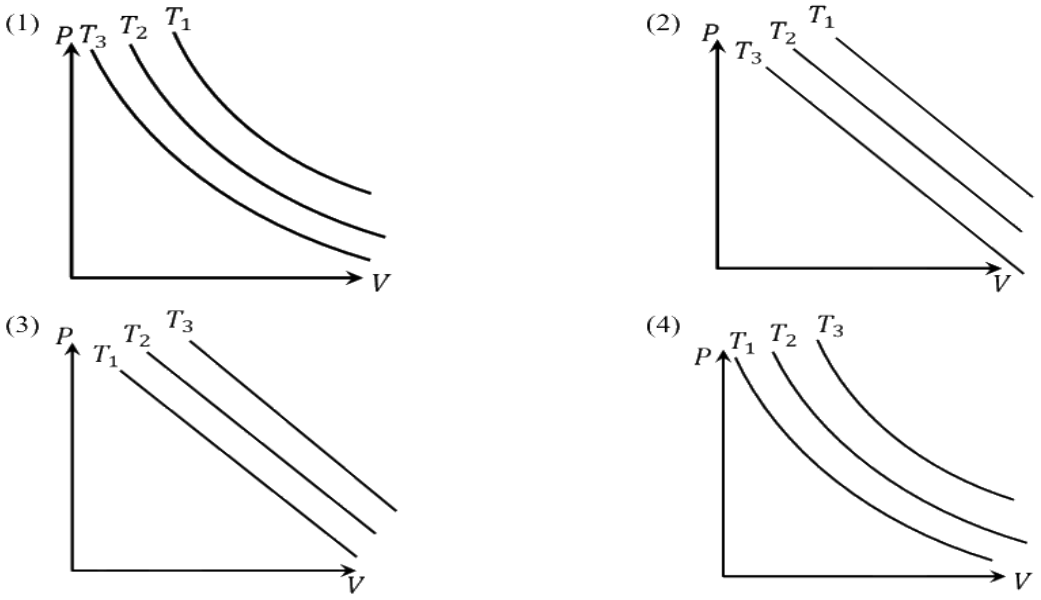
(A) 4320 J
(B) 432000 J
(C) 4800 J
(D) 4.32×10^8 J

Answer: (A) 4320 J · Key from source paper

Q80 JEE Main 2023 · 24 Jan · Shift 2 MCQ

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:

Q12. 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:



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q81 JEE Main 2022 · 29 Jul · Shift 1 Numerical

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 $\frac{d_2}{d_1} = 32$)

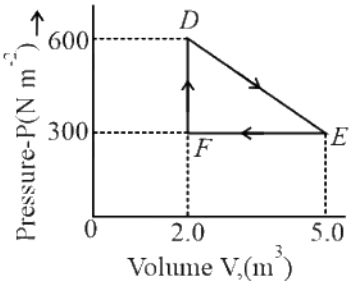
Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q82 JEE Main 2022 · 29 Jul · Shift 2 MCQ

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
(see the figure above)

Q8. 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



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

(A) -450 J
(B) 450 J
(C) 900 J
(D) 1350 J

Answer: (B) 450 J · Key from source paper

Q83 JEE Main 2022 · 28 Jul · Shift 1 MCQ

A Carnot engine has efficiency of 50%. If the temperature of sink is reduced by $40^{\circ}\mathrm{C}$, its efficiency increases by 30%. The temperature of the source will be :

(A) $166.7\ \mathrm{K}$
(B) $255.1\ \mathrm{K}$
(C) $266.7\ \mathrm{K}$
(D) $367.7\ \mathrm{K}$

Answer: (C) $266.7\ \mathrm{K}$ · Key from source paper

Q84 JEE Main 2022 · 28 Jul · Shift 2 MCQ

A vessel contains $14\ \mathrm{g}$ of nitrogen gas at a temperature of $27^{\circ}\mathrm{C}$. The amount of heat to be transferred to the gas to double the r.m.s. speed of its molecules will be : (Take $R = 8.32\ \mathrm{J\,mol^{-1}k^{-1}}$)

(A) $2229\ \mathrm{J}$
(B) $5616\ \mathrm{J}$
(C) $9360\ \mathrm{J}$
(D) $13,104\ \mathrm{J}$

Answer: (C) $9360\ \mathrm{J}$ · Key from source paper

Q85 JEE Main 2022 · 28 Jul · Shift 2 Numerical

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

Numerical value type: the answer is a number.

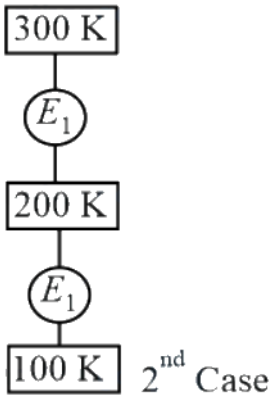
Answer: 750. · Key from source paper

Q86 JEE Main 2022 · 27 Jul · Shift 2 MCQ

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 :

(see the figure above)

Q8. In 1stmsup case, Carnot engine operates between temperatures 300 K and 100 K. In 2ndmsup case, as shown in the figure, a combination of two engines is used. The efficiency of this combination (in 2ndmsup case) will be :



2nd Case

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

(A) same as the 1st case
(B) always greater than the 1st case
(C) always less than the 1st case
(D) may increase or decrease with respect to the 1st case

Answer: (A) same as the 1st case · Key from source paper

Q87 JEE Main 2022 · 26 Jul · Shift 1 MCQ

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 $R = 8.3\ \text{J K}^{-1}\ \text{mol}^{-1}$)

(A) 5810 J
(B) 3486 J
(C) 11620 J
(D) 6972 J

Answer: (B) 3486 J · Key from source paper

Q88 JEE Main 2022 · 26 Jul · Shift 1 MCQ

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

(A) P
(B) $8P$
(C) $32P$
(D) $64P$

Answer: (C) $32P$ · Key from source paper

Q89 JEE Main 2022 · 25 Jul · Shift 1 MCQ

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 $\gamma = 1.5$)

(A) 3.536×10^{5} Pa
(B) 3.536×10^{6} Pa
(C) 1.25×10^{6} Pa
(D) 1.25×10^{5} Pa

Answer: (B) 3.536×10^{6} **Pa** · Key from source paper

Q90 JEE Main 2022 · 25 Jul · Shift 2 MCQ

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

(A) 0.41
(B) 0.56
(C) 0.73
(D) 0.70

Answer: (B) 0.56 · Key from source paper

Q91 JEE Main 2022 · 29 Jun · Shift 1 MCQ

A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by $20.0^{\circ}\mathrm{C}$ will be (Given gas constant $R = 8.3\ \mathrm{J\,K^{-1}\,mol^{-1}}$)

(A) 249 J
(B) 415 J
(C) 498 J
(D) 830 J

Answer: (C) 498 J · Key from source paper

Q92 JEE Main 2022 · 29 Jun · Shift 1 Numerical

300 calories of heat is given to a heat engine, and it rejects 225 calories of heat. If source temperature is $227^{\circ}\mathrm{C}$, then the temperature of sink will be _____ $^{\circ}\mathrm{C}$.

Numerical value type: the answer is a number.

Answer: 102. · Key from source paper

Q93 JEE Main 2022 · 29 Jun · Shift 2 MCQ

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

(A) $W_2 < W_1 < W_3$
(B) $W_1 < W_2 < W_3$
(C) $W_2 < W_3 < W_1$
(D) $W_3 < W_1 < W_2$

Answer: (A) $W_2 < W_1 < W_3$ · Key from source paper

Q94 JEE Main 2022 · 28 Jun · Shift 1 MCQ

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 $W = \dfrac{\mu R(T_2 - T_1)}{1 - \gamma}$, where $\gamma = \dfrac{C_P}{C_V}$ 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.

(A) Both statement-I and statement-II are true.
(B) Both statement-I and statement-II are false.
(C) Statement-I is true but statement-II is false.
(D) Statement-I is false but statement-II is true.

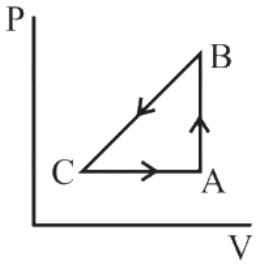
Answer: (A) Both statement-I and statement-II are true. · Key from source paper

Q95 JEE Main 2022 · 28 Jun · Shift 2 MCQ

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

(see the figure above)

Q9. 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



(1) 20 J
(2) 30 J
(3) −30 J
(4) −60 J

(A) 20 J
(B) 30 J
(C) −30 J
(D) −60 J

Answer: (B) 30 J · Key from source paper

Q96 JEE Main 2022 · 27 Jun · Shift 1 Numerical

In a carnot engine, the temperature of reservoir is $527^{\circ}\mathrm{C}$ and that of sink is $200\ \mathrm{K}$. If the workdone by the engine when it transfers heat from reservoir to sink is $12000\ \mathrm{kJ}$, the quantity of heat absorbed by the engine from reservoir is _____ $\times 10^6$ J.

Numerical value type: the answer is a number.

Answer: 16. · Key from source paper

Q97 JEE Main 2022 · 27 Jun · Shift 2 Numerical

A diatomic gas ($\gamma = 1.4$) does $400\ \mathrm{J}$ of work when it is expanded isobarically. The heat given to the gas in the process is _____ J.

Numerical value type: the answer is a number.

Answer: 1400. · Key from source paper

Q98 JEE Main 2022 · 26 Jun · Shift 1 MCQ

The efficiency of a Carnot's engine, working between steam point and ice point, will be

(A) 26.81%
(B) 37.81%
(C) 47.81%
(D) 57.81%

Answer: (A) 26.81% · Key from source paper

Q99 JEE Main 2022 · 26 Jun · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 540. · Key from source paper

Q100 JEE Main 2022 · 24 Jun · Shift 1 MCQ

A Carnot engine whose heat sinks at $27^{\circ}\mathrm{C}$, 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 ?

(A) Increases by $18^{\circ}\mathrm{C}$
(B) Increases by $200^{\circ}\mathrm{C}$
(C) Increases by $120^{\circ}\mathrm{C}$
(D) Increases by $73^{\circ}\mathrm{C}$

Answer: (B) Increases by $200^{\circ}\mathrm{C}$ · Key from source paper

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Q101 JEE Main 2022 · 24 Jun · Shift 2 MCQ

A Carnot engine takes $5000\ \mathrm{kcal}$ of heat from a reservoir at $727^{\circ}\mathrm{C}$ and gives heat to a sink at $127^{\circ}\mathrm{C}$. The work done by the engine is

(A) $3 \times 10^{6}\ \mathrm{J}$
(B) Zero
(C) $8.4 \times 10^{6}\ \mathrm{J}$
(D) $12.6 \times 10^{6}\ \mathrm{J}$

Answer: (D) $12.6 \times 10^{6}\ \mathrm{J}$ · Key from source paper

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Q102 JEE Main 2022 · 24 Jun · Shift 2 Numerical

A monoatomic gas performs a work of $\frac{Q}{4}$ where Q is the heat supplied to it. The molar heat capacity of the gas will be _____ R during this transformation. Where R is the gas constant.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q103 JEE Main 2021 · 1 Sep · Shift 2 Numerical

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}

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

Q104 JEE Main 2021 · 31 Aug · Shift 1 MCQ

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:

(A) 180.4°C
(B) 382°C
(C) 174 K
(D) 280°C

Answer: (C) 174 K · Key from source paper

Q105 JEE Main 2021 · 31 Aug · Shift 2 Numerical

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.

Numerical value type: the answer is a number.

Answer: 480. · Key from source paper

Q106 JEE Main 2021 · 27 Aug · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 500. · Key from source paper

Q107 JEE Main 2021 · 26 Aug · Shift 1 MCQ

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?

(A) 2.5×10^1 s
(B) 2.5×10^2 s
(C) 2.4×10^3 s
(D) 4.1×10^1 s

Answer: (B) 2.5×10^2 s · Key from source paper

Q108 JEE Main 2021 · 26 Aug · Shift 2 MCQ

A refrigerator consumes an average 35 W power to operate between temperature -10°C to 25°C. If there is no loss of energy then how much average heat per second does it transfer?

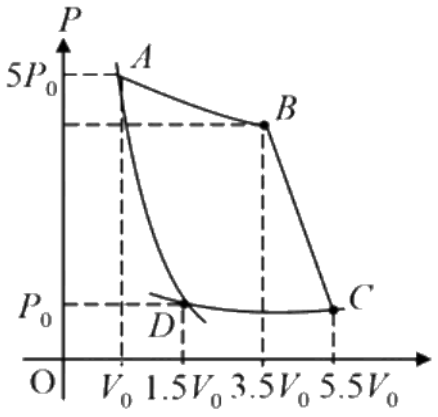
(A) 350 J s^{-1}
(B) 298 J s^{-1}
(C) 263 J s^{-1}
(D) 35 J s^{-1}

Answer: (C) 263 J s^{-1} · Key from source paper

Q109 JEE Main 2021 · 27 Jul · Shift 1 MCQ

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 $A \to B$ and $C \to D$ are T_1 and T_2 ($T_1 > T_2$) respectively. *(see the figure above)*
Choose the correct option out of the following for work done if processes BC and DA are adiabatic.

Q8. 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 $A \to B$ and $C \to D$ 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.
(1) $W_{AB} = W_{DC}$
(2) $W_{AD} = W_{BC}$
(3) $W_{BC} + W_{DA} > 0$
(4) $W_{AB} < W_{CD}$

(A) $W_{AB} = W_{DC}$
(B) $W_{AD} = W_{BC}$
(C) $W_{BC} + W_{DA} > 0$
(D) $W_{AB} < W_{CD}$

Answer: (B) $W_{AD} = W_{BC}$ · Key from source paper

Q110 JEE Main 2021 · 27 Jul · Shift 2 MCQ

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

(A) work done by the gas is close to $332\ \mathrm{J}$
(B) work done on the gas is close to $582\ \mathrm{J}$
(C) work done by the gas is close to $582\ \mathrm{J}$
(D) work done on the gas is close to $332\ \mathrm{J}$

Answer: (B) work done on the gas is close to $582\ \mathrm{J}$ · Key from source paper

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Q111 JEE Main 2021 · 27 Jul · Shift 2 MCQ

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 :

(A) $\frac{2}{3}\mathrm{T}_1 + \frac{3}{2}\mathrm{T}_3$
(B) $\frac{1}{3}\mathrm{T}_1 + \frac{2}{3}\mathrm{T}_3$
(C) $\frac{3}{2}\mathrm{T}_1 + \frac{1}{3}\mathrm{T}_3$
(D) $\frac{2}{3}\mathrm{T}_1 + \frac{1}{3}\mathrm{T}_3$

Answer: (D) $\frac{2}{3}\mathrm{T}_1 + \frac{1}{3}\mathrm{T}_3$ · Key from source paper

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Q112 JEE Main 2021 · 25 Jul · Shift 1 MCQ

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:

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

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

(C) $\frac{l_2}{l_1}$

(D) $\frac{l_1}{l_2}$

Answer: (B) $\left(\frac{l_2}{l_1}\right)^{\frac{2}{3}}$ · Key from source paper

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Q113 JEE Main 2021 · 25 Jul · Shift 1 MCQ

For a gas $C_P - C_V = R$ in a state P and $C_P - C_V = 1.10R$ in a state Q, T_P and T_Q are the temperatures in two different states P and Q, respectively. Then

(A) $T_P = T_Q$

(B) $T_P < T_Q$

(C) $T_P = 0.9T_Q$

(D) $T_P > T_Q$

Answer: (D) $T_P > T_Q$ · Key from source paper

Q114 JEE Main 2021 · 25 Jul · Shift 2 MCQ

A heat engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by $62^\circ\mathrm{C}$, its efficiency get doubled. The temperature of the source is :

(A) $124^\circ\mathrm{C}$

(B) $37^\circ\mathrm{C}$

(C) $62^\circ\mathrm{C}$

(D) $99^\circ\mathrm{C}$

Answer: (D) $99^\circ\mathrm{C}$ · Key from source paper

Q115 JEE Main 2021 · 20 Jul · Shift 1 MCQ

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

(A) $250R$

(B) $750R$

(C) $175R$

(D) $500R$

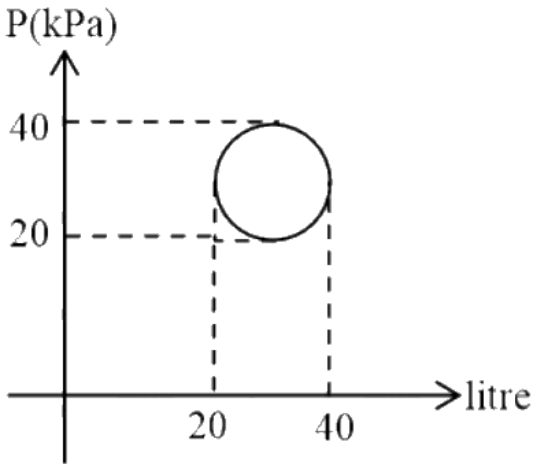
Answer: (D) $500R$ · Key from source paper

Q116 JEE Main 2021 · 20 Jul · Shift 1 Numerical

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

(see the figure above)

Q25. In the reported figure, heat energy absorbed by a system in going through a cyclic process is _____πJ.



Numerical value type: the answer is a number.

Answer: 100. · Key from source paper

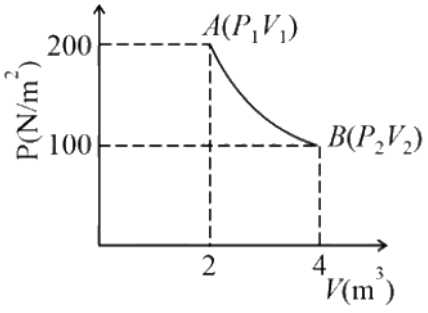
Q117 JEE Main 2021 · 20 Jul · Shift 2 Numerical

One mole of an ideal gas at 27 °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, $R = 8.3$ J mole^{-1} K, $\ln 2 = 0.6931$]
(Round off to the nearest integer)
(Round off to the nearest integer)

(see the figure above)

Q24. One mole of an ideal gas at 27 °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, $R = 8.3$ J mole^{-1} K, $\ln 2 = 0.6931$] (Round off to the nearest integer)

(Round off to the nearest integer)



Numerical value type: the answer is a number.

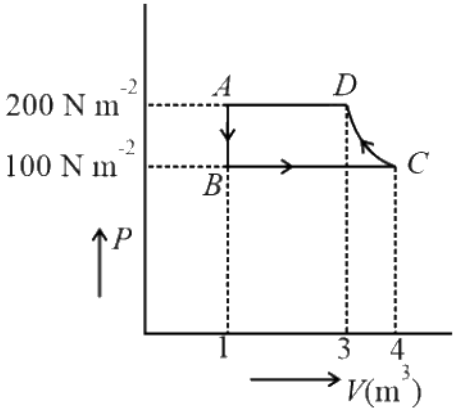
Answer: 17258. · Key from source paper

Q118 JEE Main 2021 · 18 Mar · Shift 1 MCQ

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 $\gamma = 1.4$) :

(see the figure above)

Q6. 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 $\gamma = 1.4$) :



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

(A) -500 J
(B) -400 J
(C) 400 J
(D) 200 J

Answer: (A) -500 J · Key from source paper

Q119 JEE Main 2021 · 18 Mar · Shift 2 MCQ

For an adiabatic expansion of an ideal gas, the fractional change in its pressure is equal to (where γ is the ratio of specific heats):

(A) $-\gamma\frac{dV}{V}$
(B) $-\gamma\frac{V}{dV}$
(C) $-\frac{1}{\gamma}\frac{dV}{V}$
(D) $\frac{dV}{V}$

Answer: (A) $-\gamma\frac{dV}{V}$ · Key from source paper

Q120 JEE Main 2021 · 18 Mar · Shift 2 MCQ

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:

(A) $S_1 \times S_2$
(B) $S_1 - S_2$
(C) $\frac{S_1}{S_2}$
(D) $S_1 + S_2$

Answer: (D) $S_1 + S_2$ · Key from source paper

Q121 JEE Main 2021 · 17 Mar · Shift 1 MCQ

A Carnot's engine working between $400\ \mathrm{K}$ and $800\ \mathrm{K}$ has a work output of $1200\ \mathrm{J}$ per cycle. The amount of heat energy supplied to the engine from the source in each cycle is:

(A) $3200\ \mathrm{J}$
(B) $1800\ \mathrm{J}$
(C) $1600\ \mathrm{J}$
(D) $2400\ \mathrm{J}$

Answer: (D) $2400\ \mathrm{J}$ · Key from source paper

Q122 JEE Main 2021 · 16 Mar · Shift 1 MCQ

In thermodynamics, heat and work are :

(A) Path functions
(B) Intensive thermodynamic state variables
(C) Extensive thermodynamic state variables
(D) Point functions

Answer: (A) Path functions · Key from source paper

Q123 JEE Main 2021 · 16 Mar · Shift 2 Numerical

For an ideal heat engine, the temperature of the source is $127^{\circ}\mathrm{C}$. In order to have 60% efficiency the temperature of the sink should be _____$^{\circ}\mathrm{C}$. (Round off to the nearest integer)

Numerical value type: the answer is a number.

Answer: -113. · Key from source paper

Q124 JEE Main 2021 · 26 Feb · Shift 2 Numerical

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]

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

Q125 JEE Main 2021 · 26 Feb · Shift 2 Numerical

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 $90\ \mathrm{K}$ will be xR. The value of x is [R universal gas constant]

Numerical value type: the answer is a number.

Answer: 60. · Key from source paper

Q126 JEE Main 2021 · 25 Feb · Shift 1 MCQ

A diatomic gas, having $C_P = \frac{7}{2}R$ and $C_V = \frac{5}{2}R$, is heated at constant pressure. The ratio $dU : dQ : dW$

(A) $3 : 5 : 2$

(B) $5 : 7 : 3$

(C) $5 : 7 : 2$

(D) $3 : 7 : 2$

Answer: (C) $5 : 7 : 2$ · Key from source paper

Q127 JEE Main 2021 · 25 Feb · Shift 1 Numerical

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 ;

Numerical value type: the answer is a number.

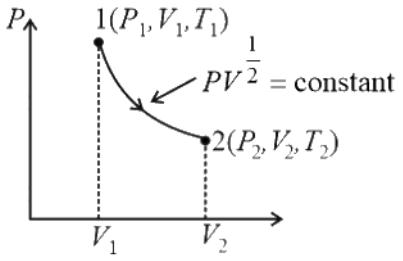
Answer: 50. · Key from source paper

Q128 JEE Main 2021 · 25 Feb · Shift 2 MCQ

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 :

(see the figure above)

Q4. 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 :



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

(A) $\sqrt{2}$
(B) $\frac{1}{\sqrt{2}}$
(C) $\frac{1}{2}$
(D) 2

Answer: (A) $\sqrt{2}$ · Key from source paper

Q129 JEE Main 2021 · 25 Feb · Shift 2 Numerical

A reversible heat engine converts one-fourth of the heat input into work. When the temperature of the sink is reduced by $52\ \mathrm{K}$, its efficiency is doubled. The temperature in Kelvin of the source will be _____.

Numerical value type: the answer is a number.

Answer: 208. · Key from source paper

Q130 JEE Main 2021 · 24 Feb · Shift 1 MCQ

Match List I with List II.
List I
(a) Isothermal
(b) Isochoric
(c) Adiabatic
(d) Isobaric
List II
(i) Pressure constant
(ii) Temperature constant
(iii) Volume constant
(iv) Heat content is constant
Choose the correct answer from the options given below:

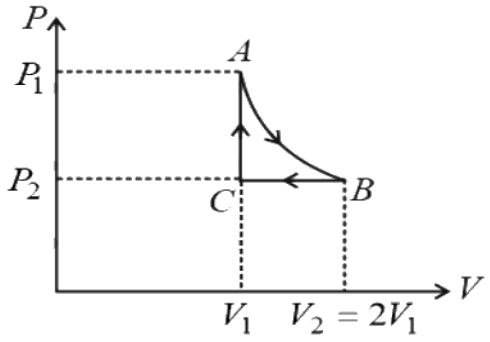
(A) (a) → (ii), (b) → (iii), (c) → (iv), (d) → (i)
(B) (a) → (iii), (b) → (ii), (c) → (i), (d) → (iv)
(C) (a) → (i), (b) → (iii), (c) → (ii), (d) → (iv)
(D) (a) → (ii), (b) → (iv), (c) → (iii), (d) → (i)

Answer: (A) (a) → (ii), (b) → (iii), (c) → (iv), (d) → (i) · Key from source paper

Q131 JEE Main 2021 · 24 Feb · Shift 1 MCQ

n mole of a perfect gas undergoes a cyclic process $ABCA$ (see figure) consisting of the following processes.
$A \to B$: 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
$B \to C$: Isobaric compression at pressure P_2 to initial volume V_1.
$C \to A$: Isochoric change leading to change of pressure from P_2 to P_1
Total work done in the complete cycle $ABCA$ is:
(see the figure above)

Q10. n mole of a perfect gas undergoes a cyclic process $ABCA$ (see figure) consisting of the following processes.
$A \to B$: 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
$B \to C$: Isobaric compression at pressure P_2 to initial volume V_1.
$C \to A$: Isochoric change leading to change of pressure from P_2 to P_1
Total work done in the complete cycle $ABCA$ is:



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

(A) $nRT\ln 2 - \frac{1}{2}$
(B) $nRT\ln 2$
(C) $nRT\ln 2 + \frac{1}{2}$
(D) 0

Answer: (A) $nRT\ln 2 - \frac{1}{2}$ · Key from source paper

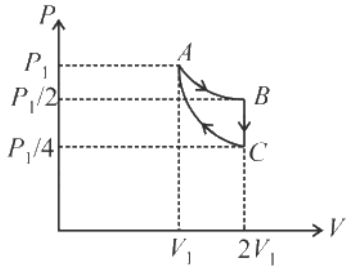
Q132 JEE Main 2021 · 24 Feb · Shift 2 MCQ

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 ($B \to C$). 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:

(see the figure above)

Q5. 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 ($B \to C$). 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:



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

(A) 0
(B) $RT\ln(2)$
(C) $-\frac{RT}{2(\gamma-1)}$
(D) $RT\left[\ln(2)-\frac{1}{2(\gamma-1)}\right]$

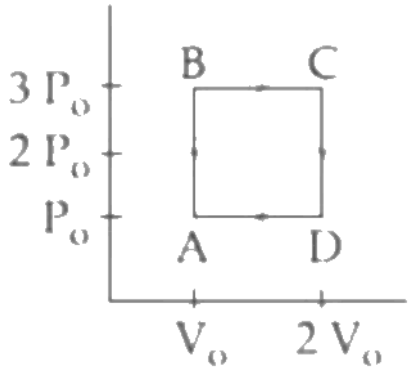
Answer: (D) $RT\left[\ln(2)-\frac{1}{2(\gamma-1)}\right]$ · Key from source paper

Q133 JEE Main 2020 · 6 Sep · Shift 2 Numerical

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

(see the figure above)

Q22. 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



Numerical value type: the answer is a number.

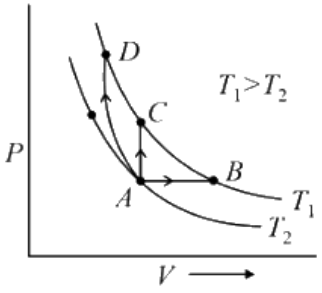
Answer: 19. · Key from source paper

Q134 JEE Main 2020 · 5 Sep · Shift 1 MCQ

Three different processes that can occur in an ideal monoatomic gas are shown in the P vs V diagram. The paths are labelled as $A \to B, A \to C$ and $A \to D$. 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:

(see the figure above)

Q7. Three different processes that can occur in an ideal monoatomic gas are shown in the P vs V diagram. The paths are labelled as $A \to B, A \to C$ and $A \to D$. 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:



(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) $E_{AB} > E_{AC} > E_{AD}, W_{AB} < W_{AC} < W_{AD}$

(A) $E_{AB} = E_{AC} < E_{AD}, W_{AB} > 0, W_{AC} = 0, W_{AD} < 0$
(B) $E_{AB} = E_{AC} = E_{AD}, W_{AB} > 0, W_{AC} = 0, W_{AD} < 0$
(C) $E_{AB} < E_{AC} < E_{AD}, W_{AB} > 0, W_{AC} > W_{AD}$
(D) $E_{AB} > E_{AC} > E_{AD}, W_{AB} < W_{AC} < W_{AD}$

Answer: (B) $E_{AB} = E_{AC} = E_{AD}, W_{AB} > 0, W_{AC} = 0, W_{AD} < 0$ · Key from source paper

Q135 JEE Main 2020 · 5 Sep · Shift 2 MCQ

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:

(A) 32
(B) 326
(C) 128
(D) $\frac{1}{32}$

Answer: (C) 128 · Key from source paper

Q136 JEE Main 2020 · 4 Sep · Shift 2 MCQ

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) $\Delta U = 0$

(A) (I) - (A), (II) - (B), (III) - (D), (IV) - (D)

(B) (I) - (B), (II) - (A), (III) - (D), (IV) - (C)

(C) (I) - (A), (II) - (A), (III) - (B), (IV) - (C)

(D) (I) - (B), (II) - (D), (III) - (A), (IV) - (C)

Answer: (D) (I) - (B), (II) - (D), (III) - (A), (IV) - (C) · Key from source paper

Q137 JEE Main 2020 · 3 Sep · Shift 1 MCQ

A balloon filled with helium ($32^{\circ}\mathrm{C}$ and $1.7\ \mathrm{atm}$) bursts. Immediately after wards the expansion of helium can be considered as :

(A) irreversible isothermal

(B) irreversible adiabatic

(C) reversible adiabatic

(D) reversible isothermal

Answer: (B) irreversible adiabatic · Key from source paper

Q138 JEE Main 2020 · 3 Sep · Shift 2 Numerical

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 $= 80\ \mathrm{Cal/gram}$) to the nearest integer?

Numerical value type: the answer is a number.

Answer: 8791. · Key from source paper

Q139 JEE Main 2020 · 2 Sep · Shift 1 Numerical

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 XkJ. The value of X to the nearest integer is:

Numerical value type: the answer is a number.

Answer: 46. · Key from source paper

Q140 JEE Main 2020 · 2 Sep · Shift 2 MCQ

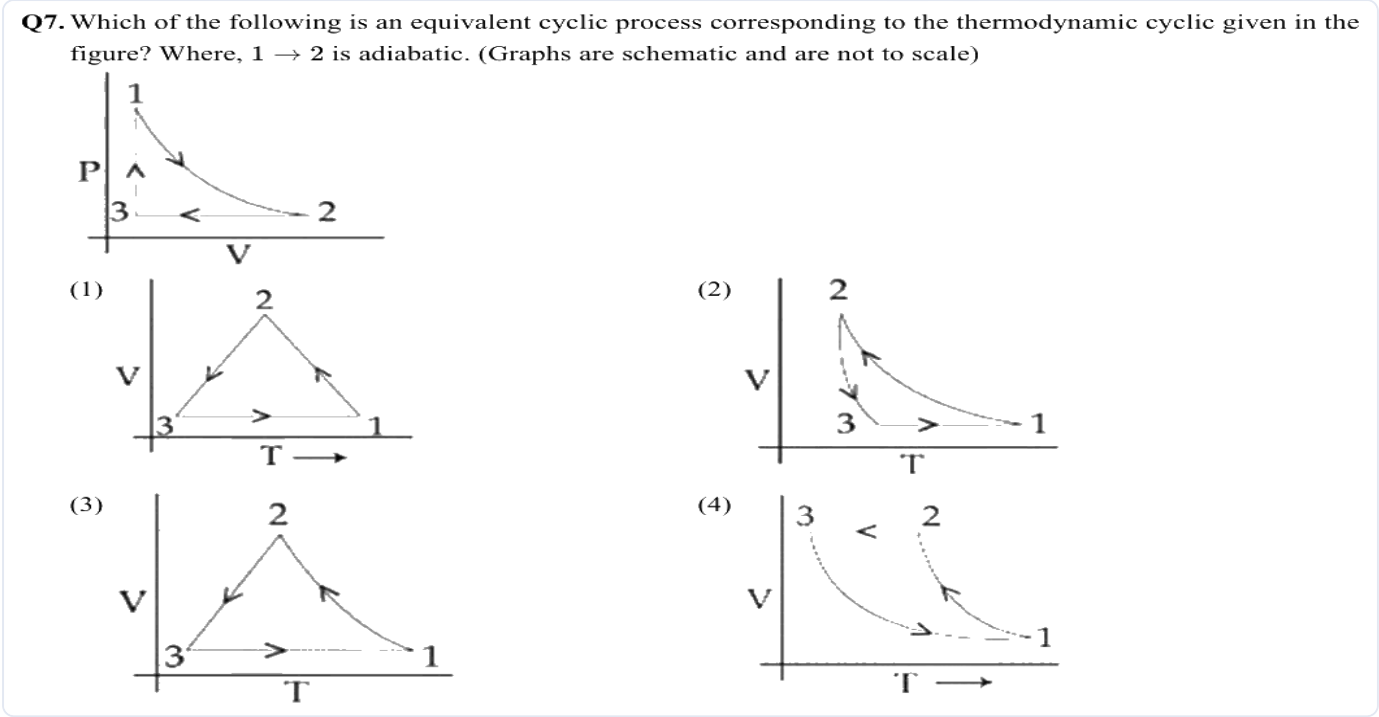
A heat engine is involved with exchange of heat of $1915\ \text{J}$, $-40\ \text{J}$, $+125\ \text{J}$ and $-Q\ \text{J}$, during one cycle achieving and efficiency of 50.0%. The value of Q is:

(A) $640\ \text{J}$
(B) $40\ \text{J}$
(C) $980\ \text{J}$
(D) $400\ \text{J}$

Answer: (C) $980\ \text{J}$ · Key from source paper

Q141 JEE Main 2020 · 9 Jan · Shift 1 MCQ

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)
(see the figure above)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q142 JEE Main 2020 · 9 Jan · Shift 2 Numerical

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 ^oK) is (to the nearest integer) _____.

Numerical value type: the answer is a number.

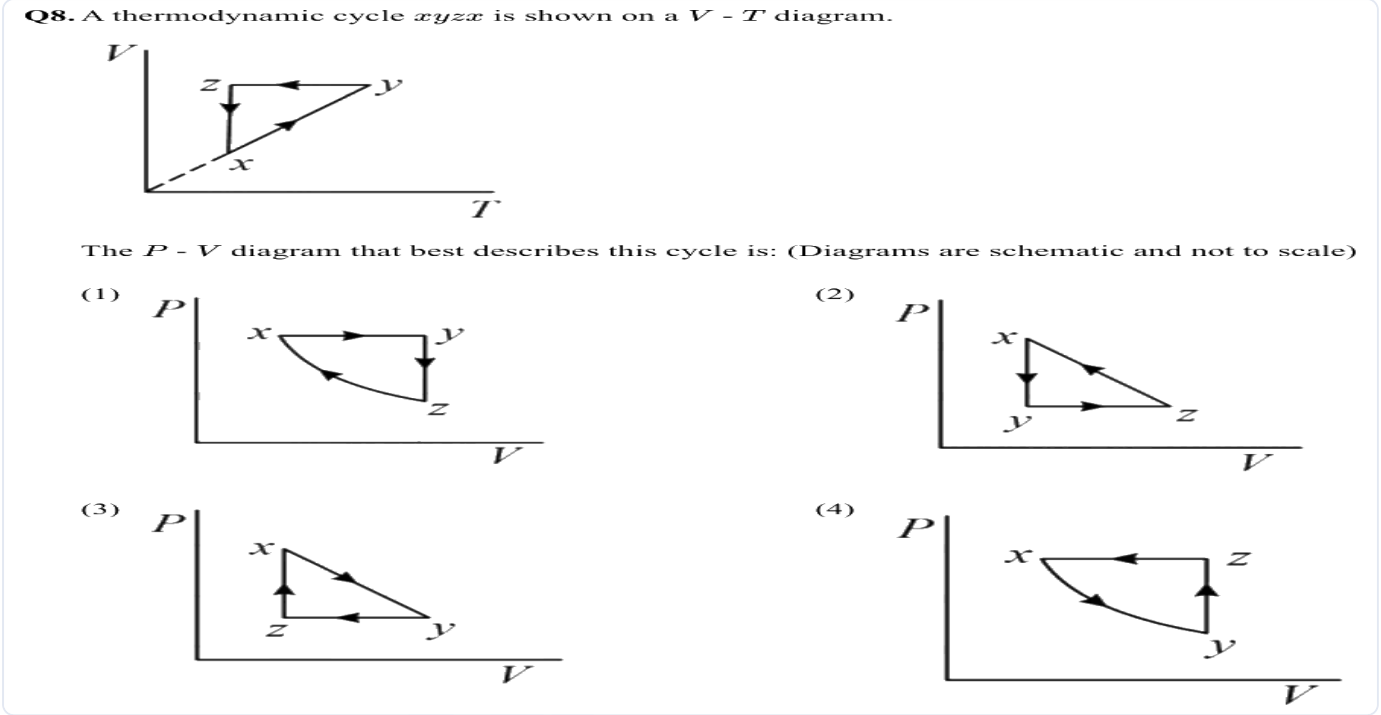
Answer: 1819. · Key from source paper

Q143 JEE Main 2020 · 8 Jan · Shift 1 MCQ

A thermodynamic cycle $xyzx$ is shown on a V - T diagram.

(see the figure above)

The P - V diagram that best describes this cycle is: (Diagrams are schematic and not to scale)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Key from source paper

Q144 JEE Main 2020 · 8 Jan · Shift 2 MCQ

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

(A) $99\ \mathrm{J}$
(B) $100\ \mathrm{J}$
(C) $1\ \mathrm{J}$
(D) $90\ \mathrm{J}$

Answer: (D) $90\ \mathrm{J}$ · Key from source paper

Q145 JEE Main 2020 · 7 Jan · Shift 1 MCQ

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: $(3^{1.4} = 4.6555)$ [Take air to be an ideal gas]

(A) $60.7\mathrm{J}$
(B) $90.5\mathrm{J}$
(C) $100.8\mathrm{J}$
(D) $48\mathrm{J}$

Answer: (B) $90.5\mathrm{J}$ · Key from source paper

Q146 JEE Main 2020 · 7 Jan · Shift 1 Numerical

A Carnot engine operates between two reservoirs of temperatures $900\mathrm{K}$ and $300\mathrm{K}$. The engine performs $1200\mathrm{J}$ of work per cycle. The heat energy (in J) delivered by the engine to the low temperature reservoir, in a cycle, is _____

Numerical value type: the answer is a number.

Answer: 600. · Key from source paper

Q147 JEE Main 2020 · 7 Jan · Shift 2 MCQ

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, $\mathrm{T_1}$ and $\mathrm{T_2}$. The temperature of the hot reservoir of the first engine is $\mathrm{T_1}$ and the temperature of the cold reservoir of the second engine is $\mathrm{T_2}$. T is temperature of the sink of first engine which is also the source for the second engine. How is T related to $\mathrm{T_1}$ and $\mathrm{T_2}$, if both the engines perform equal amount of work?

(A) $\mathrm{T} = \frac{2\mathrm{T_1T_2}}{\mathrm{T_1+T_2}}$
(B) $\mathrm{T} = \frac{\mathrm{T_1+T_2}}{2}$
(C) $\mathrm{T} = \sqrt{\mathrm{T_1T_2}}$
(D) $\mathrm{T} = 0$

Answer: (B) $\mathrm{T} = \frac{\mathrm{T_1+T_2}}{2}$ · Key from source paper

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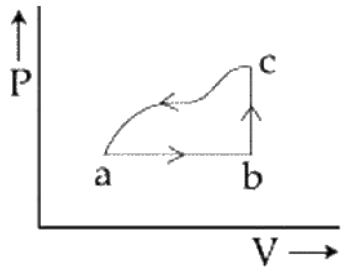
Q148 JEE Main 2019 · 12 Apr · Shift 1 MCQ

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 $-180\ \mathrm{J}$. 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:
(see the figure above)

Q10. 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:



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

(A) 130 J
(B) 100 J
(C) 120 J
(D) 140 J

Answer: (A) 130 J · Key from source paper

Q149 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A Carnot engine has an efficiency of $\frac{1}{6}$. When the temperature of the sink is reduced by $62\ ^\circ\mathrm{C}$, its efficiency is doubled. The temperatures of the source and the sink are, respectively,

(A) $124\ ^\circ\mathrm{C},\ 62\ ^\circ\mathrm{C}$
(B) $37\ ^\circ\mathrm{C},\ 99\ ^\circ\mathrm{C}$
(C) $99\ ^\circ\mathrm{C},\ 37\ ^\circ\mathrm{C}$
(D) $62\ ^\circ\mathrm{C},\ 124\ ^\circ\mathrm{C}$

Answer: (C) $99\ ^\circ\mathrm{C},\ 37\ ^\circ\mathrm{C}$ · Checked by our team

Q150 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A diatomic gas with rigid molecules does 10 J of work when expanded at constant pressure. What would be the heat energy absorbed by the gas, in this process?

(A) 40 J
(B) 35 J
(C) 25 J
(D) 30 J

Answer: (B) 35 J · Key from source paper

Q151 JEE Main 2019 · 10 Apr · Shift 1 MCQ

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:

(A) $\frac{4nR}{C_v+nR}$
(B) $\frac{4nR}{C_v-nR}$
(C) $\frac{nR}{C_v+nR}$
(D) $\frac{nR}{C_v-nR}$

Answer: (C) $\frac{nR}{C_v+nR}$ · Key from source paper

Q152 JEE Main 2019 · 10 Apr · Shift 1 MCQ

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 $20^{\circ}\mathrm{C}$ is:
[Given that $R = 8.31\ \mathrm{J\ mol^{-1}\ K^{-1}}$]

(A) $748\ \mathrm{J}$
(B) $700\ \mathrm{J}$
(C) $350\ \mathrm{J}$
(D) $374\ \mathrm{J}$

Answer: (A) $748\ \mathrm{J}$ · Key from source paper

Q153 JEE Main 2019 · 10 Apr · Shift 2 MCQ

When heat Q is supplied to a diatomic gas of rigid molecules, at constant volume its temperature increases by ΔT. The heat required to produce the same change in temperature, at a constant pressure is:

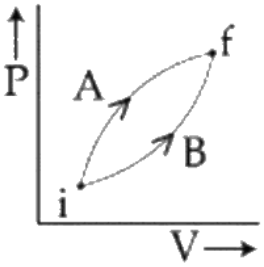
(A) $\frac{3}{2}Q$
(B) $\frac{7}{5}Q$
(C) $\frac{5}{3}Q$
(D) $\frac{2}{3}Q$

Answer: (B) $\frac{7}{5}Q$ · Key from source paper

Q154 JEE Main 2019 · 9 Apr · Shift 1 MCQ

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:
(see the figure above)

Q10. 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:



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

(A) $\Delta Q_A < \Delta Q_B;\ \Delta U_A < \Delta U_B$
(B) $\Delta Q_A = \Delta Q_B;\ \Delta U_A = \Delta U_B$
(C) $\Delta Q_A > \Delta Q_B;\ \Delta U_A = \Delta U_B$
(D) $\Delta Q_A > \Delta Q_B;\ \Delta U_A > \Delta U_B$

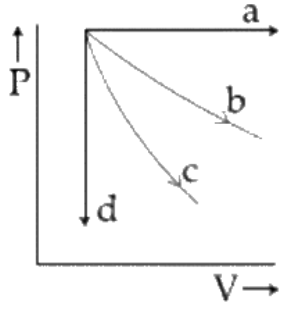
Answer: (C) $\Delta Q_A > \Delta Q_B;\ \Delta U_A = \Delta U_B$ · Key from source paper

Q155 JEE Main 2019 · 8 Apr · Shift 2 MCQ

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:

(see the figure above)

Q11. 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:



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

(A) a d b c
(B) d a b c
(C) a d c b
(D) d a c b

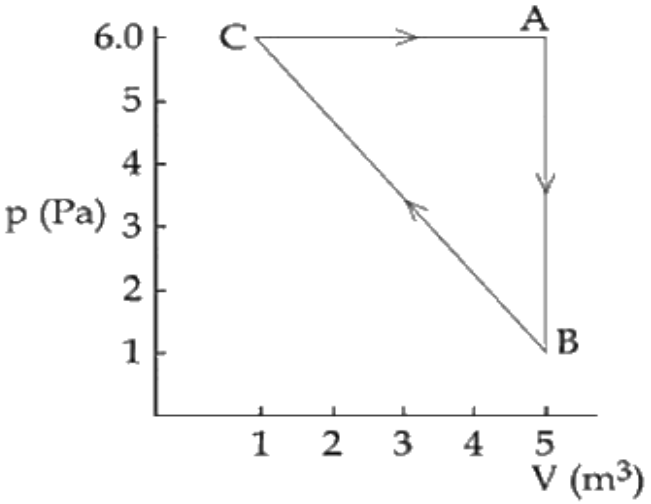
Answer: (B) d a b c · Key from source paper

Q156 JEE Main 2019 · 12 Jan · Shift 1 MCQ

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

(see the figure above)

Q9. For the given cyclic process CAB as shown for a gas, the work done is:



(1) 10 J
(2) 5 J
(3) 1 J
(4) 30 J

(A) 10 J
(B) 5 J
(C) 1 J
(D) 30 J

Answer: (A) 10 J · Key from source paper

Q157 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A rigid diatomic ideal gas undergoes an adiabatic process at room temperature. The relation between temperature and volume for this process is TV^x = constant, then x is:

(A) $\frac{3}{5}$
(B) $\frac{2}{5}$
(C) $\frac{2}{3}$
(D) $\frac{5}{3}$

Answer: (B) $\frac{2}{5}$ · Key from source paper

Q158 JEE Main 2019 · 11 Jan · Shift 2 MCQ

In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation VT = K, where K is a constant. In this process the temperature of the gas is increased by ΔT. The amount of heat absorbed by gas is (R is gas constant):

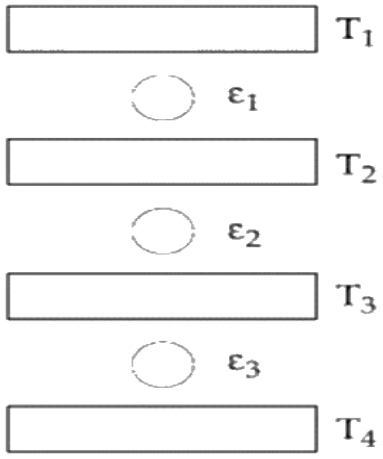
(A) $\frac{1}{2}$RΔT
(B) $\frac{1}{2}$KRΔT
(C) $\frac{3}{2}$RΔT
(D) $\frac{2K}{3}$ΔT

Answer: (A) $\frac{1}{2}$RΔT · Key from source paper

Q159 JEE Main 2019 · 10 Jan · Shift 1 MCQ

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:
(see the figure above)

Q11. 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:



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

(A) $T_2 = (T_1T_4^2)^{\frac{1}{3}}; T_3 = (T_1^2T_4)^{\frac{1}{3}}$
(B) $T_2 = (T_1T_4)^{\frac{1}{2}}; T_3 = (T_1^2T_4)^{\frac{1}{3}}$
(C) $T_2 = (T_1^2T_4)^{\frac{1}{3}}; T_3 = (T_1T_4^2)^{\frac{1}{3}}$
(D) $T_2 = (T_1^3T_4)^{\frac{1}{4}}; T_3 = (T_1T_4^3)^{\frac{1}{4}}$

Answer: (C) $T_2 = (T_1^2T_4)^{\frac{1}{3}}; T_3 = (T_1T_4^2)^{\frac{1}{3}}$ · Key from source paper

Q160 JEE Main 2019 · 10 Jan · Shift 2 MCQ

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, $R = 8.21$ J mol^{-1} K^{-1})

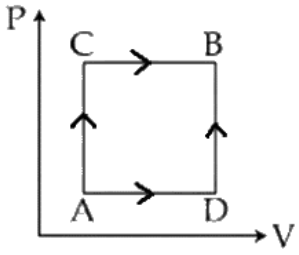
(A) 73 J
(B) 581 J
(C) 291 J
(D) 146 J

Answer: (C) 291 J · Key from source paper

Q161 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A gas can be taken from A to B via two different processes ACB and ADB.
(see the figure above)
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:

Q12. 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:

(1) 100 J (2) 20 J
(3) 40 J (4) 80 J

(A) 100 J
(B) 20 J
(C) 40 J
(D) 80 J

Answer: (C) 40 J · Key from source paper

Q162 JEE Main 2019 · 9 Jan · Shift 2 MCQ

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:

(A) $500\ K$
(B) $400\ K$
(C) $300\ K$
(D) $600\ K$

Answer: (A) $500\ K$ · Key from source paper

Q163 JEE Main 2019 · 9 Jan · Shift 2 MCQ

A $15\ \mathrm{g}$ mass of nitrogen gas is enclosed in a vessel at a temperature, $27^{\circ}\mathrm{C}$. The amount of heat transferred to the gas, so that $R.M.S.$ velocity of molecules is doubled, is about.
$\left[R = 8.3\ \mathrm{J\ (K\ mole)^{-1}}\right]$

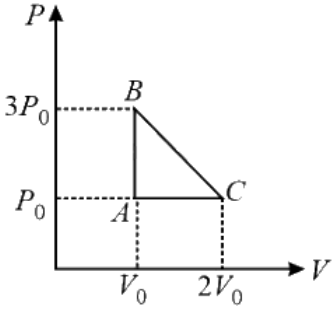
(A) $14\ \mathrm{kJ}$
(B) $10\ \mathrm{kJ}$
(C) $6\ \mathrm{kJ}$
(D) $0.9\ \mathrm{kJ}$

Answer: (B) $10\ \mathrm{kJ}$ · Key from source paper

Q164 JEE Main 2018 · 16 Apr · Online MCQ

One mole of an ideal monatomic gas is taken along the path $ABCA$ as shown in the PV diagram. The maximum temperature attained by the gas along the path BC is given by:
(see the figure above)

Q9. One mole of an ideal monatomic gas is taken along the path $ABCA$ as shown in the PV diagram. The maximum temperature attained by the gas along the path BC is given by:



(1) $\frac{25}{4}\frac{P_0V_0}{R}$
(2) $\frac{5}{8}\frac{P_0V_0}{R}$
(3) $\frac{25}{8}\frac{P_0V_0}{R}$
(4) $\frac{25}{16}\frac{P_0V_0}{R}$

(A) $\frac{25}{4}\frac{P_0V_0}{R}$
(B) $\frac{5}{8}\frac{P_0V_0}{R}$
(C) $\frac{25}{8}\frac{P_0V_0}{R}$
(D) $\frac{25}{16}\frac{P_0V_0}{R}$

Answer: (C) $\frac{25}{8}\frac{P_0V_0}{R}$ · Key from source paper

Q165 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A Carnot's engine works as a refrigerator between $250\ \mathrm{K}$ and $300\ \mathrm{K}$. It receives $500\mathrm{cal}$ heat from the reservoir at the lower temperature. The amount of work done in each cycle to operate the refrigerator is:

(A) $420\ \mathrm{J}$
(B) $2100\ \mathrm{J}$
(C) $772\ \mathrm{J}$
(D) $2520\ \mathrm{J}$

Answer: (A) $420\ \mathrm{J}$ · Key from source paper

Q166 JEE Main 2018 · 15 Apr · Shift 1 MCQ

One mole of an ideal monoatomic gas is compressed isothermally in a rigid vessel to double its pressure at room temperature, $27^{\circ}\mathrm{C}$. The work done on the gas will be:

(A) $300R\ln 6$
(B) $300\mathrm{R}$
(C) $300\mathrm{R}\ln 7$
(D) $300\mathrm{R}\ln 2$

Answer: (D) $300\mathrm{R}\ln 2$ · Key from source paper

Q167 JEE Main 2018 · 8 Apr · Offline MCQ

Two moles of an ideal monoatomic gas occupies a volume V at $27^{\circ}C$. The gas expands adiabatically to a volume $2V$. Calculate (a) the final temperature of the gas and (b) change in its internal energy.

(A) $(a)195\ \mathrm{K}\ (b)2.7\ \mathrm{kJ}$
(B) $(a)189\ \mathrm{K}\ (b)2.7\ \mathrm{kJ}$
(C) $(a)195\ \mathrm{K}\ (b)-2.7\ \mathrm{kJ}$
(D) $(a)189\ \mathrm{K}\ (b)-2.7\ \mathrm{kJ}$

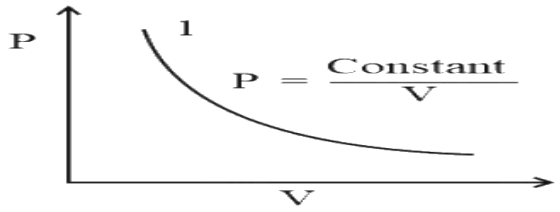
Answer: (D) $(a)189\ \mathrm{K}\ (b)-2.7\ \mathrm{kJ}$ · Key from source paper

Q168 JEE Main 2017 · 9 Apr · Online MCQ

For the $P-V$ diagram given for an ideal gas
(see the figure above)
Out of the following which one correctly represents the $T-P$ diagram?

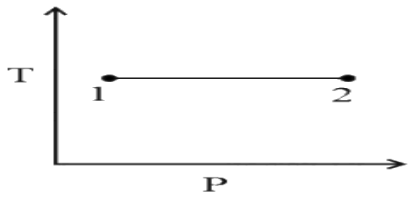
EdLoop JEE

Q10. For the $P - V$ diagram given for an ideal gas

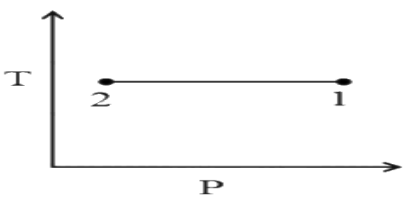


Out of the following which one correctly represents the $T - P$ diagram?

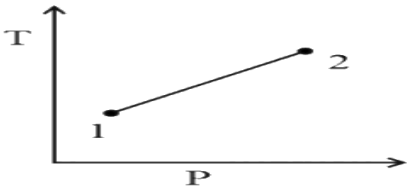
(1)



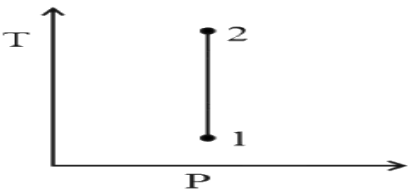
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (B) · Key from source paper

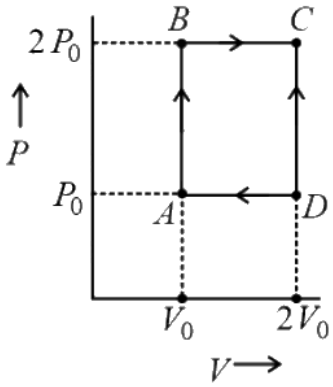
Q169 JEE Main 2017 · 8 Apr · Online MCQ

An engine operates by taking n moles of an ideal gas through the cycle $ABCDA$ shown in figure. The thermal efficiency of the engine is: (Take $C_v = 1.5R$, where R is gas constant)

(see the figure above)

Q10. An engine operates by taking n moles of an ideal gas through the cycle $ABCDA$ shown in figure. The thermal efficiency of the engine is:

(Take $C_v = 1.5R$, where R is gas constant)



(1) 0.24

(2) 0.15

(3) 0.32

(4) 0.08

(A) 0.24
(B) 0.15
(C) 0.32
(D) 0.08

Answer: (B) 0.15 · Key from source paper

Q170 JEE Main 2017 · 2 Apr · Offline MCQ

$C_p - C_v = \frac{R}{M}$ and C_v are specific heats at constant pressure and constant volume respectively. It is observed that, $C_p - C_v = a$ for hydrogen gas and $C_p - C_v = b$ for nitrogen gas. The correct relation between a and b is:

(A) $a = 28\,b$
(B) $a = \frac{1}{14}\,b$
(C) $a = b$
(D) $a = 14b$

Answer: (D) $a = 14b$ · Key from source paper

Q171 JEE Main 2016 · 10 Apr · Online MCQ

A Carnot freezer takes heat from water at $0^{\circ}C$ inside it and rejects it to the room at a temperature of $27^{\circ}C$. The latent heat of ice is $336 \times 10^3\ Jkg^{-1}$. If 5kg of water at $0^{\circ}C$ is converted into ice at $0^{\circ}C$ by the freezer, then the energy consumed by the freezer is close to :

(A) 1.51×10^5 J
(B) 1.68×10^6 J
(C) 1.71×10^7 J
(D) 1.67×10^5 J

Answer: (D) 1.67×10^5 J · Key from source paper

Q172 JEE Main 2016 · 9 Apr · Online MCQ

The ratio of work done by an ideal monoatomic gas to the heat supplied to it in an isobaric process is

(A) $\frac{2}{5}$
(B) $\frac{3}{2}$
(C) $\frac{3}{5}$
(D) $\frac{2}{3}$

Answer: (A) $\frac{2}{5}$ · Key from source paper

Q173 JEE Main 2016 · 9 Apr · Online MCQ

200 g water is heated from $40\ ^{\circ}\text{C}$ to $60\ ^{\circ}\text{C}$. Ignoring the slight expansion of water, the change in its internal energy is close to (Given specific heat of water = $4184\ \text{J kg}^{-1}\ \text{K}^{-1}$):

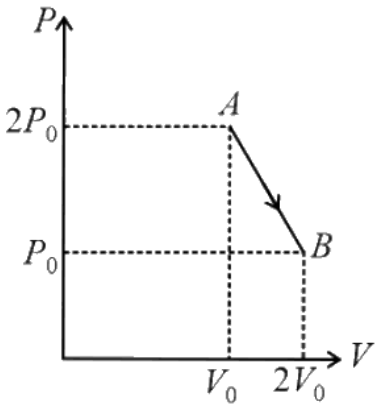
(A) 167.4 kJ
(B) 8.4 kJ
(C) 4.2 kJ
(D) 16.7 kJ

Answer: (D) 16.7 kJ · Key from source paper

Q174 JEE Main 2016 · 3 Apr · Offline MCQ

n moles of an ideal gas undergoes a process A $\rightarrow$ B as shown in the figure. The maximum temperature of the gas during the process will be:
(see the figure above)

Q8. n moles of an ideal gas undergoes a process A $\rightarrow$ B as shown in the figure. The maximum temperature of the gas during the process will be:



(1) $\frac{9\,P_0V_0}{2nR}$
(2) $\frac{9\,P_0V_0}{nR}$
(3) $\frac{9\,P_0V_0}{4nR}$
(4) $\frac{3\,P_0V_0}{2nR}$

(A) $\frac{9P_0V_0}{2nR}$
(B) $\frac{9P_0V_0}{nR}$
(C) $\frac{9P_0V_0}{4nR}$
(D) $\frac{3P_0V_0}{2nR}$

Answer: (C) $\frac{9P_0V_0}{4nR}$ · Key from source paper

Q175 JEE Main 2016 · 3 Apr · Offline MCQ

An ideal gas undergoes a quasi-static, reversible process in which its molar heat capacity C remains constant. If during this process the relation of pressure P and volume V is given by PV^n = constant, then n is given by (Here C_P and C_V are molar specific heat at constant pressure and constant volume, respectively) :

(A) $n = \frac{C_P - C}{C - C_V}$

(B) $n = \frac{C - C_V}{C - C_P}$

(C) $n = \frac{C_P}{C_V}$

(D) $n = \frac{C - C_P}{C - C_V}$

Answer: (D) $n = \frac{C - C_P}{C - C_V}$ · Key from source paper

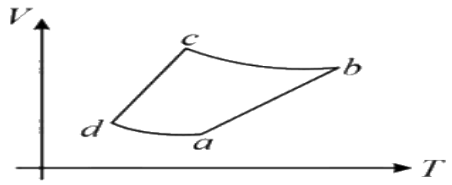
Q176 JEE Main 2015 · 10 Apr · Online MCQ

An ideal gas goes through a reversible cycle $a \to b \to c \to d$ has the V - T diagram shown below. Process $d \to a$ and $b \to c$ are adiabatic.

(see the figure above)

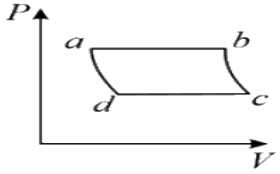
The corresponding P - V diagram for the process is (all figures are schematic and not drawn to scale) :

Q10. An ideal gas goes through a reversible cycle $a \to b \to c \to d$ has the V - T diagram shown below. Process $d \to a$ and $b \to c$ are adiabatic.

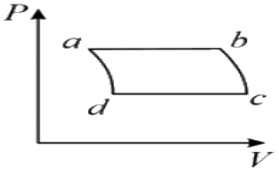


The corresponding P - V diagram for the process is (all figures are schematic and not drawn to scale) :

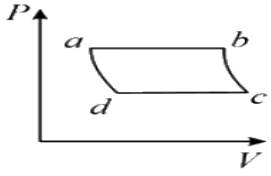
(1)



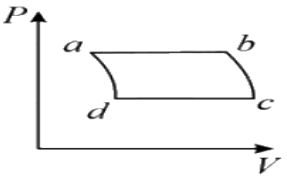
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Key from source paper

Q177 JEE Main 2015 · 4 Apr · Offline MCQ

Consider a spherical shell of radius R at temperature T. The black body radiation inside it can be considered as an ideal gas of photons with internal energy per unit volume $u = \frac{U}{V} \propto T^4$ and pressure $p = \frac{1}{3}\left(\frac{U}{V}\right)$. If the shell now undergoes adiabatic expansion the relation between T and R is:

(A) $T \propto \frac{1}{R^3}$

(B) $T \propto e^{-R}$

(C) $T \propto e^{-3R}$

(D) $T \propto \frac{1}{R}$

Answer: (D) $T \propto \frac{1}{R}$ · Key from source paper

Q178 JEE Main 2015 · 4 Apr · Offline MCQ

A solid body of constant heat capacity $1\ \mathrm{J}\ (^\circ\mathrm{C})^{-1}$ is being heated by keeping it in contact with reservoirs in two ways: (i) Sequentially keeping in contact with 2 reservoirs such that each reservoir supplies the same amount of heat. (ii) Sequentially keeping in contact with 8 reservoirs such that each reservoir supplies the same amount of heat. In both, cases the body is brought from initial temperature $100\ \mathrm{K}$ to final temperature $200\ \mathrm{K}$. Entropy change of the body in the two cases respectively is:

(A) $2\ln 2,\ 8\ln 2$

(B) $\ln 2,\ 4\ln 2$

(C) $\ln 2,\ \ln 2$

(D) $\ln 2,\ 2\ln 2$

Answer: (C) $\ln 2,\ \ln 2$ · Key from source paper

Q179 JEE Main 2014 · 19 Apr · Online MCQ

A monoatomic gas is compressed from a volume of $2\ \mathrm{m}^3$ to a volume of $1\ \mathrm{m}^3$ at a constant pressure of $100\ \mathrm{N\,m^{-2}}$. Then it is heated at constant volume by supplying $150\ \mathrm{J}$ of energy. As a result, the internal energy of the gas

(A) Decreases by $50\ \mathrm{J}$

(B) Increases by $250\ \mathrm{J}$

(C) Decreases by $250\ \mathrm{J}$

(D) $0\ \mathrm{J}$

Answer: (D) $0\ \mathrm{J}$ · Checked by our team

Q180 JEE Main 2014 · 12 Apr · Online MCQ

A Carnot engine absorbs $1000\ \mathrm{J}$ of heat energy from a reservoir at $127^\circ\mathrm{C}$ and rejects $600\ \mathrm{J}$ of heat energy during each cycle. The efficiency of engine and temperature of sink will be:

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(A) 20% and $-43^{\circ}\mathrm{C}$
(B) 40% and $-33^{\circ}\mathrm{C}$
(C) 50% and $-20^{\circ}\mathrm{C}$
(D) 70% and $-10^{\circ}\mathrm{C}$

Answer: (B) 40% and $-33^{\circ}\mathrm{C}$ · Key from source paper

Q181 JEE Main 2014 · 11 Apr · Online MCQ

During an adiabatic compression, $830\ \mathrm{J}$ of work is done on 2 moles of a diatomic ideal gas to reduce its volume by 50%. The change in its temperature is nearly: $(\mathrm{R} = 8.3\mathrm{JK}^{-1}\ \mathrm{mol}^{-1})$

(A) $40\ \mathrm{K}$
(B) $33\ \mathrm{K}$
(C) $20\ \mathrm{K}$
(D) $14\ \mathrm{K}$

Answer: (C) $20\ \mathrm{K}$ · Key from source paper

Q182 JEE Main 2014 · 9 Apr · Online MCQ

The equation of state for a gas is given by $\mathrm{PV} = \mathrm{nRT} + \alpha\mathrm{V}$, where n is the number of moles and α is a positive constant. The initial temperature and pressure of one mole of the gas contained in a cylinder are T_0 and P_0 respectively. The work done by the gas when its temperature doubles isobarically will be :

(A) $\mathrm{P}_0\,\mathrm{T}_0\,\ln 2$
(B) $\frac{\mathrm{P}_0\mathrm{T}_0\mathrm{R}}{\mathrm{P}_0+\alpha}$
(C) $\frac{\mathrm{P}_0\mathrm{T}_0\mathrm{R}}{\mathrm{P}_0-\alpha}$
(D) $\mathrm{P}_0\,\mathrm{T}_0\,\mathrm{R}$

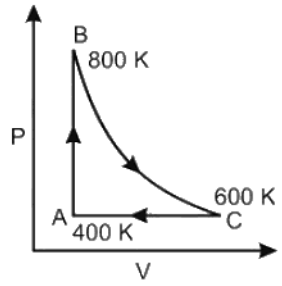
Answer: (C) $\frac{\mathrm{P}_0\mathrm{T}_0\mathrm{R}}{\mathrm{P}_0-\alpha}$ · Key from source paper

Q183 JEE Main 2014 · 6 Apr · Offline MCQ

One mole of diatomic ideal gas undergoes a cyclic process ABC as shown in figure. The process BC is adiabatic. The temperatures at A, B and C are 400 K, 800 K and 600 K respectively. Choose the correct statement :

(see the figure above)

Q13. One mole of diatomic ideal gas undergoes a cyclic process ABC as shown in figure. The process BC is adiabatic. The temperatures at A, B and C are 400 K, 800 K and 600 K respectively. Choose the correct statement :



(1) The change in internal energy in whole cyclic process is 250 R

(2) The change in internal energy in the process CA is 700 R.

(3) The change in internal energy in the process AB is - 350 R

(4) The change in internal energy in the process BC is - 500 R

(A) The change in internal energy in whole cyclic process is 250 R

(B) The change in internal energy in the process CA is 700 R.

(C) The change in internal energy in the process AB is - 350 R

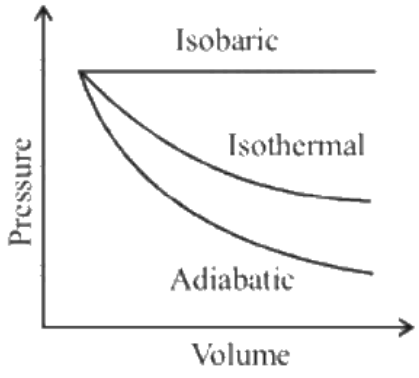
(D) The change in internal energy in the process BC is - 500 R

Answer: (D) The change in internal energy in the process BC is - 500 R · Key from source paper

Q184 JEE Main 2013 · 25 Apr · Online MCQ

A sample of gas expands from V_1 to V_2. In which of the following, the work done will be greatest? *(see the figure above)*

Q8. A sample of gas expands from V_1 to V_2. In which of the following, the work done will be greatest?



(1) Same in all processes

(2) Isobaric process

(3) Isothermal process

(4) Adiabatic process

(A) Same in all processes
(B) Isobaric process
(C) Isothermal process
(D) Adiabatic process

Answer: (B) Isobaric process · Key from source paper

Q185 JEE Main 2013 · 23 Apr · Online MCQ

This question has Statement-1 and Statement-2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: The internal energy of a perfect gas is entirely kinetic and depends only on absolute temperature of the gas and not on its pressure or volume. Statement 2: A perfect gas is heated keeping pressure constant and later at constant volume. For the same amount of heat the temperature of the gas at constant pressure is lower than that at constant volume.

(A) Statement-1 is true, Statement- 2 is true and Statement -2 is the correct explanation of Statement-1.
(B) Statement-1 is true, Statement-2 is false.
(C) Statement-1 is true, Statement-2 is true but Statement-2 is not the correct explanation of Statement-1.
(D) Statement-1 is false, Statement-2 is true.

Answer: (C) Statement-1 is true, Statement-2 is true but Statement-2 is not the correct explanation of Statement-1. · Key from source paper

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Q186 JEE Main 2013 · 22 Apr · Online MCQ

Given that $1\ \mathrm{g}$ of water in liquid phase has volume $1\ \mathrm{cm}^3$ and in vapour phase $1671\ \mathrm{cm}^3$ at atmospheric pressure and the latent heat of vaporization of water is $2256\ \mathrm{J/g}$; the change in the internal energy in joules for $1\ \mathrm{g}$ of water at $373\ \mathrm{K}$ when it changes from liquid phase to vapour phase at the same temperature is :

(A) 2256
(B) 167
(C) 2089
(D) 1

Answer: (C) 2089 · Key from source paper

Q187 JEE Main 2013 · 22 Apr · Online MCQ

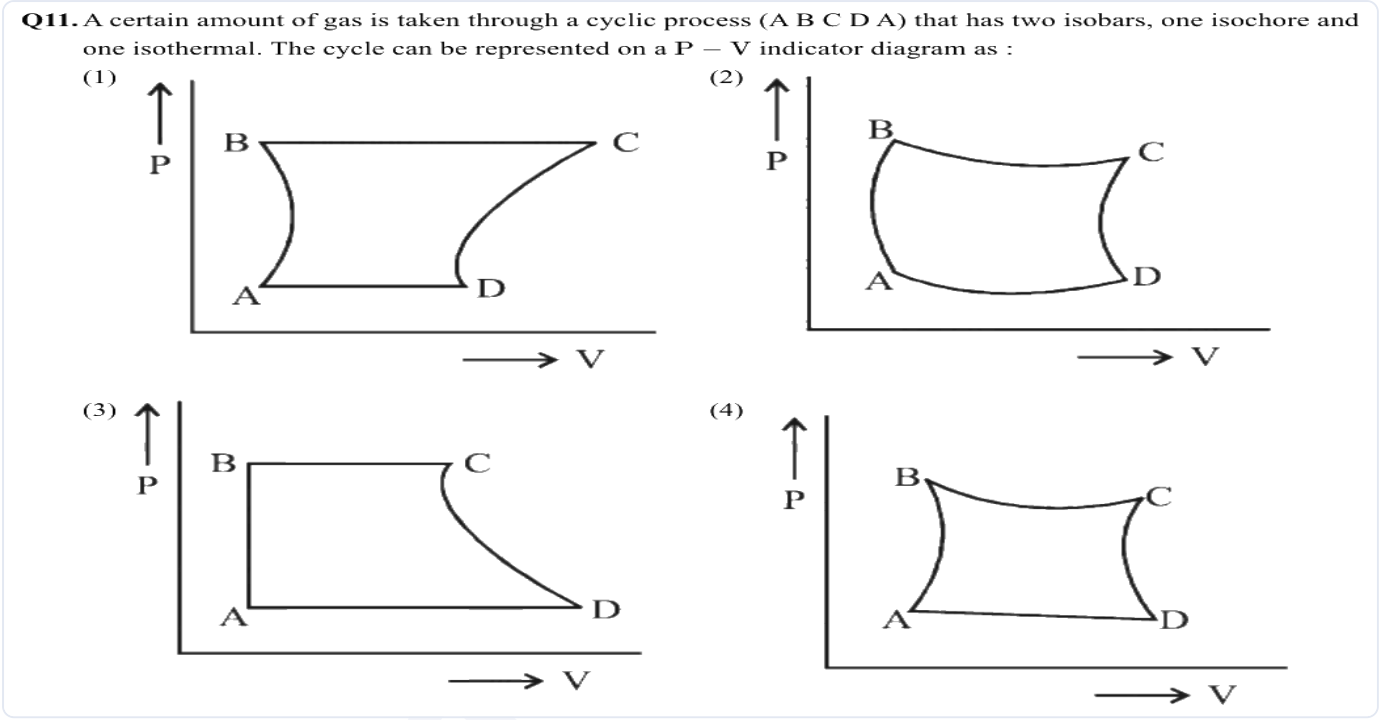
An ideal gas at atmospheric pressure is adiabatically compressed so that its density becomes 32 times of its initial value. If the final pressure of gas is 128 atmospheres, the value of ' γ 'of the gas is :

(A) 1.5
(B) 1.4
(C) 1.3
(D) 1.6

Answer: (B) 1.4 · Key from source paper

Q188 JEE Main 2013 · 22 Apr · Online MCQ

A certain amount of gas is taken through a cyclic process (A B C D A) that has two isobars, one isochore and one isothermal. The cycle can be represented on a P − V indicator diagram as :
(see the figure above)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

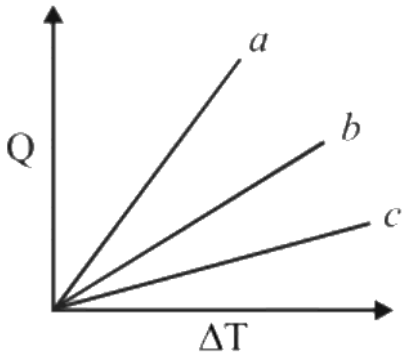
Answer: (C) · Key from source paper

Q189 JEE Main 2013 · 9 Apr · Online MCQ

Figure shows the variation in temperature (ΔT) with the amount of heat supplied (Q) in an isobaric process corresponding to a monoatomic (M), diatomic (D) and a polyatomic (P) gas. The initial state of all the gases are the same and the scales for the two axes coincide. Ignoring vibrational degrees of freedom, the lines a, b and c respectively correspond to :
(see the figure above)

Q9. Figure shows the variation in temperature (ΔT) with the amount of heat supplied (Q) in an isobaric process corresponding to a monoatomic (M), diatomic (D) and a polyatomic (P) gas. The initial state of all the gases

are the same and the scales for the two axes coincide. Ignoring vibrational degrees of freedom, the lines a, b and



c respectively correspond to :

(1) P, M and D
(2) M, D and P
(3) P, D and M
(4) D, M and P

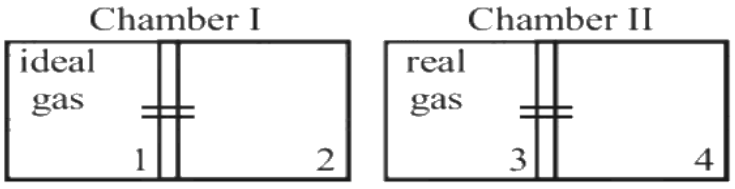
(A) P, M and D
(B) M, D and P
(C) P, D and M
(D) D, M and P

Answer: (C) P, D and M · Checked by our team

Q190 JEE Main 2013 · 9 Apr · Online MCQ

see figure

Q10.



There are two identical chambers, completely thermally insulated from surroundings. Both chambers have a partition wall dividing the chambers in two compartments. Compartment 1 is filled with an ideal gas and Compartment 3 is filled with a real gas. Compartments 2 and 4 are vacuum. A small hole (orifice) is made in the partition walls and the gases are allowed to expand in vacuum. Statement – 1 : No change in the temperature of the gas takes place when ideal gas expands in vacuum. However, the temperature of real gas goes down (cooling) when it expands in vacuum. Statement – 2 : The internal energy of an ideal gas is only kinetic. The internal energy of a real gas is kinetic as well as potential.

(1) Statement-1 is false and Statement-2 is true.
(2) Statement-1 and Statement-2 both are true. Statement-2 is the correct explanation of Statement-1.
(3) Statement-1 is true and Statement- 2 is false.
(4) Statement-1 and Statement-2 both are true. Statement-2 is not correct explanation of Statement-1.

(A) Statement-1 is false and Statement-2 is true.

(B) Statement-1 and Statement-2 both are true. Statement-2 is the correct explanation of Statement-1.

(C) Statement-1 is true and Statement- 2 is false.

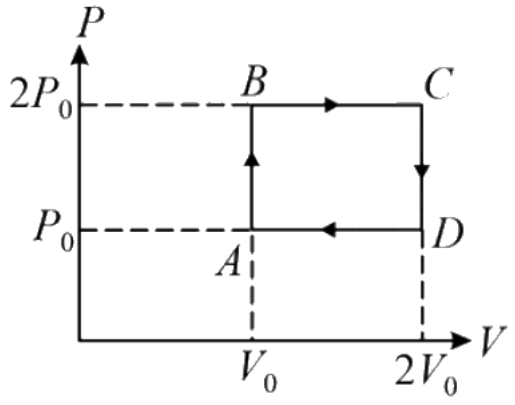
(D) Statement-1 and Statement-2 both are true. Statement-2 is not correct explanation of Statement-1.

Answer: (B) Statement-1 and Statement-2 both are true. Statement-2 is the correct explanation of Statement-1. · Checked by our team

Q191 JEE Main 2013 · 7 Apr · Offline MCQ

see figure

Q9.



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) $\left(\frac{11}{2}\right)P_0V_0$ (2) $4P_0V_0$

(3) P_0V_0 (4) $\left(\frac{13}{2}\right)P_0V_0$

(A) $\left(\frac{11}{2}\right)P_0V_0$

(B) $4P_0V_0$

(C) P_0V_0

(D) $\left(\frac{13}{2}\right)P_0V_0$

Answer: (D) $\left(\frac{13}{2}\right)P_0V_0$ · Key from source paper

Q192 AIEEE 2012 · 26 May · Online MCQ

The door of a working refrigerator is left open in a well insulated room. The temperature of air in the room will

(A) decrease
(B) increase in winters and decrease in summers
(C) remain the same
(D) increase

Answer: (D) increase · Key from source paper

Q193 AIEEE 2012 · 26 May · Online MCQ

An ideal monatomic gas with pressure P, volume V and temperature T is expanded isothermally to a volume $2V$ and a final pressure P_i. If the same gas is expanded adiabatically to a volume 2 V, the final pressure is P_a. The ratio $\frac{P_a}{P_i}$ is

(A) $2^{-1/3}$
(B) $2^{1/3^6}$
(C) $2^{2/3}$
(D) $2^{-2/3}$

Answer: (D) $2^{-2/3}$ · Key from source paper

Q194 AIEEE 2012 · 19 May · Online MCQ

This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: An inventor claims to have constructed an engine that has an efficiency of 30% when operated between the boiling and freezing points of water. This is not possible. Statement 2: The efficiency of a real engine is always less than the efficiency of a Carnot engine operating between the same two temperatures.

(A) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.
(B) Statement 1 is true, Statement 2 is false.
(C) Statement 1 is false, Statement 2 is true.
(D) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

Answer: (D) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1. · Key from source paper

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Q195 AIEEE 2012 · 19 May · Online MCQ

The pressure of an ideal gas varies with volume as $P = \alpha V$, where α is a constant. One mole of the gas is allowed to undergo expansion such that its volume becomes ' m ' times its initial volume. The work done by the gas in the process is

(A) $\frac{\alpha V}{2}(m^2-1)$
(B) $\frac{\alpha^2 V^2}{2}(m^2-1)$
(C) $\frac{\alpha}{2}(m^2-1)$
(D) $\frac{\alpha V^2}{2}(m^2-1)$

Answer: (D) $\frac{\alpha V^2}{2}(m^2-1)$ · Key from source paper

Q196 AIEEE 2012 · 12 May · Online MCQ

A given ideal gas with $\gamma = \frac{C_p}{C_v} = 1.5$ at a temperature T. If the gas is compressed adiabatically to one-fourth of its initial volume, the final temperature will be

(A) $2\sqrt{2}\,T$
(B) $4T$
(C) $2T$
(D) $8T$

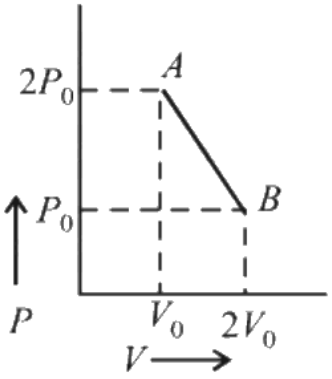
Answer: (C) $2T$ · Key from source paper

Q197 AIEEE 2012 · 12 May · Online MCQ

n moles of an ideal gas undergo a process $A \to B$ as shown in the figure. Maximum temperature of the gas during the process is

(see the figure above)

Q12. n moles of an ideal gas undergo a process $A \to B$ as shown in the figure. Maximum temperature of the gas



during the process is

(1) $\frac{9P_0V_0}{nR}$
(2) $\frac{3P_0V_0}{2nR}$
(3) $\frac{9P_0V_0}{2nR}$
(4) $\frac{9P_0V_0}{4nR}$

(A) $\frac{9P_0V_0}{nR}$
(B) $\frac{3P_0V_0}{2nR}$
(C) $\frac{9P_0V_0}{2nR}$
(D) $\frac{9P_0V_0}{4nR}$

Answer: (D) $\frac{9P_0V_0}{4nR}$ · Key from source paper

Q198 AIEEE 2012 · 7 May · Online MCQ

This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: In an adiabatic process, change in internal energy of a gas is equal to work done on/ by the gas in the process. Statement 2: The temperature of a gas remains constant in an adiabatic process.

(A) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.
(B) Statement 1 is true, Statement 2 is false.
(C) Statement 1 is false, Statement 2 is true.
(D) Statement 1 is false, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Answer: (B) Statement 1 is true, Statement 2 is false. · Key from source paper

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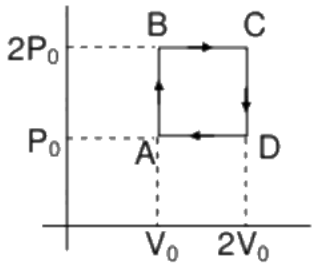
Q199 AIEEE 2012 · Offline MCQ

Helium gas goes through a cycle ABCDA (consisting of two isochoric and two isobaric lines) as shown in figure. Efficiency of this cycle is nearly: (Assume the gas to be close to ideal gas)
(see the figure above)

Q10. Helium gas goes through a cycle ABCDA (consisting of two isochoric and two isobaric lines) as shown in figure. Efficiency of this cycle is nearly: (Assume the gas to be close to ideal gas)



(1) 15.4%
(2) 9.1%
(3) 10.5%
(4) 12.5%

(A) 15.4%
(B) 9.1%
(C) 10.5%
(D) 12.5%

Answer: (A) 15.4% · Key from source paper

Q200 AIEEE 2012 · Offline MCQ

A Carnot engine, whose efficiency is 40%, takes in heat from a source maintained at a temperature of $500\ \mathrm{K}$ It is desired to have an engine of efficiency 60%. Then, the intake temperature for the same exhaust (sink) temperature must be

(A) efficiency of Carnot engine cannot be made larger than 50%
(B) $1200\ \mathrm{K}$
(C) $750\ \mathrm{K}$
(D) $600\ \mathrm{K}$

Answer: (C) $750\ \mathrm{K}$ · Key from source paper

Q201 AIEEE 2011 MCQ

$100\ \mathrm{g}$ of water is heated from $30^{\circ}\mathrm{C}$ to $50^{\circ}\mathrm{C}$. Ignoring the slight expansion of the water, the change in its internal energy is (specific heat of water is $4148\ \mathrm{J/kg/K}$):

(A) $8.4\ \mathrm{kJ}$
(B) $84\ \mathrm{kJ}$
(C) $2.1\ \mathrm{kJ}$
(D) $4.2\ \mathrm{kJ}$

Answer: (A) $8.4\ \mathrm{kJ}$ · Key from source paper

Q202 AIEEE 2011 MCQ

A Carnot engine operating between temperatures T_1 and T_2 has efficiency $\frac{1}{6}$. When T_2 is lowered by $62\ \mathrm{K}$, its efficiency increases to $\frac{1}{3}$. Then T_1 and T_2 are, respectively :

(A) $372\ \mathrm{K}$ and $330\ \mathrm{K}$
(B) $330\ \mathrm{K}$ and $268\ \mathrm{K}$
(C) $310\ \mathrm{K}$ and $248\ \mathrm{K}$
(D) $372\ \mathrm{K}$ and $310\ \mathrm{K}$

Answer: (D) $372\ \mathrm{K}$ and $310\ \mathrm{K}$ · Key from source paper

Q203 AIEEE 2010 MCQ

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

Answer: (B) 0.75 · Key from source paper

Q204 AIEEE 2009 MCQ

Two moles of helium gas are taken over the cycle ABCDA, in which A ($300\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → B ($500\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → C ($500\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → D ($300\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → A; on the P–T diagram the cycle is a rectangle, so A → B and C → D are at constant pressure and B → C and D → A are at constant temperature.
Assuming the gas to be ideal the work done on the gas in taking it from A to B is

(A) 200R
(B) 300R
(C) 400R
(D) 500R

Answer: (C) 400R · Key from source paper

Q205 AIEEE 2009 MCQ

Two moles of helium gas are taken over the cycle ABCDA, in which A ($300\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → B ($500\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → C ($500\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → D ($300\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → A; on the P–T diagram the cycle is a rectangle, so A → B and C → D are at constant pressure and B → C and D → A are at constant temperature.
The work done on the gas in taking it from D to A is

(A) $-414\mathrm{R}$
(B) $+414\mathrm{R}$
(C) $-690\mathrm{R}$
(D) $+690R$

Answer: (B) $+414\mathrm{R}$ · Checked by our team

Q206 AIEEE 2009 MCQ

Two moles of helium gas are taken over the cycle ABCDA, in which A ($300\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → B ($500\ \mathrm{K}$, $2 \times 10^5\ \mathrm{Pa}$) → C ($500\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → D ($300\ \mathrm{K}$, $1 \times 10^5\ \mathrm{Pa}$) → A; on the P–T diagram the cycle is a rectangle, so A → B and C → D are at constant pressure and B → C and D → A are at constant temperature.
The net work done on the gas in the cycle ABCDA is

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(A) Zero
(B) 276R
(C) 1076R
(D) 1904R

Answer: (B) 276R · Key from source paper

Q207 AIEEE 2008 MCQ

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) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_1+P_2V_2T_2}$

Answer: (A) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_1}$ · Key from source paper

Q208 AIEEE 2007 MCQ

A Carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

(A) 99 J
(B) 90 J
(C) 1 J
(D) 100 J

Answer: (B) 90 J · Key from source paper

Q209 AIEEE 2007 MCQ

see figure

Q13. When a system is taken from state i to state f along the path iaf, it is found that $Q = 50$ cal and W $= 20$ cal.



Along the path' ibf Q $= 36$ cal. W along the path ibf is

(1) 6 cal
(2) 16 cal.
(3) 66 cal.
(4) 14 cal.

(A) 6 cal
(B) 16 cal.
(C) 66 cal.
(D) 14 cal.

Answer: (A) 6 cal · Key from source paper

Q210 AIEEE 2007 MCQ

If C_p and C_v denote the specific heats of nitrogen per unit mass at constant pressure and constant volume respectively, then

(A) $C_p - C_v = R/28$
(B) $C_p - C_v = R/14$
(C) $C_p - C_v = R$
(D) $C_p - C_v = 28R$

Answer: (A) $C_p - C_v = R/28$ · Key from source paper

Q211 AIEEE 2006 MCQ

The work of 146 kJ is performed in order to compress one kilo mole of gas adiabatically and in this process the temperature of the gas increases by $7^\circ C$. The gas is $(R = 8.3\ J\ mol^{-1}\ K^{-1})$

(A) monoatomic
(B) diatomic
(C) triatomic
(D) a mixture of monoatomic and diatomic

Answer: (B) diatomic · Key from source paper

Q212 AIEEE 2005 MCQ

Which of the following is incorrect regarding the first law of thermodynamics?

(A) It is applicable to any cyclic process
(B) It is a restatement of the principle of conservation of energy
(C) It introduces the concept of the internal energy
(D) It introduces the concept of the entropy

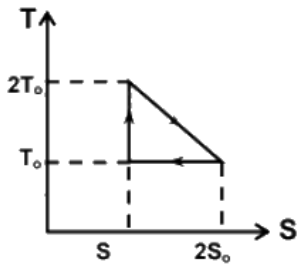
Answer: (D) It introduces the concept of the entropy · Key from source paper

Q213 AIEEE 2005 MCQ

The temperature-entropy diagram of a reversible engine cycle is given in the figure. Its efficiency is

(see the figure above)

Q31. The temperature-entropy diagram of a reversible engine cycle is given in the figure. Its efficiency is



(1) $1/2$ (2) $1/4$
(3) $1/3$ (4) $2/3$

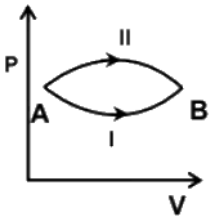
(A) $1/2$
(B) $1/4$
(C) $1/3$
(D) $2/3$

Answer: (C) $1/3$ · Key from source paper

Q214 AIEEE 2005 MCQ

A system goes from A to B via two processes I and II as shown in the figure. If ΔU_1 and ΔU_2 are the changes in internal energies in the processes I and II respectively, then
(see the figure above)

Q32. A system goes from A to B via two processes I and II as shown in the figure. If ΔU_1 and ΔU_2 are the changes



in internal energies in the processes I and II respectively, the

(1) $\Delta U_1 = \Delta U_2$ (2) relation between ΔU_1 and ΔU_2 can not be determined
(3) $\Delta U_2 > \Delta U_1$ (4) $\Delta U_2 < \Delta U_1$

(A) $\Delta U_1 = \Delta U_2$
(B) relation between ΔU_1 and ΔU_2 can not be determined
(C) $\Delta U_2 > \Delta U_1$
(D) $\Delta U_2 < \Delta U_1$

Answer: (A) $\Delta U_1 = \Delta U_2$ · Key from source paper

Q215 AIEEE 2004 MCQ

Which of the following statements is correct for any thermodynamic system?

(A) The internal energy changes in all processes.
(B) Internal energy and entropy are state functions.
(C) The change in entropy can never be zero.
(D) The work done in an adiabatic process is always zero.

Answer: (B) Internal energy and entropy are state functions. · Key from source paper

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Q216 AIEEE 2003 MCQ

"Heat cannot by itself flow from a body at lower temperature to a body at higher temperature" is a statement or consequence of

(A) second law of thermodynamics
(B) conservation of momentum
(C) conservation of momentum
(D) first law of thermodynamics

Answer: (A) second law of thermodynamics · Key from source paper

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Q217 AIEEE 2003 MCQ

Which of the following parameters does not characterize the thermodynamic state of matter?

(A) temperature
(B) Pressure
(C) Work
(D) Volume

Answer: (C) Work · Key from source paper

Q218 AIEEE 2003 MCQ

A Carnot engine takes 3×10^6 cal. of heat from a reservoir at $627^\circ\mathrm{C}$, and gives it to a sink at $27^\circ\mathrm{C}$. The work done by the engine is

(A) 4.2×10^6 J
(B) 8.4×10^6 J
(C) 16.8×10^6 J
(D) Zero

Answer: (B) 8.4×10^6 J · Key from source paper

Q219 AIEEE 2003 MCQ

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

(A) $\frac{4}{3}$
(B) 2
(C) $\frac{5}{3}$
(D) $\frac{3}{2}$

Answer: (D) $\frac{3}{2}$ · Key from source paper

Q220 AIEEE 2002 MCQ

Which statement is incorrect?

(A) all reversible cycles have same efficiency
(B) reversible cycle has more efficiency than an irreversible one
(C) Carnot cycle is a reversible one
(D) Carnot cycle has the maximum efficiency in all cycles

Answer: (A) all reversible cycles have same efficiency · Key from source paper

Q221 AIEEE 2002 MCQ

Even Carnot engine cannot give 100% efficiency because we cannot

(A) prevent radiation
(B) find ideal sources
(C) reach absolute zero temperature
(D) eliminate friction

Answer: (C) reach absolute zero temperature · Key from source paper

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