PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA

PHYSICS (GUJRATI ENGLISH)

THERMODYANMICS

Section A Questions Answer

1. Write one process where work is converted into heat and heat is converted into work.

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2. Which form of heat believed in before the modern times ?

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3. Write an experiment which describes the modern concept of heat as a form of energy and work is produced from it.

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4. What is thermodynamics ?

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5. Write difference between mechanics and thermodynamics.

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6. What is the meaning of equilibrium in mechanics and equilibrium in thermodynamics?

Watch Video Solution

7. How to get thermal equilibrium in the system ?

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8. Explain and write the Zeroth Law of Thermodynamics.

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9. Give the concept of temperature from the Zeroth Law of Thermodynamics.

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10. Explain the internal energy of a system.

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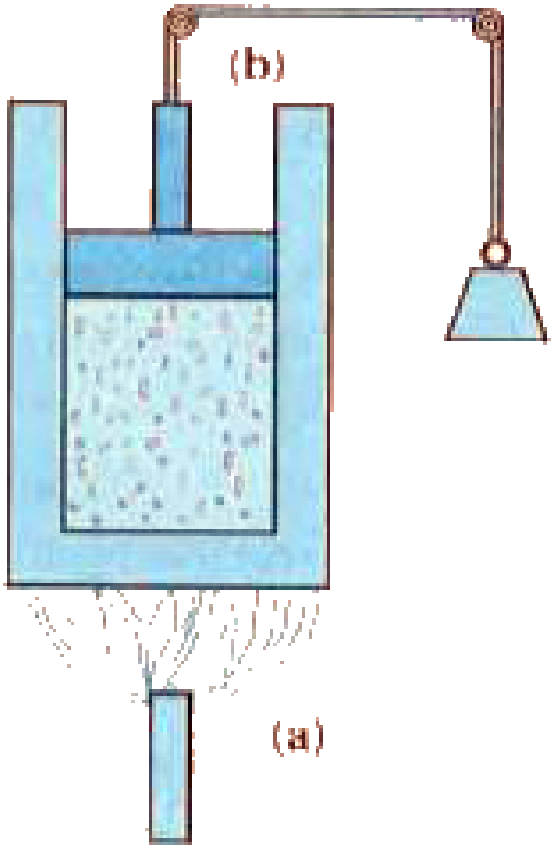
11. Discuss modes (or remedies) for change of internal energy of any system.



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12. Write the basic difference between heat and internal energy.

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13. Write and explain the first law of thermodynamics.

Watch Video Solution

14. Write first law of thermodynamics for isothermal process in an ideal gas.

Watch Video Solution

15. Obtain the form of thermodynamics at constant pressure.

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16. Calculate the change in internal energy when the 1 g water is converted into steam.

Watch Video Solution

17. What is heat capacity of a substance ?

Watch Video Solution

18. What is specific heat ? Give its unit and on which factors does specific heat depends upon

?

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19. Obtain molar specific heat solid by using law of equipartition of energy .

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20. Draw a graph of variation of specific heat capacity of water with temperature and define calorie.

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21. Define two specific heats of gas. Write the relation between them.

Watch Video Solution

22. Obtain the relation between specific heat capacity at constant pressure and specific heat capacity at constant volume for an ideal gas.

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23. What is state variables ?

Watch Video Solution

24. What is thermodynamic state equation ?

Watch Video Solution

25. Write the two kinds of thermodynamics state variables and explain.

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26. What are thermodynamic processes ?

Watch Video Solution

27. Explain Quasi-static process.

Watch Video Solution

28. Obtain an expression for work done by an ideal gas in an isothermal expansion.

Watch Video Solution

29. What is an adiabatic process ? Derive an expression for work done in an adiabatic process.

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30. Draw P-V curves for isothermal and adiabatic processes of an ideal gas.

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31. Write the note on isochoric process.

Watch Video Solution

32. Define isobaric process. Derive an expression for work done in such process.

Watch Video Solution

33. What is cyclic process ? Write note on it.

Watch Video Solution

34. Explain heat engines ? Explain its working.

Watch Video Solution

35. Give the basic features of heat engine based on cyclic process and obtain the formula of its efficiency

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36. Explain working of refrigerators/heat pumps and its coefficient of performance.

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37. Write an example in which the first law of thermodynamic is allowed but never be observed.

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38. Write a short note on reversible and irreversible processes.

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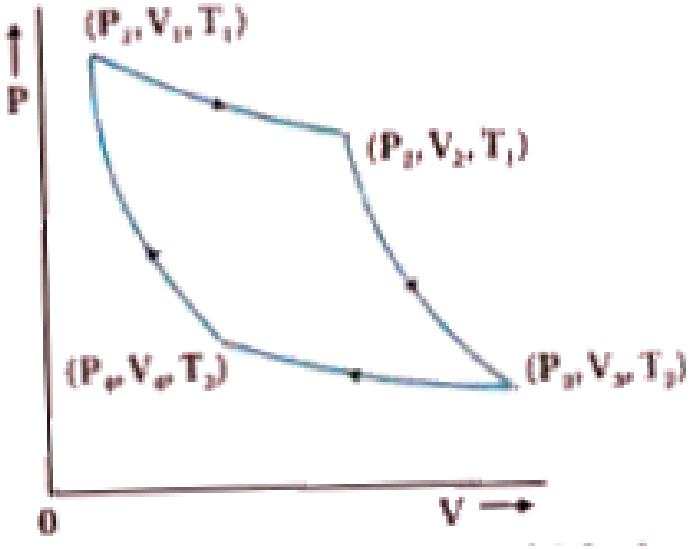
39. What is Carnot cycle ? Explain it by drawing figure.



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40. Explain: What is carnot engine ?

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41. Show four steps of carnot engine in P-V graph write the equation of each step and obtain the work done by the system. Also obtain the efficiency of a carnot engine.

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42. Obtain Carnot's theorem.

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43. Obtain the formula for the coefficient of performance of carnot engine.

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44. Obtain the relation between coefficient of performance and efficiency .

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Section A Try Your Self

1. Which form of heat believed in before the modern time ?

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2. Describe an experiment of Benjamin Thomson regarding the heat is produced by work.

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3. What conclusion be made from boring of a brass cannon ?

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4. What is thermodynamics ?

Watch Video Solution

5. What are macroscopic quantities ?

Watch Video Solution

6. What are microscopic quantities ?

Watch Video Solution

7. What is the meaning of equilibrium in mechanics?

Watch Video Solution

8. Write the meaning of equilibrium in thermodynamics.

Watch Video Solution

9. The system is in equilibrium state depend on what ?

Watch Video Solution

10. Give the characteristics of thermal equilibrium of two system.

Watch Video Solution

11. Is it necessary to change the volume and pressure to bring the equilibrium of the system ? Why ?

Watch Video Solution

12. Who formulated the zeroth law of thermodynamics ?

Watch Video Solution

13. When does the systems at different temperature attained thermal equilibrium after time goes on ?

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14. Write zeroth law of thermodynamics.

Watch Video Solution

15. If A and B are in thermal equilibrium independently then what can be said about the system A and B ?

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16. Write the meaning of temperature.

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17. What is the internal energy of a system ?

Watch Video Solution

18. The internal energy of a system depend on what ?

Watch Video Solution

19. What is heat ?

Watch Video Solution

20. Does any system posses heat ?

Watch Video Solution

21. Does any system posses heat energy ?

Watch Video Solution

22. Heat is not any object. True/False. Mention it.

Watch Video Solution

23. System cannot posses mechanical energy but posses work. Correct this statement for TRUE.

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24. In how many ways the internal energy can be changed ?

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25. Write the first law of thermodynamics.

Watch Video Solution

26. Write the limitations of first law of thermodynamics.

Watch Video Solution

27. Write sign convention for heat in thermodynamics.

Watch Video Solution

28. Write sign convention for work in thermodynamics.

Watch Video Solution

29. Write sign convention for energy in thermodynamics.

Watch Video Solution

30. Write the first law of thermodynamics in isothermal expansion.

Watch Video Solution

31. Obtain work done at constant pressure.

Watch Video Solution

32. Write the volume of vapour of 1 g water at 1 atmospheric pressure.

Watch Video Solution

33. Define heat capacity, write its unit.

Watch Video Solution

34. On what the value of heat capacity depends ?

Watch Video Solution

35. Define specific heat capacity, write its unit.

Watch Video Solution

36. On what the value of specific heat capacity depends ?

Watch Video Solution

37. What is molar specific heat capacity of a substance ? Write its unit.

Watch Video Solution

38. What is the total energy for one mole solid substance ?

Watch Video Solution

39. Write the old definition of calorie.

Watch Video Solution

40. Write the new definition of calorie.

Watch Video Solution

41. Draw a graph of variation of specific heat capacity of water with temperature.

Watch Video Solution

42. Write the value of specific heat capacity of water with unit.

Watch Video Solution

43. 1J = ... calorie. (Fill up the blank)

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44. At which temperature specific heat of water is minimum ?

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45. Equilibrium state of a thermodynamics system described on what ?

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46. Different state variables of thermodynamics depend on each other - Write true statement from this statement.

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47. What is extensive variables ?

Watch Video Solution

48. What is intensive variable ? What is that variables ?

Watch Video Solution

49. Is $P\Delta V$ extensive or intensive variables ?

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50. What is an isothermal process ? Write the first law of thermodynamics for an ideal gas.

Watch Video Solution

51. What is an adiabatic process ? Write the first law of thermodynamics for an ideal gas.

Watch Video Solution

52. What is an isobaric process ? Write the first law of thermodynamics for an ideal gas.

Watch Video Solution

53. What is an isochoric process ? Write the first law of thermodynamics for an ideal gas.

Watch Video Solution

54. What is cyclic process ? Write the first law of thermodynamics.

Watch Video Solution

55. Write equation for work done for compression for an ideal gas.

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56. What is the change in temperature when work done by gas in an adiabatic process ?

Watch Video Solution

57. Write the expression of work for an ideal gas in isobaric process.

Watch Video Solution

58. What is heat engine ?

Watch Video Solution

59. What is working substance in external combustion engine ?

Watch Video Solution

60. What is working substance in internal combustion engine ?

Watch Video Solution

61. Write common feature of heat engine based on cyclic process ?

Watch Video Solution

62. What is the efficiency of heat engine ? Write it formula.

Watch Video Solution

63. Why is a heat engine never 100% efficient ?

Watch Video Solution

64. What is theoretical efficiency of heat engine ?

Watch Video Solution

65. When does any refrigerator or heat pump work ?

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66. Draw a schematic representation of a refrigerator.

Watch Video Solution

67. Define and write the formula for coefficient of performance of a refrigerator.

Watch Video Solution

68. Write the formula of coefficient of performance of a heat pump.

Watch Video Solution

69. Why the coefficient of performance of refrigerator become infinity ?

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70. Why can't the efficiency of a heat engine ever be 100 % ?

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71. Which limitation of heat engine put by the second law of thermodynamics ?

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72. Why the coefficient of performance of a refrigerator never be infinite ?

Watch Video Solution

73. What is the efficiency of an ideal gas ?

Watch Video Solution

74. What is an ideal refrigerator ?

Watch Video Solution

75. Write Kelvin-Planck statement for second law of thermodynamics.

Watch Video Solution

76. Write clausius statement for second law of thermodynamics.

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77. What is irreversible process ?

Watch Video Solution

78. What is reversible process ?

Watch Video Solution

79. What is quasi-static ?

Watch Video Solution

80. What process is acceptable in nature, reversible or irreversible process ?

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81. Give the basic principle of thermodynamics.

Watch Video Solution

82. What is carnot cycle ?

Watch Video Solution

83. What is carnot engine ?

Watch Video Solution

84. Give the process which are quasi-static and do not dissipated energy.

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85. Name the process which is associated with dissipated energy process and reduce the efficiency.

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86. Who represented (invented) carnot engine at first ?

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87. Which type of process are done in an ideal engine ?

Watch Video Solution

88. The efficiency of carnot engine depends on what ? and from whom it is independent ?

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89. Explain why "the efficiency of carnot engine cannot be 100%" ?

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90. Write carnot theorem.

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Section B Numericals Numerical From Textual Exercise

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

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2. What amount of heat must be supplied to 2.0×10^{-2} kg of nitrogen (at room temperature) to raise its temperature by 45°

C at constant pressure ? (Molecular mass of N_2=28 , R=8.3 J $mol^{-1}K^{-1}$).

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3. Explain why :

(a) Two bodies at different temperatures 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 a nuclear plant (i.e., the liquid used to prevent the

different parts of a plant from getting too hot) should have high specific heat.

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

(d)The climate of a harbour town is more temperate than that of a town in a desert at the same latitude.

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4. A cylinder with a movable piston contains 3 moles of hydrogen at standard temperature

and pressure. The walls of the cylinder 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 increase if the gas is compressed to half its original volume ?

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5. 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 latter case ? (Take 1 cal = 4.19 J)

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6. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. 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 the temperature of the gas ?

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

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7. A steam engine delivers 5.4×10^8 J of work per minute and services 3.6×10^9 J of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute ?

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8. An electric heater supplies heat to a system at a rate of 100 W. If system performs work at

a rate of 75 joules per second. At what rate is the internal energy increasing ?

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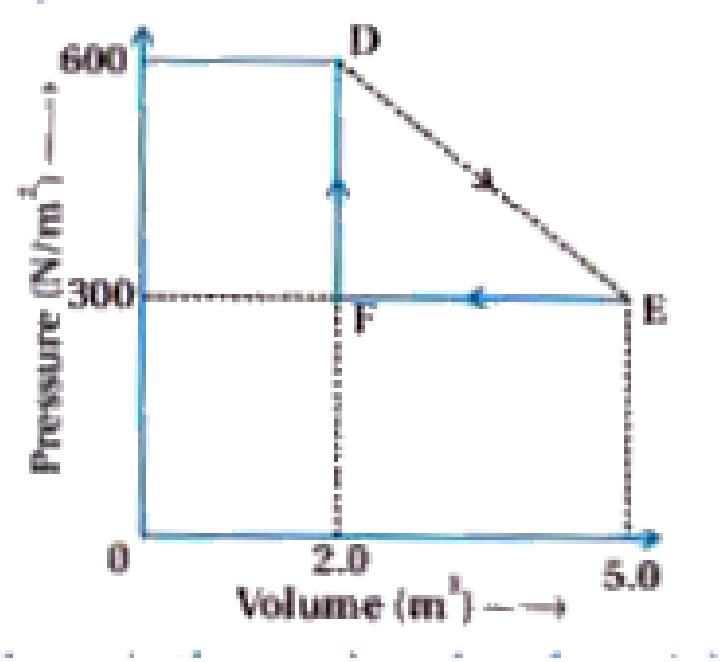
9. A thermodynamic system is taken from an original state to an intermediate state by the linear process shown in figure.



Its volume is then reduced to the original value from E to F by an isobaric process. Calculate the total work done by the gas from D to E to F.

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10. A refrigerator is to maintain eatables kept inside at 9° C. If room temperature is $36^\circ C$, calculate the coefficient of performance.

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Section B Numericals Numerical From Darpan Based On Textbook

1. A gaseous system absorbs 450 cal heat. The work done by the system is 836.2 J. Find the

change in internal energy of the gas in calorie.

(J=4.186 J cal^{-1})

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2. The heat capacity of a silver coin is $1.128\mathrm{cal}.^{\circ} C^{-1}$, What should be its mass in gram ? (The specific heat of silver is $C = 0.0564\mathrm{cal\ g}^{-1}.^{\circ} C^{-1}$)

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3. An ideal gas is enclosed in a closed container of $0.0083m^3$ at 300 K temperature and pressure of 1.6×10^6 Pa. Find final temperature and pressure of the gas if 2.49×10^4 J heat is supplied to the gas. Neglect expansion of the container. $R = 8.3\text{J mol}^{-1}K^{-1}$

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4. Calculate the work required to be done to increase the temperature of 1 mole ideal gas by $30^{\circ}C$. Expansion of the gas takes place according to the relation $V \propto T^{\frac{2}{3}}$. Take R=8.3 $\mathrm{J\ mol^{-1}K^{-1}}$.

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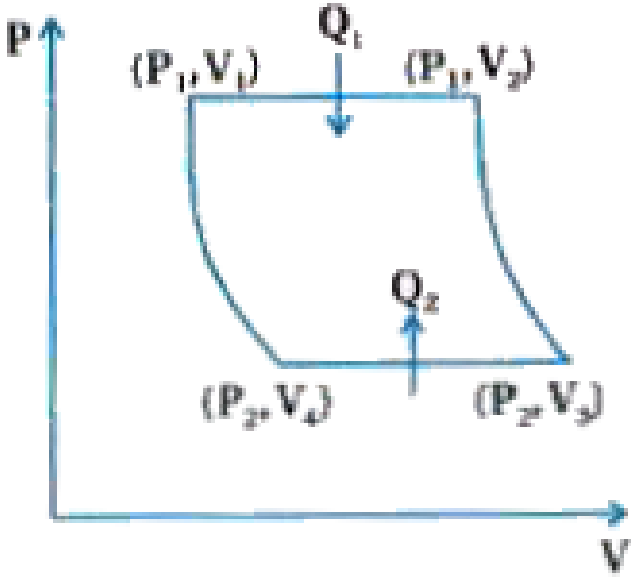
5. A cyclic process consisting of two isobaric and two adiabatic processes is shown in the figure. If $P_2 = nP_1$ then prove that efficiency

of this process is $\eta = 1 - n^{\left(1-\frac{1}{\gamma}\right)}$ where $\gamma = \frac{C_P}{C_V}$



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6. The temperature of the sink of a carnot engine is 300 K and its efficiency is 40 %. Find

the decrease in temperature of the sink required to increase the efficiency of the engine to 50% keeping temperature of the source to be constant.

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7. ab and bc curves in the figure represent an isothermal and an adiabatic process respectively. Show that at the point b the ratio of the slopes of isothermal and adiabatic curves is equal to $\frac{C_P}{C_V}$.

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8. In a carnot engine, temperature of the source is 500 K and that of the sink is 375 K. If the engine absorbs 600 k cal heat from the source per cycle, find (i) its efficiency (ii) work done per cycle, (iii) heat released in the sink. (J = 4.2 J/cal)

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9. (a) How much heat should be provided to ice of 720 g mass, lying at -$10^\circ C$ to melt it to water at $0^\circ C$? (b) How much heat should be provided to water at $0^\circ C$ to increase its temperature to $100^\circ C$?(c) How much heat should be given to water at $100^\circ C$ to transform it completely into water ?

(d) Totally, how much heat should be given to ice of 720 g at $-10^\circ C$ to convert it completely into vapour ? (C"ice"=2220 "J kg"^(-1) K^(-1), C"water"=4190 "J kg"^(-1) K^(-1) , LF=333 "kJ"/"kg", LV=2256 "kJ"/"kg"`)

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10. 1 mole of an ideal gas at 27° C temperature and 2 atm pressure is compressed adiabatically until its final temperature became 848.4 K. Find the total work done on the gas.

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11. For an adiabatic process PV^{γ} = constant. Evaluate this "constant" for an adiabatic process in which 2 mol of an ideal gas is filled at 1.0 atm pressure and 300 K temperature. Consider the ideal gas to be diatomic rigid rotator.

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Section C Objective Questions Vsqs

1. Can whole of heat be converted into work ?

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2. Can change in internal energy of an ideal gas be a isothermal process ?

Watch Video Solution

3. Can change in internal energy of an ideal gas be considered as an adiabatic process ?

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

Watch Video Solution

5. What is the specific heat of a gas in an a adiabatic process ?

Watch Video Solution

6. Is the temperature of an isolated system of gas be changed ?

Watch Video Solution

7. Can the coefficient of performance of a refrigerator be increased by increasing the mass of working substance ?

Watch Video Solution

8. If the door of a refrigerator is kept open in a room, will it make the room warm or cool ?

Watch Video Solution

9. Give the nature of $P \rightarrow V$ điagrams of isobaric and isochoric processes.

Watch Video Solution

10. Write two essential characteristics of an ideal heat engine.

Watch Video Solution

11. Under which ideal condition, the efficiency of a carnot engine become 100% ?

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12. In summer, when the valve of a bicycle tube is removed the escaping air appears cold. Why ?

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

Watch Video Solution

14. Why does a gas get heated on compression ?

Watch Video Solution

15. Can two isothermal curves intersect each other?

Watch Video Solution

16. Is the rusting of iron be a reversible process ? Why ?

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17. For all gases $C_P - C_V$ constant, then all gases $\frac{C_P}{C_V}$ hold constant ?

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18. Which quantity remains constant in an adiabatic process ?

Watch Video Solution

19. Is the specific heat of water and ice be the same? Give their values.

Watch Video Solution

20. What is the total work done in a cyclic process ?

Watch Video Solution

21. With what the internal energy of real gases be determined ?

Watch Video Solution

22. Melting of ice is an adiabatic or an isothermal process ?

Watch Video Solution

23. Can PV = RT be described with an isothermal or an adiabatic process ?

Watch Video Solution

24. Give the main points of second law of thermodynamics.

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25. What is the significance of the heat capacity ratio $\frac{C_P}{C_V}$ for a gas ?

Watch Video Solution

26. You feel enjoy by having bath in shower in summer but not in winter. Why ?

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27. Write difference between $C_P - C_V = R, C_P - C_V = \frac{R}{J}$

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28. Is the specific heat of water is greater than that of sand ?

Watch Video Solution

29. What is the main difference between P $\rightarrow$ T diagram of water and CO_2 ?

Watch Video Solution

30. Give the limitations for first law of thermodynamics.

Watch Video Solution

31. How many fixed points does a absolute Kelvin scale have ? Write their values.

Watch Video Solution

32. Does the internal energy of an ideal gas change in an isothermal process ?

Watch Video Solution

33. Does the internal energy of an ideal gas change in an adiabatic process ?

Watch Video Solution

34. What conclusion be made from zeroth law of thermodynamics ?

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35. Is the coefficient of performance of refrigerator constant ?

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36. Is it possible to convert internal energy into work or mechanical energy ?

Watch Video Solution

37. Is the carnot engine working under an isothermal state doesn't do any useful work ?

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38. What is the efficiency of a carnot's engine working between boiling point and freezing point of water ?

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39. What is the triple point ?

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40. Why work is an extensive quantity ?

Watch Video Solution

41. Can any system possess heat ?

Watch Video Solution

42. Can any system possess thermal energy ?

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43. Heat is not an object in a body. True or False ?

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44. Correct the sentence : "System cannot posses mechanical energy but posses work".

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45. What is the net amount of heat entering the system in a cyclic process equivalent to ?

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Section C Objective Questions True False

1. Prove that for an adiabatic process $TV^{\gamma-1}$ = constant.

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2. Charging process of battery is a reversible process.

 Watch Video Solution

3. Water falls below from height is a reversible process.

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4. Internal energy, volume and mass are intensive variable while pressure, temperature and density are extensive variables.

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5. The change in internal energy $\Delta U = 0$ in a cyclic process.

Watch Video Solution

6. In an adiabatic process temperature remains constant.

Watch Video Solution

7. The internal energy of a system during isothermal process decreases.

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8. Equation $\beta = \frac{Q_2}{Q_1 - Q_2}$ is true or false ?

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Section C Objective Questions Fill In The Blanks

1. The change of internal energy in cyclic process is ___

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2. The internal energy of gas is increased in _____

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3. An ideal gas at temperature T_1 is compressed to 32th of its original volume, then its temperature T_2 will be _____ $(\gamma = 1.4)$

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4. The triple point of water is at ..... pressure and ..... temperature.

Watch Video Solution

5. The temperature of freezing point ..... and temperature of boiling point ..... are taken in Fahrenheit thermometer.

Watch Video Solution

6. Zeroth law of thermodynamics define..... and first law of thermodynamics define .....

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7. At ..... temperature water and water vapour are equal dense.

Watch Video Solution

8. The _____ has maximum value of specific heat.

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9. The heat required to raise the temperature of body by 1 K is called .....

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10. A temperature difference of $10^{\circ}C$ is equivalent of a temperature difference ..... in Fahrenheit temperature scale.

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11. For isothermal process of an ideal gas $\frac{dP}{P}$= _____

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Section C Objective Questions Match

1. In Column-I processes and in Column-II formulas of work are given. Match them

appropriately :

Column-I		Column-II	
(a)	Isothermal process	(i)	$W = \frac{\mu R(T_1 - T_2)}{\gamma - 1}$
(b)	Adiabatic process	(ii)	$W = P\Delta V$
		(iii)	$W = 2.303\mu RT\log\left(\frac{V_2}{V_1}\right)$

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2. In Column-I process and in Column-II first law of thermodyanmics are given . Match them appropriately :

Column-I		Column-II	
(a)	Adiabatic	(i)	$\Delta Q = \Delta U$
(b)	Isothermal	(ii)	$\Delta Q = \Delta W$
		(iii)	$\Delta U = -\Delta W$

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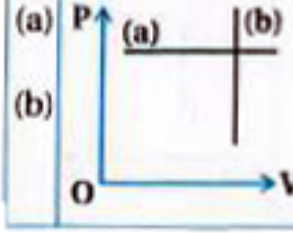
3. In Column-I a graph and in Column-II processes are given. Match them appropriately:

Column-I		Column-II	
(a)		(i)	Adiabatic process
(b)		(ii)	Isobaric process
		(iii)	Isochoric process

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4. In Column-I devices and in Column-II efficiency are given. Match them appropriately:

Column-I		Column-II	
(a)	Heat engine	(i)	$\eta = \frac{Q_2}{Q_1 - Q_2}$
(b)	Heat pump	(ii)	$\eta = \frac{Q_1 - Q_2}{Q_1}$
		(iii)	$\eta = \frac{T_1 - T_2}{T_1}$

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Section C Objective Questions Assertion Reason

1. Assertion : Work and heat are two equivalent form of energy

Reason: Work is the transfer of mechanical energy irrespective of temperature difference, whereas heat is the transfer of thermal energy because of temperature difference only.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer: A

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2. Assertion: We cannot change the temperature of body without giving (or taking) heat to (or from) it.

Reason: According to principle of conservation of energy, total energy of a system should remains conserved.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer: D

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3. Assertion: The heat supplied to a system is always equal to the increase in its internal energy.

Reason: When a system changes from one thermal equilibrium to another some heat is absorbed by it.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer: D

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4. Assertion: In isothermal process whole of the heat energy supplied to the body is converted into internal energy.

Reason: According to the first thermodynamics $\Delta Q = \Delta U + P\Delta V$

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of

the assertion

C. The assertion is true but reason is false.

D. Assertion is false but reason is true

Answer: D

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5. Assertion: The specific heat of a gas in an adiabatic process is zero and in an isothermal process is infinite.

Reason: Specific heat of a gas is directly

proportional to the heat in system and inversely proportional to change in temperature.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer: A

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6. Assertion: In adiabatic compression the internal energy and temperature of the system get decreased.

Reason: The adiabatic compression is a slow process.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer: D

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7. Assertion: When a bottle of cold carbonated drink is opened a slig! fog forms around the opening.

Reason: Adiabatic expansion of the gas causes lowering of temperature and condensation of water vapours.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer:

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8. Assertion: A room can be cooled by opening the door of a refrigerator in a closed room.

Reason: Heat flows from lower temperature to higher temperature.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion.

B. Both assertion and reason are true but reason is not the correct explanation of the assertion

C. The assertion is true but reason is false.

D. Assertion and reason both are false.

Answer:

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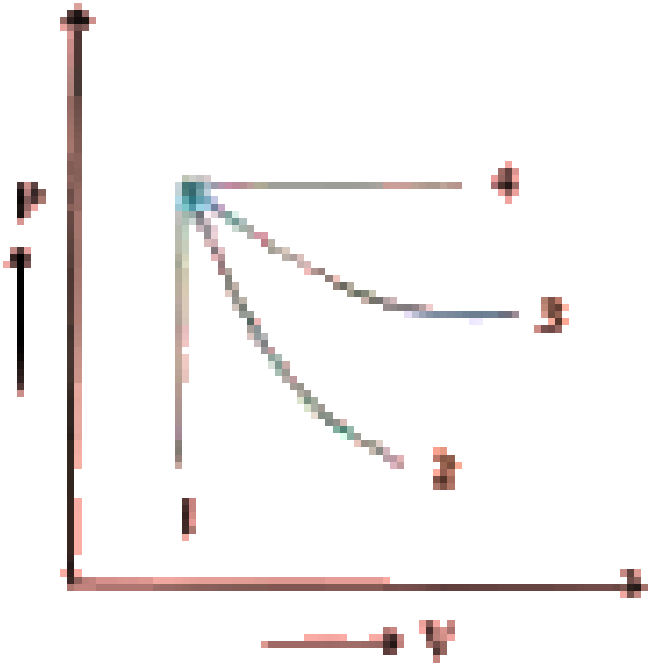
Section D Ncert Exemplar Solution Mcqs

1. An ideal gas undergoes four different processes from the same initial state as shown in figure of P-V diagram. Four processes are

adiabatic, isothermal, isobaric and isochoric.

Out of 1,2,3 and 4 which one is adiabatic ?



A. 4

B. 3

C. 2

D. 1

Answer: C

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2. If an average person jogs he produces 14.5×10^3 cal/min. This is removed by the evaporation of sweat. The amount of sweat evaporated per minute (assuming 1 kg requires 580×10^3 cal for evaporation) is

A. 0.25 kg

B. 2.25 kg

C. 0.05 kg

D. 0.20kg

Answer: A

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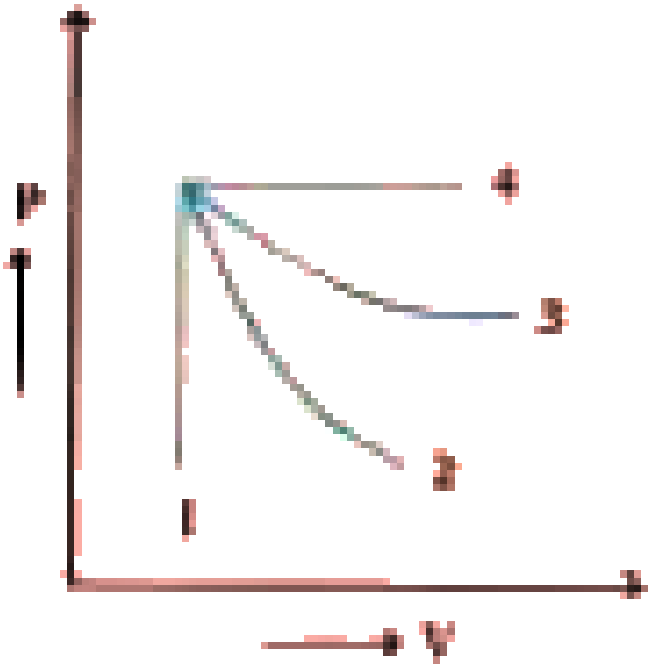
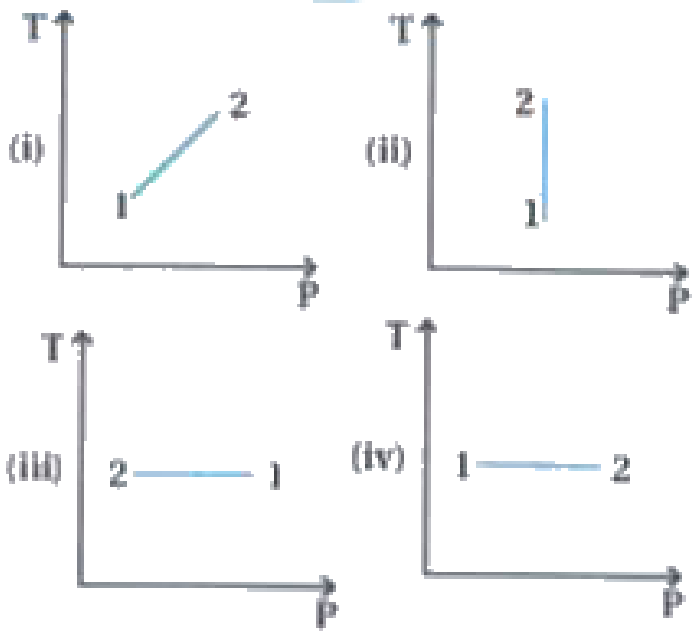
3. Consider P $\rightarrow$ V diagram for an ideal gas shown in figure.



Out of the following diagrams which figure,

represents the T $\rightarrow$ P diagram ?



A. (iv)

B. (ii)

C. (iii)

D. (i)

Answer: C

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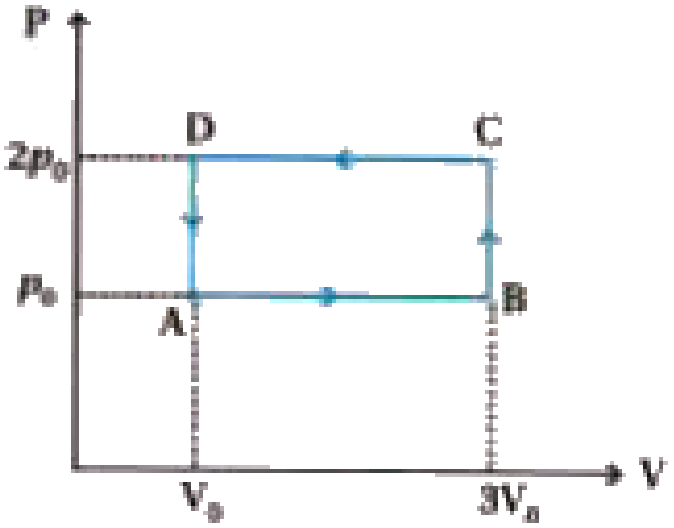
4. An ideal gas undergoes cyclic process ABCDA as shown in given P - V diagram. The amount of work done by the gas is ___



A. $6P_0V_0$

B. $-2P_0V_0$

C. $+2P_0V_0$

D. $+4P_0V_0$

Answer: B

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5. Consider two containers A and B containing identical gases at the same pressure, volume and temperature. The gas in container A is

compressed to half of its original volume isothermally while the gas in container B is compressed to half of its original value adiabatically. The ratio of final pressure of gas in B to that of gas in A is

A. $2^{\gamma-1}$

B. $\left(\frac{1}{2}\right)^{\gamma-1}$

C. $\left(\frac{1}{1-\gamma}\right)^{2}$

D. $\left(\frac{1}{\gamma-1}\right)^{2}$

Answer: A

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6. Three copper blocks of masses M_1, M_2 and M_3 kg respectively are brought into thermal contact till they reach equilibrium. Before contact they were at $T_1, T_2, T_3 (T_1 > T_2 > T_3)$. Assuming there is no heat loss to the surroundings, the equilibrium temperature T is (s is specific heat of copper)

A. $T = \frac{T_1 + T_2 + T_3}{3}$

B. $T = \dfrac{M_1T_1 + M_2T_2 + M_3T_3}{M_1 + M_2 + M_3}$

C. $T = \dfrac{M_1T_1 + M_2T_2 + M_3T_3}{3(M_1 + M_2 + M_3)}$

D. $T = \dfrac{M_1T_1s + M_2T_2s + M_3T_3s}{M_1 + M_2 + M_3}$

Answer: B

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Section D Ncert Exemplar Solution Mcqs More Than One Option

1. Which of the processes described below are irreversible ?

A. The increase in temperature of an iron rod by hammering it.

B. A gas in a small container at a temperature T_1 is brought in contact with a big reservoir at a higher temperature T_2 which increases the temperature of the gas.

C. A quasi-static isothermal expansion of an ideal gas in cylinder fitted with a frictionless piston.

D. An ideal gas is enclosed in a piston cylinder arrangement with adiabatic walls. A weight W is added to the piston resulting in compression of gas.

Answer: A::B::D

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2. An ideal gas undergoes isothermal process from some initial state i to final state f. Choose the correct alternatives.

A. $dU=0$

B. $dQ=0$

C. $dQ=dU$

D. $dQ=dW$

Answer: A::D

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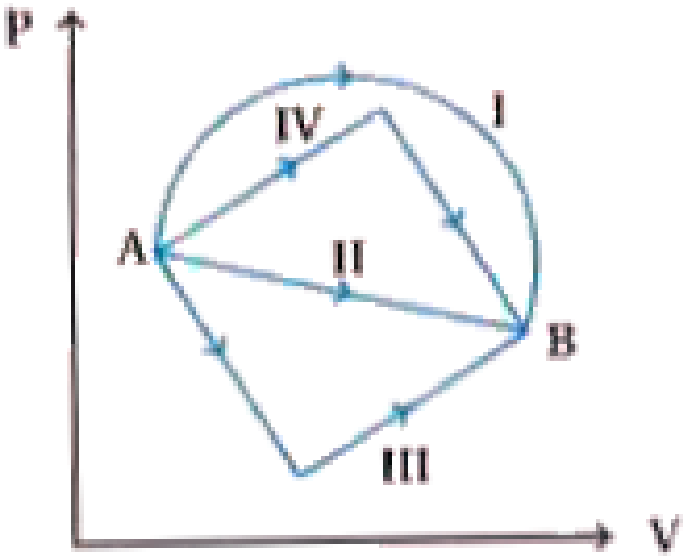
3. Figure shows the P- V diagram of an ideal gas undergoing a change of state from A to B. Four different parts I, II, III and IV as shown in the figure may lead to the same change of state.



A. Change in internal energy is same in IV and III cases, but not in I and II.

B. Change in internal energy is same in all the four cases.

C. Work done is maximum in case I

D. Work done is minimum in case II.

Answer: B::C

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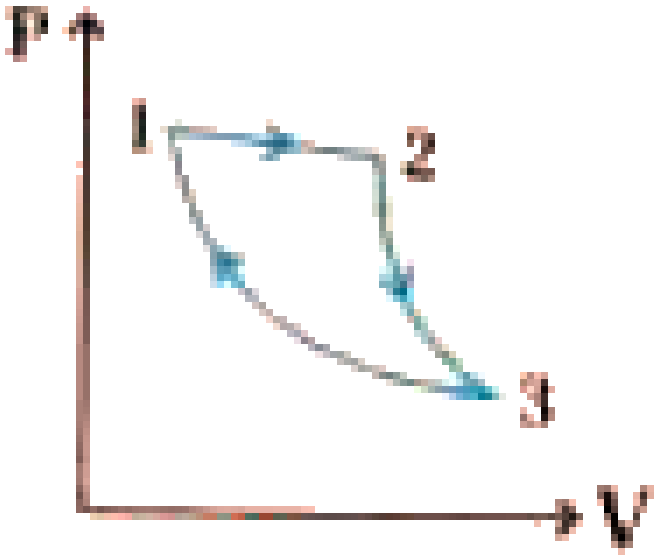
4. Consider a cycle followed by an engine as shown in figure,

1 to 2 is isothermal

2 to 3 is adiabatic

3 to 1 is adiabatic

Such a process does not exist because



A. heat is completely converted to mechanical energy in such a process, which is not possible.

B. mechanical energy is completely converted to heat in this process, which is not possible.

C. curves representing two adiabatic processes don't intersect.

D. curves representing an adiabatic process and an isothermal process don't

intersect.

Answer: A::C

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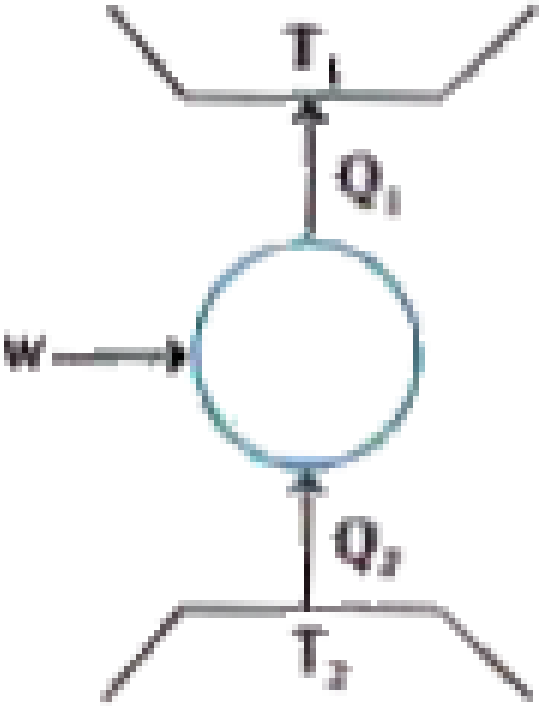
5. Consider a heat engine as shown in figure. Q_1 and Q_2 are heat added both to T_1 and heat taken from T_2 in one cycle of engine. W is the mechanical work done on the engine.



If $W > 0$, then possibilities are :

A. $Q_1 > Q_2 > 0$

B. $Q_2 > Q_1 > 0$

C. $Q_2 < Q_1 < 0$

D. $Q_1 < 0, Q_2 > 0$

Answer: A::C

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Section D Ncert Exemplar Solution Very Short Answer

1. Can a system be heated and its temperature remains constant ?

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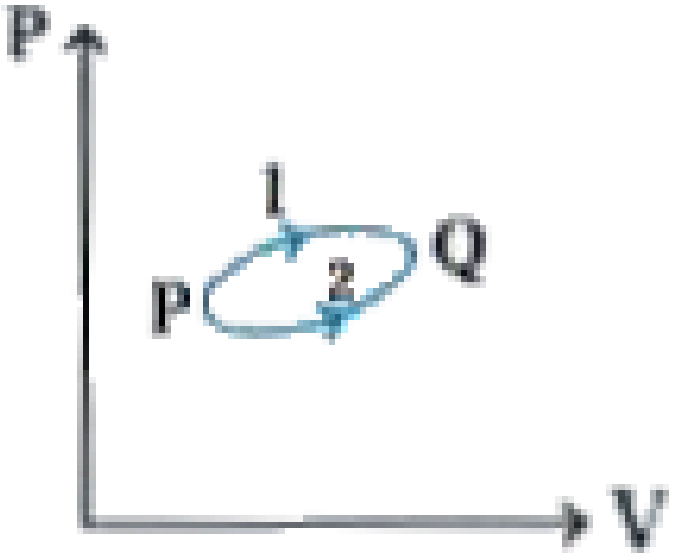
2. A system goes from P to Q by two different paths in the P -V diagram as shown in figure. Heat given to the system in path 1 is 1000 J. The work done by the system along path 1 is more than path 2 by 100 J. What is the heat exchanged by the system in path 2 ?



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Watch Video Solution

3. If a refrigerator's door is kept open, will the room become cool or hot ? Explain.

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4. Is it possible to increase the temperature of a gas without adding heat to it ? Explain.

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

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Section D Ncert Exemplar Solution Short Answer

1. Consider a Carnot's cycle operating between T_1 = 500 K and T_2 = 300 K producing 1 kJ of mechanical work per cycle. Find the heat transferred to the engine by the reservoirs.

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2. A person of mass 60 kg wants to lose 5 kg by going up and down a 10 m high stairs. Assume he burns twice as much fat while going up than coming down. If 1 kg of fat is burnt on expending 7000 kilo calories, how many times must he go up and down to reduce his weight by 5 kg ?

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3. Consider a cycle tyre being filled with air by a pump. Let V be the volume of the tyre (fixed) and at each stroke of the pump $\Delta V(< < V)$ of air is transferred to the tube adiabatically. What is the work done when the pressure in the tube is increased from P_1 to P_2 ?

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4. In a refrigerator one removes heat from a lower temperature and deposits to the surroundings at a higher temperature. In this process, mechanical work has to be done, which is provided by an electric motor. If the motor is of 1 kW power and heat is transferred from -3° C to 27° C, find the heat taken out of the refrigerator per second assuming its efficiency is 50 % of a perfect engine.

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5. If the coefficient of performance of a refrigerator is 5 and operates at the room temperature $(27^{\circ}C)$, find the temperature inside the refrigerator.

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6. The initial state of a certain gas is (P_i, V_i, T_i). It undergoes expansion till its volume becomes V_f Consider the following two cases :

(a) the expansion takes place at constant

temperature.

(b) the expansion takes place at constant pressure. Plot the P-V diagram for each case. In which of the two cases, is the work done by the gas more ?

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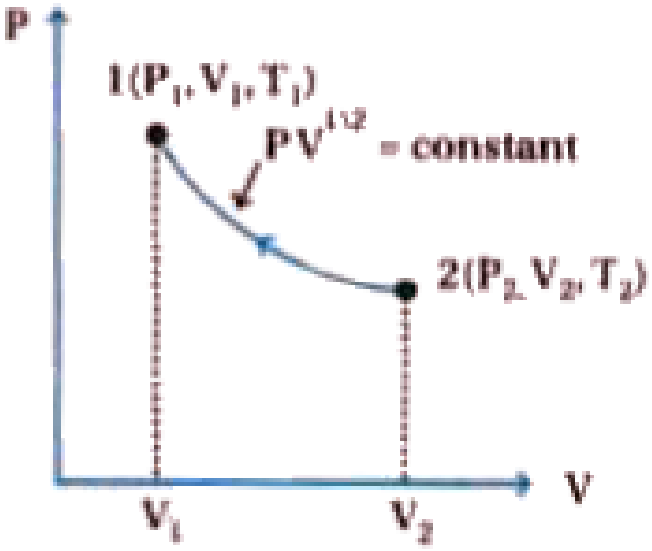
Section D Ncert Exemplar Solution Long Answer

1. Consider a P-V diagram in which the path followed by one mole of perfect gas in a

cylindrical container is shown in figure.



(a) Find the work done when the gas is taken from state 1 to state 2.

(b) What is the ratio of temperature $\frac{T_1}{T_2}$ if $V_2 = 2V_1$?

(c) Given the internal energy for one mole of gas at temperature T is $\frac{3}{2}RT$, find the heat 2

supplied to the gas when it is taken from state 1 to 2, with $V_2 = 2V_1$

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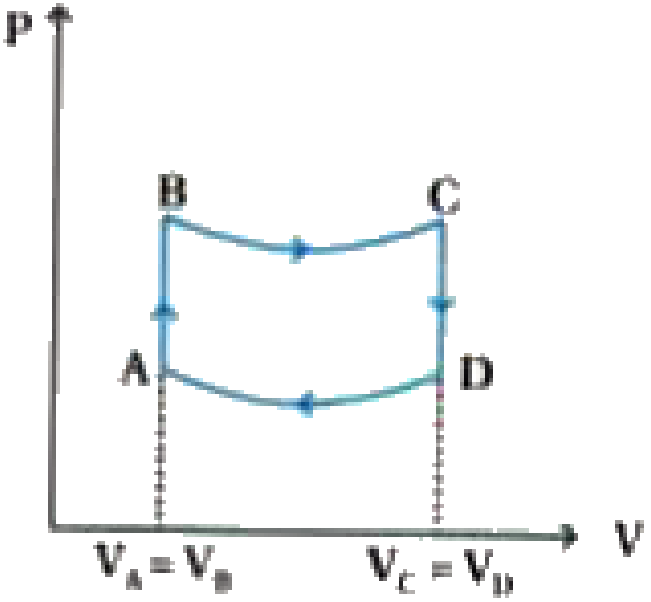
2. A cycle followed by an engine (made of one mole of perfect gas in a cylinder with a piston) is shown in figure.



A to B: volume constant

B to C: adiabatic

C to D: volume constant

D to A: adiabatic

$V_C = V_D = 2V_A = 2V_B$

(a) In which part of the cycle heat is supplied to the engine from outside ?

(b) In which part of the cycle heat is being given to the surrounding by the engine ?

(c) What is the work done by the engine in one cycle ? Write your answer in term of P_A, P_B, V_A

(d) What is the efficiency of the engine ? ($\gamma = \frac{5}{3}$ for the gas , $C_V = \frac{3}{2}R$ for one mole)

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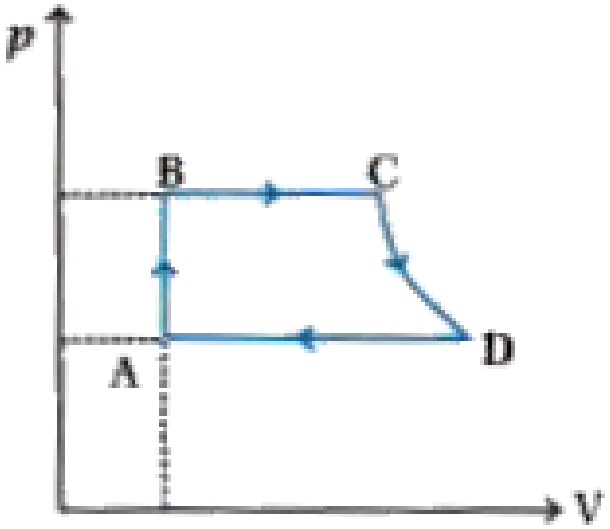
3. A cycle followed by an engine (made of one mole of an ideal gas in a cylinder with a

piston) is shown in figure. Find heat exchanged by the engine, with the surroundings for each section of the cycle.

$C_V = \frac{3}{2}R$



(a) A to B : constant volume

(b) B to C: constant pressure

(c) C to D: adiabatic

(d) D to A: constant pressure

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4. Consider that an ideal gas (n moles) is expanding in a process given by p = f (V), which passes through a point (V_0, p_0). Show that the gas is absorbing heat at (p_0, V_0) if the slope of the curve p =f (V) is larger than the slope of the adiabatic passing through (p_0, V_0).

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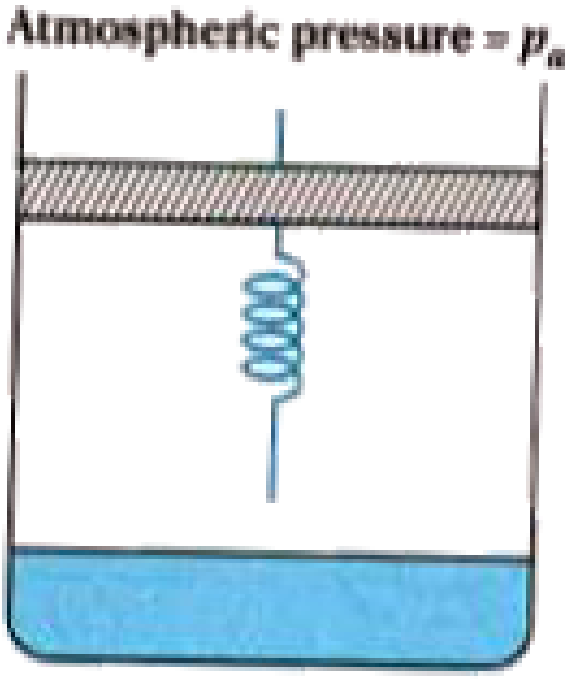
5. Consider one mole of perfect gas in a cylinder of unit cross section with a piston attached as shown in figure. A spring (spring constant k) is attached (unstretched length L) to the piston and to the bottom of the cylinder. Initially the spring is unstretched and the gas is in equilibrium. A certain amount of heat Q is supplied to the gas causing an increase of value from V_0 to V_1.



(a) What is the initial pressure of the system ?

(b) What is the final pressure of the system ?

(c) Using the first law of thermodynamics, write down a relation between Q, P_a, V, V_0 and k.

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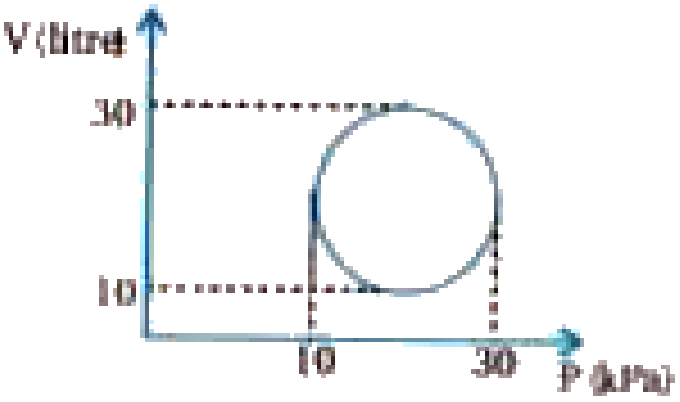
Section E Mcqs

1. Heat absorbed by the gas undergo a cylic process along closed path in one complete cycle as shown in figure will be ____ J.



A. $10^7\pi$

B. $10^4\pi$

C. $10^2\pi$

D. $10^{-3}\pi$

Answer: C

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2. A scientist says that the efficiency of heat engine which work 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: A

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3. An ideal gas heat engine operates in a carnot cycle between 227° C and 127° C. It absorbs 6 kcal at the higher temperature. The

amount of heat (in kcal) converted into work is equal to _____

A. 1.2

B. 4.8

C. 3.5

D. 1.6

Answer: A

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4. One mole of an ideal gas at an initial temperature of TK does 6R Joule of work adiabatically. If the ratio of specific heat of this gas at constant pressure and at constant volume is $\frac{5}{3}$, the final temperature of gas will be ____

A. (T-4)K

B. (T+2.4)K

C. (T-2.4)K

D. (T+4)K

Answer: A

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5. A carnot.engine whose sink is at 300 K has an efficiency of 40 %. By how much should the temperature of source be increased so as to increase its efficiency by 50% of original efficiency ?

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6. An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20°C ? The temperature of boiling water is 100° C.

A. 6.3 min

B. 8.4 min

C. 12.6 min

D. 4.2 min

Answer: A

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7. If Q, E and W denote respectively the heat added, change in internal energy and the work done by a closed cycle process, then

A. $W=0$

B. $Q=W=0$

C. $E=0$

D. $Q=0$

Answer: C

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8. In thermodynamic processes which of 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 PV^{γ} = constant.

D. In an adiabatic process the system is insulated from the surrounding.

Answer: A

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9. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process which of the following is true?

A. $\Delta U = -\Delta W$, in an adiabatic process

B. $\Delta U = \Delta W$, in an isothermal process

C. $\Delta U = \Delta W$ in an adiabatic process

D. $\Delta U = -\Delta W$ in an isothermal process

Answer: A

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10. When 1 kg of ice at 0° C melts to water at 0° C, the resulting change in its entropy,

taking latent heat of ice to be $80\text{cal}/.^{\circ} C$ is

---

A. $273\frac{\text{cal}}{K}$

B. $8 \times 104\frac{\text{cal}}{K}$

C. $80\frac{\text{cal}}{K}$

D. $293\frac{\text{cal}}{K}$

Answer: D

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11. Which quantity remains constant in an adiabatic process ?

A. Pressure

B. Volume

C. Temperature

D. Total heat of the system

Answer: D

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12. For increase in internal energy of a system is equal to the work done on the system. Which process does the system undergo ?

A. Isothermal

B. Isochoric

C. Isobaric

D. Adiabatic

Answer: D

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13. The relation between pressure and temperature of a monoatomic gas in an adiabatic process is $P \propto T^{-C}$, where C = ____

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

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

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

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

Answer: A

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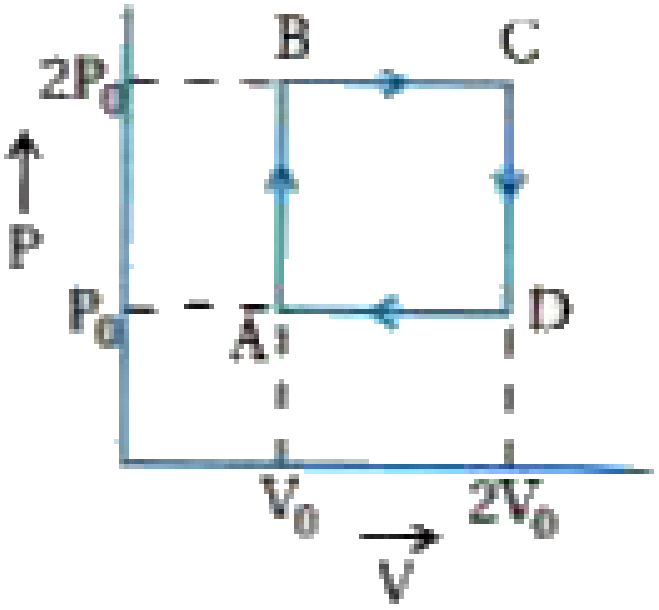
14. n moles of a monoatomic gas is carried round the reversible rectangular cycle ABCDA as shown in the diagram. The temperature at A is T_0. The thermodynamics efficiency of the cycle ___



A. $15\ \%$

B. $50\ \%$

C. $20\ \%$

D. $25\ \%$

Answer: B

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15. Pressure versus temperature graph of an ideal gas is as shown in figure. Density of the gas at point A is ρ_0 . Density at point B will be

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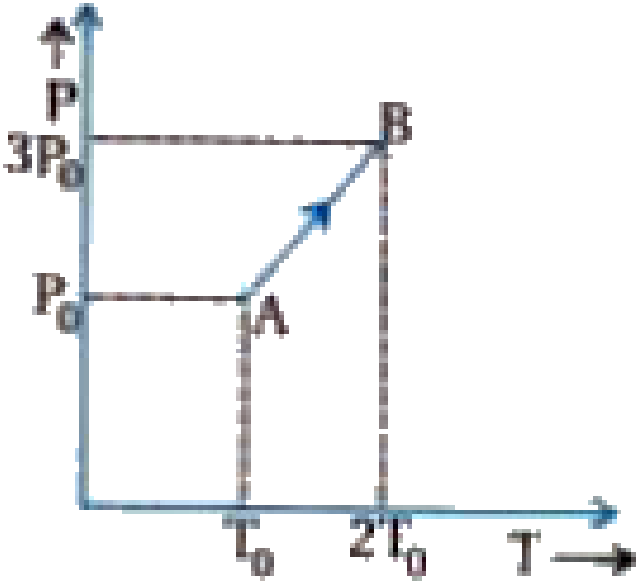

A. $\frac{3}{4}\rho_0$

B. $\frac{3}{2}\rho_0$

C. $\frac{4}{3}\rho_0$

D. $2\rho_0$

Answer: B

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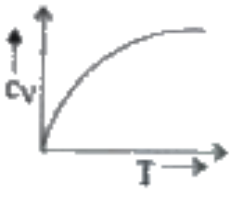
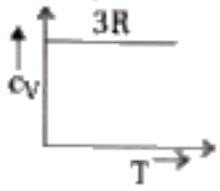
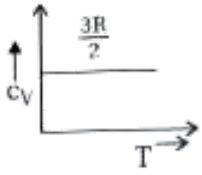
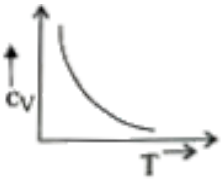
16. Graph of specific heat at constant volume for a monoatomic gas is ___

A. 

B. 

C. 

D. 

Answer: C

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17. For an adiabatic process ____

A. $\Delta S = 0$

B. $\Delta U = 0$

C. Q=0

D. W=0

Answer: A

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18. For cyclic process which of the following quantity is zero ?

A. ΔV

B. ΔU

C. W

D. ΔQ

Answer: B

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19. 1cm^3 of water at 1 atm pressure is converted into steam, volume of steam becomes 1671cm^3 hence increase in internal energy will be ____

A. 2087 J

B. 167 J

C. 373 cal

D. 373 J

Answer: C

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20. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while

box B contains one mole of helium at temperature $(7/3)T_0$. The boxes are then put into thermal contact with each other , and heat flows between them until the gases reach a common final temperature (Ignore the heat capacity of boxes). Then , the final temperature of gases, T_f , in terms of T_0 is -

A. $T_f = \frac{5}{2}T_0$

B. $T_f = \frac{3}{7}T_0$

C. $T_f = \frac{7}{3}T_0$

D. $T_f = \frac{3}{2}T_0$

Answer: D

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21. 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. 100 J

B. 99 J

C. 90 J

D. 1 J

Answer: C

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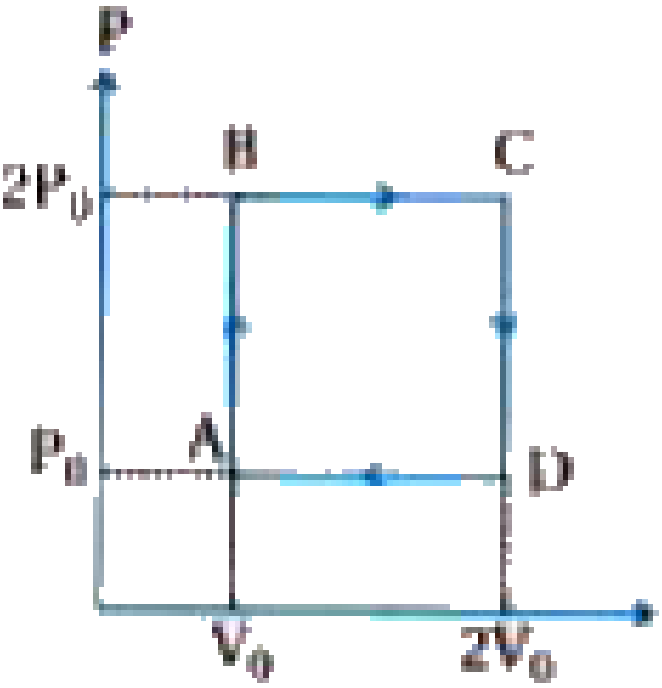
22. Helium gas goes through a cycle ABCDA as shown in figure. Efficiency of this cycle is nearly

_____ (Imagine He is an ideal gas)



A. 9.1 %

B. 10.5 %

C. 12.5 %

D. 15.4 %

Answer: D

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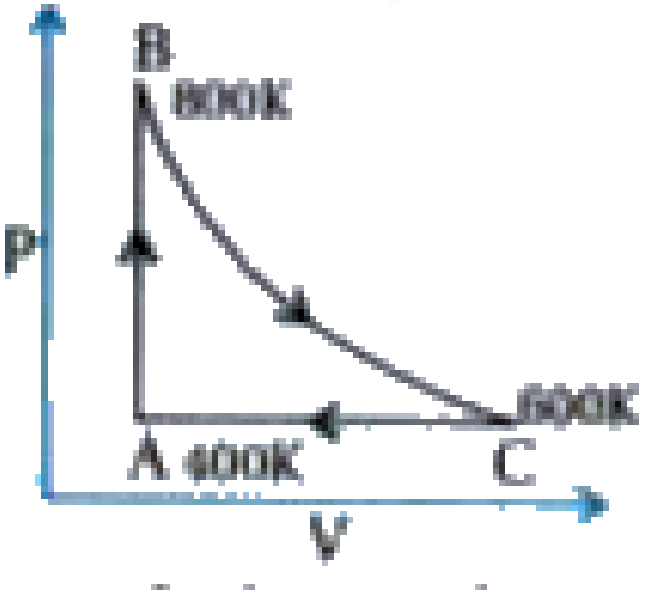
23. One mole of diatomic ideal gas undergoes a cyclic process ABC as shown in figure. The process BC is adiatomic. The temperature of A, B and C are 400 K, 800 K and 600 K

respectively. Choose the correct statement ____



A. The change in internal energy in the process AB is - 350 R.

B. The change in internal energy in the process BC is - 500 R.

C. The change in internal energy in whole cyclic process is 250 R.

D. The change in internal energy in the process CA is 700 R.

Answer: B

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24. Figure below shows two paths that may be taken by a gas to go from a state A to a state C. In 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. 380 J

B. 500 J

C. 460 J

D. 300 J

Answer: C

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25. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure, The change in internal energy of the gas during the transition is:

A. 20 kJ

B. -20 kJ

C. 20 J

D. -12 kJ

Answer: B

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26. The coefficient 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. $21^{\circ}C$

B. $31^{\circ}C$

C. $41^{\circ}C$

D. $11^{\circ}C$

Answer: B

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

A. Isothermal

B. Adiabatic

C. Isobaric

D. Isochoric

Answer: B

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28. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4} K^{-1}$. The fractional change in the density of glycerin for a rise of 40° C in its temperature is _____

A. 0.010

B. 0.015

C. 0.020

D. 0.025

Answer: C

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29. 4.0 g of a gas occupies 22.4 litres at NTP. The specific heat capacity of the gas at constant volume is $5.0 \mathrm{JK}^{-1} \mathrm{mol}^{-1}$. If the speed of sound in this gas at NTP is $952 \mathrm{ms}^{-1}$,

then the heat capacity at constant pressure is

_____ $\left(R = 8.3\text{JK}^1\text{mol}^{-1}\right)$

A. $8.5\text{JK}^{-1}\text{mol}^{-1}$

B. $8.0\text{JK}^{-1}\text{mol}^{-1}$

C. $7.5\text{JK}^{-1}\text{mol}^{-1}$

D. $7.0\text{JK}^{-1}\text{mol}^{-1}$

Answer: B

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30. A gas is compressed isothermally to half its initial volume. The same gas is compressed seperately through an adiabatic process until its volume is again reduced to half. Then _____

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

B. Compressing the gas through isothermally or adiabatically will require more work to be done.

C. Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

D. Compressing the gas isothermally will require more work to be done.

Answer: A

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31. A refrigerator works between $4^\circ C$ and $30^\circ C$. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is _____ (1 cal = 4.2 Joules)

A. 23.65 W

B. 236.5 W

C. 2365 W

D. 2.365 W

Answer: B

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32. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100° C, while the other one is at 0° C. If the two bodies are brought into contact, then assuming no heat loss the final common temperature is _____

A. less than $50^\circ C$ but greater than $0^\circ C$

B. $0^\circ C$

C. $50^\circ C$

D. more than $50^\circ C$

Answer: D

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33. One mole of an ideal monoatomic gas undergoes a process described by the equation PV^3 = constant. The heat capacity of the gas during this process is .....

A. 2R

B. R

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

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

Answer: B

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34. The temperature inside a refrigerator is $t_2^\circ C$ and the room temperature is $t_1^\circ C$. The amount of heat delivered to the room for each

joule of electrical energy consume ideally will be _____

A. $\frac{t_2 + 273}{t_1 - t_2}$

B. $\frac{t_1 + t_2}{t_2 + 273}$

C. $\frac{t_1}{t_1 - t_2}$

D. $\frac{t_1 + 273}{t_1 - t_2}$

Answer: D

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35. The volume of one mole of an ideal gas with adiabatic exponent γ is varied according to $V = \frac{b}{T}$, where b is a constant. Find the amount of Heat is absorbed by the gas in this process temperature raised by ΔT

A. $\left(\frac{1-\gamma}{\gamma+1}\right)R\Delta T$

B. $\frac{R}{\gamma-1}\Delta T$

C. $\left(\frac{2-\gamma}{\gamma-1}\right)R\Delta T$

D. $\frac{R\Delta T}{\gamma-1}$

Answer: C

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36. One mole of gas obey the equation of state P(V - b) = RT and changes its coordinate from (P_1, V_1) to (P_2, V_2) which is established on P-V diagram by line. The work done in this changes will be _____

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

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

C. $\frac{1}{2}(P_2 - P_1)(V_2 - V_1)$

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

Answer: B

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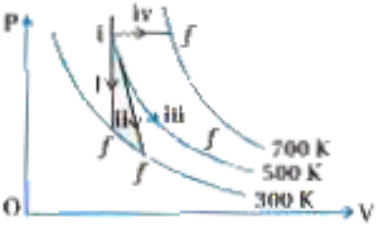
37. Thermodynamic process are indicated in the following diagram. Then match the

following process in a correct manner.



Column-I		Column-II	
(P)	Process-I	(a)	Adiabatic
(Q)	Process-II	(b)	Isobaric
(R)	Process-III	(c)	Isochoric
(S)	Process-IV	(d)	Isothermal

A. P-c,Q-a,R-d,S-b

B. P-c,Q-d,R-b,S-a

C. P-d,Q-b,R-a,S-c

D. P-a,Q-c,R-d,S-b

Answer: A

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38. A sample of 0.1 g of water at $100^\circ C$ and normal pressure $\left(1.013 \times 10^5 Nm^{-2}\right)$ 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. 84.5 J

B. 104.3 J

C. 42.2 J

D. 208.7 J

Answer: D

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39. Two wires are made of the same material and have the same volume. The first wire has cross sectional area A and the second wire has cross sectional area 3A. If the length of the first wire is increased by Δl on applying a

force F, how much force needed to stretch the second wire by the same amount ?

A. F

B. 9F

C. 4F

D. 6F

Answer: B

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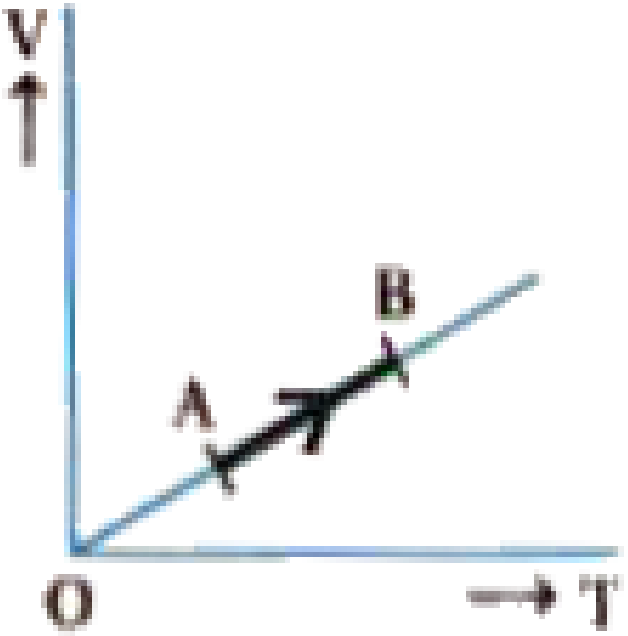
40. The volume (V) of a monoatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is ____



A. $\frac{2}{7}$

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

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

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

Answer: B

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

A. $12.5\ \%$

B. $26.8\ \%$

C. $6.25\ \%$

D. $20\ \%$

Answer: B

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42. Two moles of an ideal monoatomic gas occupies a volume V at $27^\circ C$. The gas expands adiabatically to a volume 2 V. Calculate (a) the

final temperature of the gas and (b) change on its internal energy.

A. (a)189 K (b)2.7 kJ

B. (a)195 K (b)-2.7 kJ

C. (a)189 K (b)-2.7 kJ

D. (a)195 K (b)2.7 kJ

Answer: C

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Section F Questions From Module

1. In a thermodynamics process which one of the following statement is not true ?

A. In an isochoric process pressure remains constant.

B. In an isothermal process temperature remains constant.

C. In an adiabatic process PV^r = constant.

D. In an adiabatic process the system is insulated from the surrounding.

Answer: A

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2. A carnot engine takes in 3×10^6 cal of heat from source at $627^\circ C$ and gives it to a sink at $27^\circ C$. The work done by the engine would be _____ (J=4.2 J/cal).

A. zero

B. 4.2×10^6 J

C. 8.4×10^6 J

D. 16.8×10^6 J

Answer: C

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3. If a gas is heated at constant pressure, then what percentage of total heat supplied is used up of external work ? $\left(r = \frac{4}{3}\right)$

A. $25\ \%$

B. $50\ \%$

C. 75 %

D. 80 %

Answer: A

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4. By which one of the following working temperature the efficiency of a carnot engine obtained maximum ?

A. 100 K , 80 K

B. 80 K , 60 K

C. 40 K , 20 K

D. 60 K , 40 K

Answer: C

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5. A carnot engine converts one sixth of the heat input into work. The sink temperature is reduced by $62^{\circ} C$, the efficiency of engine gets

doubled. Find the source and the sink temperature.

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

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

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

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

Answer: A

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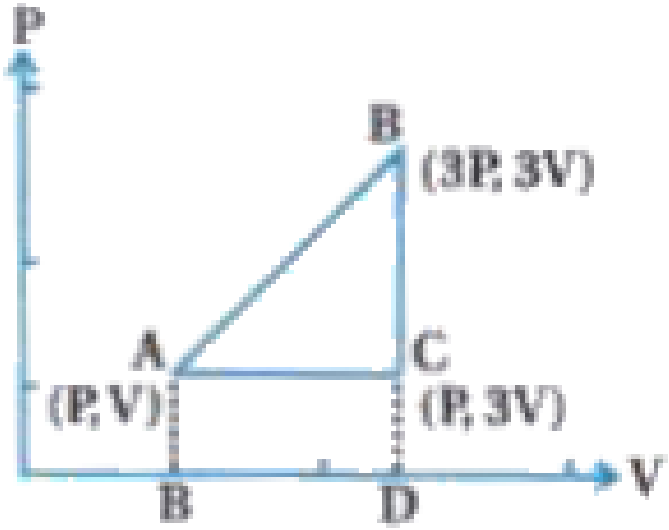
6. An ideal gas passes along path ABCA of P $\rightarrow$ V graph as shown here. The work done in one complete cycle will be .....



A. 2PV

B. PV

C. $\frac{1}{2}PV$

D. zero

Answer: A

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7. The efficiency of carnot engine working between temperatures $200^\circ C$ and $0^\circ C$ is η_1. The efficiency of this engine is η_2 when it work between temperatures $0^\circ C$and $-200^\circ C$. Then $\frac{\eta_1}{\eta_2}$=_____

A. 1.0

B. 0.721

C. 0.577

D. 0.34

Answer: C

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8. A gaseous mixture consists of 16 g of helium (He) and 16 g oxygen (O_2), the ratio $\frac{C_P}{C_V}$ of the mixture is = ...

A. 1.4

B. 1.54

C. 1.59

D. 1.62

Answer: D

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9. During an adiabatic process the pressure of gas is found to be proportional to the cube of

its absolute temperature. Then ratio $\frac{C_P}{C_V}$ = ...

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

B. 2

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

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

Answer: D

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10. A system is taken along different path in the graph of P $\rightarrow$ V from its initial state to final state. Which of following quantity does not depend on the path of the system ?

A. Exchange of heat Q

B. Work done W

C. Depend on Q but not on W

D. (Q - W)

Answer: D

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11. A refrigerator is to maintain eatables kept inside at 9° C. If room temperature is $36^\circ C$, calculate the coefficient of performance of refrigerator.

A. 10.4

B. 11.4

C. 12.4

D. 13.4

Answer: A

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12. A system absorbs 2 Kcals heat and does 500 J of work, then internal energy of the system will be .....

A. 6400 J

B. 5400 J

C. 7900 J

D. 8900 J

Answer: C

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13. If a monoatomic gas at $17^{\circ}C$ is suddenly compressed to $\frac{1}{8}$th of initial volume B, then the new temperature will be .....

A. 887 K

B. 36.25 K

C. 2320 K

D. 1160 K

Answer: D

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14. One mole of an ideal gas at 300 K expands from V to 2V volume, then work done W in this process will be ...

A. 300 Rln2

B. 600 Rln2

C. 300n2

D. 600ln2

Answer: A

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15. One mole of an ideal gas is heated at constant pressure. If an 100 Joule heat energy supplied to the gas, then work done by the gas will be ..... $(\gamma = 1.4)$

A. 28.57 J

B. 56.54 J

C. 38.92 J

D. 65.38 J

Answer: A

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16. The efficiency of a carnot engine $\eta = \frac{1}{10}$. This carnot engine used as refrigerator. If work done on system is 10 J, then heat absorbed from sink will be .....

A. 100 J

B. 99 J

C. 90 J

D. 1 J

Answer: C

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17. A gas at $27^{\circ}C$ temperature and 30 atmospheric pressure is allowed to expand to the atmospheric pressure. If the volume

becomes 10 times its initial volume, the final temperature becomes .....

A. $100^\circ C$

B. $173^\circ C$

C. $273^\circ C$

D. $-173^\circ C$

Answer: D

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18. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is .....

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

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

C. $\frac{3}{7}$

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

Answer: D

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19. The molar specific heat at constant pressure of an ideal gas is $\frac{7}{2}R$. The ratio of specific heat at constant pressure to that at constant volume is .....

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

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

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

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

Answer: D

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20. A carnot engine has efficiency 40 % and it absorbs heat from source at 500° K. How much should the temperature of source be increased so as to increase its efficiency by 60 % of original efficiency ?

A. 1200 K

B. 750 K

C. 600 K

D. Cannot increases 50% efficiency of carnot engine.

Answer: B

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Question Paper

1. Why is a steam burn more damaging than a burn with boiling water of the same ?

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2. What is coefficient of performance of a refrigerator ?

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3. With whom thermodynamics state be decided ?

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4. What is latent heat of vaporization ?

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5. On what the values of heat (Q) and work (W) depends in thermodynamics ? On what its difference (Q - W) depends ?

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6. Give the relationship between pressure and volume in an adiabatic process for an ideal gas.

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7. Discuss when can you say that the system is in thermal equilibrium and when can you say that system is in mechanical, chemical and thermodynamics equilibrium ?

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8. Obtain an expression of work for the compression of gas at constant temperature.

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

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10. A cylinder with a movable piston contains 3 moles of hydrogen at standard temperature and pressure. The walls of the cylinder are made of heat insulator and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas increase if the gas is compressed to half its original volume ?

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11. 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 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 latter case ? (Take 1 cal = 4.19)

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