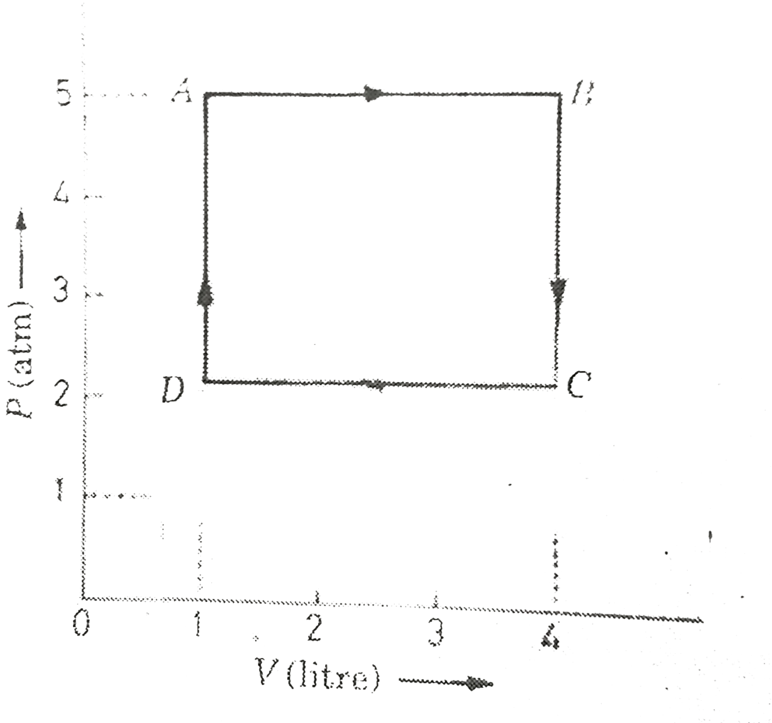
PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

Thermodynamics

Example

1. One mole of an ideal gas undergoes a cyclic change ABCD. From the given diagram calculate the net work done in the process.



Watch Video Solution

2. The $P-V$ diagram for a cyclic process is a triangle ABC drawn in order (figure). The co-ordinates of A,B,C are $(4, 1), (2, 4)$ and $(2, 1)$ respectively. The co-ordinates are in the order (P, V) Pressure is in Nm^{-2} and volume is in liter. Calculate work done during the process from A to B, B to C and C to A. Also, calculate work done in the complete cycle.

Watch Video Solution

3. 1g of water at $100^{\circ} C$ is converted into steam at the same temperature. If the volume of steam is 1671 cm^3, find the change in the internal energy of the system. Latent of steam $= 2256 Jg^{-1}$. Given 1 atmospheric pressure =$1.013 \times 10^5 Nm^{-2}$

Watch Video Solution

4. The volume of steam produced by $1g$ of water at $100^{\circ} C$ is $1650 cm^3$. Calculate the change in internal energy during the change of state. Given $J = 4.2 \times 10^7 erg.$

$cal.^{-1}, d = 981 cm^{s-2}$. Latent heat of stream $= 540 cal. G^{-1}$

Watch Video Solution

5. $1.0 m^3$ of water is converted into $1671 m^3$ of steam at atmospheric pressure and $100^{\circ} C$ temperature. The latent heat of vaporisation of water is $2.3 \times 10^6 Jkg^{-1}$. If 2.0 kg of water be converted into steam at atmospheric pressure and $100^\circ C$ temperature, then how much will be the increases in its internal energy? Density of water $1.0 \times 10^3 kgm^{-3}$, atmospheric pressure =$1.01 \times 10^5 Nm^{-2}$.

Watch Video Solution

6. At $0^\circ C$ and normal atmospheric pressure, the volume of 1 gram of water increases from $1c.cto1.091c.c$ on freezing. What will be the change in its internal energy? Normal atmospheric pressure is $1.013 \times 10^5 N/m^2$ and latent heat of melting of ice $= 80cal/gram$.

Watch Video Solution

7. 5 mole of oxygen are heated at constant volume from $10^\circ Cto20^\circ C$. What will be the change in internal energy of the gas? Gram molar specific heat of gas at constant pressure $= 8cal.\text{Mole}^{-1}.^\circ C^{-1}$ and $R = 8.36J\text{mole}^{-1}.^\circ C^{-1}$.

Watch Video Solution

Watch Video Solution

8. If 70 cal of heat is required to raise the temperature of moles of an ideal gas at constant pressure from $30^{\circ}C$ to $35^{\circ}C$, calculate (i) the work done by the gas (ii) the increases in internal energy of the gas and (iii) degrees of freedom of gas molecules. given $R = 2calmol^{-1}K^{-1}$

Watch Video Solution

9. A cyclinder with a movable piston contains $3mols$ of hydrogen at standard temperature and pressure. The walls of the cyclinder are made of a heat insulator, and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas increases, if the gas is compressed to half its original volume? Given $\gamma = 1.4$.

Watch Video Solution

10. The compression ratio of a certain diesel engine is 15. this means that air the cylinder is compressed to 1/15 of its initial volume. If the initial pressure is 1.0×10^5 Pa and the initial temperature is 300 K, find the final pressure and temperature after compression. air is mostly a mixture of oxygen and nitrogen and $\gamma = 1.4$

Watch Video Solution

11. If at $50^\circ C$ and $75cm$ of mercury pressure, a definite mass of gas is compressed (i) slowly (ii) suddenly, than what will be the final pressure and temp. of the gas in each case, if the final volume is one fourth of the initial volume? $\gamma = 1.5$.

Watch Video Solution

12. A tyre pumped to a pressure $3.375 atm at 27^\circ C$ suddenly bursts. What is the final temperature $(\gamma = 1.5)$?

Watch Video Solution

Watch Video Solution

13. A gas occupying one litre at 80 cm pressure is expanded adiabatically to $1190 cm^3$. If the pressure falls to 60 cm in the process, deduce the value of γ.

Watch Video Solution

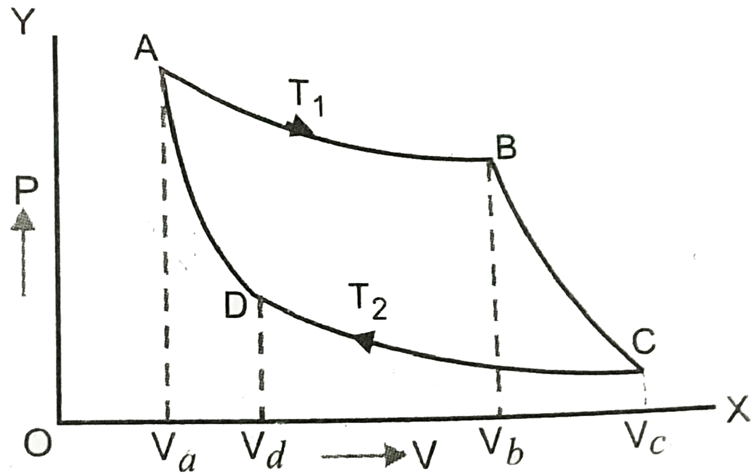
14. Ten litres of air at $17^\circ C$ and 76 cm of Hg pressure is compressed adiabatically to a volume of 0.5 litre. Calculate the final temperature and pressure attained. Given $\gamma = 1.41$

Watch Video Solution

15. Calculate the fall in temperature of helium initially at $15^\circ C$, when it is suddenly expanded to $8 \times$ its original volume $(\gamma = 5/3)$.

Watch Video Solution

16. Two different adiabatic curves for the same gas intersect two isothermals at T_1, and T_2 as shown in $P-V$ diagram, (figure). How does the ratio (V_a/V_d) compare with the ratio (V_b/V_c) ?



Watch Video Solution

17. Two sample A and B of a gas initially at the same pressure and temperature are compressed from volume V to $V/2$ (A isothermally and B adiabatically). The final pressure of A is

Watch Video Solution

18. A sound wave passing through air at NTP produces a pressure of $0.001\frac{\text{dyne}}{c}m^2$ during a compression. The corresponding change in temperature (given $\gamma = 1.5$ and assume gas to be ideal) is

Watch Video Solution

19. Three moles of an ideal gas kept at a constant temperature of $300K$ are compressed from a volume of 4 litre to 1 litre. Calculate work done in the process. $R = 8.31 Jmole^{-1}K^{-1}$.

Watch Video Solution

20. A gram molecule of a gas at $127^{\circ}C$ expands isothermally until its volume is doubled. Find the amount of work done and heat absorbed.

Watch Video Solution

21. A cylinder containing one gram molecule of the gas was compressed adiabaticaly untill its tempertaure rose from $27^{\circ} C$ to $97^{\circ} C$. Calculate the work done and heat produced in the gas $(\gamma = 1.5)$.

Watch Video Solution

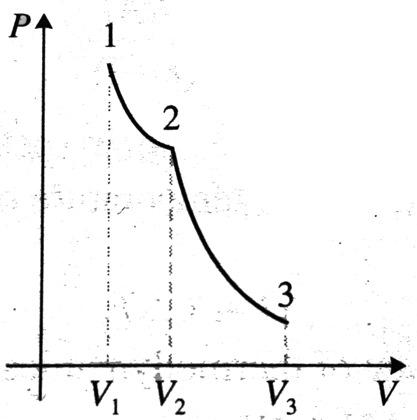
22. $1g$ mole of an ideal gas at STP is subjected to a reversible adiabatic expansion to double its volume. Find the change in internal energy $(\gamma = 1.4)$

Watch Video Solution

23. Find the work required to compress adiabatically 1 gram of air initially at N.T.P. to half its volume. Density of air at N.T.P. =0.00129 g cm^{-3} and $\gamma = 1.4$

Watch Video Solution

24. One mole of a perfect gas, initally at a pressure and temperature of $10^5 N/m^2$ and 300 K, respectively, expands isothermally unitl its volume is doubled and then adiabatically until its volume is again doubled. Find final pressure and temperature of the gas Find the total work done during the isothermal and adiabatic processes. Given $\gamma = 1.4$. Also draw the P-V diagram for the process.



Watch Video Solution

25. Efficiency of carnot engine working between ice point and steam point is

Watch Video Solution

26. One of the most efficient engines ever developed operated between 2100K and 700K. Its actual efficiency is 40%. What percentage of its maximum possible efficiency is this?

Watch Video Solution

27. The source tempreature of a Carnot engine is $127^\circ C$. It takes 500 cal of heat from the source and rejects 400 cal to the sink during each cycle. What is the temperature of the sink ?

Watch Video Solution

28. In a heat engine, the temperature of the source and sink are 500 K and 375 K. If the engine consumes $25 \times 10^5 J$ per cycle, find(a) the efficiency of the engine, (b) work done per cycle, and (c) heat rejected to the sink per cycle.

Watch Video Solution

29. The efficiency of a Carnot cycle is $1/6$. If on reducing the temperature of the sink by $65^{\circ}C$, the efficiency becomes $1/3$, find the source and sink temperatures between which the cycle is working.

Watch Video Solution

30. A reversible engine converts one fifth of heat which it absorbs from source into work. When the temp. of sink is reduced by $70^{\circ}C$, its efficiency is doubled. Calculate the temperature of the source and sink.

Watch Video Solution

31. A cornot engine has the same efficiency between (i) 100 K and 500 K and (ii) T and 900 K. Find T.

Watch Video Solution

32. A carnot engine whose heat sink is at $27^\circ C$ has an efficiency of 40%. By how many degrees should the temperature of source be changed to increase the efficiency by 10% of the original efficiency?

Watch Video Solution

33. Three designs are proposed for an engine which is to operate between 300 K and 500 K. design A is claimed to produced 3000 J of work per kcal of heat input, B is claimed to produced 2000 J and C , 1000 J. which design would you choose ? Given 1 kcal =4185 J

Watch Video Solution

34. An ideal engine operates by taking in steam from a boiler at $327^\circ C$ and rejecting heat to a sink at $27^\circ C$. The engine runs at $500r \pm$ and heat taken is $600kcal$ in each revolution. Calculate(i) efficiency of engine (ii) work done in each cycle (iii) heat rejected in each revolution and (iv) power output of engine.

Watch Video Solution

35. During isothermal expansion at 800 K, the working substance of a Carnot's engine extracts 480 cal of heat. If the sink be at 300 K, calculate (i) the work done by the working substance during isothermal expansion (ii) the work done on the substance during isothermal compression (iii) the efficiency of the ideal engine.

Watch Video Solution

36. A reversible engine takes in heat from a reservoir of heat at $527^\circ C$, and gives out to the sink at $127^\circ C$ How many calories per second must it take from the reservoir in order to produce useful mechanical work at the rate of $750 watt$? $1 cal. = 4.2 J$.

Watch Video Solution

37. An engine (whose efficiency equals that of a carnot engine working between the same temperature limits) develops 100 h.p. and operates between $227^{\circ} C$ and $27^{\circ} C$. What is the heat supplied ? What is the heat rejected ? What is the thermal efficiency ?

Watch Video Solution

38. Two carnot engines A and B are operates in series. The first one A receives heat at 800 K and rejects to a reservoir at temperature TK. The second engine B revives the heat rejected to a heat reservoir at 300 K. calculate the temperature TK for the following cases.

(i) When the outputs of the two engines are equal.

(ii) When the efficiencies of the two engines are equal.

Watch Video Solution

39. A carnot cycle is performed by $1 mole of air (\gamma = 1.4)$ initially at $327^{\circ} C$. Each stage represents a compression or expansion in the ratio

$1:6$. Calcultate (a) the lowest temperature (b) net work done during each cycle and (C) efficiency of the engine.

Take $R = 8.31 Jmole^{-1}K^{-1}$.

Watch Video Solution

40. In A double -acting steam engine, the avearge pressure of steam is $8 \times 10^4 Nm^{-2}$. The length of the stroke is 0.8 m and area of cross-section of the piston is $0.18m^2$. If the piston makes 6 revolution per second, calculate the horse power of the engine.

Watch Video Solution

41. A petrol engine consume 25 kg of petrol per hour. The calorific value of petro lis 11.4×10^6 cal kg^{-1}. The power of the engine is 99.75 kW. Calculate the efficiency of the engine.

Watch Video Solution

42. In a petrol engine, the rate of production of heat due to combustion of the fuel is $5 \times 10^6 cal h^{-1}$. The efficiency of the engine is 30%. Calculate the H.P. of the engine. Given, J=4.2 J cal^{-1} and 1 h.p. =746 W.

Watch Video Solution

43. The efficiency of otto cycle for petrol engine is 50% and the adiabatic constant is 1.4. calculate the compression ratio.

Watch Video Solution

44. How much heat energy is required to do 10 kWh of work by a petrol engine, whose adiabatic compression ratio is 10 ? Given $\gamma = 1.4$

Watch Video Solution

45. In a refrigerator, heat from inside at 277K is transferred to a room at 300K. How many joules of heat shall be delivered to the room for each joule of electrical energy consumed ideally?

Watch Video Solution

46. Calculate the least amount of work that must be done to freeze one gram of wate at $0^\circ C$ by means of a refrigerator. Temperature of surroundings is $27^\circ C$. How much heat is passed on the surroundings in this process? Latent heat of fusion $L = 80cal/g$.

Watch Video Solution

47. How much energy in watt hour may be required to convert $2kg$ of water into ice at $0^\circ C$, assuming that the refrigerator is ideal? Take room temp. $= 25^\circ C$, which is also the initial temp. of water and temp. of freezer is $-15^\circ C$.

Watch Video Solution

48. In a cold storage, ice melts at the rate of $2kg/h$ when the external temperature is $20^\circ C$. Find the minimum power output of the motor used to drive the refrigerator which just prevents the ice from melting. Latent heat of fusion of $ice = 80cal/g$

Watch Video Solution

49. A carnot engine having a perfect gas aas the working substance is driven backwards and is used for freezing water already at $0^\circ C$. If the engine is driven by $500W$ electric motor with an efficiency of 60% how long will it take to freeze $15kg$ of water? The working temps of the engine are $15^\circ C$ and $0^\circ C$. The system involves no energy losses. Given latent heat of ice $= 333 \times 10^3 Jkg^{-1}$.

Watch Video Solution

50. Heat is flowing through a rod of length $25.0cm$ having cross-sectional area $8.80cm^2$. The coefficient of thermal conductivity for the material of the rod is $K = 9.2 \times 10^{-2} kcals^{-1} m^{-1} .^{\circ} C^{-1}$. The Temperatures of the ends of the rod are $125^{\circ} C$ and $0^{\circ} C$ in the steady state. Calculate (i) temeprature gradient in the rod (ii) temperature of a point at a distance of $10.0 cm$ from the hot end and (iii) rate of flow of heat.

Watch Video Solution

51. A thermocole cubical icebox of side 30 cm has a thickness of 5.0 cm if 4.0 kg of ice are put ini the box, estimate the amount of ice remaining after 6 h. The outside temperature is $45^{\circ} C$ and coefficient of thermal conductivity of thermocole $= 0.01 J / kg$.

Watch Video Solution

52. A brass boiler has a base area of $0.15 m^2$ and thickness 1.0 cm it boils water at the rate of $6.0 kg / \min$, When placed on a gas. Estimate the temperature of the part of the flame in contact with the boiler. Thermal conductivity of brass $= 109 J / s - .^{\circ} C$) and heat of vapourization of water $= 2256 J / g$.

Watch Video Solution

53. Steam at $100^{\circ} C$ is passed into a copper cylinder 10 mm thick and of $200 cm^2$ area. Water at $100^{\circ} C$ collects at the rate of $150 g \min^{-1}$. Find the temperature of the outer surface, if the conductivity of copper is $0.8 cal s^{-1} cm^{-1} .^{\circ} C^{-1}$ and the latent heat of steam is $540 cal g^{-1}$.

Watch Video Solution

54. A metal rod of length 20 cm and diamter 2 cm is convered with a non conducting substance. One of its ends is maintained at $100^{\circ} C$, while the other end is put at $0^{\circ} C$. It is found that 25 g ice melts in 5 min. calculate the coefficient of thermal conductivity of the metal. Latent that of ice = $80 cal g^{-1}$.

Watch Video Solution

55. A layer of ice 2 cm thick is formed on a pond. The temperature of air is $-20^\circ C$. Calculate how long it will take for the thickness of ice to increase by 1mm. Density of ice $= 1gcm^{-3}$. Latent heat of ice $= 80calg^{-1}$. Conductivity of ice $= 0.008cals^{-1}cm^{-1}.^\circ C^{-1}$.

Watch Video Solution

56. Two vessels of different materials are identical in size and wall-thickness. They are filled with equal quantities of ice at $0^\circ C$. If the ice melts completely in 10 and 25 minutes respectively, compare the coefficients of thermal conductivity of the materials of the vessels.

Watch Video Solution

57. Two vessels A and B of different materials but having identical shape, size and wall-thickness are filled with ice and kep at the same plane. Ice melts at the rate of $100g \min^{-1}$ and $150g \min^{-1}$ in A and B respectively.

Assuming that heat enters the vessels through the walls only, calculate the ratio of thermal conductivity of their materials.

Watch Video Solution

58. Two plates of equal areas are placed in contact wih each other. Their thickness are 2.0 cm and 5.0 cm respectively. The temperature of the external surface of the first plate is $-20^\circ C$ and that of the external surface of the second plate is $20^\circ C$. What will be the temperature of the current surface if the plates (i) are of the same material, (ii) have thermal conductivities in the ratio $2:5$.

Watch Video Solution

59. Three bars of equal lenghts and equal area of cross-section are connected in series. Their thermal conductivities are in the ratio of $2:4:3$. If the open ends of the first and the last bars are at temperature $200^\circ C$ and $180^\circ C$ respectivity in the steady state, calculate the temperature of both the junctions.

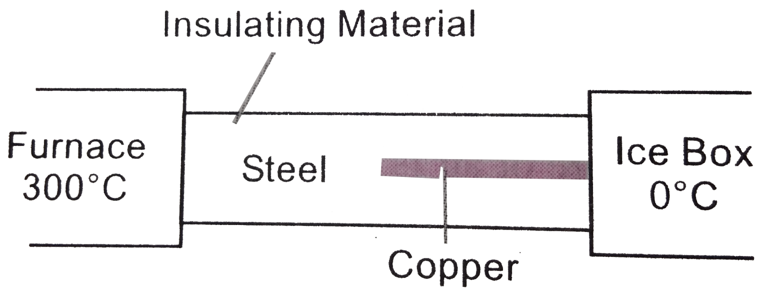
Watch Video Solution

60. Heat is supplied to a slab of cork, 5cm thick and of $2m^2$ by a heating coil spread over its surface. When the current in the coil is 1.18 A and the potential difference across its end is 20 V, the steady temperatures of the faces of the slab are $12.5^{\circ} C$ and $0^{\circ} C$. Assuming that the whole of the heat developed in the coil is conducted through the slab, calculate the thermal conductivity of the cork.

Watch Video Solution

61. What is the temperature of the steel-copper junction in the steady state system show in Fig. $7(e).17$? Length of steel rod = 15.0 cm, length of the copper rod = 10.0 cm, temperature of the furnace $= 300^{\circ} C$, temperature of other end $0^{\circ} C$. The are of cross-section of the steel rod is twice that of the copper rod. (Thermal conductivity of steel

$= 50.2 js^{-1} m^{-1} K^{-1}$ and of copper $= 3895 js^{-1} m^{-1} K^{-1}$).



Watch Video Solution

62. The surface temperature of a hot body is $1227^{\circ} C$. Find the wavelength at which it radiates maximum energy. Given Wien's constant $= 2898 cmK$.

Watch Video Solution

63. Two stars radiate maximum energy at wavelength $3.6 \times 10^{-7} m$ and $4.8 \times 10^{-7} m$ respectively. What is the ratio of their temperature?

Watch Video Solution

64. The spectral energy distribution of the sun has a maximum at 4754Å. If the temperature of the sun is 6050 K, what is the temperature of a star for which this maximum is at 9506Å?

Watch Video Solution

65. Calculate the temperature (in K) at which a perfect black body radiates energy at the rate of $5.67 W cm^{-2}$. Given $\sigma = 5.67 \times 10^8 W m^{-2} K^{-4}$.

Watch Video Solution

66. Luminosity of Rigel star in Orion constellation is 17, 000 times that of our sun. If the surface temperature of the sun is 6000 K, calculate the temperature of the star.

Watch Video Solution

67. A small hole is made in a hollow sphere whose walls are at $723^\circ C$. Find the total energy radiated per seond per cm^2. Given Stenfan's constant $= 5.7 \times 10^{-5} erg cm^{-2} s^{-1} K^{-4}$.

Watch Video Solution

68. Consider the sun to be a perfect sphere of radius $6.8 \times 10^8 m$. Calculate the energy radiated by sun in one minute. Surface temperature of the sun $= 6200 K$. Stefan's constant $= 5.67 \times 10^{-8} J m^{-2} s^{-1} K^{-4}$.

Watch Video Solution

69. How much energy in radiated per minute from the filament of an incandescent lamp at 3000 K, if the surface area is $10^{-4} m^2$ and its emissivity is 0.4? Stefan's constant $\sigma = 5.67 \times 10^{-8} W m^{-2} K^{-4}$.

Watch Video Solution

70. At what temperature will the filament of 100 W lamp operate if it is supposed to be perfectly black of area $1cm^2$.

Given $\sigma = 5.67 \times 10^{-5} ergcm^{-2}s^{-1}K^{-4}$.

Watch Video Solution

71. Due to change in main voltage, the temperature of an electric bulb rises from 3000K to 4000K. What is the percentage rise in electric power consumed?

Watch Video Solution

72. The ratio of radiant energies radiated per unit surface area by two bodies is $16:1$, the temperature of hotter body is 1000 K , then the temperature of colder body will be

Watch Video Solution

73. A black body at $27^{\circ}C$ surrounds another black body at $-73^{\circ}C$. Calculate the net heat transfer per second per square meter of the body at higher temperature..

Watch Video Solution

74. An indirectly heated filament is radiating maximum energy of wavelength $2.16 \times 10^{-5}cm$. Find the net amount of heat energy lost per second per unit area, the temperature of the surrounding air is $13^{\circ}C$. Given $b = 0.288cm - K. \sigma = 5.77 \times 10^{-5}erg/s - cm^2 - K^4$).

Watch Video Solution

75. Calculate the maximum amount of heat which may be lost per second by radiation by a sphere 14cm in diameter at a temperature of $227^{\circ}C$, when placed in an enclosure at $27^{\circ}C$. Given Stefan's constant = $5.7 \times 10^{-8}Wm^{-2}K^{-4}$.

Watch Video Solution

Watch Video Solution

76. Two bodies A and B are kept in evacuated vessels maintained at a temperature of $27^{\circ}C$. The temperature of A is $527^{\circ}C$ and that of B is $127^{\circ}C$. Compare the rates at which heat is lost from A and B.

Watch Video Solution

77. How much faster does a cup of coffee cool off from $100^{\circ}C$ than from $30^{\circ}C$? Assume the coffee to act as a black body and temp. of surrounding = $20^{\circ}C$.

Watch Video Solution

78. A liquid takes 5 minutes to cool from $80^{\circ}C$ to$50^{\circ}C$. How much time will it take to cool from $60^{\circ}C$ to $30^{\circ}C$? The temperature of surroundings is $20^{\circ}C$.

Watch Video Solution

79. A body cools in 7 minutes from $60^\circ C$ to $40^\circ C$. What will be its temperature after the next 7 minutes? The temperature of the surrounding is $10^\circ C$. Assume that Newton's law of cooling holds good throughout the process.

Watch Video Solution

80. Define the term thermodynamics.

Watch Video Solution

81. Define the terms thermodynamic system, surroundings, thermodynamic variable and equation of state.

Watch Video Solution

82. Define thermal equilibrium. How is it attained?

Watch Video Solution

83. What is an indicator diagram? What is its importance?

Watch Video Solution

84. Describe an analytical method for determining the work done during the expansion of gas.

Watch Video Solution

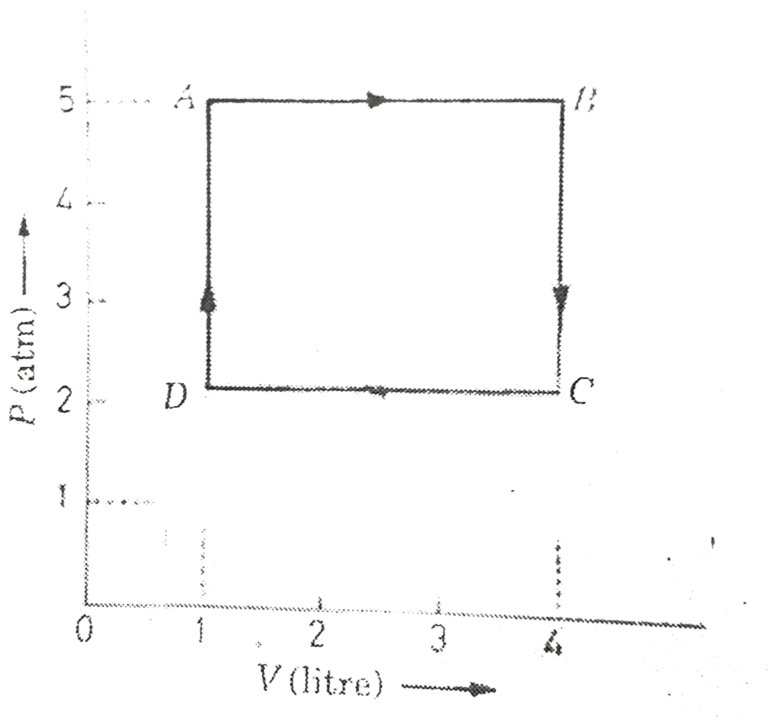
85. What is non-cyclic process? Show that the area under the P-V diagram gives the work done by a system in a non-cyclic process.

Watch Video Solution

86. What is cyclic process? Prove that the net work done durng a cyclic process is numerically equal to the area of the loop representing the cycle.

Watch Video Solution

87. One mole of an ideal gas undergoes a cyclic change ABCD. From the given diagram calculate the net work done in the process.



Watch Video Solution

88. One mole of an ideal gas undergoes a cyclic change ABCD where the (P,V) co-ordinates are A (5,1), B (5,3), C (2,3) and D (2,1). P is atmosphere and V is in litre. Calculate work done along AB, BC, CD and DA and also net work done in the process. Given $1 atmosphere = 1.01 \times 10^5 Nm^{-2}$.

Watch Video Solution

89. State and explain first law of thermodynamics. Discuss the application of first law of thermodynamics to (i) isothermal process, (ii) adiabatic process.

Watch Video Solution

90. 1g of water at $100^\circ C$ is converted into steam at the same temperature. If the volume of steam is 1671 cm^3, find the change in the internal energy of the system. Latent of steam $= 2256 J g^{-1}$. Given 1 atmospheric pressure =$1.013 \times 10^5 N m^{-2}$

Watch Video Solution

91. The volume of steam produced by $1g$ of water at $100^\circ C$ is $1650 cm^3$. Calculate the change in internal energy during the change of state. Given $J = 4.2 \times 10^7 erg$.

$cal.^{-1}$, $d = 981 cm^{s-2}$. Latent heat of stream $= 540 cal. G^{-1}$

Watch Video Solution

92. $1.0 m^3$ of water is converted into $1671 m^3$ of steam at atmospheric pressure and $100^\circ C$ temperature. The latent heat of vaporisation of water is $2.3 \times 10^6 J kg^{-1}$. If 2.0 kg of water be converted into steam at atmospheric pressure and $100^\circ C$ temperature, then how much will be the increases in its internal energy? Density of water $1.0 \times 10^3 kg m^{-3}$, atmospheric pressure =$1.01 \times 10^5 N m^{-2}$.

Watch Video Solution

Watch Video Solution

93. At $0^\circ C$ and normal atmospheric pressure, the volume of 1 gram of water increases from $1c.c \text{to} 1.091c.c$ on freezing. What will be the change in its internal energy? Normal atmospheric pressure is $1.013 \times 10^5 N/m^2$ and latent heat of melting of ice $= 80 cal/gram.$

Watch Video Solution

94. 5 mole of oxygen are heated at constant volume from $10^\circ C \text{to} 20^\circ C.$ What will be the change in internal energy of the gas? Gram molar specific heat of gas at constant pressure $= 8cal. \text{Mole}^{-1}.^\circ C^{-1}$ and $R = 8.36J\text{mole}^{-1}.^\circ C^{-1}.$

Watch Video Solution

95. A metal of mass 1 kg at constant atmospheric pressure and at initial temperature $20^\circ C$ is given a heat of 20000J. Find the following

(a) change in temperature,

(b) work done and

(c) change in internal energy.

(Given, specific heat $= 400 J / kg - ^{\circ} C$, cofficient of cubical expansion, $\gamma = 9 \times 10^{-5} / ^{\circ} C$, density $\rho = 9000 kg / m^3$, atmospheric pressure $= 10^5 N / m^2$)

Watch Video Solution

96. The efficiency of a Carnot engine operating between temperatures of $100^{\circ} C$ and $-23^{\circ} C$ will be

Watch Video Solution

97. Define the two principle specific heats of a gas. Explain wy molar specific heat at constant pressure (C_p) is greater than the molar specific hat at constant comlume (C_V) ?

Watch Video Solution

98. Applying the first law of thermodynamics, obtain the relation between the two specific hats of a gas.

Watch Video Solution

99. Calculate the specific heat capacity at constant volume for a gas. Given specific heat capacity at constant pressure is $6.85 cal mol^{-1} K^{-1}, R = 8.31 J mol^{-1} K^{-1}$.

$J = 4.18 J cal^{-1}$.

Watch Video Solution

100. Calculate the difference between the two principal specific heats of 1g of helium gas at S.T.P. Given atomic weight of helium = 4 and $J = 4.186 J cal^{-1}$ and $R = 8.31 J mol^{-1} K^{-1}$.

Watch Video Solution

101. The difference between two specific heats of a gas is $5000 J kg^{-1} K^{-1}$ and the ratio of specific heats is 1.6. Find the two specific heats.

Watch Video Solution

102. Specific heat of argon at constant pressure is $0.125 cal. g^{-1} K^{-1}$, and at constant volume $0.075 cal. g^{-1} K^{-1}$. Calculate the density of argon at N.T.P. Given $J = 4.18 \times 10^7 \text{ erg } cal^{-1}$ and normal pressure = $1.01 \times 10^6 \text{ dyne } cm^{-2}$.

Watch Video Solution

103. Calculate the value of c_v for air, given that $c_p = 0.23 \text{ calorie } g^{-1} K^{-1}$. Density of the air at S.T.P. is 1.293 $glitre^{-1}$ and $J = 4.2 \times 10^7$ erg $cal \text{ or } ie^{-1}$.

Watch Video Solution

104. For air, specific heat at constant pressure is $0.273 cal g^{-1} . ^\circ C^{-1}$ and specific heat at constant volume is $0.169 cal g^{-1} . ^\circ C^{-1}$, density of air $= 0.001293 g cm^{-3}$ at S.T.P. Calculate the value of J.

Watch Video Solution

105. An ideal gas has a specific heat at constant pressure $C_P = \frac{5R}{2}$. The gas is kept in a closed vessel of volume $0.0083 m^3$, at a temperature of 300K and a pressure of $1.6 \times 10^6 N / m^2$. An amount of 2.49×10^4 Joules of heat energy is supplied to the gas. Calculate the final temperature and pressure of the gas.

Watch Video Solution

106. What is a thermodynamics process? Mention its different types.

Watch Video Solution

107. What is a quasi-static process? Briefly explain.

Watch Video Solution

108. What is an isothermal process? Give an example. What are the essential conditions for an isothermal process to take place? Write the equation for an isothermal process.

Watch Video Solution

109. Discuss the application of the first law of thermodynamics to an isothermal process.

Watch Video Solution

110. Derive an expression for the work done during the isothermal expansion of an ideal gas.

Watch Video Solution

111. What is an adiabatic process? Give an example. What are the essential conditions for an adiabatic process to occur?

Watch Video Solution

112. Applying first law of thermodynamics, obtain an adiabatic relation between pressure and volume. Hence write relation between P and T and also between V and T.

Watch Video Solution

113. Derive an expression for the work done during the adiabatic expansion of an ideal gas.

Watch Video Solution

114. Apply first law of thermodynamics to show that the change in the internal energy of a system is equal to the heat given to or taken from the system in an ischoric process.

Watch Video Solution

115. Apply first law of thermodynamics to show that the entire heat absorbed by a system is a equal to the work done by system in a cyclic process.

Watch Video Solution

116. Discuss the application of first law of thermodynamics to an isobaric process.

Watch Video Solution

117. Apply the first law of thermodynamics to deermine the change in internal energy during the boiling process.

Watch Video Solution

118. Apply the first law of thermodynamics to determine the change in internal energy during the melting process.

Watch Video Solution

119. The compression ratio of a certain diesel engine is 15. this means that air the cylinder is compressed to 1/15 of its initial volume. If the initial pressure is 1.0×10^5 Pa and the initial temperature is 300 K, find the final pressure and temperature after compression. air is mostly a mixture of oxygen and nitrogen and $\gamma = 1.4$

Watch Video Solution

120. If at $50^{\circ} C$ and $75cm$ of mercury pressure, a definite mass of gas is compressed (i) slowly (ii) suddenly, than what will be the final pressure and temp. of the gas in each case, if the final volume is one fourth of the initial volume? $\gamma = 1.5$.

Watch Video Solution

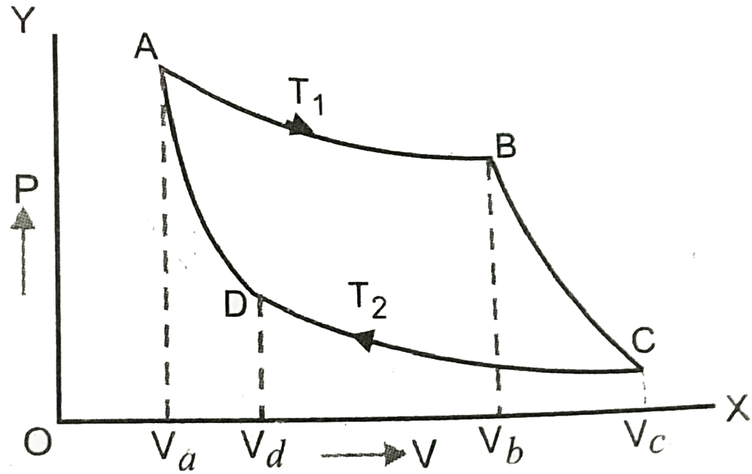
121. A tyre pumped to a pressure $3.375 atm \text{at} 27^{\circ} C$ suddenly bursts. What is the final temperature $(\gamma = 1.5)$?

Watch Video Solution

122. Calculate the fall in temperature of helium initially at $15^{\circ} C$, when it is suddenly expanded to $8 \times$ its original volume $(\gamma = 5/3)$.

Watch Video Solution

123. Two different adiabatic curves for the same gas intersect two isothermals at T_1, and T_2 as shown in $P - V$ diagram, (figure). How does the ratio (V_a / V_d) compare with the ratio (V_b / V_c) ?



Watch Video Solution

124. Two samples of a gas initially at same temperature and pressure are compressed from a volume V to $\frac{V}{2}$. One sample is compressed isothermally and the other adiabatically . In which sample is the pressure greater?

Watch Video Solution

125. Three moles of an ideal gas kept at a constant temperature of $300K$ are compressed from a volume of 4 litre to 1 litre. Calculate work done in the process. $R = 8.31 Jmole^{-1} K^{-1}$.

Watch Video Solution

126. A cylinder containing one gram molecule of the gas was compressed adiabaticaly untill its tempertaure rose from $27^\circ C$ to $97^\circ C$. Calculate the work done and heat produced in the gas $(\gamma = 1.5)$.

Watch Video Solution

127. $1g$ mole of an ideal gas at STP is subjected to a reversible adiabatic expansion to double its volume. Find the change in internal energy $(\gamma = 1.4)$

Watch Video Solution

128. A sample of gas $(\gamma = 1.5)$ is taken through an adiabatic process in which the volume is compressed from $1600cm^3$ to $400cm^3$. If the initial pressure is $150kPa$, (a) what is the final pressure and (b) how much work is done by the gas in the process?

Watch Video Solution

129. What is a heat engine? Explain the efficiency of a heat engine.

Watch Video Solution

130. What are the two types of pure substance ? Give one example of each type.

Watch Video Solution

131. What is the limitation of the first law of thermodynamics?

Watch Video Solution

132. State and explain second law of thermodynamics. What is its significance?

Watch Video Solution

133. State second law of thermodynamics.

Watch Video Solution

134. What do you understand by reversible and irreversible processed? Give examples. What are the necessary conditions for a process to be reversible?

Watch Video Solution

135. Can the Carnot engine be realised in practice?

Watch Video Solution

136. Efficiency of carnot engine working between ice point and steam point is

Watch Video Solution

137. One of the most efficient engines ever developed operated between 2100K and 700K. Its actual efficiency is 40%. What percentage of its maximum possible efficiency is this?

Watch Video Solution

138. In a heat engine, the temperature of the source and sink are 500 K and 375 K. If the engine consumes $25 \times 10^5 J$ per cycle, find(a) the efficiency of the engine, (b) work done per cycle, and (c) heat rejected to the sink per cycle.

Watch Video Solution

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

Watch Video Solution

140. The efficiency of a Carnot cycle is $1/6$. If on reducing the temperature of the sink by $65^\circ C$, the efficiency becomes $1/3$, find the source and sink temperatures between which the cycle is working.

Watch Video Solution

141. A reversible engine converts one fifth of heat which it absorbs from source into work. When the temp. of sink is reduced by $70^\circ C$, its efficiency is doubled. Calculate the temperature of the source and sink.

Watch Video Solution

142. A carnot engine has the same efficiency

(i) between $100K$ and $500K$ and

(ii) between $TK$and $900K$. Caculate the temperature T of the sink.

Watch Video Solution

143. A carnot engine whose heat sink is at $27^{\circ}C$ has an efficiency of 40%. By how many degrees should the temperature of source be changed to increase the efficiency by 10% of the original efficiency?

Watch Video Solution

144. An ideal engine operates by taking in steam from a boiler at $327^{\circ}C$ and rejecting heat to a sink at $27^{\circ}C$. The engine runs at $500r \pm$ and heat taken is $600 kcal$ in each revolution. Calculate(i) efficiency of engine (ii) work done in each cycle (iii) heat rejected in each revolution and (iv) power output of engine.

Watch Video Solution

145. Two Camot 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 :

Watch Video Solution

146. Five moles of an ideal gas are taken in a Carnot engine working between $100^\circ C$ and $30^\circ C$. The useful work done in one cycle is 420 joule. Calculate the ratio the volume of the gas at the end beginning of the isothermal expansion. $R=8.4JMo\le^{-1}K^{-1}$.

Watch Video Solution

Watch Video Solution

147. A carnot cycle is performed by $1 mole of air (\gamma = 1.4)$ initially at $327^\circ C$. Each stage represents a compression or expansion in the ratio $1:6$. Calcultate (a) the lowest temperature (b) net work done during each cycle and (C) efficiency of the engine.

Take $R = 8.31 J mole^{-1} K^{-1}$.

Watch Video Solution

148. Describe the working of a refrigerator as a heat pump. Derive an expression for its coefficient of performance.

Watch Video Solution

149. In a refrigerator, heat from inside at 277K is transferred to a room at 300K. How many joules of heat shall be delivered to the room for each joule of electrical energy consumed ideally?

Watch Video Solution

150. Calculate the least amount of work that must be done to freeze one gram of wate at $0^\circ C$ by means of a refrigerator. Temperature of surroundings is $27^\circ C$. How much heat is passed on the surroundings in this process? Latent heat of fusion $L = 80cal/g$.

Watch Video Solution

151. How much energy in watt hour may be required to convert $2kg$ of water into ice at $0^\circ C$, assuming that the refrigerator is ideal? Take room temp. $= 25^\circ C$, which is also the initial temp. of water and temp. of freezer is $-15^\circ C$.

Watch Video Solution

152. In a cold storage, ice melts at the rate of $2kg/h$ when the external temperature is $20^\circ C$. Find the minimum power output of the motor used to drive the refrigerator which just prevents the ice from melting. Latent heat of fusion of $ice = 80cal/g$

Watch Video Solution

153. A carnot engine having a perfect gas aas the working substance is driven backwards and is used for freezing water already at $0^\circ C$. If the engine is driven by $500W$ electric motor with an efficiency of 60% how long will it take to freeze $15kg$ of water? The working temps of the engine are $15^\circ C$ and $0^\circ C$. The system involves no energy losses. Given latent heat of ice $= 333 \times 10^3 Jkg^{-1}$.

Watch Video Solution

154. A geyser heats water flowing at the rate of 3.0 litres per minute from 27° to $77^\circ C$. If the geyser operates on a gas burner, what is the rate to consumption of the fuel if its heat of combustion is $4.0 \times 10^4 J/g$?

Watch Video Solution

155. What amount of heat must be supplied to 2.0×10^{-2} kg of nitrogen (at room temperature) to raise the temperature by $45^{\circ} C$ at constant pressure. Molecular mass of $N_2 = 28$, $R = 8.3 J \text{mol}^{-1} K^{-1}$.

Watch Video Solution

156. Explain why

(a) Two bodies at different temperature T_1 and T_2 if brought in thermal contact do not necessarily settle to the mean temperature $(T_1 + T_2)/2$?

(b) The coolant in a chemical or nuclear plant (i.e., the liquid used to prevent different parts of a plant from getting too hot)should have high specific heat. Comment.

(c) Air pressure in a car tyre increases during driving . Why?

(d) The climate of a harbour town is more temperature (i.e., without extremes of heat and cold) than that of a town in a desert at the same latitude. Why?

Watch Video Solution

157. Explain why

(a) Two bodies at different temperature T_1 and T_2 if brought in thermal contact do not necessarily settle to the mean temperature $(T_1 + T_2)/2$?

(b) The coolant in a chemical or nuclear plant (i.e., the liquid used to prevent different parts of a plant from getting too hot)should have high specific heat. Comment.

(c) Air pressure in a car tyre increases during driving . Why?

(d) The climate of a harbour town is more temperature (i.e., without extremes of heat and cold) than that of a town in a desert at the same latitude. Why?

Watch Video Solution

158. Air pressure in a car tyre increases during driving. Explain.

Watch Video Solution

159. Why is the climate of coastal cities milder than that of cities in the midst of large land areas?

Watch Video Solution

160. A cyclinder with a movable piston contains $3 mols$ of hydrogen at standard temperature and pressure. The walls of the cyclinder are made of a heat insulator, and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas increases, if the gas is compressed to half its original volume? Given $\gamma = 1.4$.

Watch Video Solution

161. In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to $22.3 J$ is done on the system. If the gas is taken from State A to B via a process in which the net heat absorbed by the system is $9.35 cal.$, How much is the net work done by the system in the later case? (Take $1 cal. = 4.9 J$)

Watch Video Solution

162. Two cyclinder A and B of equal capacity are connected to eachother via a stopcock. The cyclinder A contains an ideal gas at standard temperature and pressure, while the cyclindr B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following:

(a) What is the final pressure of the gas in A and B?

(b) What is the change in internal energy of the gas?

(c) What is the change in temperature of a gas?

(d) Do the intermidiate states of the system (before settling to the final equilibrium state)lie on its $P - V - T$ surface?

Watch Video Solution

163. A stream engine delivers $5.4 \times 10^8 J$ of work per minute and absorbs $3.6 \times 10^9 J$ of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?

Watch Video Solution

164. An electric heater supplies heat to a system at a rate or 100 W. If the system performs work at a rate of 75 joules per second at what rate is the internal energy increasing ?

Watch Video Solution

165. A refrigerator is to maintain eatables kept inside at $9^\circ C$, if room temperature is $36^\circ C$. Calculate the cofficient of performance.

Watch Video Solution

Problems From Competitive Examinations

1. An ideal gas is taken through a cyclic thermodynamic process through four steps. The amounts of heat involved in these steps are

$Q_1 = 5960J, Q_2 = -5585J, Q_3 = -2980J$ and $Q_4 = 3645J$, respectively. The corresponding quantities of work involved are $W_1 = 2200J, W_2 = -825J, W_3 = -1100J$ and W_4 respectively.

(1) Find the value of W_4.

(2) What is the efficiency of the cycle

Watch Video Solution

2. A vertical hollow cylinder contains an ideal gas. The gas is enclosed by a $5kg$ movable piston with an area of cross-section $5 \times 10^{-3} m^2$. Now, the gas is heated slowly from $300K$ to $350K$ and the piston rises by $0.1m$. The piston is now clamped at this position and the gas is cooled back to $300K$. Find the difference between the heat energy added during heating process and energy lost during the cooling process. $\left(1\text{atm pressure} = 10^5 Nm^{-2}\right]$

Watch Video Solution

3. The pressure of one gram mole of a monoatomic gas increases linearly from $4 \times 10^5 N / M^2$ to $8 \times 10^5 N / m^2$. Calculate

(i) Work done by the gas,

(ii) increase in internal energy, (iii) amount of heat supplied,

(iv) molar heat capacity of the gas.

Take $R = 8.31 J mole^{-1} K^{-1}$.

Watch Video Solution

4. Two moles of an ideal monoatomic gas are confined within a cylinder by a massless and frictionless spring loaded piston of cross-sectional area $4 \times 10^{-3} m^2$. The spring is, initially in its relaxed state. Now the gas is heated by an electric heater, placed inside the cylinder, for some time. During this time, the gas expands and does $50J$ of work in moving the piston through a distance $0.10m$. The temperature of the gas increases by $50K$. Calculate the spring constant and the heat supplied by the heater. $P_{atm} = 1 \times 10^5 N / m^2 R = 8.314 J / mol - K$

Watch Video Solution

5. The temperatures T_1 and $T(2)$ of two heat reservoirs in an ideal carnot engine are $1500^\circ C$ and $500^\circ C$. Which of these (a) increasing $T_1 by 100^\circ C$ or (b) decreasing $T_2 by 100^\circ C$ would result in greater improvement of the efficiency of the engine?

Watch Video Solution

6. An ideal 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 2V, the final pressure P_a. The ratio of the specific heats of the gas is 1.67. The ratio $\frac{P_a}{P_1}$ is ....

Watch Video Solution

7. An ideal gas having initial pressure P, volume V and temperature T is allowed to expands adiabatically until its volume becomes 5.66V while its temperature falls to T/2.

(i) How many degrees of freedom do the gas molecules have?

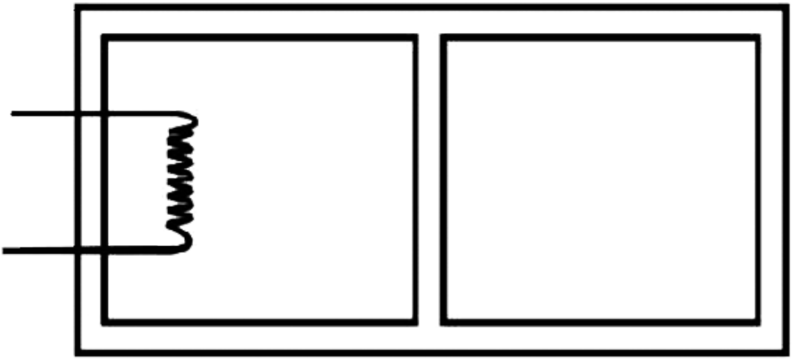
Obtain the work done by the gas during the expansion as a function of the initial pressure P and volume V.

Watch Video Solution

8. At $27^{\circ}C$ two moles of an ideal monoatomic gas occupy a volume V. The gas expands adiabatically to a volume 2V. Calculate (i) the final temperature of the gas, (ii) change in its internal energy, and (iii) the work done by the gas during this process.

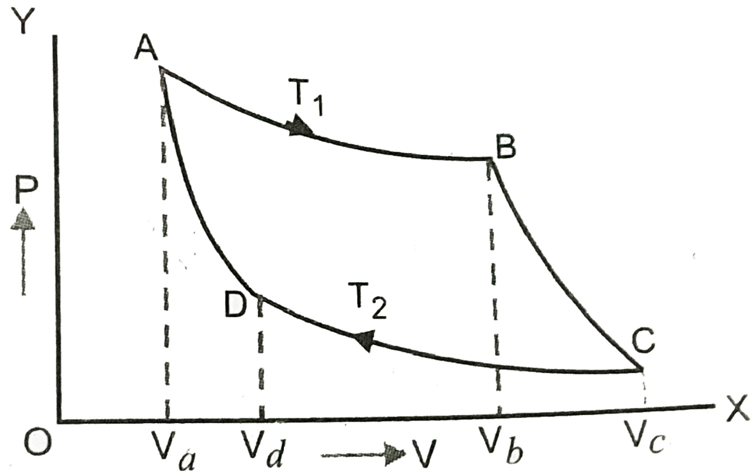
Watch Video Solution

9. The rectangular box shown in Fig has partition which can slide without friction along the length of the box. Initially each of the two chambers of the box has one mole of a mono-atomic ideal gas $(\lambda = 5/3)$ at a pressure P_0, volume V_0 and temperature T_0. The chamber on the left is slowly heated by an electric heater. The walls of the box and the lead wires of the heater is negligible. The gas in the left chamber expands pushing the partition until the final pressure in both chambers becomes $243P_0/32$. Determine (i) the final temperature of the gas in each chamber and (ii) the work done by the gas in the right chamber.



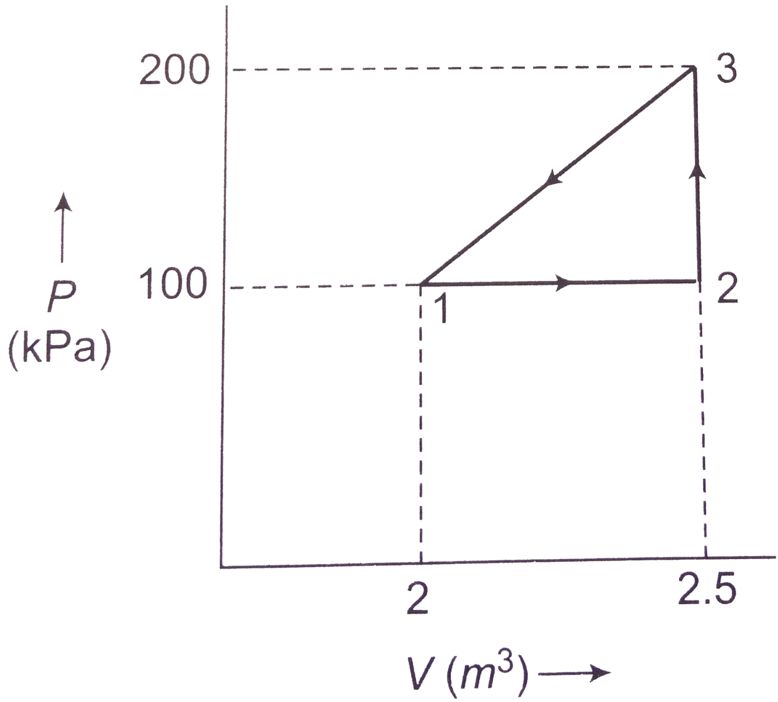
Watch Video Solution

10. Two different adiabatic curves for the same gas intersect two isothermals at T_1, and T_2 as shown in $P-V$ diagram, (figure). How does the ratio (V_a / V_d) compare with the ratio (V_b / V_c) ?



Watch Video Solution

11.



In the figure an ideal gas changes is state from state A to state C by two paths ABC and AC.

(a) Find the path along which the work done is least.

(b) The internal energy of the gas at A is 10 J and the amount of heat supplied to change its state to C through the path AC is 200 J. Calculate the internal energy at C.

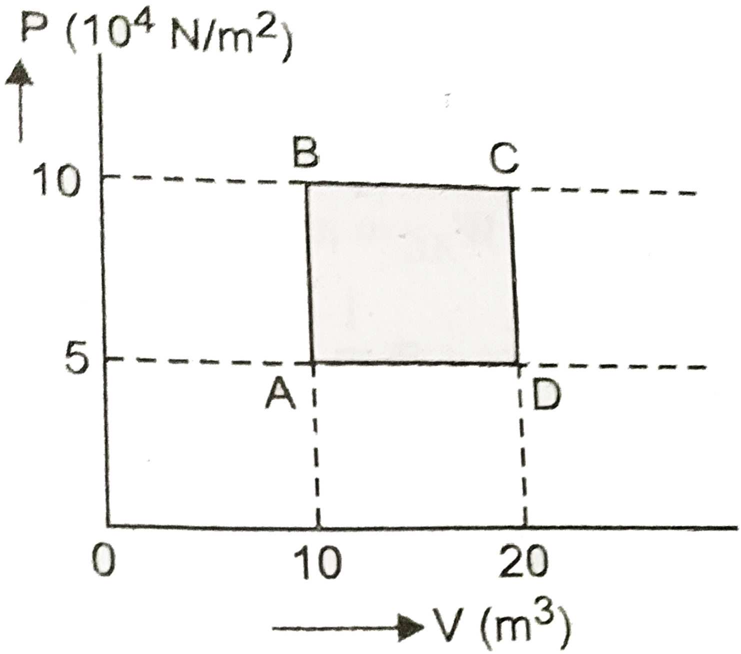
(c) The internal energy of the gas at state B is 20 J. Fid the amount of the heat supplied to gas to go from A to B.

Watch Video Solution

12. A sample of $2kg$ of monoatomic helium (assumed ideal) is taken through the process ABC and another sample of $2kg$ of the same gas is taken through the process ACD as shown in (figure). Given molecular mass of He $= 4$ and $R = 8.3 Jmole^{-1}K^{-1}$

(i) What is the temperature of He in each of the states A, B, C and D?

(ii) How much is the heat involves in process , ABC and ADC?

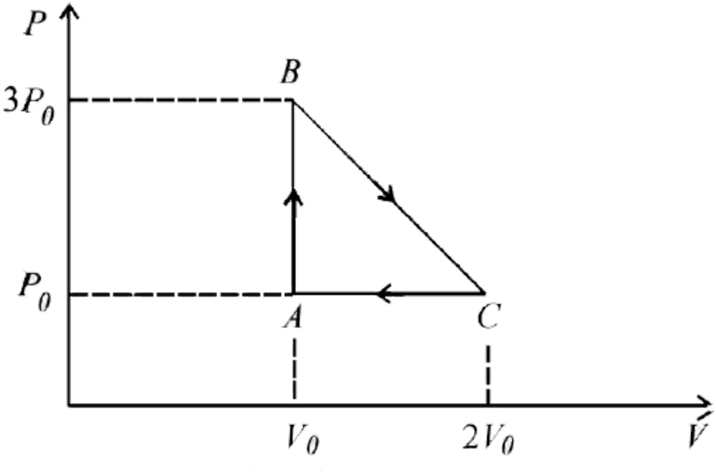


Watch Video Solution

13. One mole of a diatomic ideal gas $(\gamma = 1.4)$ is taken through a cyclic process starting from point A. The process $A \rightarrow B$ is an adiabatic compression, $B \rightarrow C$ is isobaric expansion, $C \rightarrow D$ is an adiabatic expansion, and $D \rightarrow A$ is isochoric. The volume ratios are $V_A / V_B = 16$ and $V_C / V_B = 2$ and the temperature at A is $T_A = 300K$. Calculate the temperature of the gas at the points B and D and find the efficiency of the cycle.

Watch Video Solution

14. One mole of an ideal monatomic gas is taken round the cyclic process ABCA as shown in figure. Calculate



(a) the work done by the gas.

(b) the heat rejected by the gas in the path CA and the heat absorbed by the gas in the path AB,

(c) the net heat absorbed by the gas in the path BC,

(d) the maximum temperature attained by the gas during the cycle.

Watch Video Solution

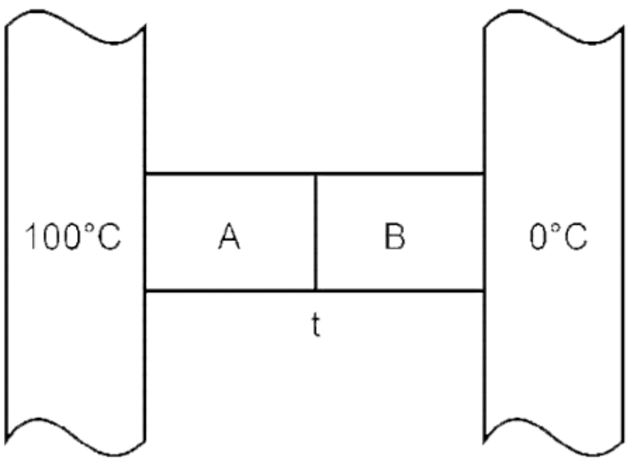
15. Two moles of an ideal monoatomic gas, initially at pressure p_1 and volume V_1, undergo an adiabatic compression until its volume is V_2. Then the gas is given heat Q at constant volume V_2.

(i) Sketch the complete process on a p-V diagram.

(b) Find the total work done by the gas, the total change in its internal energy and the final temperature of the gas. [Give your answer in terms of p_1, V_1, V_2, Q and R]

Watch Video Solution

16. Two metal cubes A and B of same size are arranged as shown in Figure. The extreme ends of the combination are maintained at the indicated temperatures. The arrangement is thermally insulated. The coefficients of thermal conductivity of A and B are $300W/m^{\circ}C$ and $200W/m^{\circ}C$, respectively. After steady state is reached the temperature t of the interface will be ......



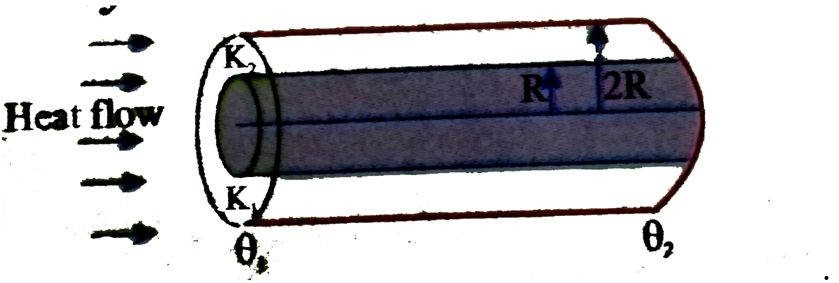
Watch Video Solution

17. One end of a copper rod of uniform cross-section and of length 3.1 m is kept in contact with ice and the other end with water at $100^{\circ} C$. At what point along it's length should a temperature of $200^{\circ} C$ be maintained so that in steady state, the mass of ice melting be equal to that of the steam produced in the same interval of time. Assume that the whole system is insulated from the surroundings. Latent heat of fusion of ice and vaporisation of water are 80 cal/gm and 540 cal/gm respectively

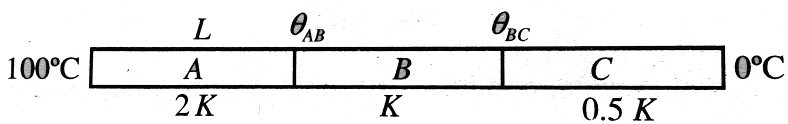
Watch Video Solution

18. A cylinder of radius R made of a material of thermal conductivity K_1 is surrounded by cylindrical shell of inner radius R and outer radius $2R$ made of a material of thermal con-ductivity K_2 The two ends of the combined system are maintained at two differnet tem-peratures There is no loss of heat across the cylindrical surface and system is in steady state

What is the effective thermal conductivity of the system



Watch Video Solution



19.

Three cylindrical rods A, B and C of equal lengths and equal diameters are joined in series as shown if Fig. Their thermal conductivities are 2K, K and 0.5K, respectively. In steady state, if the free ends of rods A and C are at $100^\circ C$ and $0^\circ C$, respectively, calculate the temperature at the two junction points. Assume negligible loss by radiaiotn through the curved surface. What will be the equivalent thermal conductivity?

Watch Video Solution

20. An electric heater is used in a room of total wall area $137m^2$ to maintain a temperature of $+20^\circ C$ inside it when the outside temperature is $-10^\circ C$. The walls have three different layers materials . The innermost layer is of wood of thickness 2.5 cm, in the middle layer is od cement of thickness 1.0 cm and the outermost layer is of brick of thickness 25.0 cm. find the power of the electric heater. Assume that there is no heat loss through the floor and the ceiling. The thermal conductives of wood, cement and brick are $0.125, 1.5 \text{ and } 1.0wa/m/.^\circ C$ respectively.

Watch Video Solution

21. A cylindrical block of length 0.4 m and area of cross-section $0.04m^2$ is placed coaxially on a thin metal disc of mass 0.4 kg and of the same cross

- section. The upper face of the cylinder is maintained at a constant temperature of 400 K and the initial temperature of the disc is 300K. if the thermal conductivity of the material of the cylinder is $10\text{watt}/m.K$ and the specific heat of the material of the disc is $600J/kg.K$, how long will it take for the temperature of the disc to increase to 350 K? Assume for purpose of calculation the thermal conductivity of the disc to be very high and the system to be thermally insulated except for the upper face of the cylinder.

Watch Video Solution

22. A wire of length 1 m and radius 10^{-3}m is carrying a heavy current and is assumed to radiate as a black body. At equilibrium, its temperature is 900 K while that of surrounding is 300 K. The resistivity of the material of the wire at 300 K is $\pi^{\circ} \times 10^{-8}$ ohm m and its temperature coefficient of resistance is $7.8 \times 10^{-3}/C$ (stefan's constant $\sigma = 5.68 \times 10^{-8} W/m^2K^2$.

The current in the wire is nearly

Watch Video Solution

Problems For Self Practice

1. An ideal monoatomic gas is taken around the cycle ABCDA, wher co-ordinates of A, B, C and D on and D on $P-V$ diagram are A $(p, V), B(2p, V), C(2p, 2V)$ and $D(p, 2V)$. Calculate work done during the cycle.

Watch Video Solution

2. Calculate net work done by the gas whose thermodynamical behaviour is represented by right angled triangle ABC on $P-V$ diagram. The $P-V$ diagram co-ordinates are : $A(20, 6), B(10, 12)$ and $C(10, 6)$ where P is in Nm^{-2} and V is in m^3

Watch Video Solution

3. One mole of an ideal gas undergoes a cyclic change ABCD where the (P-V) co-ordinates are A(5, 1), B(5, 3), C(2, 3) and D(2, 1). P is in atmosphere and V is in litre. Calculate work done along AB , BC, CD and DA and also net work done in the process. Given 1 atmosphere $= 1.01 \times 10^5 Nm^{-2}$.

View Text Solution

4. Calculate the change in internal energy of a block of copper of mass $200g$ when it is heated from $25^\circ Cto75^\circ C$. Given specific heat of copper $= 0.1cal. g^{-1}.^\circ C^{-1}$ and assume that change in volume is negligible.

Watch Video Solution

5. One kg of water at $373K$ is converted into steam at the same temperature. The volume $1cm^3$ of water becomes $1671cm^3$ on boiling. Calculate the change in internal energy of the system , if heat of vaporisation is $540calg^{-1}$. Given standard atmospheric pressure $= 1.013 \times 10^5 Nm^{-2}$.

Watch Video Solution

6. Calculate the change in internal energy when 5g of air is heated from 0° to $4^\circ C$. The specific heat of air at constant volume is $0.172 cal g^{-1}.^\circ C^{-1}$.

Watch Video Solution

7. A volume of $10m^3$ of a liquid is supplied with $100 kal$ of heat and expands at a constant pressure of $10 atm$ to a final volume of $10.2m^3$. Calculate the work done and change in internal energy.

Watch Video Solution

8. The internal energy of monoatomic ideal gas is 1.5 nRT. One mole of helium is kept in cylinder of cross section $8.5cm^2$. The cylinder is closed by a light frictionless piston. The gas is heated slowly in a process during which a total of 42 J heat is given to the gas. If the temperature rises through $2^{\circ} C$ find the distance moved by the piston. Atmospheric pressure $= 100 kPa$

Watch Video Solution

9. A certain gas at atmospheric pressure is compressed adiabatically so that its volume becomes half of its original volume. Calculate the resulting pressure in Nm^{-2}. Given γ for air = 1.4.

Watch Video Solution

10. A gas is suddenly compressed to $\frac{1}{4} th$ of its original volume. Caculate the rise in temperature when original temperature is $27^{\circ} C. \gamma = 1.5.$

Watch Video Solution

11. A tyre pumped to a pressure of $6 atmosphere$ bursts suddenly. Calculate the temperature of escaping air. Given initial room temperature is $15^\circ C$ and gamma for air is 1.4`.

Watch Video Solution

12. A tyre pumped to a pressure of 3 atmospheres suddenly bursts. Calculate the fall in temperature due to adiabatic expansion. The temperature of air before expansion is $27^\circ C$ and value of $\gamma = 1.4$.

Watch Video Solution

13. $200cm^3$ of a gas is compressed to $100cm^3$ at atmospheric pressure $\left(10^6 \text{dyne}/cm^2\right)$. Find the resultant pressure if the change is (i) slow (ii) sudden Take $\gamma = 1.4$.

Watch Video Solution

14. A quantity of air at $27^\circ C$ and atmospheric pressure is suddenly compressed to half its original volume. Find the final (i) pressure and (ii) temperature.

Given $\gamma f \text{ or } air = 1.42$.

Watch Video Solution

15. A quantity of air at normal temperature is compressed (a) slowly (b) suddenly to one third of its volume. Find the rise in temperature, if any in each case, $\gamma = 1.4$.

Watch Video Solution

16. A quantity of air is kept in a container having walls which are slightly conducting. The initial temperature and volume are $27^0 C$ (equal to the temperature of the surrounding) and $800 cm^3$ respectively. Find the rise in the temperature of the gas is compressed to $200 cm^3$ (a) in a short time (b) in a long time . Take gamma= 1.4.

Watch Video Solution

17. A litre of hydrogen at $127^\circ C$ and $10^6 dy \ne cm^{-2}$ pressure expands isothermally until its volume is doubled and then adiabatically until its volume is redoubled. Find the final pressure of the gas. Given $\gamma = 1.4$.

View Text Solution

18. Dry air at $15^\circ C$ and $10 atm$ is suddenly released at atmospheric pressure. Find the final temperature of the air $\left[\frac{C_p}{C_v} = 1.41\right]$.

Watch Video Solution

19. Calculate the rise in temperature when a gas, for which $\gamma = 1.5$ is compressed to 27 times its original pressure, assuming the initial temperature to be $27^\circ C$.

Watch Video Solution

20. $1000cm^3$ of argon at $27^\circ C$ is adiabatically compressed so that the temperature is $127^\circ C$. Calculate the resulting volume. Given $\gamma = 5/3$.

View Text Solution

21. Calculate the work done if one mole of an ideal gas is compressed isothermally at a temperature $27^\circ C$ from volume of 5 litres to 1 litre. Given $R = 8.31 Jmo \le^{-1} K^{-1}$.

View Text Solution

22. One kilogram molecule of a gas at 400 K expands isothermally until its volume is doubled. Find the amount of work done and heat produced. Given $R = 8.3 \times 10^{-3} J(kgmo \le)^{-1} K^{-1}$.

View Text Solution

23. Find the final value of a gram molecule of a gas after an isothermal expansion at $127^{\circ} C$, if the original volume is $400 c. c$ Given amount of work done by a gram molecule of a gas during expansion is 2302.6joule, $R = 8.3 \text{joule mole}^{-1} K^{-1}$

Watch Video Solution

24. One gram mole of an ideal gas at $N.T.P$ is first expanded isothermally to twice the origional volume. It is then compressed at constant volume, till its pressure is raised to the original value. Calculate the total amount of work done. Given $R = 8.3 mole^{-1} K^{-1}$.

Watch Video Solution

25. Calculate work done to compress isothermally 1g of hydrogen gas at N.T.P. to half its initially volume. Find the amount of heat evolved and change in internal energy. Given $R = 8.31 J mol^{-1} K^{-1}$.

View Text Solution

26. Ten mole of hydrogen at $N.T.P$ is compressed adiabatically so that it temperature becomes $400^{\circ}C$. How much work is done on the gas? Also, Calculate the increase in internal energy of the gas. Take $R = 8.4Jmole^{-1}K^{-1}$ and $\gamma = 1.4$.

Watch Video Solution

27. If $1gram$ of oxygen at $760mm$ pressure and $0^{\circ}C$ has its volume double in an adiabatic change , calculate the change in internal energy. Take $R = 2cal.\ Mole^{-1}K^{-1} = 4.2Jcal^{-1}$ and $\gamma = 1.4$.

Watch Video Solution

28. A sample of hydrogen of mass $6g$ is allowed to expand isothermally at $27^{\circ}C$ till its volume is doubled.

(a) How may moles of hydrogen are there?

(b) What is final temperature of H_2?

(c) Caculate work done during expansion.

Watch Video Solution

29. 50 g of oxygen at N.T.P. is compressed adiabatically to a pressure of 5 atmosphere. Caluculate the work done on the gas, if $\gamma = 1.4$ and $R = 8.31 J mol^{-1} K^{-1}$

View Text Solution

30. Find the efficiency of a Carnot's engine working between $127^\circ C$ and $27^\circ C$.

View Text Solution

31. A Carnot engine, whose temperature of the source is $400K$ receives $200 cal$ or ies of heat at this temperature and rejects $150 calaroies$ of heat to the sink. What is the temperature of the sink? Also, calculate the efficiency of the engine

Watch Video Solution

32. Calculate the efficiency of a Carnot engine operating between 450 K and 300 K. If this engine takes 5,00,000 J from the surce, how much work does it perform ?

View Text Solution

33. A Carnot engine whose low temperature reservoir is at $7^{\circ} C$ has an efficiency of 50% . It is desired to increase the efficiency to 70% By low many degrees should the temperature of the high temperature reservoir be increased

Watch Video Solution

34. Efficiency of a carnot engine is 0.4, when temp. of sink is $300K$. What is temp. of source? If temp. of source is kept same and that of sink is lowered by $50^\circ C$, what would be the efficiency?

Watch Video Solution

35. A carnot engine absorbs $1000J$ of heat energy from a reservoir at $127^\circ C$ and rejecs $600J$ of heat energy during each cycle. Calculate (i) efficiency of the engine, (ii) temperature of sink, (iii) amount of useful work done per cycle.

Watch Video Solution

36. A reversible heat engine operates with an efficiency of 50 %. If during each cycle it rejects 150 cal to a reservoir of heat at $30^\circ C$, then (i) what is the temperature of the other reservoir and (ii) how much work does it carry out per cycle ?

View Text Solution

View Text Solution

37. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by $62^{\circ} C$, the efficiency of the engine is doubled. The temperatures of the source and sink are

Watch Video Solution

38. Calculate the difference in efficiencies of a Carnot engine working between (i) 400 K and 350 K and (ii) between 350 K and 300 K

View Text Solution

39. An ideal gas heat engine operates in a Carnot's cycle between $227^{\circ} C$ and $127^{\circ} C$. It absorbs $6 \times 10^{4} J$ at high temperature. The amount of heat converted into work is

Watch Video Solution

40. The boling point of water at a pressure of 50 atmosphere is $250^\circ C$. Compare the theoretical efficincies of the engine oprating between the boling of water at (i) 1 atmosphere (ii) 50 atmosphere, assuming the temperature of sink the wach case as $27^\circ C$.

View Text Solution

41. A perfect carnot engine has source temp. $227^\circ C$ and sink temp. $127^\circ C$. Find the efficiency of the engine, If $10000 J$ of external work is to be done, find heat received from source and heat released to the sink.

Watch Video Solution

42. A Carnot engine takes in heat from a reservoir of heat at $427^\circ C$. How many calories of heat must it take from the reservoir in order to procuce useful mechanical work at the rate of $357 wa$?

Watch Video Solution

43. A Carnot's engine operates with an efficiency of 40% with its sink at $27^\circ C$. By what amount should the temperature of the source be increased with an aim to increase the efficiency by 10%

Watch Video Solution

44. A Carnot engine works between $200^\circ C$ and $0^\circ C$ and another carnot engine works between $0^\circ C$ and $-200^\circ C$. In both caes the working substance absorbes 4 kcal of heat from the source. The efficiency of first engine will be

Watch Video Solution

45. Two carnot engines A and B are operated in series. The first one A receives heat at $900K$ and rejects it to a reservoir at TK. The second engine B receives the heat rejected by the first engine and rejects it to a heat reservoir at $400K$. Calculate the value of T, when the efficiency ot two engines is the same.

Watch Video Solution

46. One mole of an ideal gas is taken in a Carnot engine working between $27^\circ C$ and $227^\circ C$. The useful work done in one cycle is 600 J. calculate the ratio of volume of gas at the end and beginning of the isothermal expansion. Given 8.3 J mole . $^{-1} K^{-1}$.

View Text Solution

47. In a double acting steam engine, the average pressure in $90Ncm^{-2}$, the area of the piston is $7.46cm^2$, the length of the strokes is 1 meter and the number of revolution per second is 5. find the horse power of the engine.

View Text Solution

48. In a reciprocating steam engine, the avearge pressure of steam is $50Nm^{-2}$. The length of half stroke is 50 cm and area of cross section of the piston is $400 cm^2$. If the engine is making 300 strokes per minute, calculate power of the engine in k W.

View Text Solution

49. An engine develops 33250 W power, consuming 10 kg fule per hour. If the clorific value of the fuel is 11450 cal g^{-1}, find the efficiency of the engine.

View Text Solution

50. A petrol engine consumes 5 kg of petrol in one hour, the calorific value of petrol being 10^8 calorie kg^{-1} . Assuming that only 12% of heat is converted into mechanical energy, find the average power developed in kilowatt.

View Text Solution

51. One kilograme of coal produces 3.6×10^6 cal of heat during combustion. Assuming that only 1/10 th energy so generated is utilised for useful purpose, find the mass of coal required per hour for running 210 kW engine.

View Text Solution

52. In a petrol engine, the rate of production of heat due to combustion of the fuel is $5 \times 10^6 calh^{-1}$. The efficiency of the engine is 30%. Calculate the H.P. of the engine. Given, J=4.2 J cal^{-1} and 1 h.p. =746 W.

Watch Video Solution

53. In a petrol engine,the rate of production of heat due to the combustion of petrol is $7.46 \times 10^5 calh^{-1}$. The efficiency of the engine is 30%. Calculate the horse power of the engine, if J is 4.2×10^7 erg cal^{-1}

Watch Video Solution

54. In a refrigerator, heat from inside at $270K$ is transferred to a room at $300K$. How many joule of heat energy is drawn from the sink for each joule of electrical energy consumed ideally ?

Watch Video Solution

55. Refrigerator A works between $-10^{\circ}C$ and $27^{\circ}C$, while refrigerator B works between $-27^{\circ}C$ and $17^{\circ}C$, both removing heat equal to 2000J from the freezer. Which of the two is the better refrigerator?

Watch Video Solution

56. Assuming that a domestic refrigerator can be regarded as a reversivle engine working between the temperature of melting ice and that of the atmosphere $(170^{\circ}C)$, calculate the energy which muct be supplied to freeze one kilogram of water already at $0^{\circ}C$.

Watch Video Solution

57. A refrigerator whose coefficient of performance η' is 4, extracts heat from the cooling compartment at the rate of 400 J per cycle.

(a) How much work per cycle is required to operate the refrigerator cycle?

(b) How much heat per cycle is discharged to the room which acts as the high temperature reservoir?

Watch Video Solution

58. A refrigerator has to transfer an average of 263J of heat per second from temperature $-10^{\circ} C$ to $25^{\circ} C$. Calculate the average power consumed, assuming no enegy losses in the process.

Watch Video Solution

59. A refrigerator freezes 5 kg of water at $0^{\circ} C$ into ice at $0^{\circ} C$ in a time internal of 20 minutes. Assume that the room temperature is $20^{\circ} C$. Calculate the minimum power needed to accomplish it.

Watch Video Solution

Watch Video Solution

60. Ice in cold storage melts at the rate of 3 kg per hour. The temperature outside is $27^\circ C$. Find the minimum power output of a motor used to drive the refrigerator, which just prevents ice from melting.Latent heat of ice $80 calg^{-1}$, $J = 4.2 \times 10^7$ erg cal^{-1}. given 1h.p. =746 W.

View Text Solution

61. The temperature gradient in a rod of $0.5m$ length is $80^\circ C/m$. It the temperature of hotter end of the rod is $30^\circ C$, then the temperature of the cooler end is

Watch Video Solution

62. Calculate the rate of loss of heat through a glass window of area $1000 cm^2$ and thickness 0.4 cm when temperature inside is $37^\circ C$ and outside is $-5^{\circ})C$. Coefficient of thermal conductivity of glass is $2.2 \times 10^{-3} cals^{-1} cm^{-1} K^{-1}$.

Watch Video Solution

63. Calculate the difference in temperature between two sides of an iron plate 20 m m thick, when heat is conducted at the rate of 6×10^5 cal/min/m^2. K for metal is 0.2 cal$s^{-1} cm^{-1} .^{\circ} C^{-1}$

Watch Video Solution

64. The length, a rod of aluminium is 1.0 m and its area of cross-section is $5.0 cm^2$. Its one end is kept at $250^{\circ} C$ and the at $50^{\circ} C$. How much heat will flow in the rod in 5.0 minutes . K for Al = $2.0 \times 10^{-1} kJs^{-1} m^{-1} .^{\circ} C^{-1}$ and $J = 4.18 cal^{-1}$

Watch Video Solution

65. A flat-bottom kettle placed on a stove is being used to boil water and the thermal conductivity of the material is $0.5 cal s^{-1} cm^{-1}$. If the amount of steam being produced in the kettle is at rate $10 g \min^{-1}$, calculate the difference of temperature between the inner and outer surface of of the bottom. the latent heat of steam is $540 cal g^{-1}$

View Text Solution

66. An iron boiler is 10 mm thick and has a heating area $2m^2$. The two surfaces of the boiler are at $240^\circ C$ and $100^\circ C$ respectively. Find the mass of the water evaporated into steam per minute. Given that latest heat of steam is $536 kcal kg^{-1}$ and thermal conductivity of iron is $1.6 \times 10^{-2} kcal s^{-1} m^{-1} . ^\circ C^{-1}$.

Watch Video Solution

67. One end of a 0.25 m long metal bar is in steam and the other is in contact with ice . If 12 g of ice melts per minute, what is the thermal conductivity of the metal? Given cross-section of the bar $= 5 \times 10^{-4} m^2$ and latent heat of ice is $80 cal g^{-1}$

Watch Video Solution

68. A layer of ice 0.15 m thick has formed on the surface of a deep pond. If the temperature of upper surface of ice is constant and equql to that of air which is $-12^{\circ} C$, determine the time it will take to increase of ice layer by 0.2 mm. take latent heat of ice =80 cal g^{-1}, density of ice =0.91 g cm^{-3} and thermal conductivity of ice =0.5 cal $s^{-1} m^{-1} K^{-1}$.

Watch Video Solution

69. Water is boiled in a rectangular steel tank of thickness 2 cm by a constant temperature furnace. Due to vaporisation, water level falls at a steady rate of 1 cm in 9 minutes. Calculate the temperature of the furnace. Given K for steel $0.2 cal s^{-1} m^{-1} . ^{\circ} C^{-1}$

Watch Video Solution

70. Estimate the rate at which ice would melt in a wooden box 20 mm thick and of inside measurement 200 cm x 100 cm x 100 cm assumming that external temperature is $27^{\circ} C$ and coefficient of thermal conductivity of wood is $0.0004 cal s^{-1} cm^{-1} . ^{\circ} C^{-1}$.

Watch Video Solution

71. Steam at $100^{\circ} C$ is passed through a tubeof radius 5 cm and length 3 m. If the thickness of tube be 2 mm and conductivity of its material be 2×10^{-4} cal $cm^{-1} K^{-1} s^{-1}$, calculate the rate of loss of heat in js^{-1}. The outside temperature is $20^{\circ} C$.

Watch Video Solution

72. The outer face of a rectangular slab of equal thickness of iron and brass are maintained at $100^{\circ} C$ and $0^{\circ} C$, respectively. Find the temperature of the interface. The conductivities of iron and brass are 14 and $126 W m^{-1} K^{-1}$ respectively.

Watch Video Solution

73. The thermal conductivity of copper is four times that of brass. Two rods of copper and brass of same length and cross-section are joined end to end. The free end of copper rod is at $0^{\circ} C$ and that of brass rod at $100^{\circ} C$. Calculate the temperature of junction at equilibrium. neglect radiation losses.

Watch Video Solution

74. A composite wall of area A is made of equal thickness of lead and iron having thermal conductivities K and 2K, respectively. The temperature on the two sides of the composite wall are $100^{\circ} C$ and $0^{\circ} C$ with the layer on the hotter side. Calculate the steady -state temperature of the lead-iron interface.

Watch Video Solution

Watch Video Solution

75. A wall consists of two layer, one of thickness 3 cm and other of 6 cm. the thermal conductivities of the materials of these layers are K and 3K respectively. The temperature of the outer surfaces of the two layers are $-5^{\circ}C$ and $20^{\circ}C$ respectively. determine the temperature of the surface of contact of the two layers in the steady state.

Watch Video Solution

76. The plane surface of two sheets of different metals are kept in contact with each other. The thickness of sheets $2.5cm$ and 3 cm respectively and the ratio of their thermal conductivities in the same order is $5:6$. If the outer surfaces of the sheets are at constant temperatures of $100^{\circ}C$ and $10^{\circ}C$ respectively, calculate the temperature of interface.

View Text Solution

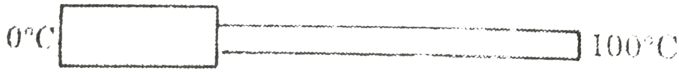
77. The temperature difference between the two ends of a bar 1.0 m long is $50^\circ C$ and that for the other bar 1.25 m long $75^\circ C$. Both the bars have same area of cross-section. If the rates of conduction of heat in the two bars are the same, find the ratio of the coefficients of thermal conductivity of the materials of the two bars.

View Text Solution

78. The ratio of the areas of cross-section of two rods of different materials is $1:2$, and the ratio of the thermal conductivities of their materials is $4:3$. On keeping equal temperature-difference between the ends of these rods, the rate of conduction of heat are equal. Determine the ratio of the lengths of the rods.

View Text Solution

79. In fig, two bars of the same metal are connected. The length of the first bar is half of that of the second, but the cross-sectional area is double. What is the temperature of the junction of the bars ?



Watch Video Solution

80. A room at $20^\circ C$ is heated by a heater of resistence 20 ohm connected to 200 VV mains. The temperature is uniform throughout the room and the heati s transmitted through a glass window of area $1m^2$ and thickness 0.2 cm. Calculate the temperature outside. Thermal conductivity of glass is $0.2cal / mC^\circ$ s and mechanical equivalent of heat is $4.2J / cal.$

Watch Video Solution

81. The sun radiates maximum energy at wavelength 4753Å. Estimate the surface temperature of the sun, if $b = 2.888 \times 10^{-3} mK.$

View Text Solution

82. The temperature of an ordinary electric bulb is around 3000 K. At what wavelength will it radiate maximum energy ? Will this wavelength be within visible region? Given $b = 0.288cmK$.

View Text Solution

83. A furnace is at a temperature of 2000K. At what wavelength will it radiate maximum intensity. Is it in visible region?

View Text Solution

84. A black body radiates energy at the rate of $1.452 \times 10^{10} ergs^{-1} m^{-2}$. Calculate the value of Stefan's constant.

View Text Solution

85. Calculate the temperature (in K) at which a perfect black body radiates energy at the rate of $5.67 W cm^{-2}$. Given $\sigma = 5.67 \times 10^{8} W m^{-2} K^{-4}$.

Watch Video Solution

86. A full radiator at $0^{\circ} C$ radiates energy at the rate of $3.2 \times 10^{4} erg cm^{-2} s^{-1}$. Find (i) Stefan's constant and (ii) the amount of heat radiated per second by a sphere of radius 4 cm and at a temperature of $1000^{\circ} C$.

Watch Video Solution

87. Surface temperature of sun is $6000K$. Considering sun as a perfectly black body, calculate the energy given out by sun per second in radiation. Radius of sun $= 6.9 \times 10^{8} m$ and $\sigma = 5.67 \times 10^{-8} J s^{-1} m^{-2} K^{-4}$

View Text Solution

88. The original temperature of a black body is . $727^\circ C$. The temperature at which this black body must be raised so as to double the total radiant energy, is

Watch Video Solution

89. The temperature of a body in increased from $27^\circ C$ to $127^\circ C$. By what factor would the radiation emitted by it increase?

Watch Video Solution

90. A black body initially at $27^\circ C$ is heated to $327^\circ C$ is heated to $327^\circ C$. How many times is total heat emitted at the higher temperature than emitted at lower temperature ? What is the wavelength of the maximum energy radiation at the higher temperature ? Wien's constant $= 2.898 \times 10^{-3} mK$.

Watch Video Solution

91. An electric bulb with tungsten filament having an area of $0.25 cm^2$ is raised to a temperature of $3000 K$, when a current passes through it. Calculate the electrical energy being consumed in watt, if the emissivity of the filament is 0.35. Stefan's constant, $\sigma = 5.67 \times 10^{-5} erg^{-1} cm^{-2} K^{-4}$. If due to fall in main voltage the fialment temperature falls to 2500 K, what will be wattage of the bulb?

Watch Video Solution

92. The energy emitted per second by a black body at $1227^\circ C$. If the temperature of the black body is increased to $2727^\circ C$, calculate the energy emitted per second in terms of E in the second case.

View Text Solution

93. A black ened metal sphere of radius 7 cm is encllosed in as evacuated chamber maintained at a temperature of $27^\circ C$. At what rate must energy be supplied to the sphere so as to keep its temperature constant at

$127^\circ C$?

$\sigma = 5.7 \times 10^{-8} Wm^{-2}K^{-4}$.

Watch Video Solution

94. A sphere of radius 10 cm is hung inside an oven walls are at a temperature of 1000 K. Calculate total energy incident per second (in Js^{-1}) on the sphere. Given $\sigma = 5.67 \times 10^{-8} SI$ units.

Watch Video Solution

95. A body which has a surface area $5.0 cm^2$ and a temperature of $727^\circ C$ radiater 300 J energy each minute. What is its emissivity? Stefan's Boltzmann's constat is $5.76 \times 10^{-8} Wm^{-2}K^{-4}$.

Watch Video Solution

96. A thin brass rectangular sheet of sides 15.0 and 12.0 cm is heated in a furnace to 600° C and taken out. How much electric power is needed to maintain the sheet at this temperature, given that its emissivity is 0.250? Neglect heat loss due to convection (Stefan-Boltzmann constant, $\sigma = 5.67 \times 10^{-8} W/m^2 - K^4$).

Watch Video Solution

97. A metal ball of surface area $200 cm^2$ and temperature $527^{\circ} C$ is surrounded by a vessel at $27^{\circ} C$. If the emissivity of the metal is 0.4, then the rate of loss of heat from the ball is $(\sigma = 5.67 \times 10^{-8} J/m^2 - s - k^4)$

Watch Video Solution

Exercise

1. An ideal monoatomic gas is taken around the cycle ABCDA, wher co-ordinates of A, B, C and D on and D on $P-V$ diagram are A (p, V), $B(2p, V)$, $C(2p, 2V)$ and $D(p, 2V)$. Calculate work done during the cycle.

Watch Video Solution

2. Calculate net work done by the gas whose thermodynamical behaviour is represented by right angled triangle ABC on $P-V$ diagram. The $P-V$ diagram co-ordinates are : $A(20, 6), B(10, 12)$ and $C(10, 6)$ where P is in Nm^{-2} and V is in m^3

Watch Video Solution

3. Calculate the change in internal energy of a block of copper of mass $200g$ when it is heated from $25^\circ Cto75^\circ C$. Given specific heat of copper $= 0.1cal. g^{-1}.^\circ C^{-1}$ and assume that change in volume is negligible.

Watch Video Solution

Watch Video Solution

4. One kg of water at $373K$ is converted into steam at the same temperature. The volume $1cm^3$ of water becomes $1671cm^3$ on boiling. Calculate the change in internal energy of the system , if heat of vaporisation is $540calg^{-1}$. Given standard atmospheric pressure $= 1.013 \times 10^5 Nm^{-2}$.

Watch Video Solution

5. Calculate the change in internal energy when 5g of air is heated from 0° to $4^\circ C$. The specific heat of air at constant volume is $0.172calg^{-1}.^\circ C^{-1}$.

Watch Video Solution

6. A volume of $10m^3$ of a liquid is supplied with $100kal$ of heat and expands at a constant pressure of $10atm$ to a final volume of $10.2m^3$.

Calculate the work done and change in internal energy.

Watch Video Solution

7. The internal energy of a monatomic ideal gas is $1.5nRT$.One mole of helium is kept in a cylinder of cross section $8.5cm^2$. The cylinder is closed by a light frictionless piston. The gas is heated slowly in a process during which a total of $42J$ heat is given to the gas. If the temperature rise through $2^\circ C$, find the distance moved by the piston. atmospheric pressure $= 100kPa.$

Watch Video Solution

8. Calculate the difference between two specific heats of 1 g of nitrogen. Given molecular weight of nitrogen = 28 and $J = 4.2 \times 10^7 ergcal^{-1}$.

Watch Video Solution

9. Calculate the gas constant for 1 g of gas from the following data :

$C_p = 0.245 \text{cal g}^{-1} . ^\circ C^{-1}, C_v = 0.165 \ \text{ cal g}^{-1} . ^\circ C^{-1}$ and $J = 4.2 \times 10^7 e$

Watch Video Solution

10. Calculate difference in specific heats for 1 gram of air at $N.T.P.$ Given density of air at N.T.P. is $1.293 glitre^{-1}, j = 4.2 \times 10^7 \ \text{ erg } \ cal^{-1}$.

Watch Video Solution

11. Calculate the ratio of specific heats for nitrogen. Given that the specific heat of nitrogen at cinstant pressure $= 0.236$ cal $g^{-1} K^{-1}$ and density at S.T.P. is $0.001234 g / cc$. Atmospheric pressure $= 1.01 \times 10^6 dyne / cm^2$.

Watch Video Solution

12. For hydrogen gas, $C_p = 3.409 cal g^{-1} \hat{} \circ C^{-1}$, $C_V = 2.409 cal g^{-1} \hat{} \circ C^{-1}$ and molecular weigh of hydrogen = 2. Calculate the value of J.

Watch Video Solution

13. The specific heat of argon at constant pressure is 0.127 and ratio of specific hats is 1.667. Calculate the value of J. One litre of argon weighs 1.786 g at N.T.P.

Watch Video Solution

14. Two moles of oxygen is heated at a constant pressure from $0^\circ C$. What must be the gas for the volume to be doubled ? The specific heat of oxygen under these condition is $0.218 cal g^{-1} K^{-1}$.

Watch Video Solution

15. A certain gas at atmospheric pressure is compressed adiabatically so that its volume becomes half of its original volume. Calculate the resulting pressure in Nm^{-2}. Given γ for air = 1.4.

Watch Video Solution

16. A gas is suddenly compressed to $\frac{1}{4}th$ of its original volume. Caculate the rise in temperature when original temperature is $27^{\circ}C$. $\gamma = 1.5$.

Watch Video Solution

17. A tyre pumped to a pressure of 6 atmosphere, suddenly bursts. Room temperature is $15^{\circ}C$. Calculate the temperature of escaping air $\gamma = 1.4$.

Watch Video Solution

18. $200cm^3$ of a gas is compressed to $100cm^3$ at atmospheric pressure $(10^6 \text{dyne}/cm^2)$. Find the resultant pressure if the change is (i) slow (ii) sudden Take $\gamma = 1.4$.

Watch Video Solution

19. A quantity of air at $27^{\circ} C$ and atmospheric pressure is suddenly compressed to half its original volume. Find the final (i) pressure and (ii) temperature.

Given $\gamma f \text{ or } air = 1.42$.

Watch Video Solution

20. A quantity of air at normal temperature is compressed (a) slowly (b) suddenly to one third of its volume. Find the rise in temperature, if any in each case, $\gamma = 1.4$.

Watch Video Solution

21. A quantity of air is kept in a container having walls which are slightly conducting. The initial temperature and volume are 27^0C (equal to the temperature of the surrounding) and $800cm^3$ respectively. Find the rise in the temperature of the gas is compressed to $200cm^3$ (a) in a short time (b) in a long time . Take gamma= 1.4.

Watch Video Solution

22. Dry air at 10 atm pressure and $15^\circ C$ is suddenly compressed to compressed to atmospheric pressure. Find the new temperature. Given $\gamma = 1.41, \log 2.88 = 0.4594, \log 1.474 = 0.1686.$

Watch Video Solution

23. Calculate the rise in temperature when a gas, for which $\gamma = 1.5$ is compressed to 27 times its original pressure, assuming the initial temperature to be $27^\circ C$.

Watch Video Solution

Watch Video Solution

24. $1000cm^3$ of argon at $27^\circ C$ is adiabattically compressed so that the temperature is $127^\circ C$. Calculate the resulting volume. Given $\gamma = \frac{5}{3}$.

Watch Video Solution

25. Find the final value of a gram molecule of a gas after an isothermal expansion at $127^\circ C$, if the original volume is $400c.c$ Given amount of work done by a gram molecule of a gas during expansion is $2302.6\text{joule}, R = 8.3\text{joule mole}^{-1}K^{-1}$

Watch Video Solution

26. Calculate work done to compress isothemally 1 g of hydrogen gas at N.T.P to half its initial volume. Find the amount of heat evolved and change in internal energy. Given $R = 8.31Jmol^{-1}K - 1$.

Watch Video Solution

27. A sample of hydrogen of mass 6 g is allowed to expand isothermally at $27^{\circ} C$. Till its volume is doubled: How many moles of H_2 do we have? Given, R=8.31 J $mol^{-K} \hat{} - 1$.

Watch Video Solution

28. A sample of hydrogen of mass $6g$ is allowed to expand isothermally at $27^{\circ} C$ till its volume is doubled.

(a) How may moles of hydrogen are there?

(b) What is final temperature of H_2?

(c) Caculate work done during expansion.

Watch Video Solution

29. A sample of hydrogen of mass $6g$ is allowed to expand isothermally at $27^{\circ} C$ till its volume is doubled.

(a) How may moles of hydrogen are there?

(b) What is final temperature of H_2?

(c) Caculate work done during expansion.

Watch Video Solution

30. 50g of oxygen at NTP is compressed adiabatically to a pressure of 5 atmosphere. The work done on the gas, if $\gamma = 1.4$ and $R = 8.31 Jmol^{-1} K^{-1}$ is

Watch Video Solution

31. Efficiency of an engine is 0.4, when temperature of its sink (cold body) is 300 K. What id the temperature of the hot body? Find its efficiency, if the temperature of the hot body is kept unchanged, while temperature of the sink (cold body) is lowered by 50 K. Treat it as reversible engine).

Watch Video Solution

32. A Carnot heat engine operates with an efficiency of 50%. If during each cycle it rejects 150 cal to a reserviour of heat at $30^\circ C$ then what is the temperature of the other reservoir.

Watch Video Solution

33. A Carnot heat engine operates with an efficiency of 50%. If during each cycle it rejects 150 cal to a reserviour of heat at $30^\circ C$ then how much work does it carry out per cycle?

Watch Video Solution

34. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by $62^\circ C$, the efficiency of the engine is doubled. The temperatures of the source and sink are

Watch Video Solution

35. Calculate the difference in efficiencies of Carnot engine working between 400 K and 350 K

Watch Video Solution

36. Calculate the difference in efficiencies of Carnot engine working between 350 K and 300 K.

Watch Video Solution

37. An engine has been designed to work between sources and sink temperature of $177^{\circ}C$ and $27^{\circ}C$ respectively. If the energy input per cycle is 3600 J, then find its efficiency

Watch Video Solution

38. An engine has been designed to work between sources and sink temperature of $177^{\circ}C$ and $27^{\circ}C$ respectively. If the energy input per

cycle is 3600 J, then find work done by the engine per cycle.

Watch Video Solution

39. A perfect Carnot engine utilises an ideal gas as the working substance. The source temperature is $227^{\circ} C$ and the sink temperature is $127^{\circ} C$. Find the efficiency of the engine, and find the heat received from the source and the heat released to the sink when 10,000 J of external work is done.

Watch Video Solution

40. A Carnot engine takes in heat from a reservoir of heat at $427^{\circ} C$ and gives out heat to sink at $77^{\circ} C$. How many clories per second must it take from the reservoir in order to produce useful mechanical work at the rate of 357 W?

Watch Video Solution

41. Two carnot engines A and B are operated in series. The first one A receives heat at $900K$ and rejects it to a reservoir at TK. The second engine B receives the heat rejected by the first engine and rejects it to a heat reservoir at $400K$. Calculate the value of T, when the efficiency ot two engines is the same.

Watch Video Solution

42. Two carnot engines A and B are operated in series. The first one A receives heat at $900K$ and rejects it to a reservoir at TK. The second engine B receives the heat rejected by the first engine and rejects it to a heat reservoir at $400K$. Calculate the value of T, when the efficiency ot two engines is the same.

Watch Video Solution

43. Refrigerator A works between $-10^{\circ}C$ and $27^{\circ}C$, while refrigerator B works between $-27^{\circ}C$ and $17^{\circ}C$, both removing heat equal to 2000J from the freezer. Which of the two is the better refrigerator?

Watch Video Solution

44. Assuming that a domestic refrigerator can be regarded as a reversivle engine working between the temperature of melting ice and that of the atmosphere $(170^{\circ}C)$, calculate the energy which muct be supplied to freeze one kilogram of water already at $0^{\circ}C$.

Watch Video Solution

45. A refrigerator, whose coefficient performance β is 5, extracts heat from the collingcompartment at the rate of 250 J per cycle.

(a) How much work per cycle is required to operate the refrigerator?

(b) How much heat per cycle is discharges the room which acts as the high temperature reservoir?

Watch Video Solution

46. A refrigerator has to transfer an average of 263J of heat per second from temperature $-10^\circ C$ to $25^\circ C$. Calculate the average power consumed, assuming no enegy losses in the process.

Watch Video Solution

47. A refrigerator freezes 5 kg of water at $0^\circ C$ into ice at $0^\circ C$ in a time internal of 20 minutes. Assume that the room temperature is $20^\circ C$. Calculate the minimum power needed to accomplish it.

Watch Video Solution

48. What is the change in the internal energy of a system over one complete cycle of a cyclic process?

Watch Video Solution

49. State the first law of thermodynamics.

Watch Video Solution

50. The internal energy of an ideal gas depends upon

Watch Video Solution

51. Is the internal energy of a gas a function of the pressure? Explain.

Watch Video Solution

52. Which one among a solid, liquid and gas of same mass and at the same temp. has the greatest internal energy? Which one least? Why?

Watch Video Solution

53. When is the heat supplied to a system equal to the increase in its internal energy?

Watch Video Solution

54. A gas does work during isothermal expansion. What is the source of mechanical energy so produced?

Watch Video Solution

55. A gas does work during isothermal expansion. What is the source of mechanical energy so produced?

Watch Video Solution

56. The temperature of a gas rises during an adiabatic compression, although no heat is given to the gas from outside. Why?

Watch Video Solution

57. An ideal gas is compressed at a constant temperature, will its internal energy increase or decrease?

Watch Video Solution

58. Cooling is produced when a gas at high pressure suddenly expands. Why?

Watch Video Solution

59. When a gas is suddenly compressed, its temperature rises. Why?

Watch Video Solution

60. When a tyre bursts, the air coming out is cooler than the surrounding air.Explain.

Watch Video Solution

61. Is it possible that there is change in temperature of a body without giving / taking heat to from it ?

Watch Video Solution

62. Is it possible that there is change in temperature of a body without giving//taking heat to//from it?

Watch Video Solution

63. Can the temperature of a gas increased keeping its pressure and volume constant ?

Watch Video Solution

64. Air pressure in a car tyre increase during. Explain.

Watch Video Solution

65. Which molecules, ice at $10^{\circ} C$ or water at $0^{\circ} C$ have greater potential energy and why?

Watch Video Solution

66. A device that converts electric energy into mechanical energy.

Watch Video Solution

67. During a process, the volume of a gas is found to depend inversely on the square of its absolute temperature. Find how its pressure will depend on the absolute temperature.

Watch Video Solution

68. Linear expansion is the change in __________when object is heated or cooled.

Watch Video Solution

69. When air of the atmosphere rises up, it cools. Why?

Watch Video Solution

70. Is the equation $PV = RT$ valid for both, isothermal and adiabatic changes?

Watch Video Solution

71. Is the equation $PV = RT$ valid for both the isothermal and adiabatic changes?

Watch Video Solution

72. First law of thermodynamics does not forbid flow of heat from lower teperature to higher temperature. Comment.

Watch Video Solution

73. Can two isothermal curves intersect each other?

Watch Video Solution

74. What is the significance of area of closed curve on P-V diagrams?

Watch Video Solution

75. Can the work done during a cyclic process be zero?

Watch Video Solution

76. How many specific heat does a gas passes?

Watch Video Solution

77. A gas has more than one specific heats, whereas a liquid and solid have only one. Why?

OR

Why gas has two principle specific heat capacities.

Watch Video Solution

78. Compare the formula $C_p - C_v = R$ for an ideal gas with the thermodynamics relation $\Delta U = \Delta Q - P\Delta V$.

Watch Video Solution

79. Define two principal specific heats of a gas. Which is greater and why?

Watch Video Solution

Watch Video Solution

80. What is the physical signficance of the difference of two principal specific heat of a gas?

Watch Video Solution

81. Can specific heat of a gas be negative?

Watch Video Solution

82. What is specific heat of a gas is an isothermal process?

Watch Video Solution

83. What is specific heat of a gas is an adiabatic process?

Watch Video Solution

84. By what method can the internal energy of an ideal gas be changed?

Watch Video Solution

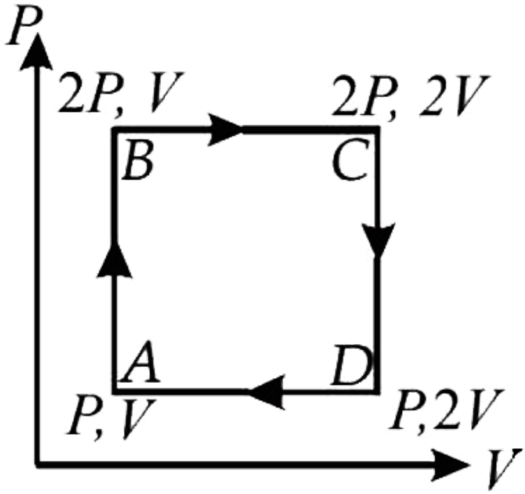
85. Heat equivalent to 50 joule is supplied to a thermodynamic system and 10 joule work is done on the system. What is the change in the internal energy of the system in the process ?

Watch Video Solution

86. 400 J of work is done on a gas to reduce its volume by compression adiabatically. What is the change in internal energy of the gas?

Watch Video Solution

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



Watch Video Solution

88. What is the difference between heat and temperature ?

Watch Video Solution

89. Why is conversion of heat into work not possible without a sink at lower temperature?

Watch Video Solution

90. Explain why a Carnot engine cannot have 100% efficiency?

Watch Video Solution

91. Why can a ship not use the internal energy of sea water to operate its engine?

Watch Video Solution

92. In a Carnot engine, the temperature of the sink is increased. What will happen to its efficiency?

Watch Video Solution

93. What is meant by reversible engine? Explain, why the efficiency of a reversible engine is maximum.

Watch Video Solution

94. The temperature of the surface of the sun is approximately 6000 K. If we take a big lens and focus the sun rays, can we produce a temperature of 8000 K?

Watch Video Solution

95. Is the efficiency of a heat engine more in hilly areas than in plains?

Watch Video Solution

96. Is it theoretically possible to device a heat engine which will create no thermal pollution ?

Watch Video Solution

97. Can a kitchen be cooled by leaving the door of an electric refrigerator open?

Watch Video Solution

98. Milk is poured into a cup of tea and is mixed with a spoon. Is this an example of a reversible process ? Give reason.

Watch Video Solution

99. A system goes from state A to B via two processes I and II, as shown in Fig. 12.25, How are $\delta\mu_1$ and $\delta\mu_2$ (the changes in internal energies in the processes I and II) related to each other ?

Watch Video Solution

100. A thermos flask contains coffee. It is vigorously sheken, considering the coffee as the system. (a) Does its temperature rise ? (b) Has heat been added to it ? (c) Has work been done on it ?

Watch Video Solution

101. A thermos flask contains coffee. It is shaken vigorously. (i) Has any heat been added to it.

(ii) Has any work been done on it.

(iii) Does it internal energy change?

(iv) Does its temp. rise?

Watch Video Solution

102. A thermos flask contains coffee. It is vigorously sheken, considering the coffee as the system. (a) Does its temperature rise ? (b) Has heat been added to it ? (c) Has work been done on it ?

Watch Video Solution

103. For an isothermal process

Watch Video Solution

104. What is an adiabatic process ? What are the essential conditions for an adiabatic process to take place ?

Watch Video Solution

105. Internal energy of a compressed gas is less than that of a rarefield gas, at the same temperature.

Watch Video Solution

106. Two bodies of specific heats C_1 and C_2 having same heat capacities are combined to form a single composite body. What is the specific heat of the composite body?

Watch Video Solution

107. A gas expands in such a manner that its pressure and volume comply with the condition PV^2 = constant. Will the gas cool or get heated on expansion?

Watch Video Solution

108. What happens to the change in internal energy of a gas during adiabatic expansion?

Watch Video Solution

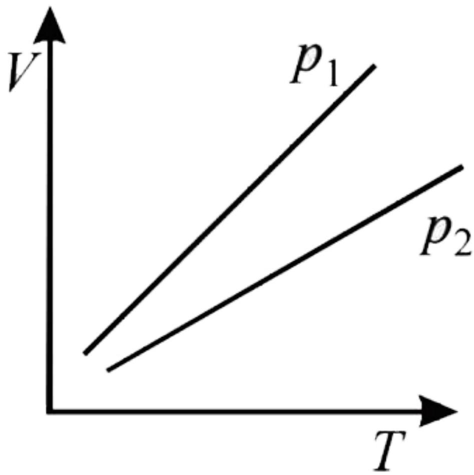
109. What happens to the change in internal energy of a gas during adiabatic expansion?

Watch Video Solution

110. Show that the slope of adiabatic curve at any point is λ times the slope of an isothermal curve at the corresponding point.

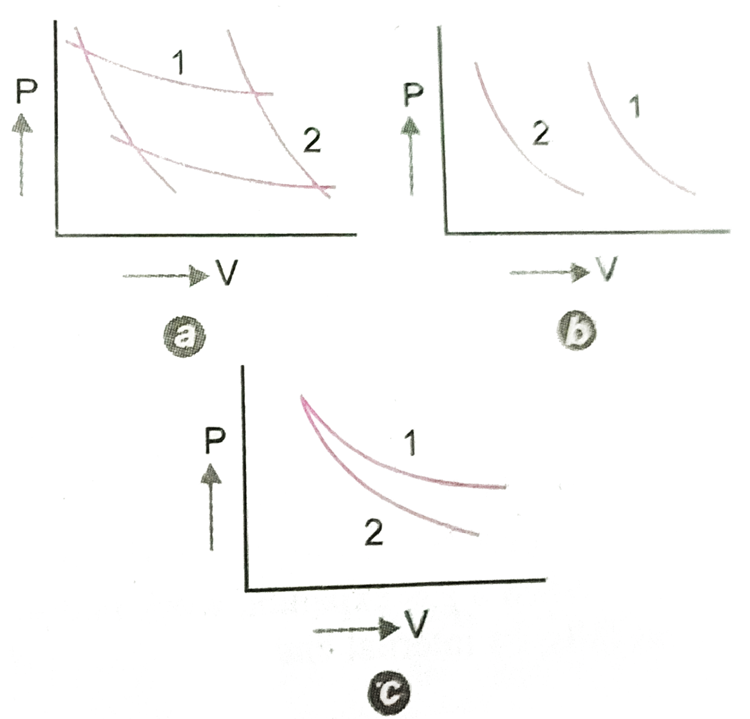
Watch Video Solution

111. The volume V versus temperature T graphs for a certain amount of a perfect gas at two pressure p_1 and p_2 are as shown in Fig. It follows from the graphs that p_1 is greater than p_2.



Watch Video Solution

112. Identify isothermal and adiabatic process in the following diagram



Watch Video Solution

113. No real engine can have an efficiency greater than that of a carnot engine working between the same two temperatures, why?

Watch Video Solution

114. Can the Carnot engine be realised in practice?

Watch Video Solution

115. The volume of an ideal gas is V at pressure P. On increasing the pressure by ΔP, change in volume of gas is ΔV_1, under isothermal conditions and ΔV_2 under adiabatic conditions. Which is more and why?

Watch Video Solution

116. Discuss whether the following phenomena are reversible?

(i) Water fall (ii) Rusting of iron

(iii) Electrolysis.

Watch Video Solution

117. Discuss whether the following phenomena are reversible ? (i) Waterfall (ii) Rusting of iron and (iii) Electrolysis

Watch Video Solution

118. Discuss whether the following phenomena are reversible?

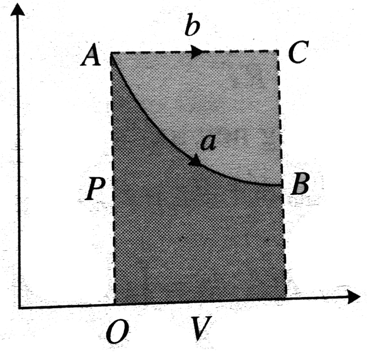
(i) Water fall (ii) Rusting of iron

(iii) Electrolysis.

Watch Video Solution

119. A quantity of gas occupies an initial volume V_0 at pressure p_0 and temperature T_0. It expands to a volume V (a) constant temperature and

(b) constant pressure. In which case does the gas do more work ?

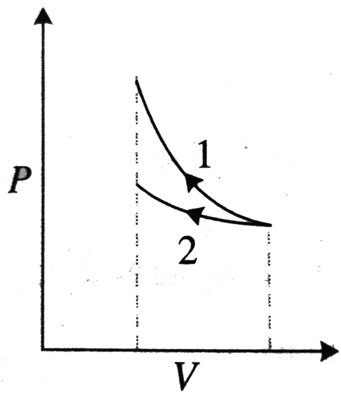


Watch Video Solution

120. A certain mass of an ideal gas is at pressure P_1 and volume V_1. If is compressed isothermally and then allowed to expand adiabatically untill its pressure returns to P_1. The gas is then allowed to expand its original volume. Which of the following $P - V$ graphs are these process correctly shown?

Watch Video Solution

121. A certain mass of a gas is compressed first adiabatically, and then isothermally. In both cases, the initial state of the gas is the same. Is the work done W_1 in the first case greater than the work done W_2 in the second case ? Explain.



Watch Video Solution

122. Two samples of a gas initially at same temperature and pressure are compressed from a volume V to $\frac{V}{2}$. One sample is compressed isothermally and the other adiabatically . In which sample is the pressure greater?

Watch Video Solution

123. Two gases have the same initial pressure P, volume V and temperature T. They both expand to the same volume from V to 2V, one adiabatically and the other isothermally. Plot P-V diagram for the given situation and hence explain. In which case is the final temperature greater?

Watch Video Solution

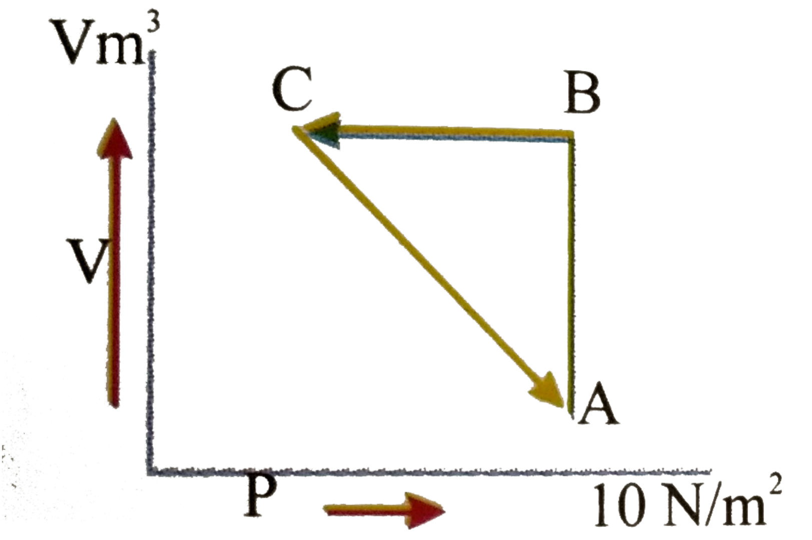
124. The work of 146 kJ is performed in order to compress one kilo mole of a gas adiabatically and in this process the temperature of the gas increases by $7^{\circ}C$. The gas is $\left(R = 8.3ml^{-1}Jmol^{-1}K^{-1}\right)$

Watch Video Solution

125. In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas

Watch Video Solution

126. An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$ As shown in figure. If net heat supplied to the gas in the cycle is 5j. Find the work done by the gas in the process $C \rightarrow A$ in Joule (taken mole value)



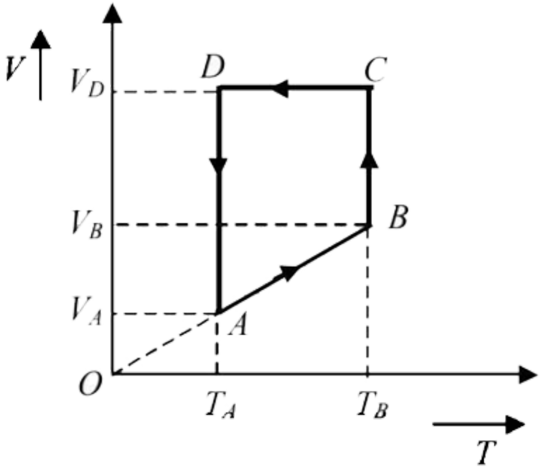
Watch Video Solution

Watch Video Solution

127. A monoatomic ideal gas, initially at temperature T_1, is enclosed in a cylinder fitted with a friction less 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 length of the gas column before expansion respectively, then $\frac{T_1}{T_2}$ is given by

Watch Video Solution

128. A monoatomic ideal gas of two moles is taken through a cyclic process starting from A as shown in figure. The volume ratios are $\frac{V_B}{V_A}=2$ and $\frac{V_D}{V_A}=4$. If the temperature T_A at A is $27^\circ C$.



Calculate,

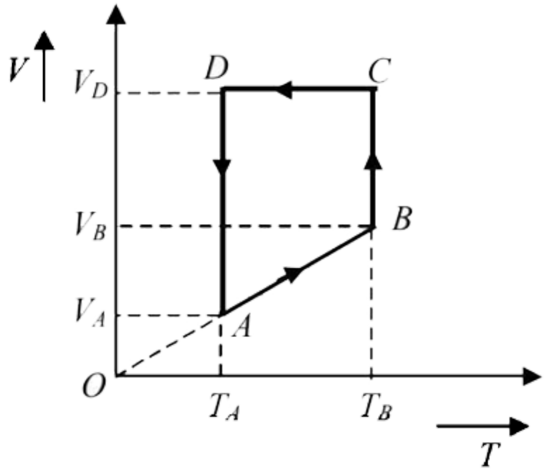
(a) the temperature of the gas at point B,

(b) heat absorbed or released by the gas in each process,

(c) the total work done by the gas during the complete cycle. Express your answer in terms of the gas constant R.

Watch Video Solution

129. A monoatomic ideal gas of two moles is taken through a cyclic process starting from A as shown in figure. The volume ratios are $\frac{V_B}{V_A} = 2$ and $\frac{V_D}{V_A} = 4$. If the temperature T_A at A is $27^\circ C$.



Calculate,

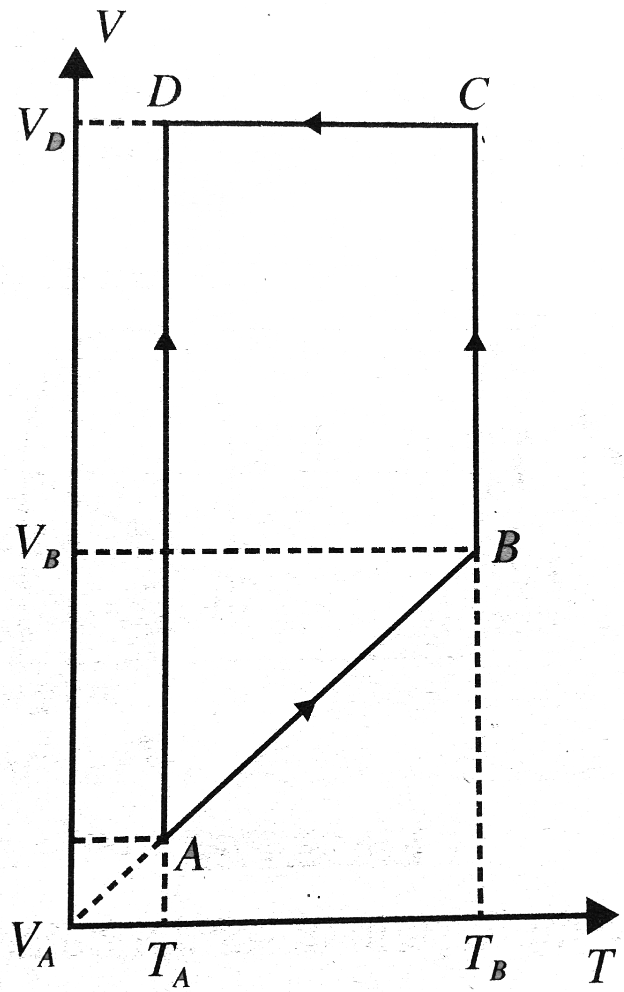
(a) the temperature of the gas at point B,

(b) heat absorbed or released by the gas in each process,

(c) the total work done by the gas during the complete cycle. Express your answer in terms of the gas constant R.

Watch Video Solution

130. A monatomic idea gas of $2mol$ is taken through a cyclic process starting from A as shown in figure. The volume ratio are $V_B / V_A = 2$ and $V_D / V_A = 4$. If the temperature T_A at A is $27^\circ C$, and gas constant is R. Calculate.



The total work done by the gas during the complete cycle.

Watch Video Solution

131. An ideal gas is taken through a cyclic thermodynamical process through four steps. The amounts of heat involved in these steps are $Q_1 = 5960J, Q_2 = -5585J, Q_3 =$ and $-2980JQ_4 = 3645J,$ respectively . The corresponding works involved are $W_1 = 2200J, W_2 = -825J, W_3 =$ and $-1100JW_4$ respectively. The value of W_4 is

Watch Video Solution

132. The temperatures T_1 and $T(2)$ of two heat reservoirs in an ideal carnot engine are $1500^\circ C$ and $500^\circ C$. Which of these (a) increasing $T_1 by 100^\circ C$ or (b) decreasing $T_2 by 100^\circ C$ would result in greater improvement of the efficiency of the engine?

Watch Video Solution

133. An ideal gas having initial pressure p, volume V and temperature T is allowed to expand adiabatically until its volume becomes 5.66V, while its temperature falls to $T/2$.

(a) How many degrees of freedom do the gas molecules have?

(b) Obtain the work done by the gas during the expansion as a function of the initial pressure p and volume V.

Given that $(5.66)^{0.4} = 2$

Watch Video Solution

134. An ideal gas having initial pressure P, volume V and temperature T is allowed to expands adiabatically until its volume becomes 5.66V while its temperature falls to T/2.

(i) How many degrees of freedom do the gas molecules have?

Obtain the work done by the gas during the expansion as a function of the initial pressure P and volume V.

Watch Video Solution

135. The state of a thermodynamic system is represented by

A. pressure only

B. volume only

C. pressure, volume and temperature

D. number of moles

Answer:

Watch Video Solution

136. Which of the following is not a state function :-

A. temperature

B. entropy

C. pressure

D. work

Answer:

Watch Video Solution

137. Which of the following is not a state function

A. work done at constant pressure

B. enthalpy

C. work done by conservative force

D. work done by non-conservative force.

Answer:

Watch Video Solution

138. Which is an intensive property?

A. volume

B. mass

C. refractive index

D. weight.

Answer:

Watch Video Solution

139. Air is expanded from 50 litres to 150 litres at 2 atomospheric pressure . The external work done is (Give , 1 atm=$10^5 N^{-2}$)

A. $2 \times 10^{-8} J$

B. $2 \times 10^4 J$

C. 200 J

D. 2000 J

Answer:

Watch Video Solution

140. The first law of thermodynamics confirms the law of

A. conservation of energy

B. heat flow from hotter to cooler body

C. law of conservation of angular momentum

D. Newton's law of cooling.

Answer:

Watch Video Solution

141. Which one is not correct?

A. In an isobaric process, t:.P =0

B. In an isochoric process, t:. W = 0

C. In an isothermal process, t:.T =0

D. In an isothermal process, t:.Q =0

Answer:

Watch Video Solution

142. $\delta\mu + \delta W = 0$is valid for

A. adiabatic process

B. isothermal process

C. isobaric process

D. isochoric process

Answer:

Watch Video Solution

143. When heat is given to a gas in an isothermal change, the result will be

A. external work done

B. rise in temperature

C. increase in internal energy

D. external work done and also rise in temperature

Answer:

Watch Video Solution

144. Calculate the work done by 1 mole of gas if temperature is changed from $O^{\circ}C$ to $200^{\circ}C$ at one atmosphere (`R =2 cal K^-1 mole^-1').

A. 100 cal

B. 200 cal

C. 400 cal

D. 800 cal.

Answer:

Watch Video Solution

145. The heat of 100 J is added to a gaseous system whose internal energy is 40 J, then the amount of external work done will be

A. 70 J

B. 140 J

C. 40 J

D. none of these

Answer:

Watch Video Solution

146. In thermodynamic process, pressure of a fixed mass of a gas is changes in such a manner that the gas molecules gives out 20 J of heat and 10 J of work is done in the gas. If the initial internal energy of the gas was 40 J, then the final internal energy will be

A. 30J

B. 20J

C. 60 J

D. 40 J

Answer:

Watch Video Solution

147. At 1 atmospheric pressure, 1.000 g of water having a volume of $1.000 cm^3$ becomes 1671 cm^3 of steam when boiled. The heat of vaporization of water at 1 atmosphere is $539 cal / g$. What is the change in internal energy during the process ?

A. 540 cal

B. 500 cal

C. 1681 cal

D. none of these.

Answer:

Watch Video Solution

148. If C_p and C_v are molar heats at constant pressure and constant volume respectively and R is gas constant for 1 mole, then the correct relation is

A. $C_p - C_v = R$

B. $C_p - C_v itR$

C. $C_p - C_v > R$

D. $C_p - C_v = 0$

Answer:

Watch Video Solution

149. Universal gas constant is

A. $\frac{C_p}{C_v}$

B. Cp-Cv

C. Cp+Cv

D. $\frac{C_v}{C_p}$

Answer:

Watch Video Solution

150. A Container having 1 mole of a gas at a temperature 27° has a movable piston which maintains at constant pressure in container of 1 atm . The gas is compressed until temperature becomes 127°. The work done is (C for gas is 7.03 cal / mol – K)

A. 703 J

B. 814 J

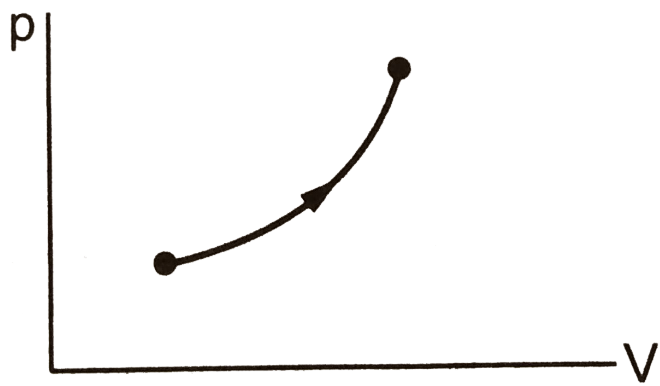
C. 121 J

D. 2035 J

Answer:

Watch Video Solution

151. 70 calories of heat is required to raise the temperature of 2 mole of an ideal gas at constant pressure from $30^\circ C$ to $35^\circ C$. The amount of heat required to raise the temperature of the same gas through the same range at constant volume is



A. 30 cal

B. 50 cal

C. 60 cal

D. 80 cal

Answer:

Watch Video Solution

152. The percentage change in internal energy, when a gas is cooled from $927^{\circ} C$ to $27^{\circ} C$, is

A. 1

B. 3

C. 2

D. 0.75

Answer:

Watch Video Solution

153. Two cylinders of equal size are filled with equal amount of ideal diatomic gas at room temperature. Both the cylinders are fitted with pistons. In cylinder A the piston is free to move, while in cylinder B the piston is fixed. When same amount of heat is added to both the cylinders, the temperature of the gas in cylinder A raises by 20 K. What will be the rise in temperature of the gas in cylinder B?

A. 28 K

B. 20 K

C. 15 K

D. 10 K

Answer:

Watch Video Solution

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

A. diatomic

B. a mixture of monoatomic and diatomic

C. monoatomic

D. triatomic

Answer:

Watch Video Solution

155. For a monoatomic gas, work done at constant pressure is W. The heat supplied at constant volume for the same rise in temperature of the gas is

A. $\frac{w}{2}$

B. $3\frac{w}{2}$

C. work done by conservative force

D. $5\frac{w}{2}$

Answer:

Watch Video Solution

156. A diatomic gas does 100 J of work when it is expanded isobarically. The heat given to the gas during this process is

A. 700 J

B. 350 J

C. 175 J

D. 1050 J

Answer:

Watch Video Solution

157. The molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of Q is supplied to it is

A. $2\frac{R}{5}$

B. $5\frac{R}{2}$

C. $10\frac{R}{3}$

D. $6\frac{R}{7}$

Answer:

Watch Video Solution

158. During adiabatic compression of a gas, its temperature

A. falls

B. remains constant

C. rises

D. becomes zero

Answer:

Watch Video Solution

159. Air in a cylinder is suddenly compressed by a piston, which is then maintained at the same position. With the passage of time

A. pressure will increase

B. pressure remains the same

C. pressure will decrease

D. pressure may increase or decrease

Answer:

Watch Video Solution

160. Assertion : In adiabatic system, $\Delta U = w_{ad}$.

Reason : In adiabatic system, no transfer of heat takes place.

A. pYTY -1 =constant

B. pYT1-Y =constant

C. PTY =constant

D. p1-YTY =constant.

Answer:

Watch Video Solution

161. In an adiabatic process, the state of a gas is changed from $P_1, V_1, T_1, \text{to} P_2, V_2, T_2$. Which of the following relation is correct

A. $T_1V_1^{\gamma} \hat{} -1 = T_2V_2\gamma^{-1}$

B. $P_1V_1^{\gamma} \hat{} -1 = P_2V_2\gamma^{-1}$

C. $T_1P_1\gamma = T_2P_2\gamma$

D. $T_1V_1\gamma = T_2V_2\gamma$

Answer:

Watch Video Solution

162. If AB is an isothermal BC is an isochoric ad AC is an adiabatic, which of the graphs correctly represents given in figure.

A.

B.

C.

D.

Answer:

Watch Video Solution

163. For which of the following processes is the entropy change zero,

A. Isobaric

B. Isothermal

C. Adiabatic

D. None of these

Answer:

Watch Video Solution

164. Two samples A and B of a certain gas, which are initially at the same temperature and pressure, are compressed from volume V to V /2. A is compressed isothermally, while Bis compressed adiabatically. The final pressure of A is

A. more than that of B

B. equal to that of B

C. less than that of B

D. twice that of B

Answer:

Watch Video Solution

165. $1g$ mole of an ideal gas at STP is subjected to a reversible adiabatic expansion to double its volume. Find the change in internal energy $(\gamma = 1.4)$

A. 1169.5 J

B. 769.5 J

C. 1369.5 J

D. 969.5 J

Answer:

Watch Video Solution

166. A gas is suddenly compressed to $\frac{1}{4}th$ of its original volume. Caculate the rise in temperature when original temperature is $27^{\circ} C. \gamma = 1.5.$

A. 273 K

B. 573 K

C. 373 K

D. 473 K

Answer:

Watch Video Solution

167. The efficiency of the reversible heat engine is η_r and that of irreversible heat engine is η_l. Which of the following relations is correct?

A. Positive work

B. An adiabatic process

C. An isobatic process

D. An isobatic process

Answer:

Watch Video Solution

168. The efficiency of Carnot's engine operating between reservoirs, maintained at temperatures $27^{\circ} C$ and $-123^{\circ} C$ is

A. 0.5

B. 0.24

C. 0.0075

D. 0.004

Answer:

Watch Video Solution

169. The temperature of sink of Carnot engine is $27^{\circ} C$. Efficiency of engine is 25% . Then temeperature of source is

A. $27^{\circ} C$

B. $127^{\circ} C$

C. $227^{\circ} C$

D. $327^{\circ} C$

Answer:

Watch Video Solution

170. In a Carnot engine the temperature of source is 1000 K and the efficiency of engine is 70%. What is the temperature of the sink ?

A. 600 K

B. 300 K

C. 450 K

D. 700 K

Answer:

Watch Video Solution

171. A Carnot engine has the same efficiency between $800K$ to $500K$ and $xK \rightarrow 600K$. The value of x is

A. 1000 K

B. 846 K

C. 960 K

D. 754 K

Answer:

Watch Video Solution

172. A Carnot engine has efficiency 25%. It operates between reservoirs of constant temperatuers with temperature difference of $80^{\circ} C$. What is the temperature of the low -temperature reservoir ?

A. $-25^{\circ} C$

B. $25^{\circ} C$

C. $25^{\circ} C$

D. $33^{\circ} C$

Answer:

Watch Video Solution

173. A carnot engine has efficiency $1/5$. Efficiency becomes $1/3$ when temperature of sink is decreased by 50 K What is the temperature of sink ?

A. 325 K

B. 375 K

C. 300 K

D. 350 K

Answer:

Watch Video Solution

174. v24

A. 20 J

B. 30 J

C. 33.3 J

D. 50 J

Answer:

Watch Video Solution

175. In a Carnot engine when $T_2 = 0^\circ C$ and $T_1 = 200^\circ C$ its efficiency is η_1 and when $T_1 = 0^\circ C$ and $T_2 = -200^\circ C$. Its efficiency is η_2, then what is η_1 / η_2?

A. 0.577

B. 0.733

C. 0.638

D. cannot be calculated

Answer:

Watch Video Solution

176. A heat engine undergoes a process in which its intemal energy decreases by 400 J and it gives out 150 J of heat. During the process

A. it does 250 J of work and its temperature rises

B. it does 250 J of work and its temperature falls

C. it does 550 J of work and its temperature rises

D. it does 550 J of work and its temperature falls

Answer:

Watch Video Solution

177. During une cycle uf a heal engine 2000 calories of heat is supplied and 1500 calories rejected. The amount of work done equals (assuming $J = 4.186J/cal$)

A. 2093 J

B. 4186 J

C. 1042 J

D. 0

Answer:

Watch Video Solution

178. An ideal gas heat engine operates in Carnot cycle between $227^{\circ}C$ and $127^{\circ}C$. It absorbs $6.0 \times 10^4 cal$ of heat at high temperature. Amount of heat converted to work is :

A. $1.2 \times 10^4 cal$

B. $2.4 \times 10^4 cal$

C. $6.2 \times 10^4 cal$

D. $4.8 \times 10^4 cal$

Answer:

Watch Video Solution

179. A heat engine is 20% efficient. If the engine does 500 J of work every second, how much heat does the engine exhaust every second ?

A. 2000 J

B. 2500 J

C. 400 J

D. 500 J

Answer:

Watch Video Solution

180. The temperature inside and outside a refrigerator are 273 K and 300 K respectively. Assuming that the refrigerator cycle is reversible. For every joule of work done heat delivered to the surrounding will be nearly :-

A. 10 J

B. 20 J

C. 30 J

D. 50 J

Answer:

Watch Video Solution

181. If the door of a refrigerator is kept open, then which of the following is true

A. get heated

B. get neither heated nor cooled

C. get cooled

D. both (a) and ©

Answer:

Watch Video Solution

182. The reezer in a refrigeratror is located at the top section so that

A. the entire chamber of the refrigerator is cooled quickly due to convection

B. the motor is not heated

C. the heat gained from the environment is high

D. the heat gained from the environment is low.

Answer:

Watch Video Solution

183. What is an isobaric process ?

Watch Video Solution

184. What is an isochoric process ?

Watch Video Solution

185. FREE EXPANSION

Watch Video Solution

186. Which of the following is the mathematical statement of the first law of thermodynamics?

Watch Video Solution

187. Is it possible to increase the temperature of a gas without giving it heat?

OR

Name the process, in which no heat is transfereed to from a system but the temperature of the system changes.

Watch Video Solution

188. An ideal gas is compressed at a constant temperature, will its internal energy increase or decrease?

Watch Video Solution

189. Can the temperature of an isolated system remain constant?

Watch Video Solution

190. To an expanding gas, no external energy is suppiled. Will the gas do any work? If yes, what will be the source of energy?

Watch Video Solution

191. What thermodynamics variable is defined by (a) Zeroth law (b) First law?

Watch Video Solution

192. Is it possible to convert internal energy into works?

Watch Video Solution

193. A sample of an ideal gas in a cyclinder is compressed adiabatically to $\frac{1}{3}rd$ of its volume. Will final pressure be more or less than $3 \times$ the initial pressure?

Watch Video Solution

194. Can two states of an ideal gas be connected by an isothermal process as well as an adiabatic process?

Watch Video Solution

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

Watch Video Solution

196. What is the limitation of the first law of thermodynamics?

Watch Video Solution

197. What is a heat engine? Obain an expression for its efficiency. Mention different types of heat engines.

Watch Video Solution

198. The law of thermodynamics arising from conversion of heat energy into work.

Watch Video Solution

199. Can the Carnot engine be realised in practice?

Watch Video Solution

200. Is rusting of iron a reversible process?

Watch Video Solution

201. What is the nature of $P-V$ diagram for isobaric and isochoric processes?

Watch Video Solution

202. How is efficiency of carnot engine affected by the nature of working substance?

Watch Video Solution

203. Can we increase the coefficient of performance of a refrigerator by increasing the amount of working substance?

Watch Video Solution

204. A refrigerator transfers heat from the cold coling coils to the warm surroundings. Is it against the second law of thermodynamics? Justify your answer?

Watch Video Solution

205. Is cofficient of performance of refrigerator always constant?

Watch Video Solution

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

Watch Video Solution

207. When is the heat supplied to a system equal to the increase in its internal energy?

Watch Video Solution

208. Define coefficient of performance of a refrigerator.

Watch Video Solution

209. State Zeroth law of thermodynamics. How does it lead to the concept of temperature?

Watch Video Solution

210. The internal energy of an ideal gas depends upon

Watch Video Solution

211. What is the limitation of the first law of thermodynamics?

Watch Video Solution

212. Define two principal specific heats of a gas. Which is greater and why?

Watch Video Solution

213. Derive the relation between specific heats of a gas at constant pressure and at constant volume, when the amount of gas is one gram molecule.

Watch Video Solution

214. State second law of thermodynamics.

Watch Video Solution

215. Give two characteristics of Carnot engine as compared to other engines, which are sometimes known as Carnot's theorem.

Watch Video Solution

216. State second law of thermodynamics.

Watch Video Solution

217. Describe when a system is said to be in a state of thermodynamic equilibrium.

Watch Video Solution

218. What is a cyclic process ? Prove that the net work done during a cyclic process is numerically equal to the area of the loop representing the cycle.

Watch Video Solution

219. Define two principal specific heats of a gas . Which is greater and why ?

Watch Video Solution

220. Define C_p and C_V. Why is $C_P > C_V$? For an ideal gas, prove that $C_P - C_V = R$.

Watch Video Solution

221. A gas has more than one specific heats, whereas a liquid and solid have only one. Why?

OR

Why gas has two principle specific heat capacties.

Watch Video Solution

222. Define two principal specific heats of a gas. Which is greater and why?

Watch Video Solution

223. State and explain first law of thermodynamics. Establish the relation between two principle specific heats of a gas on the basis of this law.

Watch Video Solution

224. Apply the first law of thermodynamics to deermine the change in internal energy during the boiling process.

Watch Video Solution

225. What do you learn by applying first law of thermodynamics to isothermal and adiabatic processes?

Watch Video Solution

226. What are reversible and irreversible processes? Give some examples of each.

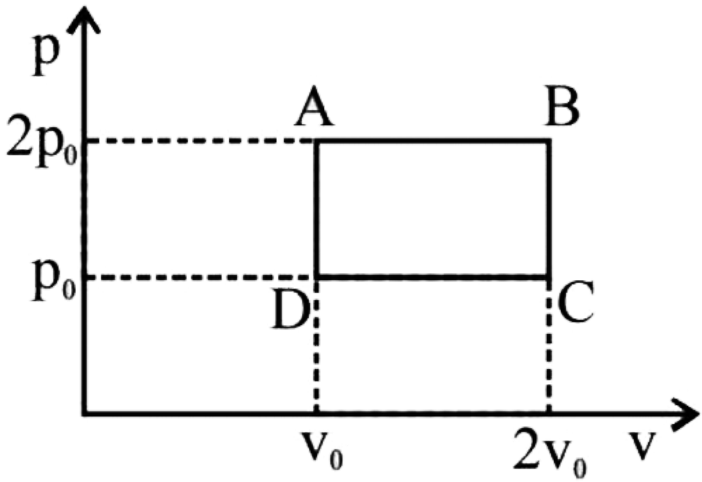
Watch Video Solution

227. In an isothermal process

Watch Video Solution

228. Derive an expression for work done in an adiabatic process.

Watch Video Solution



229.

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

Watch Video Solution

230. Define C_p and C_V. Why is $C_P > C_V$? For an ideal gas, prove that $C_P - C_V = R$.

Watch Video Solution

231. Derive an expression for work done in an adiabatic process.

Watch Video Solution

232. What is an isothermal process? State essential conditions for such a process to take place. Show analytically that work done by one mole of an ideal gas during isothermal expansion from volume V_1 to volume V_2 is given by $= \mathrm{RT} \log_e \frac{V_2}{V_1}$. What is the change in internal energy of a gas, which is compressed isothermally?

Watch Video Solution

233. When a poly-atomic gas undergoes an adiabatic process, its temperature and volume are related by the equation $TV^n =$ constant, the value of n will be

Watch Video Solution

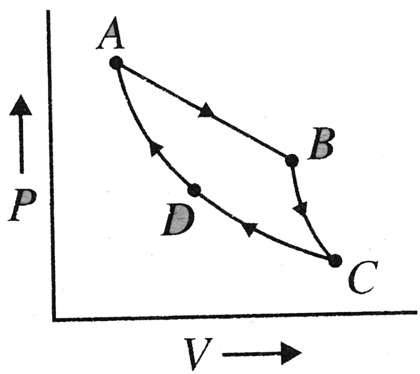
234. Define an adiabatic process and state two essential conditions for such a process to take place.

Watch Video Solution

235. State second law of thermodynamics.

Watch Video Solution

236. Figure. Shows the $P - V$ diagram for a Carnot cycle. In this diagram



Watch Video Solution

237. An electric heater supplies heat to a system at a rate of 100 W. If the system performs work at a rate of 75 joules per second at what rate is the internal energy increasing ?

Watch Video Solution

238. In reversible isothermal expansion of an ideal gas :

Watch Video Solution

239. A stream engine delivers $5.4 \times 10^8 J$ of work per minute and absorbs $3.6 \times 10^9 J$ of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?

Watch Video Solution

240. In a given process for an ideal gas dW = 0 and $dQ > 0$. Then for the gas

A. the temperatUre will decrease

B. the volume will increase

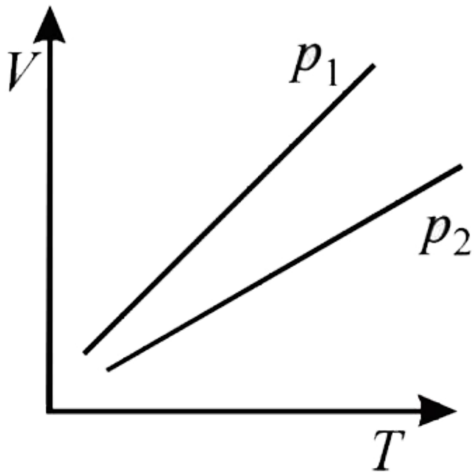
C. the pressure will remain constant

D. the temperature will increase.

Answer:

Watch Video Solution

241. The volume V versus temperature T graphs for a certain amount of a perfect gas at two pressure p_1 and p_2 are as shown in Fig. It follows from the graphs that p_1 is greater than p_2.



A. pl it p2

B. P1 dt p2

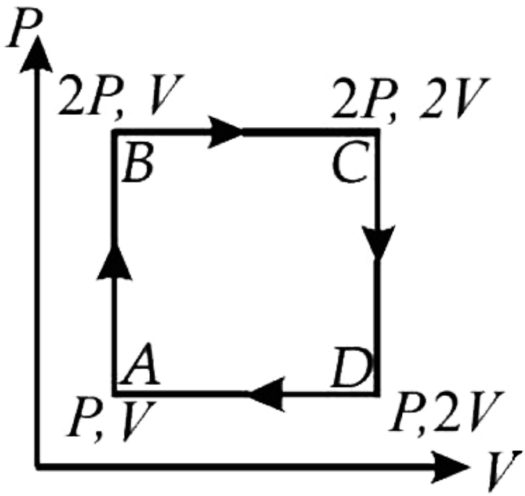
C. Pl = P2

D. information is insufficient to draw any conclusion.

Answer:

Watch Video Solution

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



A. PV

B. 2 PV

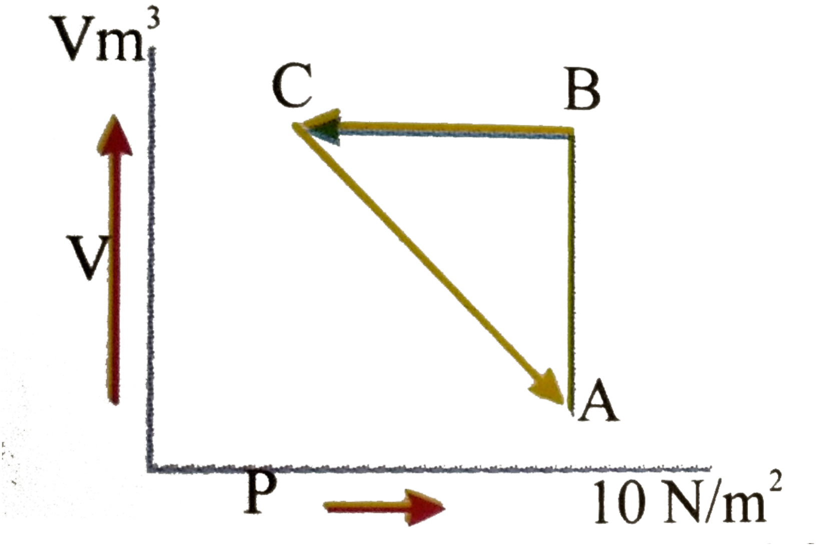
C. PV/2

D. zero.

Answer:

Watch Video Solution

243. An ideal gas is taken through the cycle $A \to B \to C \to A$ As shown in figure. If net heat supplied to the gas in the cycle is 5j. Find the work done by the gas in the process $C \to A$ in Joule (taken mole value)



A. - 5 J

B. - 10 J

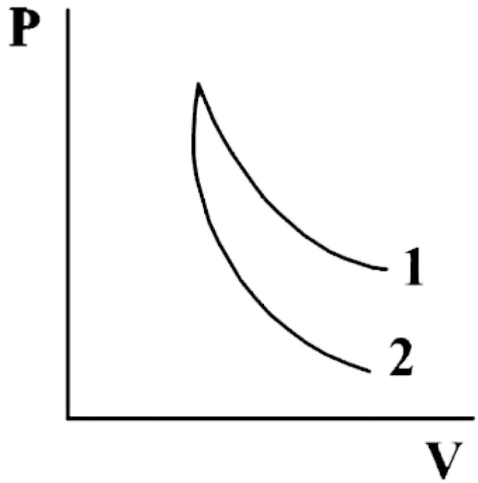
C. -15J

D. - 20 J

Answer:

Watch Video Solution

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



A. He and 0_2

B. 0_2 and He

C. He and Ar

D. 0_2 and N_2

Answer:

Watch Video Solution

245. An ideal gas is initially at P_1, V_1 is expands to P_2, V_2 and then compressed adiabatically to the same volume V_1 and pressure P_3. If W is the net work done by the gas in complete process which of the following is true.

A. $W > 0, P3 > P1$

B. $WitO, P3 > P1$

C. $WitO, P3 > P1$

D. $WitO, P3itP_1$

Answer:

Watch Video Solution

246. A monoatomic ideal gas, initially at temperature $T_1,$ is enclosed in a cylinder fitted with a friction less 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 length of the gas column before expansion respectively, then $\frac{T_1}{T_2}$ is given by

A. $\frac{\frac{L_1}{L_2}^2}{3}$

B. $\frac{L_1}{L_2}$

C. $\frac{L_2}{L_1}$

D. $\frac{\frac{L_2}{L_1}^2}{3}$

Answer:

Watch Video Solution

247. One mole of an ideal monoatomic gas is heated at a constant pressure of one atmosphere from0° to $100^\circ C$. Then the change in the internal energy is

A. 2.3 J

B. 46 J

C. $8.67 \times 103J$

D. $1.25 \times 103J$

Answer:

Watch Video Solution

248. An ideal gas heat engine operates in Carnot cycle between $227^{\circ} C$ and $127^{\circ} C$. It absorbs $6.0 \times 10^{4} cal$ of heat at high temperature. Amount of heat converted to work is :

A. 2000 J

B. 4000 J

C. 8000 J

D. 5600 J

Answer:

Watch Video Solution

249. 5.6 liter of helium gas at STP is adiabatically compressed to 0.7 liter. Taking the initial temperature to be T_1, the work done in the process is

A. $\frac{9}{8}RT_1$

B. $\frac{3}{2}RT_1$

C. $\frac{15}{8}RT_1$

D. $\frac{9}{2}RT_1$

Answer:

Watch Video Solution

250. An ideal gas is taken from the state A (pressure P, volume V) to the state B (pressure $p/2$, volume 2V) along a straight line path in the P-V diagram. Select the correct statement (s) from the following :

A. the work done by the gas in the process A to B exceeds the work that would be done by it, if the system were taken from A to B along an isotherm

B. in the T-V diagram, the path AB becomes a part of a parabola

C. in the P-T diagram, the path AB becomes a part of a hyperbola

D. in going from A to B, the temperature T of the gas first increases to a maximum value and then decreases.

Answer:

Watch Video Solution

251. During the melting of a slab of ice at 273K at atmospheric pressure,

A. positive work is done by the ice-water system on the atmosphere

B. positive work is done on the ice-water system by the atmosphere

C. the internal energy of the ice-water system increases

D. the internal energy of the ice-water system decreases.

Answer:

Watch Video Solution

252. 70 calories of heat required to raise the temperature of 2 moles of an ideal gas at constant pressure from $30^\circ C \to 35^\circ C$. The amount of heat required (in calories) to raise the temperature of the same gas through the same range $(30^\circ C \to 35^\circ C)$ at constant volume is:

A. 30

B. 50

C. 70

D. 90

Answer:

Watch Video Solution

253. For an ideal gas :

A. the change in internal energy in a constant pressure process from temperature T1 to T2 is equal to nCv (T2 -T1), where Cv is the molar specific heat at constant volume and 11, the number of moles of the gas

B. the change in internal energy of the gas and the work done by the gas are equal in magnitude in an adiabatic process

C. no heat is added or removed in an adiabatic process

D. the internal energy does not change in an isothermal process.

Answer:

Watch Video Solution

254. Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that

B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. 18 K

B. 30 K

C. 50 K

D. 42 K

Answer:

Watch Video Solution

255. Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same velocity V. The mass of the gas in A is m_A, and that in B is m_B. The gas in each cylinder is now allowed to expand isothermally to the same final volume 2V. The changes in the pressure in A and B are found to be ΔP and $1.5 \Delta P$ respectively. Then

A. $2m_A = 3m_8$

B. $3m_A = 2m_8$

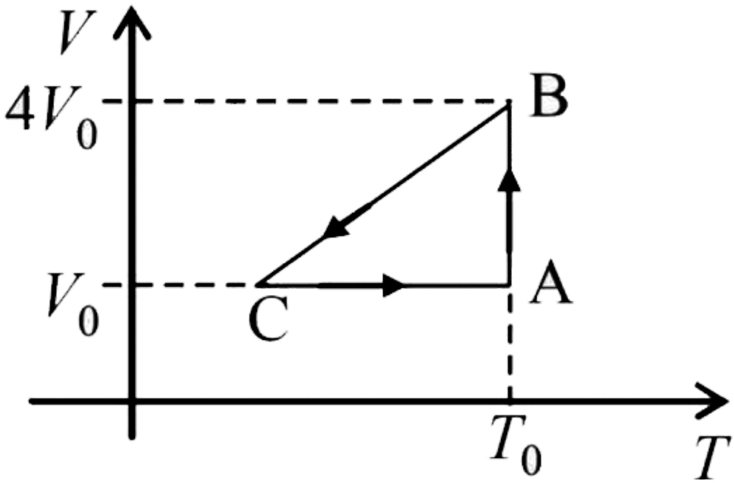
C. $4m_A = 9m_8$

D. $9m_A = 4m_8$

Answer:

Watch Video Solution

256. One mole of an ideal gas in initial state A undergoes a cyclic process ABCA, as shown in the figure. Its pressure at A is P_0. Choose the correct option (s) from the following



A. Internal energies v at A and B are the same

B. Work done by the gas in process AB is P0V0 ln 4

C. Pressure at C is _ P_0/4

D. Temperature at C is _T_0/4

Answer:

Watch Video Solution

257. One mole of a monatomic ideal gas undergoes a cyclic process as shown in the figure (where V is the volume and T is the temperature). Which of the statements below is (are) true?

A. Process I is an isochoric process

B. In process II, gas absorbs heat

C. In process IV, gas releases heat

D. Processes I and III are not isobaric

Answer:

Watch Video Solution

258. A diatomic ideal gas is compressed adiabatically to 1/32 of its initial volume. If the initial temperature of the gas is T_i (in Kelvin) and the final temperature is a T_i, the value of a is

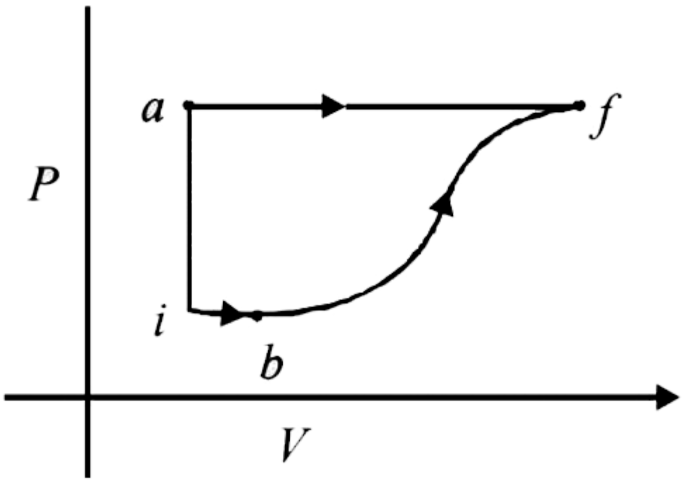
Watch Video Solution

259. Two spherical bodies A (radius 6cm) and B (radius 18cm) are at temperature T_1 and T_2 respectively The maximum intensity in the emission spectrum of A is at $500nm$ and in that of B is at $1500nm$ considering them to be black bodies, what will be the ratio of the rate of total energy radiated by A to that of B . ?

Watch Video Solution

260. A thermodynamic system is taken from an initial state I with internal energy $U_i = -100J$ to the final state f along two different paths iaf and ibf, as schematically shown in the figure. The work done by the system along the pat af, ib and bf are

$W_{af} = 200J, W_{ib} = 50J$ and $W_{bf} = 100J$ respectively. The heat supplied to the system along the path iaf, ib and bf are Q_{iaf}, Q_{ib}, Q_{bf} respectively. If the internal energy of the system in the state b is $U_b = 200J$ and $Q_{iaf} = 500J$, The ratio $\frac{Q_{bf}}{Q_{ib}}$ is



Watch Video Solution

261. One mole of a monatomic ideal gas undergoes an adiabatic expansion in which its volume becomes eight times its initial value. If the initial temperature of the gas is 100 universal gas constant 8.0, the decrease in its internal energy, in , is________.

Watch Video Solution

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

A. Temperature

B. Pressure

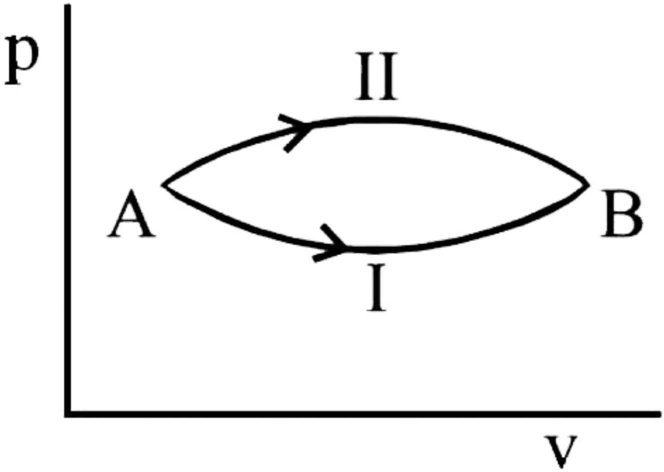
C. Work

D. Volume

Answer:

Watch Video Solution

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



A. $\delta_1 = \delta_2$

B. $\delta_1 > \delta_2$

C. $\delta_1 it \delta_2$

D. relation between "'U1 and "'U2 cannot be determined.

Answer:

Watch Video Solution

264. The internal energy change when a system goes fromk state A to B is $40 kJ mol^{-1}$. If the system goes from A to B by a reversible path and returns to state A by an irreversible path, what would be the net change in internal energy?

A. 40 KJ

B. dt 40 KJ

C. it 40 KJ

D. zero.

Answer:

Watch Video Solution

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

A. It introduces the concept of the internal energy

B. It introduces the concept of the entropy

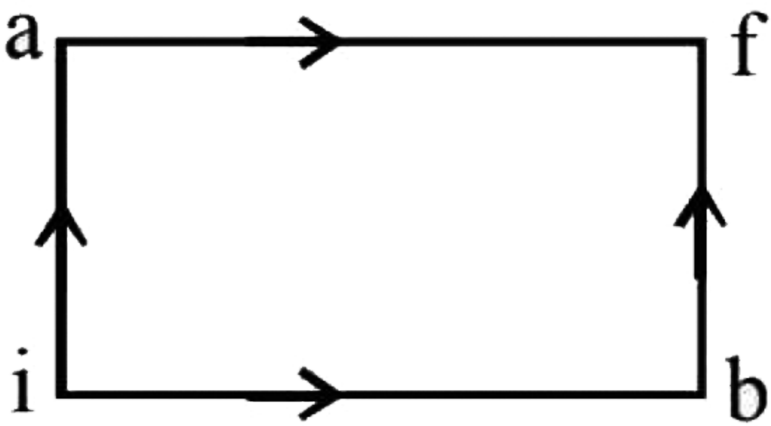
C. It is not applicable to any cyclic process

D. 1t is a restatement of the principle of conservation of energy.

Answer:

Watch Video Solution

266. When a system is taken from state i to state f along the path iaf, it is found that $Q = 50cal$ and $W = 20cal$. Along the path ibf $Q = 36cal$. W along the path ibf is



A. 6 cal

B. 16 cal

C. 66 cal

D. 14 cal

Answer:

Watch Video Solution

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

A. The internal energy changes in all processes

B. Internal energy and entopy are state functions

C. The change in entropy can never be zero

D. The work done in an adiabatic process is always zero.

Answer:

Watch Video Solution

268. If C_P and C_v denote the specific heats nitrogen per unite mass at constant pressure and constant volume respectively, then

(1) $C_P - C_v = \frac{R}{28}$ (2) $C_P - C_v = \frac{R}{14}$

(3) $C_P - C_v = R$ (4) $C_P - C_v = 28R$

A. $c_p - c_v = \frac{R}{28}$

B. $c_p - c_v = \frac{R}{14}$

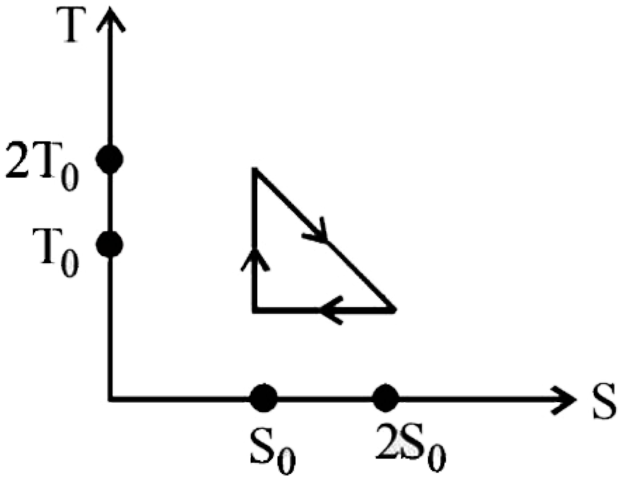
C. $c_p - c_v = R$

D. $c_p - c_v = \frac{28}{R}$

Answer:

Watch Video Solution

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



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

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{4}$

Answer:

Watch Video Solution

270. "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 mass

D. first law of thermodynamics.

Answer:

Watch Video Solution

271. 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:

Watch Video Solution

272. 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 of all the cycles.

Answer:

Watch Video Solution

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

A. zero

B. $8.4 \times 106J$

C. $4.2 \times 106J$

D. $16.8 \times 106J$

Answer:

Watch Video Solution

274. A Carnot engine, having an efficiency of $\eta = \frac{1}{10}$ 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. 1 J

B. 90 J

C. 99 J

D. 100 J

Answer:

Watch Video Solution

275. 100g of water is heated from $30^{\circ}C \rightarrow 50^{\circ}C$. Ignoring the slight expansion of the water, the change in its internal energy is (specific heat of water is $4184J/kg/K$):

A. 4.2 KJ

B. 8.4 KJ

C. 84 KJ

D. 2.1 KJ

Answer:

Watch Video Solution

276. A Carnot engine operating between temperature T_1 and T_2 has efficiency 1/6. When T_2 is lowered by 62K its efficiency increase to 1/3. Then T_1 and T_2 are, respectively:

A. 372 K and 310 K

B. 372 K and 330 K

C. 330 K and 268 K

D. 310 K and 248 K

Answer:

Watch Video Solution

277. A diatomic ideal gas is used in a Carnot engine as the working substance. If during the adiabatic expansion part of the cycle the volume of the gas increase from V to 32V, the efficiency of the engine is

A. 0.25

B. 0.5

C. 0.75

D. 0.99

Answer:

Watch Video Solution

278. A Carnot engine, whose efficiency is 40%, takes in heat from a source maintained at a temperature of 500K. 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 K

C. 750 K

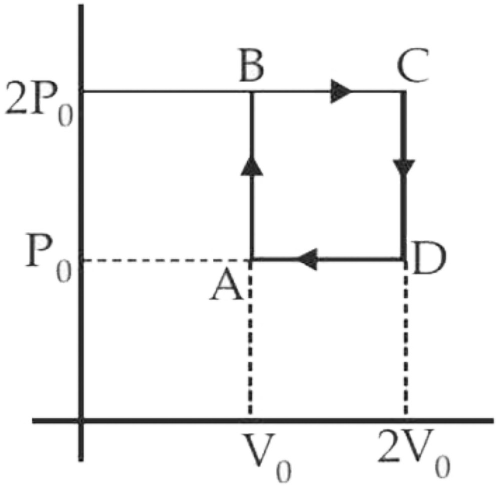
D. 600 K

Answer:

Watch Video Solution

279. Helium gas goes through a cycle ABCDA (consisting of two isochoric and isobaric lines) as shown in figure Efficiency of this cycle is nearly:

(Assume the gas to be close to ideal gas)



A. 0.154

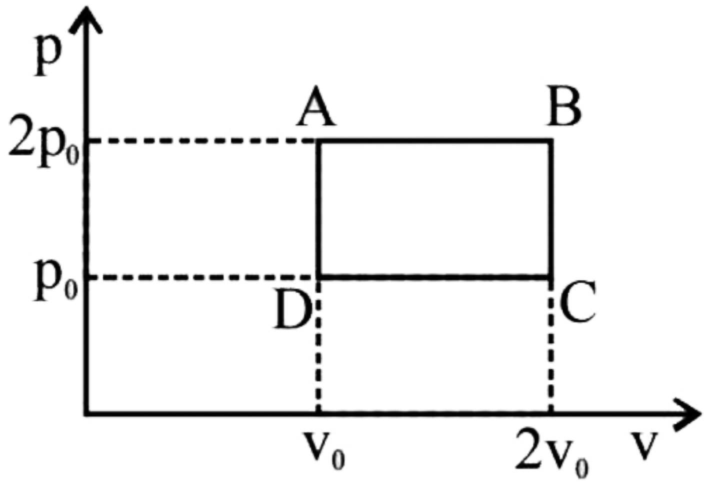
B. 0.091

C. 0.105

D. 0.125

Answer:

Watch Video Solution



280.

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

A. P_0V_0

B. $\frac{13}{2}P_0V_0$

C. $\frac{11}{2}P_0V_0$

D. $4P_0V_0$

Answer:

Watch Video Solution

281. 200 g of water is heated from $40^\circ C \text{to} 60^\circ C$. Ignoring the slight expansion of water , the change in its internal energy is closed to (Given specific heat of water = $4184 J/kg/K$):

A. 16.7 kJ

B. 167.4 kJ

C. 4.2 kJ

D. 8.4 kJ

Answer:

Watch Video Solution

282. The ratio of work done by an ideal diatomic gas to the heat supplied by the gas in an isobatic process is

A. $\frac{3}{2}$

B. $\frac{2}{3}$

C. $\frac{3}{5}$

D. $\frac{2}{5}$

Answer:

Watch Video Solution

283. 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. (i) 189 K (ii) 2.7 k]

B. (1) 195 K (ii) -2.7 kJ

C. (i) 189 K (ii) - 2.7 kJ

D. (i) 195 K (ii) 2.7 k]

Answer:

Watch Video Solution

284. Which of the following is not a thermodynamics co-ordinate

A. P

B. T

C. V

D. R

Answer:

Watch Video Solution

285. Which of the following is path dependent

A. U

B. P dv

C. P

D. V

Answer:

Watch Video Solution

286. A gas expands $0.25m^2$ at constant perssure $10^3 N/m^2$, the work done is

A. 2.5 erg

B. 250 erg

C. 25. W

D. 250 N

Answer:

Watch Video Solution

287. The latent heat of vaporisation of water is 2240 J/gm. If the work done in the process of expansion of 1 g of water is 168 J, then increase in internal energy is

A. 2,408 J

B. 2240 J

C. 2072 J

D. 1904 J

Answer:

Watch Video Solution

288. If the amount of heat given to a system is 3 5 J and the amount of work done on the system is 15 J, then the change in internal energy of the system is

A. 20 J

B. 50 J

C. 30 J

D. 40 J

Answer:

Watch Video Solution

289. When 20J of work was done on a gas, 40J of heat energy was released. If the initial internal enrgy of the gas was 70J, what is the final internal energy?

A. 50 J

B. 150 J

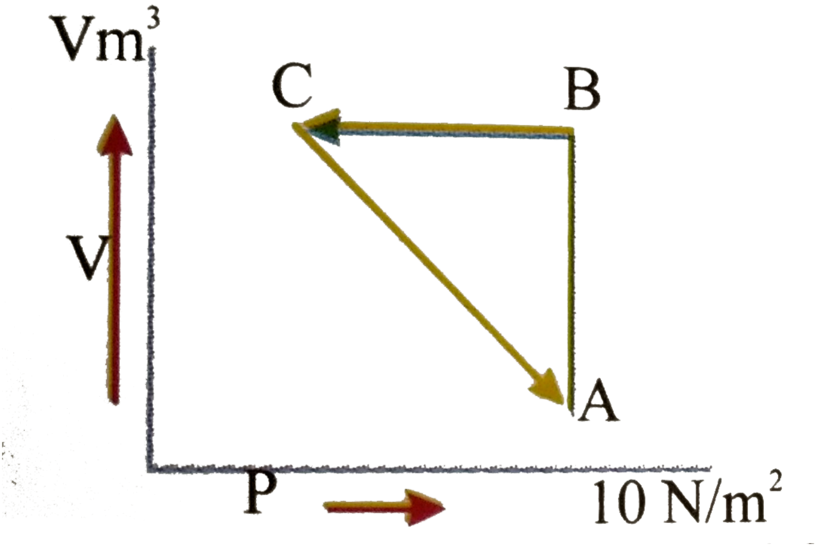
C. 90 J

D. 110 J

Answer:

Watch Video Solution

290. An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$ As shown in figure. If net heat supplied to the gas in the cycle is 5j. Find the work done by the gas in the process $C \rightarrow A$ in Joule (taken mole value)



A. 2 J

B. 3 J

C. 4 J

D. Infinity

Answer:

Watch Video Solution

291. In a cyclic process, work done by the system is

A. zero

B. more than the heat given to system

C. equal to heat given to system

D. independent of heat given to system

Answer:

Watch Video Solution

292. $C_p$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

$C_p = C_V = b$ for nitrogen gas

The correct relation between a and b is:

A. ideal and real gases at all pressures

B. ideal gas at all pressures and real gas at moderate pressure

C. ideal gas and nearly true for real gases at high pressure

D. ideal gas and nearly true for real gases at moderate pressure.

Answer:

Watch Video Solution

293. In an isobaric process of an ideal gas. The ratio of heat supplied annd work done by the system $\left[i.e., \left(\frac{Q}{W}\right)\right]$ is

A. $\frac{\gamma - 1}{\gamma}$

B. gamma

C. $\frac{\gamma}{\gamma - 1}$

D. 1

Answer:

Watch Video Solution

294. The gas equation $PV/T =$ constant is true for a constant mass of an ideal gas undergoing

A. isothermal change only

B. adiabatic change only

C. both isothermal and adiabatic changes

D. neither isothermal nor adiabatic changes

Answer:

Watch Video Solution

295. A perfect gas contained in a cylinder is kept in vacuum. If the cylinder suddenly bursts, then the temperature of the gas

A. becomes zero K

B. is decreased

C. is increased

D. remains unchanged

Answer:

Watch Video Solution

296. The potential energy of a system increased if work is done

A. isochoric

B. adiabatic

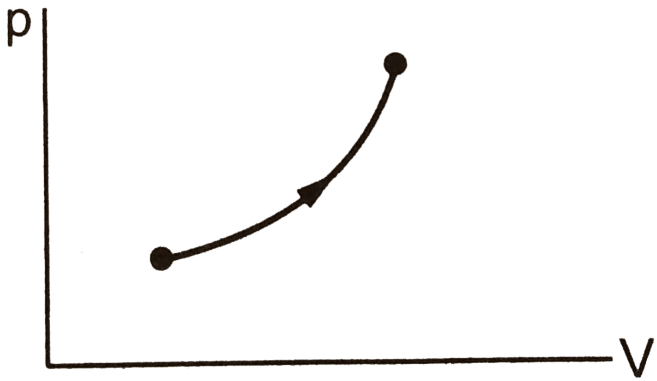
C. isobaric

D. isothermal.

Answer:

Watch Video Solution

297. 70 calories of heat is required to raise the temperature of 2 mole of an ideal gas at constant pressure from $30^\circ C$ to $35^\circ C$. The amount of heat required to raise the temperature of the same gas through the same range at constant volume is



A. 30 cal

B. 50 cal

C. 70 cal

D. 90 cal

Answer:

Watch Video Solution

298. A Carnot engine working between K 300 and 600 K has work output of 800 J per cycle. What is amount of heat energy supplied to the engine from source per cycle

A. 1,200 J

B. 1,600 J

C. 2,400 J

D. 3,200 J

Answer:

Watch Video Solution

299. If specific heat of a substance is infinite, it means

A. heat is given out

B. heat is taken out

C. no change in temperature, whether heat is taken in or given out

D. all of these

Answer:

Watch Video Solution

300. If the temperature of a source increases, then the efficiency of a heat engine

A. increases

B. decreases

C. remains constant

D. first increases and then remains constant

Answer:

Watch Video Solution

301. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by $62^\circ C$, the efficiency of the engine is doubled. The temperatures of the source and sink are

A. $99^\circ C, 37^\circ C$

B. $80^\circ C, 37 \circ C$

C. $95^\circ C$, 37^circC`

D. $90^\circ C, 37^\circ C$

Answer:

Watch Video Solution

302. A carnot engine operates with source at $127^\circ C$ and sink at $27^\circ C$. If the source supplies $40kJ$ of heat energy. The work done by the engine is

A. 30 KJ

B. 10 KJ

C. 4 Kj

D. 1 Kj

Answer:

Watch Video Solution

303. A diatomic gas which has initial volume of 1 litre is isothermally compressed to 1/15th of its original volume, where initial pressure is 1 atm. If temperature is $27^\circ C$, then the work done by gas is

A. $-2.70 \times 103J$

B. $2.70 \times 103J$

C. $-1.35 \times 103J$

D. $1.35 \times 103J$

Answer:

Watch Video Solution

304. The first law of thermodynamics confirms the law of

A. conservation of momentum of molecules

B. conservation of energy

C. flow of heat in a particular direction

D. conservation of heat energy and mechanical energy.

Answer:

Watch Video Solution

305. A sample of gas expands from volume V_1 to V_2. The amount of work done by the gas is greatest when the expansion is

A. isothermal

B. isobaric

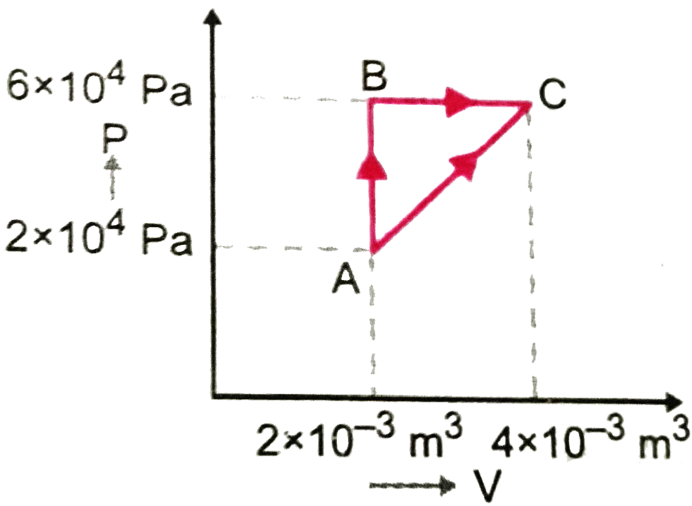
C. adiabatic

D. equal in all cases.

Answer:

Watch Video Solution

306. In (figure). shows two path that may be taken by a gas to go from a state A to state C



In the process AB, $400 J$ of heat is added to the system and in process Bc, $100 J$ of heat is added to the system. The heat absorbed by the system in the process AC will be

A. 500 J

B. 460 J

C. 300 J

D. 380 J

Answer:

Watch Video Solution

307. The internal energy change in a system that has absorbed $2kcal$ of heat and done $500J$ of work is

A. 6400 J

B. 5400 J

C. 7900 J

D. 8900 J

Answer:

Watch Video Solution

308. In thermodynamic processes which of the following statement is not true?

A. in an isochoric process pressure remains constant.

B. in an isothermal process the temperature remains constant

C. in an adiabatic process PVY = constant

D. in an adiabatic process the system is insulated from the surroundings

Answer:

Watch Video Solution

309. Which of the following is not thermodynamical function

A. Enthalpy

B. Work done

C. Gibb's energy

D. Internal energy

Answer:

Watch Video Solution

310. 110 J of heat is added to a gaseous system, whose internal energy change is 40J. Then the amount of external work done is

A. 150 J

B. 70 J

C. 110 J

D. 40 J

Answer:

Watch Video Solution

311. In an isothermal change, an ideal gas obeys

A. 0.5 t.W

B. t.W

C. 1.5 t.W

D. 2 t.W

Answer:

Watch Video Solution

312. $C_p$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 $C_p = C_V = b$ for nitrogen gas

The correct relation between a and b is:

A. a= 16b

B. 16b =a

C. a =4b

D. a= b

Answer:

Watch Video Solution

313. The molar specific heat at constant pressure of an ideal gas is $(7/2R)$. The ratio of specific heat at constant pressure to that at constant volume is

A. $\frac{9}{7}$

B. $\frac{8}{7}$

C. $\frac{7}{5}$

D. $\frac{5}{7}$

Answer:

Watch Video Solution

314. For a certain gas the ratio of specific heat is given to be $\gamma = 1.5$ for this gas

A. Cv = 3R/J

B. CP = 3R/J

C. Cv = 5R/J

D. CP = 5R/J

Answer:

Watch Video Solution

315. One mole of an ideal gas requires 207 J heat to raise its temperature by 10 K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperature by the same 10 K, the heat required will be (R, the gas constant = $8.3JK^{-1}mol^{-1}$):

A. 198.7 J

B. 29 J

C. 215.3 J

D. 124 J.

Answer:

Watch Video Solution

316. In adiabatic expansion of a gas

A. pryr- t =constant

B. pr- tyr =constant

C. pryl-y =constant

D. pl-ryr =constant

Answer:

Watch Video Solution

317. An ideal gas at $27^\circ C$ is compressed adiabatically to $8/27$ of its original volume. If $\gamma = 5/3$, then the rise in temperature is

A. 275 K

B. 375 K

C. 475 K

D. 175 K

Answer:

Watch Video Solution

318. A diatomic gas initially at 18° is compressed adiabatically to one-eighth of its original volume. The temperature after compression will b

A. $18^\circ C$

B. $887.4^\circ C$

C. $395.5^{\circ} C$

D. $144^{\circ} C$

Answer:

Watch Video Solution

319. In an adiabatic change, the pressure and temperature of a monoatomic gas are related with relation as $P \propto T^{C}$, Where C is equal to:

A. $\frac{5}{2}$

B. $\frac{5}{3}$

C. $\frac{2}{5}$

D. $\frac{3}{5}$

Answer:

Watch Video Solution

320. One mole of an ideal gas at an initial temperature true of TK does $6R$ joule of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $5/3$, the final temperature of the gas will be

A. (T + 2.4) K

B. (T -2.4) K

C. (T + 4) K

D. (T- 4) K

Answer:

Watch Video Solution

321. An ideal gas is compressed to half its initial volume by means of several peocesses. Which of the process results in the maximum work done on the gas ?

A. Isothermal

B. Adiabatic

C. Isobaric

D. Isochodc

Answer:

Watch Video Solution

322. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_P / C_V for the gas is

A. $\frac{4}{3}$

B. 2

C. $\frac{5}{3}$

D. $\frac{3}{2}$

Answer:

Watch Video Solution

323. A monatomic gas at a pressure P, having a volume V expands isothermally to a volume 2 V and then adiabatically to a volume 16 V. The final pressure of the gas is (take $\gamma = \frac{5}{3}$)

A. 64P

B. 32P

C. $\frac{P}{64}$

D. 16 P

Answer:

Watch Video Solution

324. A mass of diatomic gas$(\gamma = 1.4)$ at a pressure of 2 atomphere is compressed adiabitically so that its temperature rises from $27^\circ C$ to $927^\circ C$. The pressure of the gas in the final state is

A. 256 atm

B. 8 atm

C. 28 atm.

D. 68.7 atm

Answer:

Watch Video Solution

325. When $1kg$ of ice at $0^\circ C$ melts to water at $0^\circ C$, the resulting change in its entropy, taking latent heat of ice to be $80cal/g$ is

A. 273 cal/K

B. $8 \times 104ca\frac{l}{K}$

C. 80 cal/K

D. 293 cal/K

Answer:

Watch Video Solution

326. Which of the following processes is reversible?

A. transfer of heat by conduction

B. transfer of heat by radiation

C. isothermal compression

D. electrical heating of a nichrome wire.

Answer:

Watch Video Solution

327. The efficiency of a Carnot engine operating between temperatures of $100^{\circ} C$ and $-23^{\circ} C$ will be

A. $\frac{100+23}{100}$

B. $\frac{100-23}{100}$

C. $\frac{373+250}{373}$

D. $\frac{373-250}{373}$

Answer:

Watch Video Solution

328. A scientist says that the efficiency of his heat engine which operates at source temperature $127^{\circ} C$ and sink temperature $27^{\circ} C is 26 \%$, then

A. it is impossible

B. it is possible but less probable

C. it is quite probable

D. data are incomplete

Answer:

Watch Video Solution

329. An ideal gas heat engine operates in Carnot cycle between $227^\circ C$ and $127^\circ C$. It absorbs $6x10^4 cals$ of heat at higher temperature. Amount of heat converted to work is

A. $1.2 \times 104cal$

B. $2.4 \times 104cal$

C. $4.8 \times 104cal$

D. $6 \times 104cal$

Answer:

Watch Video Solution

330. An ideal gas heat engine operates in a carnot cycle between $227^{\circ} C$ and $127^{\circ} C$ .It absorbs 6 kcal at the higher temperature. The amount of heat (in kcal converted into work is equal to

A. 1.2 kJ

B. 1.6 kJ

C. 3.5 kJ

D. 4.8 kJ

Answer:

Watch Video Solution

331. An ideal Carnot's engine whose efficiency 40% receives heat of 500K. If the efficiency is to be 50% then the temperature of sink will be

A. 600 K

B. 700 K

C. 800 K

D. 900 K

Answer:

Watch Video Solution

332. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by $62^{\circ} C$, the efficiency of the engine is doubled. The temperatures of the source and sink are

A. $80^{\circ} C, 37^{\circ} C$

B. $90^{\circ} C, 37^{\circ} C$

C. $95^{\circ} C, 37^{\circ} C$

D. $97^{\circ} C, 37^{\circ} C$

Answer:

Watch Video Solution

333. An engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by $62^\circ C$, its efficiency is doubled. Temperature of the source is

A. $124^\circ C$

B. $37^\circ C$

C. $62^\circ C$

D. $99^\circ C$

Answer:

Watch Video Solution

334. A carnot engine whose sink is at 290 K has an efficiency of 30%. By how much the temperature of the source be increased to have its efficiency equal to 50%, keeping sink temperature constant

A. 380K

B. 275 k

C. 325 K

D. 250 K

Answer:

Watch Video Solution

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

A. 100 K

B. 400 K

C. 500 K

D. 600 K

Answer:

Watch Video Solution

336. The cofficient of performance of a refrigerator is 5. If the temperature inside freezer is $-20^{\circ} C$, the temperature of the surroundings to which it rejects heat is :

A. 21 ^circC

B. 31 ^circC

C. 41 ^circC

D. 11 ^circC

Answer:

Watch Video Solution

337. A Carnot engine, having an efficiency of $\eta = \frac{1}{10}$ 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:

Watch Video Solution

338. A refrigerator works between $4^{\circ} C$ and $30^{\circ} C$. It is required to remove $600 cal$ or ies of heat every second in order to keep the temperature of the refrigerator space constant.The power required is (Take $1 cal$ or $ie = 4.2 J$)

A. 2.365 W

B. 23.65 W

C. 236.5 W

D. 2365 W

Answer:

Watch Video Solution

339. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process untill its volume is again reduced to half. Then

A. Compressing the gas isithermally will require more work to be done

B. Compressing the gas through adiabatic process will require more work to be done

C. compressing the gas isithermally or adiabatic will require the same amount of work

D. Which of the case requires more work will depend upon the atomicity of the gas

Answer:

Watch Video Solution

Watch Video Solution

340. The temperature inside a refrigerator is t_2 °C and the room temperature is t_1 °C. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be

A. frac{t_2+271}{t_1-t_2}`

B. frac{t_1-t_2}{t_1+271}`

C. frac{t_1}{t_1-t_2}`

D. frac{t_1+273}{t_1-t_2}`

Answer:

Watch Video Solution

341. A sample of $0.1g$ of water of $100^\circ C$ and normal pressure $(1.013 \times 10^5 Nm^{-2})$ requires 54 cal of heat energy to convert to steam at $100^\circ C$. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample is

A. 104.3 J

B. 84.5 J

C. 42.2 J

D. 208.7 J

Answer:

Watch Video Solution

342. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

A. 0.268

B. 12.55

C. 0.0625

D. 205

Answer:

Watch Video Solution