Exercise - I (ONLY ONE OPTION IS CORRECT)

SECTION (A) : KINETIC THEORY OF GASES

1. When an ideal gas is compressed isothermally then its pressure increases because :
(A) its potential energy increases
(B) its kinetic energy increases and molecules move apart
(C) its number of colisions per unit area with walls of container increases
(D) molecular energy increases

2. Which of the following is correct for the molecules of a gas in thermal equilibrium ?
(A) All have the same speed
(B) All have different speeds which remain constant
(C) They have a certain constant average speed
(D) They do not collide with one another.

3. Which of the following quantities is zero on an average for the molecules of an ideal gas in equilibrium ?
(A) kinetic energy (B) momentum
(C) density (D) speed

4. The average momentum of a molecules in a sample of an ideal gas depends on
(A) temperature (B) number of moles
(C) volume (D) none of these

5. A gas behaves more closely as an ideal gas at
(A) low pressure and low temperatue
(B) low pressure and high temperature
(C) high pressure and low temperature
(D) high pressure and high temperature.

6. The temperature at which the r.m.s velocity of oxygen molecules equal that of nitrogen molecules at 100°C is nearly :
(A) 426.3 K (B) 456.3 K (C) 436.3 K (D) 446.3 K

7. Suppose a container is evacuated to leave just one molecule of a gas in it. Let v_a and ν_{rms} represent the average speed and the rms speed of the gas.
(A) $\nu_a > \nu_{rms}$ (B) $\nu_a < \nu_{rms}$
(C) $\nu_a = \nu_{rms}$ (D) ν_{rms} is undefined

8. The rms speed of oxygen molecules in a gas is ν. If the temperature is doubled and the O_2 molecule dissociated into oxygen atoms, the rms speed will become
(A) ν (B) $\nu\sqrt{2}$ (C) 2ν (D) 4ν

9. The quantity pV/kT represents
(A) mass of the gas
(B) kinetic energy of the gas
(C) number of moles of the gas
(D) number of molecules in the gas

10. Consider a mixture of oxygen and hydrogen kept at room temperature. As compared to a hydrogen molecule an oxygen molecule hits the wall
(A) With greater average speed
(B) with smaller average speed
(C) with greater average kinetic energy
(D) with smaller average kinetic energy.

11. Keeping the number of moles, volume and temperature the same, which of the following are the same for all ideal gas ?
(A) rms speed of a molecule
(B) density
(C) pressure
(D) average magnitude of moentum.

12. Consider the quantity MkT / pV of an ideal gas where M is the mass of the gas. It depends on the
(A) temperature of the gas (B) volume of the gas
(C) pressure of the gas (D) nature of the gas

13. If v_{rms} = root mean square speed of molecules,
v_{av} = average speed of molecules.
v_{mp} = most probable speed of molecules,
v = speed of sound in a gas
Then, identify the correct relation between these speeds.
(A) $v_{rms} > v_{av} > v_{mp} > v_s$ (B) $v_{av} > v_{mp} > v_{rms} > v_s$
(C) $v_{mp} > v_{av} > v_{rms} > v_s$ (D) $v_{rms} > v_{av} > v_s > v_{mp}$

14. Three closed vessels A, B and C are at the same temperature T and contain gases which obey the Maxwellian distribution of velcoities. Vessel A contains only O_2, B only N_2 and C a mixture of equal quantities of O_2 and N_2. If the average speed of O_2 molecules in vessel A is V_1, that of the N_2 molecules in vessel B is V_2, the average speed of the O_2 molecules in vessel C will be :
(A) $(V_1 + V_2) / 2$ (B) V_1
(C) $(V_1V_2)^{1/2}$ (D) $\sqrt{3kT/M}$

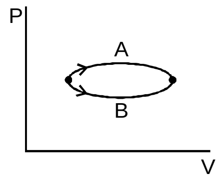
15. A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300 K. The ratio of the average rotational kinetic energy per O_2 molecule to that per N_2 molecule is :
(A) 1 : 1 (B) 1 : 2 (C) 2 : 1
(D) depends on the moments of inertia of the two molecules

16. Three particles have speeds of 2u, 10u and 11u. Which of the following statements is correct ?
(A) The r.m.s speed exceeds the mean speed by about u.
(B) The mean speed exceeds the r.m.s speed by about u.
(C) The r.m.s speed equals the mean speed.
(D) The r.m.s. speed exceeds the mean speed by more than 2u.

17. The pressure of an ideal gas is written as $P = \frac{2E}{3V}$. Here E refers to
(A) translational kinetic energy
(B) rotational kinetic energy
(C) vibrational kinetic energy
(D) total kinetic energy.

18. Which of the following quantities is the same for all ideal gases at the same temperature ?
(A) the kinetic energy of 1 mole
(B) the kinetic energy of 1 g
(C) the number of molecules in 1 mole
(D) the number of molecules in 1 g

19. Refer to fig. Let ΔU_1 and ΔU_2 be the changes in internal energy of the system in the processes A and B then



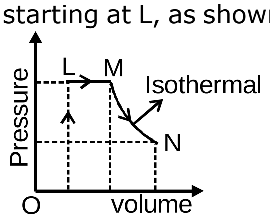
(A) $\Delta U_1 > \Delta U_2$ (B) $\Delta U_1 = \Delta U_2$
(C) $\Delta U_1 < \Delta U_2$ (D) $\Delta U_1 \neq \Delta U_2$

20. N(< 100) molecules of a gas have velocities 1,2,3..... N/km/s respectively. Then
(A) rms speed and average speed of molecules is same.
(B) ratio of rms speed to average speed is $\sqrt{(2N + 1)(N + 1) / 6N}$
(C) ratio of rms speed to average speed is $\sqrt{(2N + 1)(N + 1) / 6 N}$
(D) ratio of rms speed to average speed of a molecules is $2/\sqrt{6} \times \sqrt{(2N + 1)/(N + 1)}$

21. Five particles have speeds 1,2,3,4,5 m/s. the average velocity of the particles is (in m/s)
(A) 3 (B) 0 (C) 2.5
(D) cannot be calculated

SECTION (B) : THERMODYNAMICS

22. A fixed mass of ideal gas undergoes changes of pressure and volume starting at L, as shown in figure.



Which of the following is correct :

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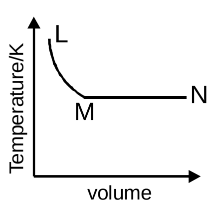

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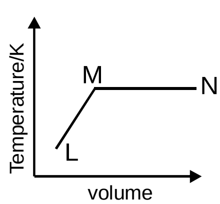

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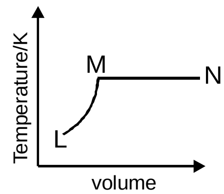
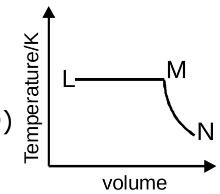
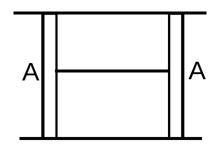


(D)


23. Find the approx. number of molecules contained in a vessel of volume 7 litres at 0°C at 1.3×10^5 pascal
(A) 2.4×10^{23} (B) 3×10^{23}
(C) 6×10^{23} (D) 4.8×10^{23}

24. A cylindrical tube of cross-sectional area A has two air tight frictionless pistons at its two ends. The pistons are tied with a straight two ends. The pistons are tied with a straight piece of metallic wire.



The tube contains a gas at atmospheric pressure P_0 and temperature T_0. If temperature of the gas is doubled then the tension inthe wire is -
(A) $4 P_0A$ (B) $P_0A/2$ (C) P_0A (D) $2P_0A$

25. An ideal gas mixture filled inside a balloon expands according to the relation $PV^{2/3}$ = constant. The temperature inside the balloon is
(A) increasing (B) decreasing
(C) constant (D) can't be said

26. A rigid tank contains 35 kg of nitrogen at 6 atm. Sufficient quantity of oxygen is supplied to increase the pressure to 9 atm, while the temperatute remains constant. Amount of oxygen supplid to the tank is :
(A) 5 kg (B) 10 kg (C) 20 kg (D) 40 kg

27. A perfect gas of a given mass is heated first in a small vessel and then in a large vesssel, such that their volumes remain unchanged. The P-T curves are
(A) parabolic with same curvature
(B) parabolic with different curvature
(C) linear with same slopes
(D) linear with different slopes

28. At a temperature T K, the pressure of 4.0 g argon in a bulb is p. The bulb is put in a bath having temperature higher by 50 K than the first one. 0.8 g of argon gas had to be removed to maintained original pressure. The temperature T is equal to
(A) 510 K (B) 200 K (C) 100 K (D) 73 K

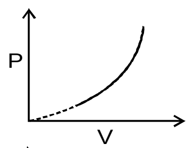
29. When 2 gms of a gas are introduced into an evacuated flask kept at 25°C the pressure is found to be one atmosphere. If 3 gms of another gas added to the same flask the pressure becomes 1.5 atmospheres. The ratio of the molecular weights of these gases will be

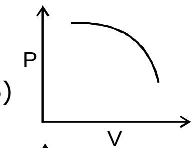
(A) 1 : 3 (B) 3 : 1 (C) 2 : 3 (D) 3 : 2

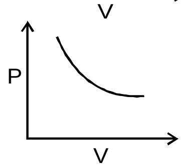
30. An open and wide glass tube is immersed vertically in mercury in such a way that length 0.05 m extends above mercury level. The open end of the tube is closed and the tube is raised further by 0.43 m. The length of air column above mercury level in the tube will be : Take P_{atm} = 76 cm of mercury
(A) 0.215 m (B) 0.2 m (C) 0.1 m (D) 0.4 m

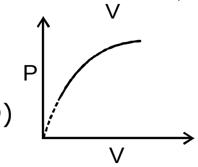
31. A vessel of volume 0.02 m^3 contains a mixture of hydrogen and helium at 20°C and 2 atmospheric pressure. The mass of mixture is 5 gms. Find the ratio of mass of hydrogen to that of helium in the mixture.
(A) 1 : 2 (B) 1 : 3 (C) 2 : 3 (D) 3 : 2

32. An ideal gas follows a process PT = constant. The correct graph between pressure & volume is

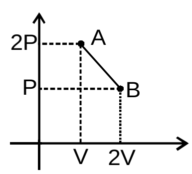
(A) 

(B) 

(C) 

(D) 

33. The process AB is shown in the diagram. As the gas is taken from A to B, its temperature

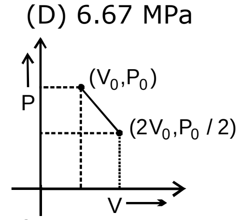


(A) initially increases then decreases
(B) initially decreases then increases
(C) remains constant
(D) variation depends on type of gas

34. During an experiment an ideal gas obeys an addition equation of state P^2V = constant. The initial temperature and pressure of gas are T and V respectively. When it expands to volume 2V, then its temperature will be :
(A) T (B) $\sqrt{2}T$ (C) 2 T (D) $2\sqrt{2}T$

35. A barometer tube, containing mercury, is lowered in a vessel containing mercury until only 50 cm of the tube is above the level of mercury in the vessel. If the atmospheric pressure is 75 cm of mercury, what is the pressure at the top of the tube ?
(A) 33.3 kPa (B) 66.7 kPa
(C) 3.33 MPa (D) 6.67 MPa

36. One mole of a gas expands obeying the relation as shown in the P/V diagram. The maximum temperature in this process is equal to



(A) $\frac{P_0V_0}{R}$ (B) $\frac{3P_0V_0}{R}$ (C) $\frac{9P_0V_0}{8R}$ (D) None

37. A vessel with open mouth contains air at 60°C. When the vessel is heated upto temperature T, one fourth of the air goes out. The value of T is
(A) 80°C (B) 171°C (C) 333°C (D) 444°C

38. 28 gm of N_2 gas is contained in a flask at a pressure of 10 atm and at a temperature of 57°. It is found that due to leakage in the flask, the pressure is reduced to half and the temperature reduced to 27°C. The quantity of N_2 gas the leaked out is
(A) 11/20 gm (B) 20/11 gm (C) 5/63 gm (D) 63/5 gm

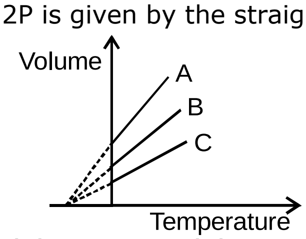
39. If a mixture of 28 g of Nitrogen, 4 g of Hydrogen and 8 gm of Helium is contained in a vessel at temperature 400 K and pressure 8.3 × 10^5 Pa, the density of the mixture will be :
(A) 3 kg/m^3 (B) 0.2 kg/m^3
(C) 2 g/litre (D) 1.5 g/litre

40. The temperature of a gas is doubled (i) on absolute scale (ii) on centigrade scale. The increase in root mean square velocity of gas will be
(A) More in case (i) (B) More in case (ii)
(C) Same in both case
(D) Information not sufficient

41. A cylinder containing gas at 27°C is divided into two parts of equal volume each 100cc and at equal pressure by a piston of cross sectional area 10.85 cm^2. The gas in one part is raised in temperature to 100°C while the other maintained at original temperature. The piston and wall are perfect insulators. How far will the piston move during the change in temperature?
(A) 1 cm (B) 2 cm (C) 0.5 cm (D)1.5 cm

42. 12 gms of gas occupy a volume of 4 × 10^{-3} m^3 at a temperature of 7°C. After the gas is heated at constant pressure its density becomes 6 × 10^{-4} gm/cc. What is the temperature to which the gas was heated.
(A) 1000 K (B) 1400 K (C) 1200 K (D) 800 K

43. The expansion of an ideal gas of mass m at a constant pressure P is given by the straight line B. Then the expansion of the same ideal gas of mass 2 m at a pressure 2P is given by the straight line



(A) C (B) A (C) B (D) none

44. A vessel contains 1 mole of O_2 gas (molar mass 32) at a temperature T. The pressure of the gas is P. An identical vessel containing one mole of He gas (molar mass 4) at a temperature 2T has a pressure of

(A) P/8 (B) P (C) 2P (D) 8P

45. A container X has volume double that of contianer Y and both are connected by a thin tube. Both contains same ideal gas. The temperature of X is 200 K and that of Y is 400 K. If mass of gas in X is m then in Y it will be :

(A) m/8 (B) m/6 (C) m/4 (D) m/2

46. An ideal gas of Molar mass M is contained in a vertical tube of height H, closed at both ends. The tube is accelerating vertically upwards with acceleration g. Then, the ratio of pressure at the bottom and the mid point of the tube will be

(A) exp [2MgH/RT] (B) exp[–2MgH/RT]

(C) exp[MgH/RT] (D) MgH/RT

47. The ratio of average translational kinetic energy to rotational kinetic energy of a diatomic molecule at temperature T is

(A) 3 (B) 7/5 (C) 5/3 (D) 3/2

48. One mole of an ideal gas at STP is heated in an insulated closed container until the average speed of its molecules is doubled. Its pressure would therefore increase by factor.

(A) 1.5 (B) $\sqrt{2}$ (C) 2 (D) 4

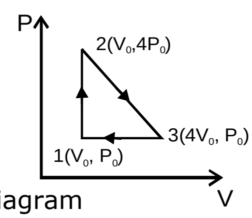
49. The ratio of specific heat of a gas is 9/7, then the number of degrees of freedom of the gas molecules for translational motion is :

(A) 7 (B) 3 (C) 6 (D) none

50. A diatomic gas of moleculer weight 30 gm/mole is filled in a container at 27°C. It is moving at a velocity 100 m/s. If it is suddenly stopped, the rise in temperature of gas is :

(A) 60/R (B) $\frac{600}{R}$ (C) $\frac{6\times10^4}{R}$ (D) $\frac{6\times10^5}{R}$

51. One mole of an ideal diatomic gas is taken through the cycle as shown in the figure.



$1 \rightarrow 2$: isochoric process

$2 \rightarrow 3$: straight line on P - V diagram

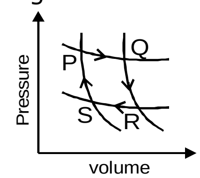
$3 \rightarrow 1$: isobaric process

The average of molecular speed of the gas in the states 1, 2 and 3 are in the ratio

(A) 1 : 2 : 2 (B) 1 : $\sqrt{2}$: $\sqrt{2}$

(C) 1 : 1 : 1 (D) 1 : 2 : 4

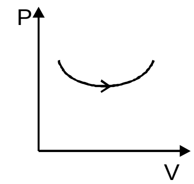
52. A fixed mass of gas undergoes the cycle of changes represented by PQRSP as shown in figure. In some of the changes, work is done on the gas and in others, work is done by the gas. In which pair of the changes work is done on the gas ?



(A) PQ and RS (B) PQ and QR

(C) OR and RS (D) RS and SP

53. Consider the process on a system shown in fig. During the process, the cumulative work done by the system



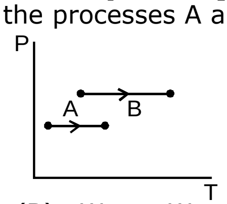
(A) continuously increase

(B) continuously decreases

(C) first increases then decreases

(D) first decreases then increases

54. Consider two processes on a system as shown in fig. The volume in the initial states are the same in the two processes and the volumes in the final states are also the same. Let ΔW_1 and ΔW_2 be the work done by the system in the processes A and B respectively.



(A) $\Delta W_1 > \Delta W_2$ (B) $\Delta W_1 = \Delta W_2$ (C) $\Delta W_1 < \Delta W_2$

(D) Nothing can be said about the relation between ΔW_1 and ΔW_2

55. A mass of an ideal gas undergoes a reversible isothermal compression. Its molecules will then have compared with initial state, the same

(i) root mean square velocity

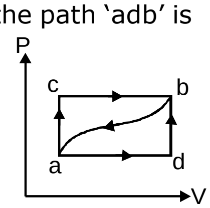
(ii) mean momentum

(iii) mean kinetic energy

(A) (i), (ii), (iii) correct (B) (i), (ii) correct

(C) (ii), (iii) correct (D) (i) correct

56. When a system is taken from state 'a' to state 'b' along the path 'acb', it is found that a quantity of heat Q = 200 J is absorbed by the system and a work W = 80 J is done by it. Along the path 'adb', Q = 144J. The work done along the path 'adb' is



(A) 6J (B) 12J (C) 18 J (D) 24 J

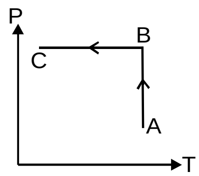
57. In the above question, if the work done on the system along the curved path 'ba' is 52J, heat absorbed is

(A) – 140 J (B) – 172 J (C) 140 J (D) 172 J

58. In above question, if U_a = 40 J, value of U_b will be
(A) –50 J (B) 100 J (C) –120 J (D) 160 J

59. In above question, if U_d = 88 J, heat absorbed for the path 'db' is
(A) –72 J (B) 72 J (C) 144 J (D) –144 J

60. Ideal gas is taken through process shown in figure :



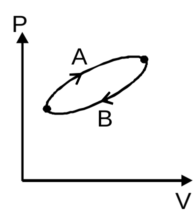
(A) In process AB, work done by system is positive.
(B) In process AB, heat is rejected out of the system.
(C) In process AB, internal energy increases
(D) In process AB internal energy decreases and in process BC internal energy increases.

61. If heat is supplied to an ideal gas in an isothermal process, -
(A) the internal energy of the gas will increase
(B) the gas will do positive work
(C) the gas will do negative work
(D) the said process is not possible

62. A gas is contained in a metallic cylinder fitted with a piston. The piston is suddenly moved in to compress the gas and is maintaioned at this position. As time passes the pressure of the gas in the cylinder
(A) increases (B) decreases
(C) remains constant
(D) increases or decreases depending on the nature of the gas.

63. A system can be taken from the initial state p_1, V_1 to the final state p_2, V_2 by two different methods. Let ΔQ and ΔW represent the heat given to the system and the work done by the system. Which of the following must be the same in both the methods ?
(A) ΔQ (B) ΔW (C) $\Delta Q + \Delta W$ (D) $\Delta Q - \Delta W$

64. Refer to fig. Let ΔU_1 and ΔU_2 be change in internal energy in process A and B respectively, ΔQ be the net heat given to the system in process A + B and ΔU be the net work done by the system in the process A + B.



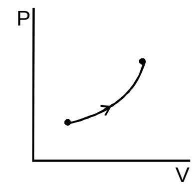
(A) $\Delta U_1 + \Delta U_2 = 0$ (B) $\Delta U_1 - \Delta U_2 = 0$
(C) $\Delta Q - \Delta W = 0$ (D) $\Delta Q + \Delta W = 0$

SECTION (C) : SPECIFIC HEAT CAPACITIES OF GASES

65. Supposing the distance between the atoms of a dimtomic gas to be constant, its specific heat at constant volume per mole (gram mole) is
(A) 5/2 R (B) 3/2 R (C) R (D) 1/2 R

66. For an ideal gas, the heat capacity at constant pressure is larger than that at constant volume because
(A) work is done during expansion of the gas by the external pressure
(B) work is done during expansion by the gas against external pressure
(C) work is done during expansion by the gas against intermolecular forces of attraction.
(D) more collisions occur per unit time when volume is kept constant.

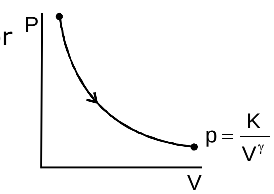
67. Fig shows a process on a gas in which pressure and volume both change. The molar heat capacity for this process is C.



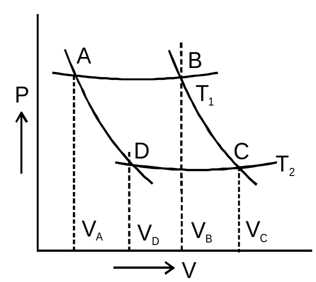
(A) C = 0 (B) $C = C_v$ (C) $C > C_v$ (D) $C < C_v$

68. For a solid with a small expansion coefficient,
(A) $C_p - C_v = R$ (B) $C_p - C_v = R$
(C) C_p is slightly greater than C_v
(D) C_p is slightly less than C_v

69. The molar heat capacity for the process shown in fig. is
(A) $C = C_p$
(B) $C = C_v$
(C) $C > C_v$
(D) C = 0

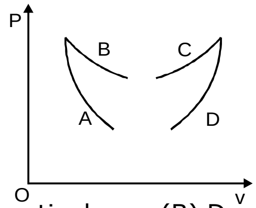


70. In the following P – V diagram of an ideal gas, two adiabates cut two isotherms at T_1 and T_2. The value of V_B/V_C is



AB → T_1, DC → T_2
(A) $= V_A / V_D$ (B) $< V_A / V_D$
(C) $> V_A / V_D$ (D) cannot say

71. Four curves A, B, C and D are drawn in the fig. for a given amount of gas. The curves which represent adiabatic and isothermal changes are



(A) C and D respectively (B) D and C respectively
(C) A and B respectively (D) B and A respectively

72. When an ideal gas undergoes an adiabatic change causing a temperature change ΔT
(i) there is no heat gained or lost by the gas
(ii) the work done is equal to change in internal energy
(iii) the change in internal energy per mole of the gase is $C_v \Delta T$, where C_v is the molar heat capacity at constant volume.
(A) (i), (ii), (iii) correct (B) (i), (ii) correct
(C) (i), (iii) correct (D) (i) correct

73. Starting with the same initial conditins, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is isothemal, W_2 if isobaric and W_3 if adiabatic, then :
(A) $W_2 > W_1 > W_3$ (B) $W_2 > W_3 > W_1$
(C) $W_1 > W_2 > W_3$ (D) $W_1 > W_3 > W_2$

74. The internal energy of an ideal gas decreases by the same amount as the work done by the system
(A) The process must be adiabatic
(B) The process must be isothermal
(C) The process must be isobaric
(D) The temperatuer must decrease

Question No. 75 to 78 (4 questions)
Five moles of helium are mixed with two moles of hydrogen to form a mixture. Take molar mass of helium M_1 = 4g and that of hydrogen M_2 = 2g

75. The equivalent molar mass of the mixture is
(A) 6 g (B) $\frac{13g}{7}$ (C) $\frac{18g}{7}$ (D) none

76. The equivalent degree of freedom f of the mixture is
(A) 3.57 (B) 1.14 (C) 4.4 (D) none

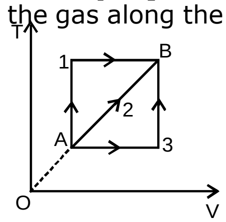
77. The equivalent value of γ is
(A) 1.59 (B) 1.53 (C) 1.56 (D) none

78. If the internal energy of He sample of 100J and that of the hydrogen sample is 200 J, then the internal energy of the mixture is
(A) 900 J (B) 128.5 J (C) 171.4 J (D) 300 J

79. Two monoatomic ideal gas at temperature T_1 and T_2 are mixed. There is no loss of energy. If the masses of molecules of the two gases are m_1 and m_2 and number of their molecules are n_1 and n_2 respectively. The temperature of the mixture will be :
(A) $\frac{T_1 + T_2}{n_1 + n_2}$ (B) $\frac{T_1}{n_1} + \frac{T_2}{n_2}$
(C) $\frac{n_2T_1 + n_1T_2}{n_1 + n_2}$ (D) $\frac{n_1T_1 + n_2T_2}{n_1 + n_2}$

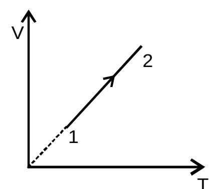
80. At temperature T, N molecules of gas A each having mass m and at the same temperature 2N molecules of gas B each having mass 2m are filled in a container. The mean square velocity of molecules of gas B is v^2 and mean square of x component of velocity of molecules of gas A is w^2. The ratio of w^2/v^2 is :
(A) 1 (B) 2 (C) 1/3 (D) 2/3

81. A given mass of a gas expands from a state A to the state B by three paths 1,2 and 3 as shown in T - V indicator diagram. If W_1, W_2 and W_3 respectively be the work done by the gas along the three paths, then



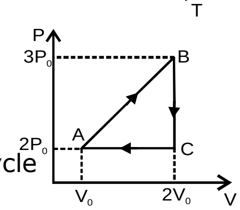
(A) $W_1 > W_2 > W_3$ (B) $W_1 < W_2 < W_3$
(C) $W_1 = W_2 = W_3$ (D) $W_1 < W_2$, $W_1 > W_3$

82. An ideal gas undergoes the process 1 → 2 as shown in the figure, the heat supplied and work done in the process is ΔQ and ΔW respectively. The ratio $\Delta Q : \Delta W$ is



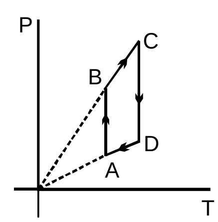
(A) $\gamma : \gamma - 1$ (B) γ
(C) $\gamma - 1$ (D) $\gamma - 1/\gamma$

83. In the above thermodynamic process, the correct statement is



(A) Heat given in the complete cycle ABCA is zero
(B) Work done in the complete cycle ABCA is zero
(C) Work done in the complete cycle ABCA is $(1/2\ P_0V_0)$ (D) None

4. Pressure versus temperature graph of an ideal gas is shown in figure.



(A) During the process AB work done by the gas is - positive

(B) during the process CD work done by the gas is negative

(C) during the process BC internal energy of the gas is increasing

(D) None

85. A reversible adiabatic path on a P-V diagram for an ideal gas passes through state A where $P = 0.7 \times 10^5$ N/m^{-2} and $v = 0.0049$ m^3. The ratio of specific heat of the gas is 1.4. The slope of path at A is :

(A) 2.0×10^7 Nm^{-5} (B) 1.0×10^7 Nm^{-5}
(C) -2.0×10^7 Nm^{-5} (D) -1.0×10^7 Nm^{-5}

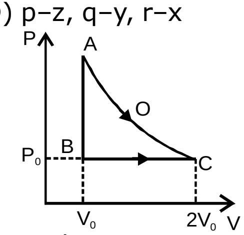
86. An ideal gas at pressure P and volume V is expanded to volume 2V. Column I represents the thermodynamic processes used during expansion. Column II represents the work during these processes in the random order.

Column I	Column II
(p) isobaric	(x) $\frac{PV(1-2^{1-\gamma})}{\gamma-1}$
(q) isothermal	(y) PV
(r) adiabatic	(z) PV *l*n 2

The correct matching of column I and column II is given by :

(A) p – y, q – z, r – x (B) p – y, q – x, r – z
(C) p–x, q–y, r–z (D) p–z, q–y, r–x

87. An ideal gas is taken from point A to point C on P–V diagram through two process AOC and ABC as shown in the figure. Process AOC is isothermal

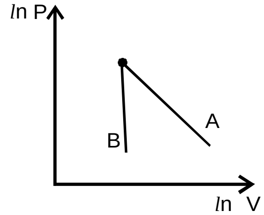


(A) Process AOC requires more heat than process ABC.
(B) Process ABC requires more heat than process AOC.
(C) Both process AOC & ABC require same amount of heat.
(D) Data is insufficient for comparison of heat requirement for the two processes.

88. One mole of an ideal gas is contained piston with in a cyclinder by a frictionless piston and is initially at temperature T. The pressure of the gas is kept constant while it is heated and its volume doubles. If R is molar gas constant, the work done by the gas in increasing its volume is

(A) RT *l*n2 (B) 1/2 RT (C) RT (D) 3/2 RT

89. The figure, shows the graph of logarithmic reading of pressure and volume for two ideal gases A and B undergoing adiabatic process. From figure it can be concluded that



(A) gas B is diatomic
(B) gas A and B both are diatomic
(C) gas A is monoatomic
(D) gas B is monoatomic & gas A is diatomic

90. A thermodynamic cycle takes in heat energy at a high temperature and rejects energy at a lower temperature. If the amount of energy rejected at the low temperature is 3 times the amount of work done by the cycle, the efficiency of the cycle is

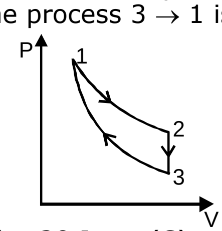
(A) 0.25 (B) 0.33 (C) 0.67 (D) 0.9

91. Monoatomic, diatomic and triatomic gases whose initial volume and pressure are same, are compressed till their volume becomes half the initial volume.
(A) If the compression is adiabatic then monoatomic gas will have maximum final pressure.
(B) If the compression is adiabatic then triatomic gas will have maximum final pressure.
(C) If the compression is adiabatic then their final pressure will be same.
(D) If the compression is isothermal then their final pressure will be different.

92. If heat is added at constant volume, 6300 J of heat are required to raise the temperature of an ideal gas by 150 K. If instead, heat is added at constant pressure, 8800 joules are required for the same temperature change. When the temperature of the gas changes by 300K, the internal energy of the gas changes by

(A) 5000 J (B) 12600 J (C) 17600 J (D) 22600 J

93. Three processes from a thermodynamic cycle as shown on P-V diagram for an ideal gas. Process $1 \rightarrow 2$ takes place at constant temperature (300 K). Process $2 \rightarrow 3$ takes place at constant volume. During this process 40J of heat leaves the system. Process $3 \rightarrow 1$ is adiabatic and temperature T_3 is 275K. Work done by the gas during the process $3 \rightarrow 1$ is



(A) – 40 J (B) – 20 J (C) + 40 J (D) +20 J

94. When unit mass of water boils to become steam at 100°C, it absorbs Q amount of heat. The densities of water and steam at 100°C are ρ_1 and ρ_2 respectively and the atmospheric pressure is p_0. The increase in internal energy of the water is

(A) Q (B) $Q + p_0\left(\frac{1}{\rho_1} - \frac{1}{\rho_2}\right)$

(C) $Q + p_0\left(\frac{1}{\rho_2} - \frac{1}{\rho_1}\right)$ (D) $Q - p_0\left(\frac{1}{\rho_1} + \frac{1}{\rho_2}\right)$

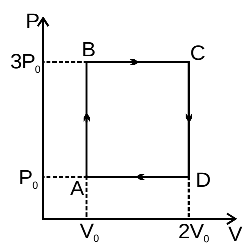
95. A polyatomic gas with six degrees of freedom does 25 J of work when it is expanded at constant pressure. The heat given to the gas is
(A) 100 J (B) 150 J (C) 200 J (D) 250 J

96. An ideal gas expands from volume V_1 to V_2. This may be achieved by either of the three processes : isobaric, isothermal and adiabatic, Let ΔU be the change in internal energy of the gas, Q be the quantity of heat added to the system and W be the work done by the system on the gas. Identify which of the following statements is false for ΔU?
(A) ΔU is least under adiabatic process
(B) ΔU is greatest under adiabatic process.
(C) ΔU is greatest under the isobaric process
(D) ΔU in isothermal process lies in-between the values obtained under isobaric and adiabatic processes.

97. In an isobaric expansion of an ideal gas, which of the following is zero ?
(A) work done (B) ΔQ (C) ΔU (D) d^2V/dT^2

98. A perfect gas is found to obey the relation $PV^{3/2}$ = constant, during an adiabatic process. If such a gas, initially at a temperature T, is compressed adiabatically to half' its initial volume, then its final temperature will be
(A) 2T (B) 4T (C) $\sqrt{2}T$ (D) $2\sqrt{2}T$

99. A ideal monoatomic gas is carried around the cycle ABCDA as shown in the fig. The efficiency of the gas cycle is

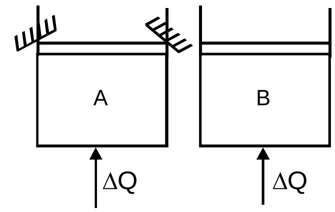


(A) $\frac{4}{21}$ (B) $\frac{2}{21}$
(C) $\frac{4}{31}$ (D) $\frac{2}{31}$

100. In thermodynamic process pressure of a fixed mass of gas is changed in such a manner that the gas releases 30 joule of heat and 18 joule of work was done on the gas. If the initial internal energy of the gas was 60 joule, then, the final internal energy will be :
(A) 32 joule (B) 48 joule (C) 72 joule (D) 96 joule

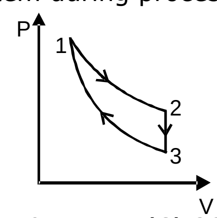
101. A cyclinder made of perfectly non conducting material closed at both ends is divided into two equal parts by a heat proof piston. Both parts of the cylinder contain the same masses of a gas at a temperature t_0 = 27° and pressure P_0 = 1 atm. Now if the gas in one of the parts is slowly heated to t = 57°C while the temperature of first part is maintained at t_0 the distance moved by the piston from the middle of the cylinder will be (length of the cyclinder = 84 cm)
(A) 3 cm (B) 5 cm (C) 2 cm (D) 1 cm

102. Two identical vessels A & B contain equal amount of ideal monoatomic gas. The piston of A is fixed but that of B is free. Same amount of heat is absorbed by A & B. If B's internal energy increases by 100 J the change in internal energy of A is



(A) 100 J (B) $\frac{500}{3}$J (C) 250 J (D) none

103. Three processes compose a thermodynamics cycle shown in the PV diagram. Process 1 → 2 takes place at constant temperature. Process 2 → 3 takes place at constant volume, and process 3 → 1 is adiabatic. During the complete cycle, the total amount of work done is 10 J. During process 2 → 3, the internal energy decrease by 20J and during process 3 → 1, 20 J of work is done on the system. How much heat is added to the system during process 1 → 2 ?

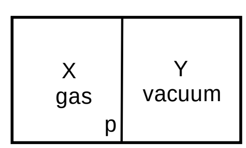


(A) 0 (B) 10 J (C) 20 J (D) 30 J

104. An ideal gas undergoes an adiabatic process obeying the relation $PV^{4/3}$ = constant. If its initial temperature is 300 K and then its pressure is increased upto four times its initial value, then the final temperature (in Kelvin) :
(A) $300\sqrt{2}$ (B) $300\sqrt[3]{2}$ (C) 600 (D) 1200

105. The adiabatic Bulk modulus of a diatomic gas at atmospheric pressure is
(A) 0 Nm^{-2} (B) 1 Nm^{-2}
(C) 1.4×10^4 Nm^{-2} (D) 1.4×10^5 Nm^{-2}

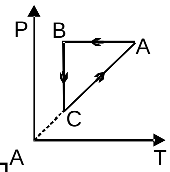
106. A closed container is fully insulated from outside. One half of it is filled with an ideal gas X separated by a plate P from the other half Y which contains a vacuum as shown in figure. When P is removed, X moves into Y. Which of the following statements is correct ?

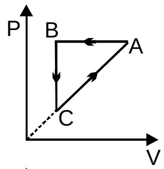


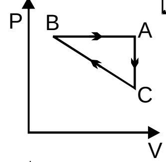
(A) No work is done by X
(B) X decreases in temperature

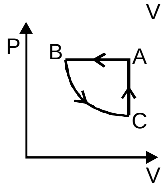
(C) X increases in internal energy
(D) X doubles in pressure.

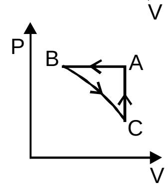
107. A cyclic process ABCA is shown in PT diagram. When presented on PV, it would



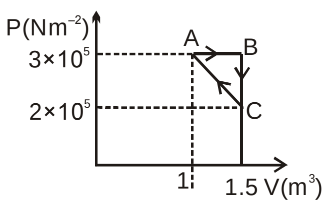
(A) 

(B) 

(C) 

(D) 

108. Considere the thermodynamics cycle shown on PV diagram. The process A $\rightarrow$ B is isobaric, B $\rightarrow$ C is isochoric and C $\rightarrow$ A is a straight line process. The following internal energy and heat are given :



$\Delta U_{A \rightarrow B}$ = + 400 kJ and $Q_{B \rightarrow C}$ = – 500 kJ
The heat flow in the process $Q_{C \rightarrow A}$ is :
(A) – 20 kJ (B) + 25 kJ
(C) – 25 kJ (D) Data are insufficient

109. 1 kg of a gas does 20 kJ of work and receives 16 kJ of heat when it is expanded between two states. A second kind of expansion can be found between the initial and final state which requires a heat input of 9 kJ. The work done by the gas in the second expansion is :
(A) 32 kJ (B) 5 kJ (C) – 4 kJ (D) 13 kJ

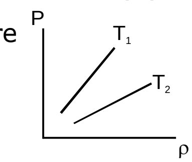
110. A vessel contains an ideal monoatomic gas which expands at constant pressure, when heat Q is given to it. Then the work done in expansion is :
(A) Q (B) $\frac{3}{5}Q$ (C) $\frac{2}{5}Q$ (D) $\frac{2}{3}Q$

111. One mole of an ideal monoatomic gas at temperature T_0 expands slowly according to the law P/V = constant. If the final temperature is $2T_0$, heat supplied to the gas is :
(A) $2RT_0$ (B) $\frac{3}{2}RT_0$ (C) RT_0 (D) $\frac{1}{2}RT_0$

112. One mole of an ideal gas at temperature T_1 expends according to the law $\frac{P}{V^2} = a$ (constant). The work done by the gas till temperature of gas becomes T_2 is :
(A) $\frac{1}{2}R(T_2 - T_1)$ (B) $\frac{1}{3}R(T_2 - T_1)$
(C) $\frac{1}{4}R(T_2 - T_1)$ (D) $\frac{1}{5}R(T_2 - T_1)$

113. 2 moles of a diatomic gas undergoes the process : PT^2 / V = constant. Then, the molar heat capacity of the gas during the process will be equal to
(A) 5R/2 (B) 9R/2 (C) 3R (D) 4R

114. Fig. shows graphs of pressure vs. density for an ideal gas at two temperature T_1 and T_2.



(A) $T_1 > T_2$ (B) $T_1 = T_2$
(C) $T_1 < T_2$ (D) any of the three is possible