Exercise - I (Conceptual Questions) Build Up Your Understanding

TEMPERATURE & THERMAL EXPANSION

1. At what temperature does the temperature in Celsius and Fahrenheit equalise

(1) –40° (2) 40° (3) 36.6° (4) 38°

PTM001

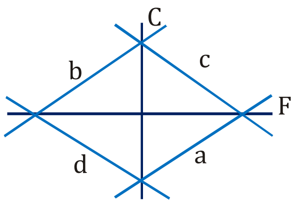
2. A difference of temperature of 25° C is equivalent to a difference of :

(1) 45° F (2) 72° F

(3) 32° F (4) 25° F

PTM002

3. Which of the curves in figure represents the relation between Celsius and Fahrenheit temperature?

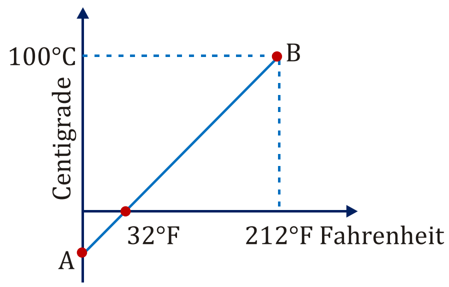


(1) Curve a (2) Curve b

(3) Curve c (4) Curve d

PTM003

4. The graph AB shown in figure is a plot of temperature of a body in degree Celsius and degree Fahrenheit. Then



(1) slope of line AB is 9/5

(2) slope of line AB is 5/9

(3) slope of line AB is 1/9

(4) slope of line AB is 3/9

PTM004

5. Oxygen boils at –183°C. This temperature is approximately in Fahrenheit is :-

(1) –329°F (2) –261°F

(3) –215°F (4) –297°F

PTM005

6. Using which of the following instrument, the temperature of the sun can be determined?

(1) Platinum thermometer

(2) Gas thermometer

(3) Pyrometer

(4) Vapour pressure thermometer

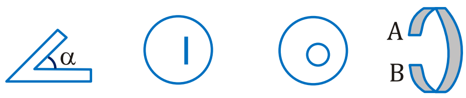
PTM006

7. Two thermometers X and Y have ice points marked at 15° and 25° and steam points marked as 75° and 125° respectively. When thermometer X measures the temperature of a bath as 60° on it, what would thermometer Y read when it is used to measure the temperature of the same bath?

(1) 60° (2) 75° (3) 100° (4) 90°

PTM007

8. The figure below shows four isotropic solids having positive coefficient of thermal expansion. A student predicts that on heating the solid following things can happen. Mark true (T) or False (F) for comments made by the student.



(i) The angle α in figure (1) will not change.

(ii) The length of line in figure (2) will decrease.

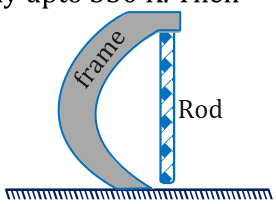
(iii) The radius of inner hole will decrease.

(iv) The distance AB will increase.

(1) T F F T (2) F T T F (3) T T T T (4) F F T F

PTM008

9. At STP a rod is hung from a frame as shown in figure, leaving a small gap between the rod and floor. The frame and rod system is heated uniformly upto 350 K. Then



(1) The rod will never touch the floor in any case.

(2) If $\alpha_{rod} > \alpha_{frame}$, then rod may touch the floor.

(3) If $\alpha_{rod} < \alpha_{frame}$, then rod may touch the floor.

(4) None of the above

PTM009

10. The volume of a metal sphere increases by 0.15% when its temperature is raised by 24°C.The coefficient of linear expansion of metal is :
(1) 2.5×10^{-5}/°C (2) 2.0×10^{-5}/°C
(3) -1.5×10^{-5}/°C (4) 1.2×10^{-5}/°C
PTM010

11. Suppose there is a hole in a copper plate. On heating the plate, diameter of hole, would :
(1) always increase
(2) always decrease
(3) always remain the same
(4) none of these
PTM011

12. The table gives the initial length ℓ_0, change in temperature ΔT and change in length $\Delta\ell$ of four rods. Which rod has greatest coefficient of linear expansion

Rod	ℓ_0(m)	ΔT(°C)	$\Delta\ell$(m)
A_1	1	100	1
A_2	1	100	2
A_3	1.5	50	3
A_4	2.5	20	4

(1) A_1 (2) A_2 (3) A_3 (4) A_4
PTM012

13. An iron bar (Young's modulus = 10^{11} N/m^2, $\alpha = 10^{-6}$ /°C) 1 m long and 10^{-3} m^2 in area is heated from 0°C to 100°C without being allowed to bend or expand. Find the compressive force developed inside the bar.
(1) 10,000 N (2) 1000 N
(3) 5000 N (4) 10^5 N
PTM013

14. A rod of length 2m rests on smooth horizontal floor. If the rod is heated from 0°C to 20°C. Find the longitudinal strain developed?
($\alpha = 5 \times 10^{-5}$/°C)
(1) 10^{-3} (2) 2×10^{-3} (3) Zero (4) None
PTM014

CALORIMETRY

15. A body of mass 5 kg falls from a height of 30 metre. If its all mechanical energy is changed into heat, then heat produced will be:-
(1) 350 cal (2) 150 cal (3) 60 cal (4) 6 cal
PTM015

16. A bullet moving with velocity v collides against wall. consequently half of its kinetic energy is converted into heat. If the whole heat is acquired by the bullet, the rise in temperature will be:–
(1) $v^2/4S$ (2) $4v^2/2S$ (3) $v^2/2S$ (4) v^2/S
PTM016

17. The amount of heat required in converting 1 g ice at –10°C into steam at 100°C will be :–
(1) 3028 J (2) 6056 J (3) 721 J (4) 616 J
PTM017

18. 2 kg ice at – 20°C is mixed with 5 kg water at 20°C. Then final amount of water in the mixture would be;
Given specific heat of ice = 0.5 cal/g°C,
Specific heat of water = 1 cal/g°C,
Latent heat of fusion for ice = 80 cal/g.
(1) 6 kg (2) 5 kg (3) 4 kg (4) 2 kg
PTM018

19. Two identical masses of 5 kg each fall on a wheel from a height of 10m. The wheel disturbs a mass of 2kg water, the rise in temperature of water will be :
(1) 2.6° C (2) 1.2° C
(3) 0.32° C (4) 0.12° C
PTM019

20. A block of mass 2.5 kg is heated to temperature of 500°C and placed on a large ice block. What is the maximum amount of ice that can melt (approx.). Specific heat for the body = 0.1 cal/g°C.
(1) 1 kg (2) 1.5 kg (3) 2 kg (4) 2.5 kg
PTM020

21. 1 kg of ice at –10°C is mixed with 4.4 kg of water at 30°C. The final temperature of mixture is: (specific heat of ice = 2100 J/kg-k)
(1) 2.3°C (2) 4.4°C (3) 5.3°C (4) 8.7°C
PTM021

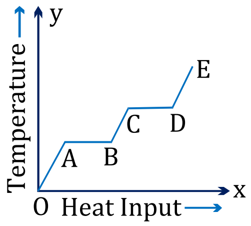
22. The amount of heat required to convert 1 g of ice at 0°C into steam at 100°C, is
(1) 716 cal. (2) 500 cal.
(3) 180 cal. (4) 100 cal.
PTM022

23. The latent heat for vapourisation for 1 g water is 536 cal. Its value in Joule/kg will be :-
(1) 2.25×10^6 (2) 2.25×10^3
(3) 2.25 (4) None of these
PTM023

24. If 10 g ice at 0°C is mixed with 10 g water at 20°C, the final temperature will be :-
(1) 50°C (2) 10°C (3) 0°C (4) 15°C
PTM024

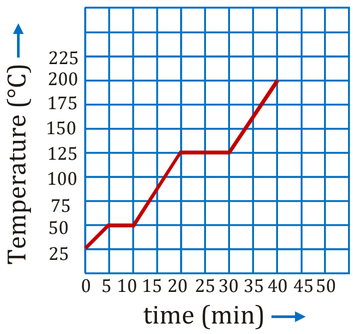
25. 420 joule of energy supplied to 10 g of water will raise its temperature by nearly :-
(1) 1°C (2) 4.2°C (3) 10°C (4) 42°C
PTM025

26. A solid material is supplied with heat at a constant rate. The temperature of material is changing with heat input as shown in the figure. What does slope DE represent.



(1) latent heat of liquid
(2) latent heat of vapour
(3) heat capacity of vapour
(4) inverse of heat capacity of vapour
PTM026

27. The graph shown in the figure represent change in the temperature of 5 kg of a substance as it absorbs heat at a constant rate of 42 kJ min^{-1}. The latent heat of vaporization of the substance is :

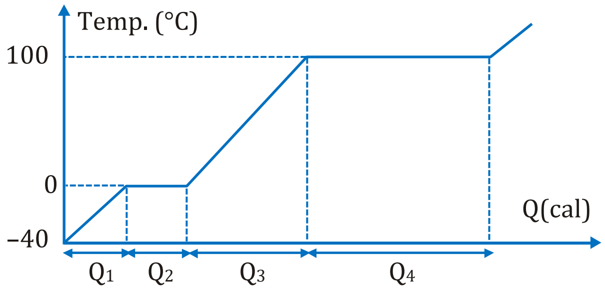


(1) 630 kJ kg^{-1} (2) 126 kJ kg^{-1}
(3) 84 kJ kg^{-1} (4) 12.6 kJ kg^{-1}
PTM027

28. A block of ice with mass m falls into a lake. After impact, a mass of ice m/5 melts. Both the block of ice and the lake have a temperature of 0°C. If L represents the heat of fusion, the minimum distance the ice fell before striking the surface is
(1) $\frac{L}{5g}$ (2) $\frac{5L}{g}$ (3) $\frac{gL}{5m}$ (4) $\frac{mL}{5g}$
PTM028

29. 10 g of ice at 0°C is kept in a calorimeter of water equivalent 10 g. How much heat should be supplied to the apparatus to evaporate the water thus formed? (Neglect loss of heat)
(1) 6200 cal (2) 7200 cal
(3) 13600 cal (4) 8200 cal
PTM029

30. Figure shows the temperature variation when heat is added continuously to a specimen of ice (10 g) at –40 °C at constant rate. (Specific heat of ice = 0.53 cal/g °C and L_{ice} = 80 cal/g, L_{water}= 540 cal/g)



Column–I	Column–II
(A) Value of Q_1 (in cal)	(P) 800
(B) Value of Q_2 (in cal)	(Q) 1000
(C) Value of Q_3 (in cal)	(R) 5400
(D) Value of Q_4 (in cal)	(S) 212
	(T) 900

(1) A→S; B→P; C→Q; D→T
(2) A→P; B→S; C→Q; D→R
(3) A→P; B→S; C→R; D→Q
(4) A→S; B→P; C→Q; D→R
PTM030

31. The thermal capacity of any body is
(1) a measure of its capacity to absorb heat
(2) a measure of its capacity to provide heat
(3) the quantity of heat required to raise its temperature by a unit degree
(4) the quantity of heat required to raise the temperature of a unit mass of the body by a unit degree
PTM031

32. 2 litre water at 27°C is heated by a 1 kW heater in an open container. On an average heat is lost to surroundings at the rate 160 J/s. The time required for the temperature to reach 77°C is
(1) 8 min 20 sec (2) 10 min
(3) 7 min (4) 14 min
PTM032

33. A 2100 W continuous flow geyser (instant geyser) has water inlet temperature = 10°C while the water flows out at the rate of 20 g/s. The outlet temperature of water must be about

(1) 20°C (2) 30°C (3) 35°C (4) 40°C

PTM033

34. The ratio of coefficient of thermal conductivity of two different materials is 5:3. If the thermal resistance of rods of same area of these material is same, then what is ratio of length of these rods-

(1) 3:5 (2) 5:3 (3) 25:9 (4) 9:25

PTM034

35. Rate of heat flow through a cylindrical rod is Q_1. Temperatures of ends of rod are T_1 and T_2. If all the linear dimensions of the rod become double and temperature difference remains same, it's rate of heat flow is Q_2, then :–

(1) $Q_1 = 2Q_2$ (2) $Q_2 = 2Q_1$

(3) $Q_2 = 4Q_1$ (4) $Q_1 = 4Q_2$

PTM035

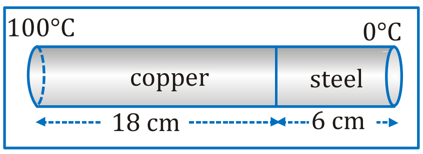
36. A heat flux of 4000 J/s is to be passed through a copper rod of length 10 cm and area of cross section 100 cm^2. The thermal conductivity of copper is 400 W/m°C. The two ends of this rod must be kept at a temperature difference of

(1) 1°C (2) 10°C

(3) 100°C (4) 1000°C

PTM036

37. The coefficient of thermal conductivity of copper is nine times that of steel. In the composite cylindrical bar shown in the figure what will be the temperature at the junction of copper and steel?

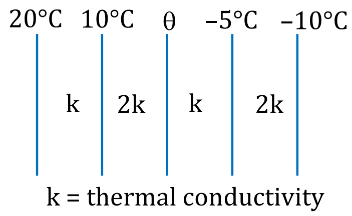


(1) 75°C (2) 67°C

(3) 33°C (4) 25°C

PTM037

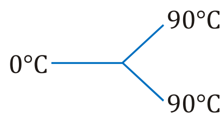
38. The figure shows the face and interface temperature of a composite slab containing of four layers of two materials having identical thickness. Under steady state condition, find the value of temperature θ.



(1) 5°C (2) 10°C (3) –15°C (4) 15°C

PTM038

39. Three rods made of the same material and having the same cross-section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at 0°C and 90°C respectively. The temperature of the junction of the three rods will be :



(1) 45°C (2) 60°C (3) 30°C (4) 20°C

PTM039

40. The coefficient of thermal conductivity depends upon-

(1) Temperature difference of two ends

(2) Area of the plate

(3) Thickness of the plate

(4) Material of the plate

PTM040

41. Which of the following cylindrical rods will conduct most heat, when their ends are maintained at the same steady temperature

(1) Length 1 m; radius 1 cm

(2) Length 2 m; radius 1 cm

(3) Length 2 m; radius 2 cm

(4) Length 1 m; radius 2 cm

PTM041

42. Gravitational force is required for –

(1) Stirring of liquid (2) Convection

(3) Conduction (4) Radiation

PTM042

43. The layers of atmosphere are heated through -

(1) Convection (2) Conduction

(3) Radiation (4) 2 and 3 both

PTM043

44. The lengths and radii of two rods made of same material are in the ratios 1 : 2 and 2 : 3 respectively. If the temperature difference between the ends for the two rods be the same then in the steady state. The amount of heat flowing per second through them will be in the ratio of

(1) 1 : 3 (2) 4 : 3 (3) 8 : 9 (4) 3 : 2

PTM044

45. Two metal rods, 1 & 2 of same length have same temperature difference between their ends, their thermal conductivities are K_1 & K_2 and cross sectional areas A_1 & A_2 respectively. What is required condition for same rate of heat conduction in them.

(1) $K_1 = K_2$ (2) $K_1 A_1 = K_2 A_2$

(3) $\frac{K_1}{A_1} = \frac{K_2}{A_2}$ (4) $\frac{K_1}{\ell_1^2} = \frac{K_2}{\ell_2^2}$

PTM045

46. The temperature of hot and cold end of a 20 cm long rod in thermal steady state are at 100°C and 20°C respectively. Temperature at the centre of the rod is

(1) 50°C (2) 60°C (3) 40°C (4) 30°C

PTM046

47. Consider a compound slab consisting of two different materials having equal thicknesses and thermal conductivities K and 2K, respectively. The equivalent thermal conductivity of the slab is

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

PTM047

48. Under steady state, the temperature of a body

(1) Increases with time

(2) Decreases with time

(3) Does not change with time and is same at all the points of the body

(4) Does not change with time but is different at different points of the body

PTM048

49. The area of the glass of a window of a room is $10 m^2$ and thickness 2 mm. The outer and inner temperature are 40°C and 20°C respectively. Thermal conductivity of glass in MKS system is 0.2 then heat flowing in the room per second will be -

(1) 3×10^4 joules (2) 2×10^4 joules

(3) 30 joules (4) 45 joules

PTM049

50. If the coefficient of conductivity of aluminium is 0.5cal/cm-sec-°C, then in order to conduct $10 cal/sec\text{-}cm^2$ in the steady state, the temperature gradient in aluminium must be

(1) 5°C/cm (2) 10°C/cm

(3) 20°C/cm (4) 10.5°C/cm

PTM050

51. The dimensional formula for thermal resistance is

(1) $M^{-1}L^{-2}T^3\theta$ (2) $M^{-1}L^{-2}T^{-3}\theta$

(3) $ML^2T^{-2}\theta$ (4) $ML^2T^2\theta^{-1}$

PTM051

52. The material used in the manufacture of cooker must have (K-coefficient of thermal conductivity, S - specific heat of material used) :

(1) high K and low S (2) low K and low S

(3) high K and high S (4) low K and high S

PTM052

53. The cause of air currents from ocean to ground is example of

(1) The specific heat of water is more than that of sand

(2) Convection

(3) Radiation

(4) Diffraction

PTM053

54 On a cold morning, a person will feel metal surface colder to touch than a wooden surface because

(1) Metal has high specific heat

(2) Metal has high thermal conductivity

(3) Metal has low specific heat

(4) Metal has low thermal conductivity

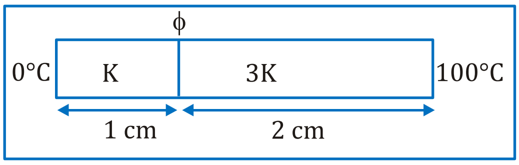
PTM054

55. The ratio of the diameters of two metallic rods of the same material is 2 : 1 and their lengths are in the ratio 1 : 4. If the temperature difference between them are equal, the rate of flow of heat in them will be in the ratio of -

(1) 2 : 1 (2) 4 : 1 (3) 8 : 1 (4) 16 : 1

PTM055

56. Two bars of thermal conductivities K and 3K and lengths 1 cm and 2 cm respectively have equal cross-sectional area. they are joined length wise as shown in the figure. If the temperature at the ends of this composite bar is 0°C and 100°C respectively (see figure), then the temperature of the interface (ϕ) is



(1) 50°C
(2) $\frac{100}{3}$ °C
(3) 60°C
(4) $\frac{200}{3}$ °C

PTM056

57. Mud houses are cooler in summer and warmer in winter because
(1) Mud is super conductor of heat
(2) Mud is good conductor of heat
(3) Mud is bad conductor of heat
(4) None of these

PTM057

58. Two walls of thicknesses d_1 and d_2 and thermal conductivity K_1 and K_2 are in contact. In the steady state, if the temperatures at the outer surface are T_1 and T_2, the temperature at the common wall is-

(1) $\frac{K_1T_1d_2 + K_2T_2d_1}{K_1d_2 + K_2d_1}$
(2) $\frac{K_1T_1 + K_2T_2}{d_1 + d_2}$
(3) $\left(\frac{K_1d_1 + K_2d_2}{T_1 + T_2}\right)T_1T_2$
(4) $\frac{K_1d_1T_1 + K_2d_2T_2}{K_1d_1 + K_2d_2}$

PTM058

59. In which of the following phenomenon heat convection does not take place
(1) land and sea breeze
(2) boiling of water
(3) heating of glass surface due to filament of the bulb
(4) air around the furnace

PTM059

60. In natural convection, a heated portion of a liquid moves because :
(1) Its molecular motion becomes aligned
(2) Of molecular collisions within it
(3) Its density is less than that of the surrounding fluid
(4) Of currents of the surrounding fluid

PTM060

61. It is hotter at the same distance over the top of a fire than it is in the side of it, mainly because
(1) Air conducts heat upwards
(2) Heat is radiated upwards
(3) Convection takes more heat upwards
(4) Convection, conduction and radiation all contribute significantly transferring heat upward

PTM061

RADIATION

62. A spherical body of area A, and emissivity e = 0.6 is kept inside a black body. What is the rate at which energy is radiated per second at temperature T.
(1) $0.6\,\sigma AT^4$
(2) $0.4\,\sigma AT^4$
(3) $0.8\,\sigma AT^4$
(4) $1.0\,\sigma AT^4$

PTM062

63. Radius of two spheres of same material are 1 & 4 m respectively and their temperature are 4×10^3 and 2×10^3 K respectively. Then ratio of emitted energy of spheres per sec. will be -
(1) 1:2
(2) 2:1
(3) 1:1
(4) 4:1

PTM063

64. Cooling rate of a sphere of 600 K at external environment (200 K) is R. When the temperature of sphere is reduced to 400 K then cooling rate of the sphere becomes :
(1) $\frac{3}{16}$R
(2) $\frac{16}{3}$R
(3) $\frac{9}{27}$R
(4) None

PTM064

65. If temperature of ideal black body increased by 10%, then percentage increase in quantity of radiation emitted from it's surface will be :-
(1) 10%
(2) 40%
(3) 46%
(4) 100%

PTM065

66. The rectangular surface of area 8cm × 4 cm of a black body at a temperature of 127°C emits energy at the rate of E. If the length and breadth of the surface are each reduced to half of the initial value and the temperature is raised to 327°C, the rate of emission of energy will become.
(1) $\frac{3}{8}$E
(2) $\frac{81}{16}$E
(3) $\frac{9}{16}$E
(4) $\frac{81}{64}$E

PTM066

67. The rate of emission of radiation of a black body at 273°C is E, then the rate of emission of radiation of this body at 0°C will be

(1) $\frac{E}{16}$ (2) $\frac{E}{4}$ (3) $\frac{E}{8}$ (4) 0

PTM067

68. If a liquid takes 30 s in cooling from 95°C to 90°C and 70 s in cooling from 55°C to 50°C then temperature of room is -

(1) 16.5°C (2) 22.5°C
(3) 28.5°C (4) 32.5°C

PTM068

69. The thermal capacities of two bodies are in the ratio of 1:4. If the rate of loss of heat are equal for the two bodies under identical conditions of surroundings, then the ratio of rate of fall of temperature of the two bodies is -

(1) 1:4 (2) 4:1 (3) 1:8 (4) 8:1

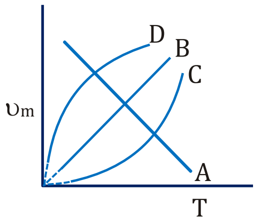
PTM069

70. Newton's law of cooling is used in laboratory for the determination of the

(1) Specific heat of the gases
(2) The latent heat of gases
(3) Specific heat of liquids
(4) Latent heat of liquids

PTM070

71. The υ_m – T curve for a perfect black body is –
($\upsilon_m \rightarrow$ frequency corresponding to maximum emission of radiation)



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

PTM071

72. Two stars appear to be red and blue, what is true about them -

(1) The red star is nearer
(2) The blue star is nearer
(3) The temperature of red star is more
(4) The temperature of blue star is more

PTM072

73. The temperature of a furnace is 2324°C and the intensity is maximum in its radiation spectrum nearly at 12000A°. If the intensity in the spectrum of a star is maximum nearly at 4800A°, then the surface temperature of star is

(1) 8400°C (2) 7200°C
(3) 6219.5°C (4) 5900°C

PTM073

74. There is a black spot on a body. If the body is heated and carried in a dark room then it glows more. This can be explained on the basis of –

(1) Newton's law of cooling
(2) Wein's law
(3) Kirchhoff's law
(4) Stefan's law

PTM074

75. The colour of a star is an indication of its -

(1) Weight (2) Distance
(3) Temperature (4) Size

PTM075

76. If a carved black utensil is heated to high temperature and then brought in dark then :

(1) Both utensil and its carving will shine
(2) Only carving will shine
(3) Only utensil will shine
(4) None of the utensil and carving will shine

PTM076

77. According to Newton's law of cooling, the rate of cooling of a body is proportional to :–

(1) Temperature of the body
(2) Temperature of the surrounding
(3) Fourth power of the temperature of body
(4) Difference of the temperature of the body and the surrounding.

PTM077

78. The original temperature of a black body is 727°C. Calculate temperature at which total radiant energy from this black body becomes double :
($2^{1/4} = 1.19$)

(1) 971 K (2) 1190 K
(3) 2001 K (4) 1458 K

PTM078

79. Ratio of radius of curvature of cylindrical emitters of same material is 1:4 and their temperature are in ratio 2:1. Then ratio of amount of heat emitted by them is –
(For Cylinder length = radius)

(1) 2:1 (2) 1:1 (3) 4:1 (4) 1:4

PTM079

80. The ideal black body is :
(1) Hot coal at high temperature
(2) Surface of glass printed with coal tar
(3) Metal surface
(4) A hollow container painted with black colour
PTM080

81. The energy emitted per second by a black body at 27°C is 10 J. If temperature of the black body is increased to 327°C, the energy emitted per second will be :-
(1) 20 J (2) 40 J (3) 80 J (4) 160 J
PTM081

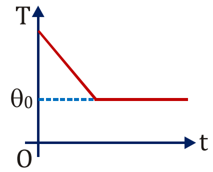
82. Energy is being emitted from the surface of black body at 127°C at the rate of 1.0×10^6 J/s m^2. The temperature of black body at which the rate of energy is 16.0×10^6 J/s m^2 will be :
(1) 754°C (2) 527°C
(3) 254°C (4) 508°C
PTM082

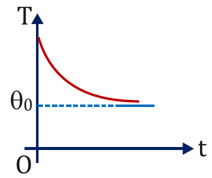
83. Solar constant for earth is 2 cal/min cm^2, if distance of mercury from sun is 0.4 times than distance of earth from sun then solar constant for mercury will be?
(1) 12.5 cal/min cm^2 (2) 25 cal/min cm^2
(3) 0.32 cal/min cm^2 (4) 2 cal/min cm^2
PTM083

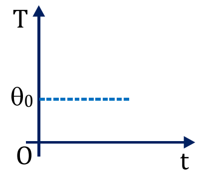
84. Two spherical bodies A (radius 6 cm) and B (radius 18 cm) are at temperature T_1 and T_2 respectively. The maximum intensity in the emission spectrum of A is at 500 nm and in that of B is at 1500 nm. Considering them to be black bodies, what will be the ratio of the rate of total energy radiated by A to that of B?
(1) 9 (2) 6 (3) 12 (4) 3
PTM084

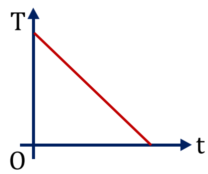
85. Star S_1 emits maximum radiation of wavelength 420 nm and the star S_2 emits maximum radiation of wavelength 560 nm, what is the ratio of the temperature of S_1 and S_2 :
(1) 4/3 (2) $(4/3)^{1/4}$
(3) 3/4 (4) $(3/4)^{1/2}$
PTM085

86. If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0, the graph between the temperature T of the metal and time t will be closest to

(1) 

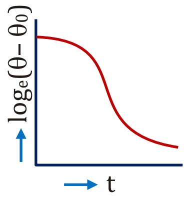
(2) 

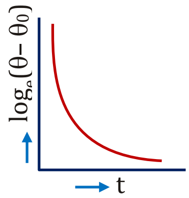
(3) 

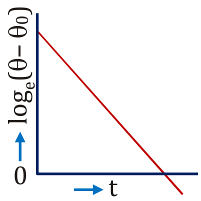
(4) 

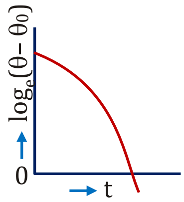
PTM086

87. A liquid in a beaker has temperature θ at time t and θ_0 is temperature of surroundings, then according to Newton's law of cooling, correct graph between $\log_e(\theta - \theta_0)$ and t is:

(1) 

(2) 

(3) 

(4) 

PTM087

88. A bucket full of hot water cools from 75°C to 70°C in time T_1, from 70°C to 65°C in time T_2 and from 65°C to 60°C in time T_3, then
(1) $T_1 = T_2 = T_3$ (2) $T_1 > T_2 > T_3$
(3) $T_1 < T_2 < T_3$ (4) $T_1 > T_2 < T_3$
PTM088

89. The Wein's displacement law express relation between :-
(1) Wavelength corresponding to maximum energy and temperature.
(2) Radiation energy and wavelength
(3) Temperature and wavelength
(4) Colour of light and temperature
PTM089

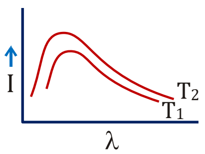
90. Four identical calorimeters painted in different colours, are heated to same temperature and then allowed to cool in vacuum. Which will cool fastest?
(1) One which is painted bright
(2) One which is painted thick white
(3) One which is painted thick black
(4) One which is painted bright white
PTM090

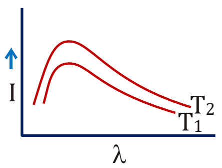
91. A body cools from 60°C to 50°C in 10 minutes. If the room temperature is 25°C and assuming Newton's cooling law holds good, the temperature of the body at the end of next 10 minutes is :
(1) 45°C (2) 42.85°C (3) 40°C (4) 38.5°C
PTM091

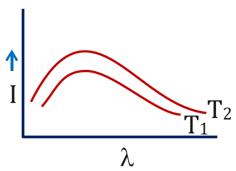
92. As compared to the person with white skin, the person with black skin will experience
(1) Less heat and more cold
(2) More heat and more cold
(3) More heat and less cold
(4) Less heat and less cold
PTM092

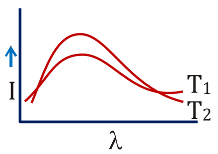
93. We consider the radiation emitted by the human body. Which of the following statements is true?
(1) The radiation is emitted during the summers and absorbed during the winters
(2) The radiation emitted lies in the ultraviolet region and hence is not visible
(3) The radiation emitted is in the infra-red region
(4) The radiation is emitted only during the day
PTM093

94. Shown below are the black body radiation curves at temperatures T_1 and T_2 ($T_2 > T_1$). Which of the following plots is correct :–

(1)


(2)


(3)


(4)


PTM094

95. The radii of two spheres made of same metal are r and 2r. These are heated to the same temperature and placed in the same surrounding. The ratio of rates of decrease of their temperature will be
(1) 1 : 1 (2) 4 : 1 (3) 1 : 4 (4) 2 : 1
PTM095

96. If E is the total energy emitted by a body at a temperature T K and $E_{\lambda max}$ is the maximum spectral energy emitted by it at the same temperature, then-
(1) $E \propto T^4; E_{\lambda_{max}} \propto T^5$ (2) $E \propto T^4; E_{\lambda_{max}} \propto T^{-5}$
(3) $E \propto T^{-4}; E_{\lambda_{max}} \propto T^4$ (4) $E \propto T^5; E_{\lambda_{max}} \propto T^4$
PTM096

97. If e_λ and a_λ be the emissive power and absorption power respectively of a body and E_λ be the emissive power of an ideal black body, then from Kirchhoff's laws
(1) $a_\lambda = E_\lambda / e_\lambda$ (2) $a_\lambda / e_\lambda = E_\lambda$
(3) $e_\lambda / a_\lambda = E_\lambda$ (4) $e_\lambda = E_\lambda / a_\lambda$
PTM097

98. A liquid takes 5 min. to cool from 80°C to 50°C. How much time it will take to cool from 60°C to 30°C. Temperature of surroundings is 20°C –
(1) 15 min. (2) 20 min.
(3) 100 min. (4) 9 min.
PTM098

99. A cup of tea cools from 80°C to 60°C in one minute. The ambient temperature is 30°C. In cooling from 60°C to 50°C, it will take :
(1) 50 sec. (2) 90 sec
(3) 60 sec. (4) 48 sec.
PTM099

100. If λ_m denotes the wavelength at which the radiation emission from a black body at a temperature T K is maximum then :
(1) $\lambda_m \propto T$ (2) $\lambda_m \propto T^2$
(3) $\lambda_m \propto T^{-1}$ (4) $\lambda_m \propto T^{-2}$
PTM100

101. A body is in thermal equilibrium with the surrounding:
(1) It will stop emitting heat radiation
(2) Amount of radiation emitted and absorbed by it will be equal
(3) It will emit heat radiation at faster rate
(4) It will emit heat radiation slowly
PTM101

102. Which of the following statement is correct for ideal black body :
(1) This absorbs visible radiation only.
(2) This absorbs infrared radiation only
(3) This absorbs half of radiation only and reflects the half
(4) This totally absorbs heat radiation of all the wavelengths

PTM102

103. Two spheres P and Q of same colour having radii 8 cm and 2 cm are maintained at temperatures 127°C and 527°C respectively. The ratio of energy radiated by P and Q is –
(1) 0.054 (2) 0.0034
(3) 1 (4) 2

PTM103

104. On increasing the temperature of a black body, wavelength for maximum emission.
(1) Shifts towards smaller wavelength
(2) Shifts towards greater wavelength
(3) Does not shift
(4) Depends on the shape of source.

PTM104

105. A solid cube and sphere are made of same substance and both have same surface area. If the temperature of both bodies 120° C then :
(1) Both will loss of Heat by same rate
(2) Rate of loss of Heat of cube will be more than that of the sphere
(3) Rate of loss of Heat of the sphere will be more than that of the cube
(4) Rate of loss of Heat will be more for that whose mass is more

PTM105

106. Two spheres of radii in the ratio 1 : 2 and densities in the ratio 2 : 1 and of same specific heat, are heated to same temperature and left in the same surrounding. Their rate of falling temperature will be in the ratio :
(1) 2 :1 (2) 1 : 1 (3) 1 : 2 (4) 1 : 4

PTM106

107. A black body at 200 K is found to emit maximum energy at a wavelength 14 μm. When its temperature is raised to 1000 K, then wavelength at which maximum energy emitted is:
(1) 14 μm (2) 15 μm
(3) 2.8 μm (4) 28 μm

PTM107

108. The spectrum from a black body radiation is a :
(1) line spectrum
(2) band spectrum
(3) continuous spectrum
(4) line & band both

PTM108

109. The temperature of a perfect black body is 727°C and its area is 0.1 m^2. If Stefan's constant is 5.67×10^{-8} watt/m^2–K^4, then heat radiated by it in 1 minute is :
(1) 8100 cal (2) 81000 cal
(3) 810 cal (4) 81 cal

PTM109

110. A black body radiates energy at the rate of E watt/m^2 at a high temperature T K. When the temperature is reduced to $\frac{T}{2}$ K, the radiant energy will be
(1) $\frac{E}{16}$ (2) $\frac{E}{4}$ (3) 4 E (4) 16 E

PTM110

111. In solar spectrum Fraunhofer's lines are presents because :
(1) Definite absorption takes place in photosphere of sun.
(2) Definite absorption takes place in chromosphere of sun.
(3) These wave lengths are not at all emitted by sun.
(4) Nuclear reactions take place in sun.

PTM111

112. On reducing temperature of surface to one third, amount of radiation becomes :-
(1) $\frac{1}{27}$ (2) $\frac{1}{81}$ (3) $\frac{1}{9}$ (4) $\frac{1}{3}$

PTM112

113. The absorptive power of a perfectly black body is
(1) zero (2) infinity (3) 1.5 (4) 1.0

PTM113

KTG & GAS LAWS AND IDEAL GAS EQUATION

114. Find the approximate number of molecules contained in a vessel of volume 7 litres at 0°C at 1.3×10^5 pascals

(1) 2.4×10^{23} (2) 3×10^{23}
(3) 6×10^{23} (4) 4.8×10^{23}

PTM114

115. A real gas behaves like an ideal gas if its

(1) pressure and temperature are both high
(2) pressure and temperature are both low
(3) pressure is high and temperature is low
(4) pressure is low and temperature is high

PTM115

116. Two gases of equal molar amount are in thermal equilibrium. If P_a, P_b and V_a, V_b are their respective pressures and volumes, then which relation is true:–

(1) $P_a \neq P_b$, $V_a = V_b$ (2) $V_a = V_b$, $V_a \neq V_b$
(3) $P_a/V_b = P_b/V_b$ (4) $P_aV_a = P_bV_b$

PTM116

117. Equal volume of H_2, O_2 and He gases are at same temperature and pressure. Which of these will have large number of molecules :-

(1) H_2
(2) O_2
(3) He
(4) All the gases will have same number of molecules

PTM117

118. Gases obey Vander - Waal's equation at :

(1) Only normal temperature and pressure
(2) Only high temperature and high pressure
(3) Only high temperature and low pressure
(4) All temperature and pressure

PTM118

119. A box contains N molecules of a gas. If the number of molecules is doubled, then the pressure will :-

(1) Decrease (2) Be same
(3) Be doubled (4) Get tripled

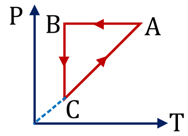
PTM119

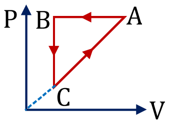
120. An ideal gas mixture filled inside a balloon expands according to the relation $PV^{2/3}$ = constant. The temperature inside the balloon is

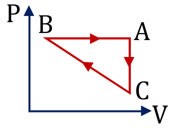
(1) increasing (2) decreasing
(3) constant (4) can't be said

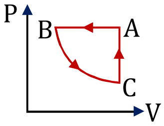
PTM120

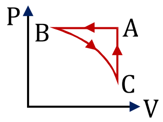
121. A cyclic process ABCA is shown in P–T diagram. When presented on P–V, it would



(1) 

(2) 

(3) 

(4) 

PTM121

122. During an experiment an ideal gas obeys an additional equation of state P^2V = constant. The initial temperature and volume of gas are T and V respectively. When it expands to volume 2V, then its temperature will be :

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

PTM122

123. 250 litre of an ideal gas is heated at constant pressure from 27°C such that its volume becomes 500 liters. The final temperature is :

(1) 54°C (2) 300°C (3) 327°C (4) 600°C

PTM123

124. A balloon contains 500 m^3 of helium at 27°C and 1 atmosphere pressure. The volume of the helium at –3°C temperature and 0.5 atmosphere pressure will be-

(1) 500 m^3 (2) 700 m^3
(3) 900 m^3 (4) 1000 m^3

PTM124

125. A vessel has 6g of oxygen at pressure P and temperature 400 K. A small hole is made in it so that oxygen leaks out. How much oxygen leaks out if the final pressure is P/2 and temperature is 300 K?

(1) 3g (2) 2g (3) 4g (4) 5g

PTM125

126. Relation PV = RT is given for following condition for real gas -

(1) High temperature and high density
(2) Low temperature and low density
(3) High temperature and low density
(4) Low temperature and high density

PTM126

127. A container of 5 litre has a gas at pressure of 0.8 m column of Hg. This is joined to an evacuated container of 3 litre capacity. The resulting pressure will be:- (At constant temp.)

(1) 4/3 (2) 0.5m (3) 2.0m (4) 3/4m

PTM127

128. At a given temperature, the pressure of an ideal gas of density ρ is proportional to -

(1) $\frac{1}{\rho^2}$ (2) $\frac{1}{\rho}$ (3) ρ^2 (4) ρ

PTM128

129. O_2 gas is filled in a cylinder. When pressure is increased 2 times, temperature becomes four times. then how much times their density will become :

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

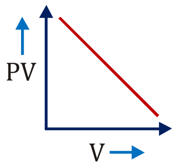
PTM129

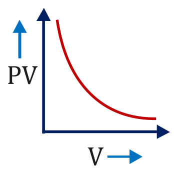
130. On increasing the temperature of a gas filled in a closed container by 1°C its pressure increases by 0.4%, then initial temperature of the gas is-

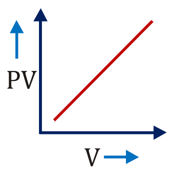
(1) 25°C (2) 250°C
(3) 250 K (4) 2500°C

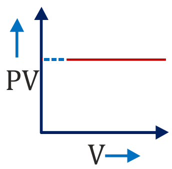
PTM130

131. The variation of PV graph with V of a fixed mass of a ideal gas at constant temperature is graphically represented as shown in figure :

(1) 

(2) 

(3) 

(4) 

PTM131

132. The number of oxygen molecules in a cylinder of volume 1 m^3 at a temperature of 27°C and pressure 13.8 Pa is :

(Boltzmann's constant k = 1.38×10^{-23} JK^{-1})

(1) 6.23×10^{26} (2) 0.33×10^{28}
(3) 3.3×10^{21} (4) None of these

PTM132

133. A cylinder contains 10 kg of gas at pressure of 10^7 N/m^2. When final pressure is reduce to 2.5×10^6 N/m^2 then quantity of gas taken out of the cylinder will be : (temperature of gas is constant)

(1) 15.2 kg (2) 3.7 kg
(3) zero (4) 7.5 kg

PTM133

134. Hydrogen and helium gases of volume V at same temperature T and same pressure P are mixed to have same volume V. The resulting pressure of the mixture will be :

(1) P/2
(2) P
(3) 2P
(4) Depending on the relative mass of the gases

PTM134

135. The equation of state for 5g of oxygen at a pressure P and temperature T occupying a volume V, will be :– (where R is the gas constant)

(1) PV = 5 RT (2) PV = (5/2) RT
(3) PV = (5/16) RT (4) PV = (5/32) RT

PTM135

136. In kinetic theory of gases, it is assumed that molecules :-

(1) Have same mass but can have different volume
(2) Have same volume but masses can be different
(3) Have both mass and volume different
(4) Have same mass but negligible volume

PTM136

137. The volume of an ideal gas is V at pressure P and temperature T. The mass of each molecule of the gas in m. The density of gas will be : - (K is Boltzmann's constant)

(1) mKT (2) Pm / KT
(3) P / KTV (4) P / KT

PTM137

138. The thermodynamic variables of a jar filled with gas A are P, V and T and another jar B filled with another gas are 2P, V/4 and 2T, where the symbols have their usual meaning. The ratio of the number of molecules of jar A to those of jar B is :

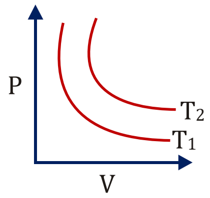
(1) 4 : 1 (2) 2 : 1 (3) 1 : 2 (4) 1 : 1

PTM138

139. At N.T.P. volume of a gas is changed to one fourth volume, at constant temperature then the new pressure will be :
(1) 2 atm. (2) $2^{5/3}$ atm.
(3) 4 atm. (4) 1 atm.

PTM139

140. Find the correct relation in given P-V diagram:
(1) $T_1 = T_2$
(2) $T_1 > T_2$
(3) $T_1 < T_2$
(4) $T_1 \lessgtr T_2$



PTM140

141. Simple behaviour under all conditions of real gas is governed by the equation :-
(1) PV = μRT
(2) $\left(P+\frac{a}{V^2}\right)(V-b)=RT$
(3) PV = constant
(4) PV^{γ} = constant

PTM141

VARIOUS SPEEDS, DEGREE OF FREEDOM, SPECIFIC HEAT CAPACITIES OF GASES AND MEAN FREE PATH

142. The root mean square velocity of the molecules of an ideal gas is :-
(1) $\sqrt{RT/M_w}$ (2) $\sqrt{3RT/M_w}$
(3) $\sqrt{3RTM_w}$ (4) $\sqrt{RT/3M_w}$

PTM142

143. At constant pressure hydrogen is having temperature of 327° C. Till what temperature it is to be cooled so that the rms velocity of its molecules becomes half of the earlier value :-
(1) –123°C (2) 123°C (3) –100°C (4) 0°C

PTM143

144. The rms velocity of gas molecules of a given amount of a gas at 27°C and 1.0×10^5 N m^{-2} pressure is 200 m sec^{-1}. If temperature and pressure are respectively 127°C and 0.5×10^5 N m^{-2}, the rms velocity will be :-
(1) $400/\sqrt{3}$ ms^{-1} (2) $100\sqrt{2}$ ms^{-1}
(3) $100\sqrt{2}/3$ ms^{-1} (4) $50\sqrt{\frac{2}{3}}$ ms^{-1}

PTM144

145. Two containers of same volume are filled with atomic Hydrogen and Helium respectively at 1 and 2 atm pressure. If the temperature of both specimen are same then average speed < C_H > for hydrogen atoms will be -
(1) $\langle C_H \rangle = \sqrt{2}\langle C_{He} \rangle$ (2) $\langle C_H \rangle = \langle C_{He} \rangle$
(3) $\langle C_H \rangle = 2\langle C_{He} \rangle$ (4) $\langle C_H \rangle = \frac{\langle C_{He} \rangle}{2}$

PTM145

146. The r.m.s. speed of a gas molecule is 300 m/s. Calculate the r.m.s. speed if the molecular weight is doubled while the temperature is halved-
(1) 300 m/s (2) 150 m/s
(3) 600 m/s (4) 75 m/s

PTM146

147. The root mean square velocity of hydrogen molecules at 300 K is 1930 m/s. Then the r.m.s. velocity of oxygen molecules at 1200 K will be :
(1) 482.5 m/s (2) 965.0 m/s
(3) 1930 m/s (4) 3860 m/s

PTM147

148. The rms velocity of H_2 is 2×10^3 m /s. What will be the rms velocity of O_2 molecules at the same temperature :-
(1) 10^3 m/s (2) 500 m/s
(3) 0.5×10^4 m/s (4) 3×10^3 m/s

PTM148

149. The temperature at which root mean square velocity of molecules of helium is equal to root mean square velocity of hydrogen at N.T.P is-
(1) 273°C (2) 273 K
(3) 546°C (4) 844 K

PTM149

150. If the pressure of a gas is doubled at constant temperature, then the mean square velocity will become :-
(1) No change (2) double
(3) Four times (4) None of the above

PTM150

151. The reason for the absence of atmosphere on moon is that the :
(1) Value of v_{rms} of the molecules of gas is more than the value of escape velocity
(2) Value of v_{rms} of gas is less than escape velocity
(3) Value of v_{rms} is negligible
(4) None of the above

PTM151

152. The speeds of 5 molecules of a gas (in arbitrary units) are as follows 2, 3, 4, 5, 6. The root mean square speed for these molecules is -
(1) 2.91 (2) 3.52 (3) 4.00 (4) 4.24
PTM152

153. The root mean square speed of the molecules of a gas is :
(1) Independent of its pressure but directly proportional to its Kelvin temperature
(2) Directly proportional to the square roots of both its pressure and its Kelvin temperature
(3) Independent of its pressure but directly proportional to the square root of its Kelvin temperature
(4) Directly proportional to both its pressure and its Kelvin temperature
PTM153

154. At 0°C temperature root mean square speed of which of the following gases will be maximum:-
(1) H_2 (2) N_2 (3) O_2 (4) SO_2
PTM154

155. The root mean square speed of hydrogen molecules of an ideal hydrogen gas kept in a gas chamber is 3180 m/s. The pressure of the hydrogen gas is :-
(Density of hydrogen gas = 8.99×10^{-2} Kg/m^3, 1 atmosphere = 1.01×10^5 N/m^2)
(1) 1.0 atmosphere (2) 1.5 atmosphere
(3) 2.0 atmosphere (4) 3.0 atmosphere
PTM155

156. If the rms velocity of molecules of a gas in a container is doubled then the pressure will:-
(1) Become four times (2) Also get doubled
(3) Be same (4) Become one half
PTM156

157. The root mean square velocity of a gas molecule of mass m at a given temperature is proportional to –
(1) m^0 (2) m
(3) $\sqrt{m}$ (4) $\frac{1}{\sqrt{m}}$
PTM157

158. v_{rms}, v_{av} and v_{mp} are root mean square, average and most probable speeds of molecules of a gas obeying Maxwell's velocity distribution. Which of the following statements is correct
(1) $v_{rms} < v_{av} < v_{mp}$ (2) $v_{rms} > v_{av} > v_{mp}$
(3) $v_{mp} < v_{rms} < v_{av}$ (4) $v_{mp} > v_{rms} > v_{av}$
PTM158

159. If the r.m.s. velocity of hydrogen becomes equal to the escape velocity from the earth surface, then the temperature of hydrogen gas would be-
(1) 1060 K (2) 5030 K
(3) 8270 K (4) 10^4 K
PTM159

160. The pressure exerted by a gas in P_0. If the mass of molecules becomes half and their velocities become double, then pressure will become
(1) $\frac{P_0}{2}$ (2) P_0 (3) $2P_0$ (4) $4P_0$
PTM160

161. The root mean square (rms) speed of oxygen molecules O_2 at a certain temperature T (absolute) is v. If the temperature is doubled and oxygen gas dissociates into atomic oxygen. The rms speed :
(1) becomes $v/\sqrt{2}$ (2) remains v
(3) becomes $\sqrt{2}v$ (4) becomes 2v
PTM161

162. If the root mean square speed of hydrogen molecules is equal to root mean square speed of oxygen molecules at 47°C, the temperature of hydrogen is -
(1) 20 K (2) 47 K (3) 50 K (4) 94 K
PTM162

163. The root mean square and most probable speed of the molecules in a gas are :
(1) same
(2) different
(3) cannot say
(4) depends on nature of the gas
PTM163

164. According to Maxwell's law of distribution of velocities of molecules, the most probable velocity is :-
(1) greater than the mean speed
(2) equal to the mean speed
(3) equal to the root mean square speed
(4) less than the root mean square speed
PTM164

165. The ratio of average translational kinetic energy to rotational kinetic energy of a diatomic molecule at temperature T is
(1) 3 (2) 7/5 (3) 5/3 (4) 3/2
PTM165

166. For hydrogen gas $c_P - c_V = a$ and for oxygen gas $c_P - c_V = b$ then the relation between a and b is (where c_P & c_V are gram specific heats)
(1) a = 16 b (2) b = 16 a
(3) a = b (4) None of these
PTM166

167. A gas mixture consists of 2 moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is
(1) 4 RT (2) 15 RT
(3) 9 RT (4) 11 RT
PTM167

168. The average kinetic energy of a gas molecule at 27°C is 6.21×10^{-21} J. Its average kinetic energy at 227°C will be
(1) 52.2×10^{-21} J (2) 5.22×10^{-21} J
(3) 10.35×10^{-21} J (4) 11.35×10^{-21} J
PTM168

169. Two containers A and B contain molecular gas at same temperature with masses of molecules are m_A and m_B, then relation of momentum P_A and P_B will be-
(1) $P_A = P_B$ (2) $P_A = \left(\frac{m_A}{m_B}\right)^{1/2} P_B$
(3) $P_A = \left(\frac{m_B}{m_A}\right)^{1/2} P_B$ (4) $P_A = \left(\frac{m_A}{m_B}\right) P_B$
PTM169

170. A cylinder of 200 litre capacity is containing H_2. The total translational kinetic energy of molecules is 1.52×10^5 J. The pressure of H_2 in the cylinder will be in N m^{-2} :-
(1) 2×10^5 (2) 3×10^5
(3) 4×10^5 (4) 5×10^5
PTM170

(171–172) 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

171. The equivalent molar mass of the mixture is
(1) 6g (2) $\frac{13g}{7}$ (3) $\frac{18g}{7}$ (4) $\frac{24g}{7}$
PTM171

172. The equivalent value of γ in the above question is
(1) 1.59 (2) 1.53 (3) 1.56 (4) none
PTM172

173. Two monoatomic ideal gas at temperature T_1 and T_2 are mixed. There is no loss of energy. If the mass of molecules of the two gases are m_1 and m_2 and number of their molecules are n_1 and n_2 respectively, then temperature of the mixture will be :
(1) $\frac{T_1 + T_2}{n_1 + n_2}$ (2) $\frac{T_1}{n_1} + \frac{T_2}{n_2}$
(3) $\frac{n_2T_1 + n_1T_2}{n_1 + n_2}$ (4) $\frac{n_1T_1 + n_2T_2}{n_1 + n_2}$
PTM173

174. The total kinetic energy of 1 mole of N_2 at 27°C will be approximately :-
(1) 1500 J (2) 1500 calorie
(3) 1500 kilo calorie (4) 1500 erg.
PTM174

175. Mean kinetic energy (or average energy) per gm. molecule of a monoatomic gas is given by:
(1) 3RT/2 (2) kT/2
(3) RT/3 (4) 3kT/2
PTM175

176. Relation between the ratio of specific heats (γ) of gas and degree of freedom 'f' will be
(1) $\gamma = f + 2$ (2) $\frac{1}{\gamma} = \frac{1}{f} + \frac{1}{2}$
(3) $f = 2 / (\gamma - 1)$ (4) $f = 2(\gamma - 1)$
PTM176

177. Relation between pressure (P) and energy density (E) of an ideal gas is -
(1) $P = \frac{2E}{3}$ (2) $P = \frac{3E}{2}$
(3) $P = \frac{3E}{5}$ (4) P = E
PTM177

178. On mixing 1 g mole of a monoatomic with 1 g mole of a diatomic gas the specific heat of mixture at constant volume will be :–
(1) R (2) 3/2 R (3) 2R (4) 5/2R
PTM178

179. Absolute zero temperature is one at which-
(1) All liquids convert into solid
(2) All gases convert to solid
(3) All matter is in solid state
(4) The K.E. of molecules becomes zero
PTM179

180. For a gas $\frac{R}{C_V} = 0.67$. This gas is made up of molecules which are :
(1) Diatomic
(2) Mixture of diatomic and polyatomic molecules
(3) Monoatomic
(4) Polyatomic
PTM180

181. If the total number of H_2 molecules is double that of the O_2 molecules then ratio of total kinetic energies of H_2 to that of O_2 at 300 K is:
(1) 1: 1 (2) 1 : 2 (3) 2 : 1 (4) 1 : 16
PTM181

182. At which of the following temperature any gas has average molecular kinetic energy double that of at 20°C
(1) 40°C (2) 80°C
(3) 313°C (4) 586°C
PTM182

183. When temperature is increased from 0°C to 273°C, what will be the ratio of final to initial the average kinetic energy of molecules?
(1) 1 (2) 3 (3) 4 (4) 2
PTM183

184. The kinetic energy associated with per degree of freedom of a molecule is -
(1) $\frac{1}{2}MC^2_{rms}$ (2) kT
(3) kT/2 (4) 3kT/2
PTM184

185. Which of the following statement is true according to kinetic theory of gases?
(1) The collision between two molecules is inelastic and the time between two collisions is less than the time taken during the collision.
(2) There is a force of attraction between the molecules
(3) All the molecules of a gas move with same velocity
(4) The average of the distances travelled between two successive collisions is mean free path.
PTM185

186. Gas exerts pressure on the walls of container because the molecules-
(1) Are loosing their Kinetic energy
(2) Are getting stuck to the walls
(3) Are transferring their momentum to walls
(4) Are accelerated towards walls.
PTM186

187. For a diatomic gas, change in internal energy for unit change in temperature at constant pressure and volume is U_1 and U_2 respectively then $U_1 : U_2$ is :
(1) 5 : 3 (2) 7 : 5 (3) 1 : 1 (4) 5 : 7
PTM187

188. The specific heat of an ideal gas depends on temperature is -
(1) $\frac{1}{T}$
(2) T
(3) $\sqrt{T}$
(4) Does not depends on temperature
PTM188

189. The specific heat of a gas :
(1) Has only two value Cp and Cv
(2) Has a unique value at a given temperature
(3) Can have any value between 0 and ∞
(4) Depends upon the mass of the gas
PTM189

190. 22 g of CO_2 at 27°C is mixed with 16 g of O_2 at 37°C. The temperature of the mixture is :–
(At room temperature, degrees of freedom of CO_2 = 7 and degrees of freedom of O_2 = 5)
(1) 31.16°C (2) 27°C
(3) 37°C (4) 30°C
PTM190

191. At 27°C temperature, the kinetic energy of an ideal gas is E_1. If the temperature is increased to 327°C, then kinetic energy would be

(1) $2E_1$ (2) $\frac{1}{2}E_1$

(3) $\sqrt{2}E_1$ (4) $\frac{1}{\sqrt{2}}E_1$

PTM191

192. Oxygen and hydrogen gases are at temperature T. Then average K.E of each molecule of oxygen gas is equal to how many times of average K.E. of each molecule of hydrogen gas :-

(1) 16 times (2) 8 times

(3) Equal (4) 1/16 times

PTM192

193. The average energy of the molecules of a monoatomic gas at temperature T is :-
(K = Boltzmann constant)

(1) $\frac{1}{2}kT$ (2) kT (3) $\frac{3}{2}kT$ (4) $\frac{5}{2}kT$

PTM193

194. A diatomic molecule has

(1) 1 degree of freedom

(2) 3 degree of freedom

(3) 5 degree of freedom

(4) 6 degree of freedom

PTM194

195. Two moles of monoatomic gas are mixed with 1 mole of a diatomic gas. Then γ for the mixture is:

(1) 1.4 (2) 1.55 (3) 1.62 (4) 1.67

PTM195

ZEROTH AND FIRST LAW OF THERMODYNAMICS, HEAT, WORK AND INTERNAL ENERGY

196. The first law of thermodynamics is based on:-

(1) Law of conservation of energy

(2) Law of conservation of mechanical energy

(3) Law of conservation of gravitational P.E.

(4) None of the above

PTM196

197. In a process, 500 calories of heat is given to a system and at the same time 100 joules of work is done on the system. The increase in the internal energy of the system is :-

(1) 40 calories (2) 1993 joules

(3) 2193 joules (4) 82 calories

PTM197

198. In a thermodynamic process pressure of a fixed mass of a gas is changed in such a manner that the gas releases 20 joules of heat and 8 joules of work was done on the gas. If the initial internal energy of the gas was 30 joules, then the final internal energy will be: -

(1) 2 J (2) 42 J (3) 18 J (4) 58 J

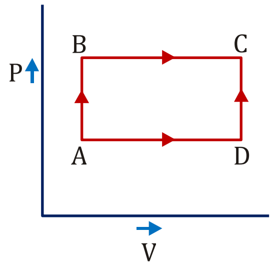
PTM198

199. 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 same initial and final state which requires a heat input of 9 kJ. The work done by the gas in the second expansion is :

(1) 32 kJ (2) 5 kJ (3) –4 kJ (4) 13 kJ

PTM199

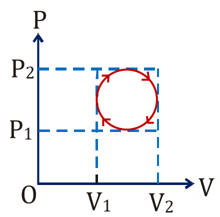
200. As shown in the figure the amount of heat absorbed along the path ABC is 90J and the amount of work done by the system is 30 J. If the amount of work done along the path ADC is 20 J then amount of heat absorbed will be :-



(1) 80 J (2) 90 J (3) 110 J (4) 120 J

PTM200

201. In a cyclic process shown on the P – V diagram, the magnitude of the work done is :

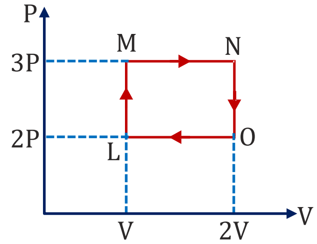


(1) $\pi\left(\frac{P_2-P_1}{2}\right)^2$ (2) $\pi\left(\frac{V_2-V_1}{2}\right)^2$

(3) $\frac{\pi}{4}(P_2-P_1)(V_2-V_1)$ (4) $\pi(P_2V_2-P_1V_1)$

PTM201

202. The work by an ideal monoatomic gas along the cyclic path LMNOL is



(1) PV (2) 2PV (3) 3 PV (4) 4 PV

PTM202

203. For a gas $C_v = 4.96$ cal/mole K, the increase in internal energy of 2 mole gas in heating from 340 K to 342 K will be :-

(1) 27.80 cal (2) 19.84 cal
(3) 13.90 cal (4) 9.92 cal

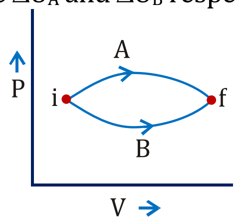
PTM203

204. When a system changes from one to another state the value of work done :-

(1) Depends on the force acting on the system
(2) Depends on the nature of material present in a system
(3) Does not depend on the path
(4) Depends on the path

PTM204

205. A system is taken along the paths A and B as shown. If the amounts of heat given in these processes are Q_A and Q_B and change in internal energy are ΔU_A and ΔU_B respectively then :-



(1) $Q_A = Q_B$; $\Delta U_A < \Delta U_B$ (2) $Q_A \geq Q_B$; $\Delta U_A = \Delta U_B$
(3) $Q_A < Q_B$; $\Delta U_A > \Delta U_B$ (4) $Q_A > Q_B$; $\Delta U_A = \Delta U_B$

PTM205

206. If the heat of 110 J is added to a gaseous system and change in internal energy is 40 J, then the amount of external work done is :

(1) 180 J (2) 70 J (3) 110 J (4) 30 J

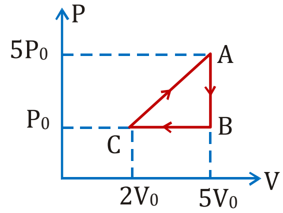
PTM206

207. If amount of heat supplied is Q, work done is W and change in internal energy is $mC_V\,dT$, then relation among them is. (C_v = gram specific heat)

(1) $mC_V\,dT = Q + W$ (2) $Q = W + mC_V\,dT$
(3) $Q + mC_V\,dT = W$ (4) None of these.

PTM207

208. The work done by a gas taken through the closed process ABCA is

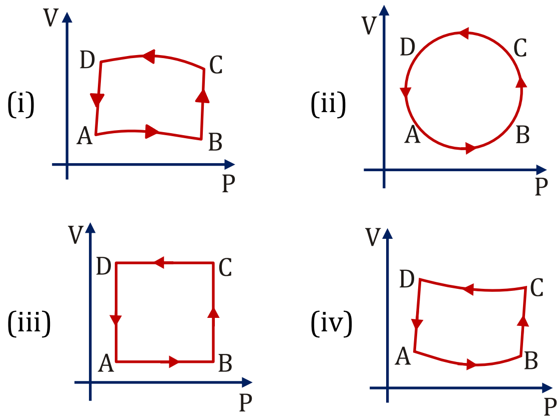


(1) $6P_0V_0$ (2) $4P_0V_0$
(3) P_0V_0 (4) zero

PTM208

CYCLIC, ISOCHORIC, ISOBARIC, ISOTHERMAL, ADIABATIC AND POLYTROPIC PROCESS

209. In the diagrams (i) to (iv) of variation of volume with changing pressure is shown. A gas is taken along the path ABCDA. The change in internal energy of the gas will be: -



(1) Positive in all cases (i) to (iv)
(2) Positive in cases (i), (ii) and (iii) but zero in case (iv)
(3) Negative in cases (i), (ii) and (iii) but zero in case (iv)
(4) Zero in all the four cases

PTM209

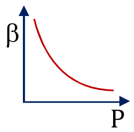
210. The temperature of 5 moles of a gas which was held at constant volume was changed from 100°C to 120°C. The change in internal energy was found to be 80 joules. The total heat capacity of the gas at constant volume will be equal to: -

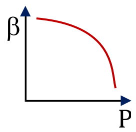
(1) 8 J/K (2) 0.8 J/K
(3) 4.0 J/K (4) 0.4 J/K

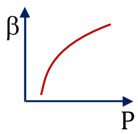
PTM210

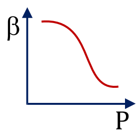
211. Monoatomic, diatomic and triatomic gases whose initial volume and pressure are same, are compressed till their volume become half the initial volume.
(1) If the compression is adiabatic then monoatomic gas will have maximum final pressure.
(2) If the compression is adiabatic then triatomic gas will have maximum final pressure.
(3) If the compression is adiabatic then their final pressure will be same.
(4) If the compression is isothermal then their final pressure will be different.
PTM211

212. Which of the following graphs correctly represents the variation of $\beta = -(dV/dP)/V$ with P for an ideal gas at constant temperature?

(1) 

(2) 

(3) 

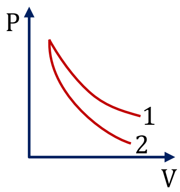
(4) 

PTM212

213. The adiabatic Bulk modulus of a diatomic gas at atmospheric pressure is
(1) 0 Nm^{-2} (2) 1 Nm^{-2}
(3) 1.4×10^4 Nm^{-2} (4) 1.4×10^5 Nm^{-2}
PTM213

214. A given quantity of an ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is :
(1) 2P/3 (2) P (3) 3P/2 (4) 2P
PTM214

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



(1) He and O_2 (2) O_2 and He
(3) He and Ar (4) O_2 and N_2
PTM215

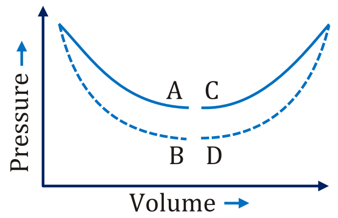
216. For an adiabatic expansion of a perfect gas, the value of $\Delta P/P$ is equal to: -
(1) $-\sqrt{\gamma}\ \Delta V/V$ (2) $-\Delta V/V$
(3) $-\gamma\ \Delta V/V$ (4) $-\gamma^2\ \Delta V/V$
PTM216

217. An ideal gas at 27°C is compressed adiabatically to 8/27 of its original volume. If $\gamma = 5/3$, then the rise in temperature is:-
(1) 450 K (2) 375 K
(3) 675 K (4) 405 K
PTM217

218. For monoatomic gas the relation between pressure of a gas and temperature T is given by $P \propto T^C$. Then value of C will be:
(For adiabatic process)
(1) $\frac{5}{3}$ (2) $\frac{2}{5}$ (3) $\frac{3}{5}$ (4) $\frac{5}{2}$
PTM218

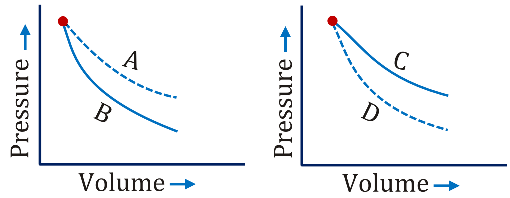
219. A gas for which $\gamma = 5/3$ is heated at constant pressure. The percentage of total heat given that will be used for external work is :
(1) 40% (2) 30% (3) 60% (4) 20%
PTM219

220. In which of the figure no heat exchange between the gas and the surroundings will take place, if the gas is taken along curve:
(curves are isothermal and adiabatic)



(1) A (2) B (3) C (4) D
PTM220

221. In the following figures, four curves A, B, C, D are shown the curves are :–



(1) Isothermal for A and B while adiabatic for C and D
(2) Isothermal for A and C while adiabatic for B and D
(3) Isothermal for A and D
(4) Adiabatic for A and C while isothermal for B and D
PTM221

222. Equal volumes of a perfect gas are compressed to half of their initial volumes. The first is brought about by isothermal process and the second by adiabatic process then :

(1) Both temperature and pressure will increase in the isothermal process.

(2) In the isothermal process, the temperature will decrease and pressure will increases

(3) Both temperature and pressure will increase in adiabatic process

(4) In the adiabatic process, the temperature will decrease and pressure will increase

PTM222

223. 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 :

(1) Q (2) $\frac{3}{5}$Q (3) $\frac{2}{5}$Q (4) $\frac{2}{3}$Q

PTM223

224. 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 :

(1) $\frac{1}{2}R(T_2 - T_1)$ (2) $\frac{1}{3}R(T_2 - T_1)$

(3) $\frac{1}{4}R(T_2 - T_1)$ (4) $\frac{1}{5}R(T_2 - T_1)$

PTM224

225. 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 -

(1) 2/5 (2) 3/5 (3) 3/7 (4) 5/7

PTM225

226. Pressure-temperature relationship for an ideal gas undergoing adiabatic change is ($\gamma = C_p/C_v$)

(1) PT^{γ} = constant

(2) $PT^{-1+\gamma}$ = constant

(3) $PT^{\gamma-1}T^{\gamma}$ = constant

(4) $P^{1-\gamma}T^{\gamma}$ = constant

PTM226

227. The value of internal energy in an adiabatic process :-

(1) Remains unchanged

(2) Only increases

(3) Only diminishes

(4) May diminish and may also increase

PTM227

228. One mole of an ideal monoatomic gas is heated at a constant pressure of one atmosphere from 0°C to 100°C. Then the change in the internal energy is

(1) 20.80×10^2 J (2) 12.48×10^2 J

(3) 832×10^2 J (4) 6.25×10^2 J

PTM228

229. The specific heat of a gas at constant pressure is more than that of the same gas at constant volume because :-

(1) Work is done in the expansion of gas at constant pressure

(2) Work is done in the expansion of the gas at constant volume

(3) The molecular attraction increase under constant pressure

(4) The vibration of molecules increases under constant pressure

PTM229

230. When a gas is adiabatically compressed then it's temperature increase because :–

(1) Work done is zero

(2) Internal energy is increased

(3) Heat is supplied to it

(4) No change in pressure

PTM230

231. Air is filled in a tube of the wheel of a car at 27°C and 2 atm pressure if the tube is suddenly bursts, the final temperature of air will be :– ($\gamma = 1.5$, $2^{1/3} = 1.251$)

(1) –33° C (2) 0° C

(3) 21.6° C (4) 240° C

PTM231

232. Specific heat of a gas undergoing adiabatic change is :

(1) Zero (2) Infinite

(3) Positive (4) Negative

PTM232

233. A quantity of air (γ = 1.4) at 27°C is compressed suddenly, the temperature of the air system will :
(1) Fall
(2) Rise
(3) Remain unchanged
(4) First rise and then fall

PTM233

234. A gas specimen in one vessel is expended isothermally to double its volume and a similar specimen in the second vessel is expanded adiabatically the same extent, then:
(1) In the second vessel, both pressure and work done are more
(2) In the second vessel, pressure in more, but the work done is less.
(3) In the first vessel, both pressure & work done are more.
(4) In the first vessel, pressure is more, but work done is less

PTM234

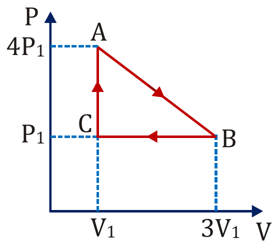
235. If an ideal gas is compressed during isothermal process then :-
(1) No work is done against gas
(2) heat is rejected by gas
(3) It's internal energy will increase
(4) Pressure does not change

PTM235

236. Graphs between P–V diagram for isothermal and adiabatic processes are drawn the relation between their slopes will be :–
(1) Slope of adiabatic curve = γ (slope of isothermal curve)
(2) Slope of isothermal curve = γ (slope of adiabatic curve)
(3) Slope of isothermal curve = slope of adiabatic curve
(4) Slope of adiabatic curve = γ^2 (slope of isothermal curve)

PTM236

237. An ideal gas is taken round the cycle ABCA. In the cycle the amount of work done involved is:-



(1) 12 P_1V_1 (2) 6 P_1V_1
(3) 3 P_1V_1 (4) P_1V_1

PTM237

238. One mole ideal gas is compressed adiabatically at 27°C. Its temperature becomes 102°C. The work done in this process will be :- (γ = 1.5)
(1) –625 J (2) 625 J
(3) 1245 J (4) –1245 J

PTM238

239. In an isometric change :
(1) $\delta Q = dU$ (2) $\delta W = dU$
(3) $\delta Q + \delta W = dU$ (4) None of these

PTM239

240. The volume of a gas expands by 0.25 m^3 at a constant pressure of 10^3 N/m^2. The work done is equal to
(1) 2.5 erg (2) 250 J
(3) 250 W (4) 250 N

PTM240

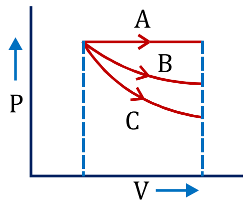
241. The process in which the heat given to a system is completely transformed into work is for ideal gas :–
(1) Isobaric process
(2) Isometric process
(3) Isothermal process
(4) Adiabatic process

PTM241

242. The volume of a poly-atomic gas $\left(\gamma = \frac{4}{3}\right)$ compressed adiabatically to $\frac{1}{8^{th}}$ of the original volume. If the original pressure of the gas is P_0 the new pressure will be: -
(1) 8 P_0 (2) 16 P_0
(3) 6 P_0 (4) 2 P_0

PTM242

243. During isothermal, isobaric and adiabatic processes, work done for same change in volume will be maximum for :-



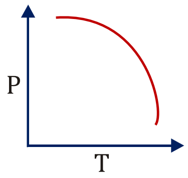
(1) Isothermal
(2) Isobaric
(3) Adiabatic
(4) None of the above

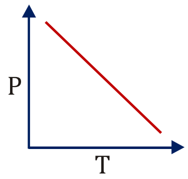
PTM243

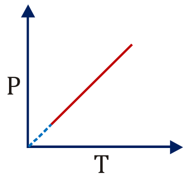
244. In an adiabatic process the quantity which remains constant is :-
(1) Temperature
(2) Pressure
(3) Total heat content of the system
(4) Volume

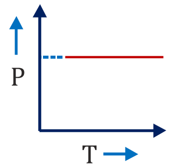
PTM244

245. Graph of isometric process is :-

(1) 

(2) 

(3) 

(4) 

PTM245

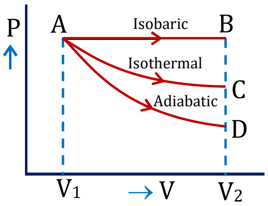
246. An ideal gas undergoes an adiabatic change in volume (V) with pressure (P). Then :-
(1) $P^{\gamma}V$ = constant (2) PV^{γ} = constant
(3) $(PV)^{\gamma}$ = constant (4) PV = constant

PTM246

247. 300 calories of heat is supplied to raise the temperature of 50 gm of air from 20°C to 30°C without any change in its volume. Change in internal energy per gram of air is
(1) zero (2) 0.6 calories
(3) 1.2 calories (4) 6.0 calories

PTM247

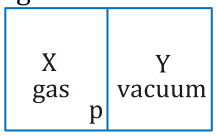
248. A gas is expanded from volume V_1 to volume V_2 in three processes, shown in the figure. If UA, UB, UC and UD represent the internal energies of the gas in state A,B,C and D respectively, the which of the following is not correct



(1) $U_B - U_A > 0$ (2) $U_C - U_A = 0$
(3) $U_D - U_A < 0$ (4) $U_B = U_C = U_D$

PTM248

249. 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?



(1) No work is done by X
(2) X decreases in temperature
(3) X increases in internal energy
(4) X doubles in pressure

PTM249

SECOND LAW OF THE THERMODYNMAMICS, HEAT ENGINES AND REFRIGERATORS

250. According to the second law of thermodynamics:
(1) heat energy cannot be completely converted to work
(2) work cannot be completely converted to heat energy
(3) for all cyclic processes we have dQ/T < 0
(4) the reason all heat engine efficiencies are less than 100% is friction, which is unavoidable

PTM250

251. "Heat cannot flow by itself from a body at lower temperature to a body at higher temperature" is a statement or consequence of :
(1) second law of thermodynamics
(2) conservation of momentum
(3) conservation of mass
(4) first law of thermodynamics

PTM251

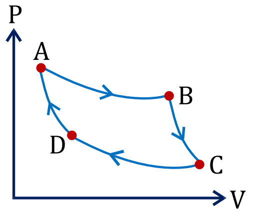
252. A Carnot engine takes 3×10^6 cal of heat from reservoir at 627°C and gives it to a sink at 27°C. Then work done by the engine is
(1) 4.2×10^6 J (2) 8.4×10^6 J
(3) 16.8×10^6 J (4) zero

PTM252

253. A reversible refrigerator operates between a low temperature reservoir at T_C and a high temperature reservoir at T_H. Its coefficient of performance is given by :
(1) $(T_H - T_C)/T_C$ (2) $T_C/(T_H - T_C)$
(3) $(T_H - T_C)/T_H$ (4) $T_H/(T_H - T_C)$

PTM253

254. In the given graph the isothermal curves are :-



(1) AB and CD (2) AB and AD
(3) AD and BC (4) BC and CD

PTM254

255. In the above question, the curve for which the heat is absorbed from the surroundings is :–
(1) AB (2) BC (3) CD (4) DA

PTM255

256. A Carnot engine shows efficiency of 40% on taking energy at 500 K. To increase the efficiency to 50%, at what temperature it should take energy?
(1) 400 K (2) 700 K
(3) 600 K (4) 800 K

PTM256

257. If the system takes 100 cal. heat, and releases 80 cal to sink, if source temperature is 127°C find the sink temperature :–
(1) 47° C (2) 127° C
(3) 67° C (4) 107° C

PTM257

258. A Carnot engine working between 300 K and 600 K has work output of 800 J per cycle. The amount of heat energy supplied to the engine from source per cycle will be :
(1) 800 J (2) 1600 J
(3) 1200 J (4) 900 J

PTM258

259. An ideal gas heat engine operates in Carnot cycle between 227°C and 127°C. It absorbs 6×10^4 cal of heat at higher temperature. Then amount of heat converted to work is :
(1) 2.4×10^4 cal (2) 6×10^4 cal
(3) 1.2×10^4 cal (4) 4.8×10^4 cal

PTM259

260. A refrigerator works between temperature –10°C & 27°C, the coefficient of performance is :
(1) 7.1 (2) 1
(3) 8.1 (4) 15.47

PTM260

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	1	1	2	4	3	3	1	2	2	1	4	1	3	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	1	1	4	2	4	1	1	3	3	4	3	1	4	4
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	1	3	2	2	3	1	1	2	4	4	2	1	3	2
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	2	2	4	2	3	1	1	2	2	4	3	3	1	3	3
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	3	1	3	1	3	4	1	2	2	3	2	4	3	3	3
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	3	4	2	2	4	4	2	1	1	1	2	3	3	1	3
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	2	2	3	1	4	1	3	4	4	3	2	4	3	1	1
Question	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Answer	2	3	3	2	1	2	2	4	1	4	4	4	4	3	1
Question	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Answer	3	2	3	3	2	3	2	4	4	3	4	3	4	3	4
Question	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Answer	4	2	1	3	3	2	2	1	1	3	2	2	2	1	1
Question	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Answer	1	4	3	1	4	1	4	2	4	3	4	1	2	4	4
Question	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Answer	1	4	3	2	4	4	3	4	2	1	3	1	3	4	3
Question	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
Answer	3	3	4	3	4	3	3	4	3	1	1	3	3	3	2
Question	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
Answer	1	3	3	4	1	3	1	2	4	4	2	2	1	4	3
Question	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
Answer	1	1	4	2	2	3	2	4	1	2	2	3	3	2	4
Question	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
Answer	4	4	2	1	2	1	1	2	3	2	1	3	4	1	2
Question	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
Answer	3	2	2	3	3	2	4	4	1	1	1	2	2	1	1
Question	256	257	258	259	260										
Answer	3	1	2	3	1										

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. Steam at 100°C is passed into 20 g of water at 10°C. When water acquires a temperature of 80°C, the mass of water present will be :
[Take specific heat of water = 1 cal g^{-1} °C^{-1} and latent heat of steam = 540 cal g^{-1}]

(1) 24 g (2) 31.5 g
(3) 42.5 g (4) 22.5 g

PTM293

2. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is:-

(1) 45°C (2) 20°C
(3) 42°C (4) 10°C

PTM294

3. The mean free path of molecules of a gas, (radius 'r') is inversely proportional to :-

(1) r^3 (2) r^2 (3) r (4) $\sqrt{r}$

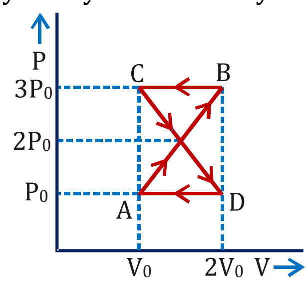
PTM295

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

(1) 64P (2) 32P (3) $\frac{P}{64}$ (4) 16P

PTM296

5. A thermodynamic system undergoes cyclic process ABCDA as shown in fig. The work done by the system in the cycle is :-

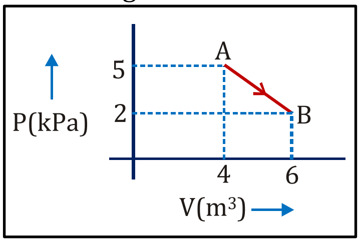


(1) P_0V_0 (2) $2P_0V_0$ (3) $\frac{P_0V_0}{2}$ (4) Zero

PTM297

AIPMT 2015

6. 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 :

(1) –20 kJ (2) 20 J
(3) –12 kJ (4) 20 kJ

PTM298

7. On observing light from three different stars P, Q and R, it was found that intensity of violet color is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. If T_P, T_Q and T_R are the respective absolute temperatures of P, Q and R, then it can be concluded from the above observation that :

(1) $T_P > T_R > T_Q$ (2) $T_P < T_R < T_Q$
(3) $T_P < T_Q < T_R$ (4) $T_P > T_Q > T_R$

PTM299

8. 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 :-

(1) 99 J (2) 90 J (3) 1 J (4) 100 J

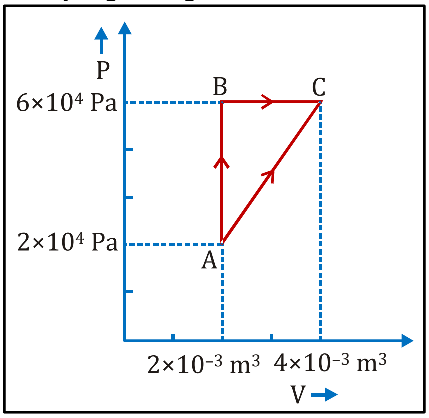
PTM300

9. The ratio of the specific heats $\frac{C_P}{C_V} = \gamma$ in terms of degrees of freedom (n) is given by :

(1) $\left(1+\frac{n}{3}\right)$ (2) $\left(1+\frac{2}{n}\right)$
(3) $\left(1+\frac{n}{2}\right)$ (4) $\left(1+\frac{1}{n}\right)$

PTM301

10. 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 :

(1) 500 J (2) 460 J (3) 300 J (4) 380 J

PTM302

11. The two ends of a metal rod are maintained at temperatures 100°C and 110°C. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures 200°C and 210°C, the rate of heat flow will be :

(1) 16.8 J/s (2) 8.0 J/s
(3) 4.0 J/s (4) 44.0 J/s

PTM303

Re-AIPMT 2015

12. Two vessels separately contain two ideal gases A and B at the same temperature, the pressure of A being twice that of B. Under such conditions, the density of A is found to be 1.5 times the density of B. The ratio of molecular weight of A and B is:

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

PTM304

13. 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 JK^{-1} mol^{-1}. If the speed of sound in this gas at NTP is 952 ms^{-1}, then the heat capacity at constant pressure is

(Take gas constant R = 8.3 JK^{-1} mol^{-1})

(1) 8.5 JK^{-1} mol^{-1} (2) 8.0 JK^{-1} mol^{-1}
(3) 7.5 JK^{-1} mol^{-1} (4) 7.0 JK^{-1} mol^{-1}

PTM305

14. The coefficient of performance of a refrigerator is 5. If the temperature inside freezer is –20°C, the temperature of the surroundings to which it rejects heat is :

(1) 21°C (2) 31°C (3) 41°C (4) 11°C

PTM306

15. 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?

(1) Isothermal (2) Adiabatic
(3) Isobaric (4) Isochoric

PTM307

16. The value of coefficient of volume expansion of glycerine is 5×10^{-4} K^{-1}. The fractional change in the density of glycerine for a rise of 40°C in its temperature, is :-

(1) 0.010 (2) 0.015
(3) 0.020 (4) 0.025

PTM308

NEET-I 2016

17. A refrigerator works between 4°C and 30°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:

(Take 1 cal = 4.2 Joules)

(1) 2.365 W (2) 23.65 W
(3) 236.5 W (4) 2365 W

PTM309

18. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, b = 2.88×10^6 nm K. Which of the following is correct?

(1) $U_1 = 0$ (2) $U_3 = 0$
(3) $U_1 > U_2$ (4) $U_2 > U_1$

PTM310

19. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are ℓ_1 and ℓ_2 respectively. If $(\ell_2 - \ell_1)$ is maintained same at all temperatures, which one of the following relations holds good?

(1) $\alpha_1\ell_2 = \alpha_2\ell_1$ (2) $\alpha_1\ell_2^2 = \alpha_2\ell_1^2$
(3) $\alpha_1^2\ell_2 = \alpha_2^2\ell_1$ (4) $\alpha_1\ell_1 = \alpha_2\ell_2$

PTM311

20. The molecules of a given mass of a gas have r.m.s. velocity of 200 m/s at 27°C and 1.0×10^5 N/m^2 pressure. When the temperature and pressure of the gas are respectively, 127°C and 0.05×10^5 N/m^2, the r.m.s. velocity of its molecules in m/s is :

(1) $100\sqrt{2}$ (2) $\frac{400}{\sqrt{3}}$ (3) $\frac{100\sqrt{2}}{3}$ (4) $\frac{100}{3}$

PTM312

21. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then: -

(1) Compressing the gas isothermally will require more work to be done.

(2) Compressing the gas through adiabatic process will require more work to be done.

(3) Compressing the gas isothermally or adiabatically will require the same amount of work.

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

PTM313

22. A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is :

[Latent heat of ice is 3.4×10^5 J/kg and g = 10 N/kg]

(1) 34 km (2) 544 km

(3) 136 km (4) 68 km

PTM314

NEET-II 2016

23. 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 :-

(1) less than 50 °C but greater than 0 °C

(2) 0 °C

(3) 50 °C

(4) more than 50 °C

PTM315

24. A body cools from a temperature 3T to 2T in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be: -

(1) $\frac{4}{3}$T (2) T (3) $\frac{7}{4}$T (4) $\frac{3}{2}$T

PTM316

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

(1) 2 R (2) R (3) $\frac{3}{2}$R (4) $\frac{5}{2}$R

PTM317

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

(1) $\frac{t_2+273}{t_1-t_2}$ (2) $\frac{t_1+t_2}{t_1+273}$

(3) $\frac{t_1}{t_1-t_2}$ (4) $\frac{t_1+273}{t_1-t_2}$

PTM318

27. A given sample of an ideal gas occupies a volume V at a pressure P and absolute temperature T. The mass of each molecule of the gas is m. Which of the following gives the density of the gas?

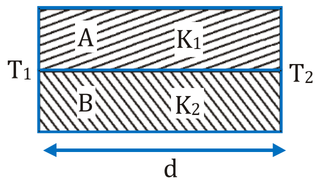
(1) P/(kTV) (2) mkT

(3) P/(kT) (4) Pm/(kT)

PTM319

NEET(UG)-2017

28. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite rod will be: -

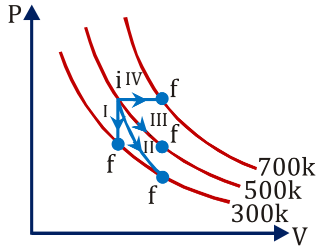


(1) $\frac{3(K_1+K_2)}{2}$ (2) $K_1 + K_2$

(3) $2(K_1 + K_2)$ (4) $\frac{K_1+K_2}{2}$

PTM320

29. Thermodynamic processes are indicated in the following diagram: -



Match the following

	Column-1		**Column-2**
P.	Process I	a.	Adiabatic
Q.	Process II	b.	Isobaric
R.	Process III	c.	Isochoric
S.	Process IV	d.	Isothermal

(1) $P \to c, Q \to a, R \to d, S \to b$
(2) $P \to c, Q \to d, R \to b, S \to a$
(3) $P \to d, Q \to b, R \to a, S \to c$
(4) $P \to a, Q \to c, R \to d, S \to b$

PTM321

30. A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be: -
(1) 450 (2) 1000 (3) 1800 (4) 225

PTM322

31. A carnot engine having an efficiency of $\frac{1}{10}$ 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 :-
(1) 90 J (2) 99 J (3) 100 J (4) 1 J

PTM323

32. A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is:-
(1) 15 RT (2) 9 RT (3) 11 RT (4) 4 RT

PTM324

NEET(UG)-2018

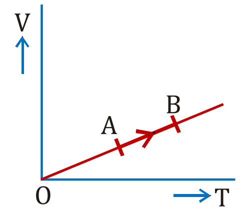
33. A sample of 0.1 g of water at 100°C and normal pressure (1.013×10^5 Nm^{-2}) requires 54 cal of heat energy to convert to steam at 100°C. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample, is :-
(1) 104.3 J (2) 208.7 J
(3) 42.2 J (4) 84.5 J

PTM325

34. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $\frac{3}{4}\lambda_0$, the power radiated by it becomes nP. The value of n is: -
(1) $\frac{3}{4}$ (2) $\frac{4}{3}$ (3) $\frac{256}{81}$ (4) $\frac{81}{256}$

PTM326

35. The volume (V) of a monatomic 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 :-



(1) $\frac{2}{5}$ (2) $\frac{2}{3}$ (3) $\frac{1}{3}$ (4) $\frac{2}{7}$

PTM327

36. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is :-
(1) 26.8% (2) 20%
(3) 6.25% (4) 12.5%

PTM328

37. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere?
(Given: Mass of oxygen molecule (m) = 2.76×10^{-26} kg Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ J K^{-1}) :-
(1) 2.508×10^4 K (2) 8.360×10^4 K
(3) 5.016×10^4 K (4) 1.254×10^4 K

PTM329

NEET(UG) 2019

38. In which of the following processes, heat is neither absorbed nor released by a system?
(1) isothermal (2) adiabatic
(3) isobaric (4) isochoric

PTM330

39. Increase in temperature of a gas filled in a container would lead to :
(1) increase in its mass
(2) increase in its kinetic energy
(3) decrease in its pressure
(4) decrease in intermolecular distance

PTM331

40. A copper rod of 88 cm and an aluminum rod of unknown length have their increase in length independent of increase in temperature. The length of aluminum rod is :
($\alpha_{Cu} = 1.7 \times 10^{-5}\ K^{-1}$ and $\alpha_{Al} = 2.2 \times 10^{-5}\ K^{-1}$)
(1) 6.8 cm (2) 113.9 cm
(3) 88 cm (4) 68 cm

PTM332

41. The unit of thermal conductivity is :
(1) $J\ m\ K^{-1}$ (2) $J\ m^{-1}\ K^{-1}$
(3) $W\ m\ K^{-1}$ (4) $W\ m^{-1}\ K^{-1}$

PTM333

NEET(UG) 2019 (Odisha)

42. An object kept in a large room having air temperature of 25°C takes 12 minutes to cool from 80°C to 70°C.
The time taken to cool for the same object from 70°C to 60°C would be nearly: -
(1) 10 min (2) 12 min
(3) 20 min (4) 15 min

PTM334

43. A deep rectangular pond of surface area A, containing water (density = ρ, specific heat capacity = s), is located in a region where the outside air temperature is at a steady value of –26°C. The thickness of the frozen ice layer in this pond, at a certain instant is x.
Taking the thermal conductivity of ice as K, and its specific latent heat of fusion as L, the rate of increase of the thickness of ice layer, at this instant would be given by :-
(1) $26K/\rho r(L-4s)$ (2) $26K/(\rho x^2-L)$
(3) $26K/(\rho xL)$ (4) $26K/\rho r(L+4s)$

PTM335

44. The value of $\gamma\left(=\frac{C_p}{C_v}\right)$, for hydrogen, helium and another ideal diatomic gas X (whose molecules are not rigid but have an additional vibrational mode), are respectively equal to: -
(1) $\frac{7}{5},\frac{5}{3},\frac{9}{7}$ (2) $\frac{5}{3},\frac{7}{5},\frac{9}{7}$
(3) $\frac{5}{3},\frac{7}{5},\frac{7}{5}$ (4) $\frac{7}{5},\frac{5}{3},\frac{7}{5}$

PTM336

45. 1g of water, of volume 1 cm^3 at 100°C, is converted into steam at same temperature under normal atmospheric pressure ($\simeq 1\times10^5$Pa). The volume of steam formed equals 1671 cm^3. If the specific latent heat of vaporisation of water is 2256 J/g, then the change in internal energy is,
(1) 2423 J (2) 2089 J
(3) 167 J (4) 2256 J

PTM337

NEET(UG) 2020

46. The average thermal energy for a mono-atomic gas is : (k_B is Boltzmann constant and T, absolute temperature)
(1) $\frac{7}{2}k_BT$ (2) $\frac{1}{2}k_BT$
(3) $\frac{3}{2}k_BT$ (4) $\frac{5}{2}k_BT$

PTM338

47. The mean free path for a gas, with molecular diameter d and number density n can be expressed as :
(1) $\frac{1}{\sqrt{2}\,n^2\pi^2d^2}$ (2) $\frac{1}{\sqrt{2}\,n\pi d}$
(3) $\frac{1}{\sqrt{2}\,n\pi d^2}$ (4) $\frac{1}{\sqrt{2}\,n^2\pi d^2}$

PTM339

48. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5\ r_2$) through 1 K are in the ratio:
(1) $\frac{5}{3}$ (2) $\frac{27}{8}$ (3) $\frac{9}{4}$ (4) $\frac{3}{2}$

PTM340

49. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C.
Its density is : (R = 8.3 J $mol^{-1}\ K^{-1}$)
(1) 0.02 kg/m^3 (2) 0.5 kg/m^3
(3) 0.2 kg/m^3 (4) 0.1 kg/m^3

PTM341

50. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is: -
(1) isobaric (2) isothermal
(3) adiabatic (4) isochoric

PTM342

NEET(UG) 2020 (COVID-19)

51. The efficiency of a Carnot engine depends upon
(1) the temperature of the sink only
(2) the temperatures of the source and sink
(3) the volume of the cylinder of the engine
(4) the temperature of the source only

PTM343

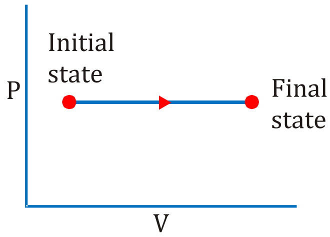
52. The mean free path ℓ for a gas molecule depends upon diameter, d of the molecule as :
(1) $\ell \propto \frac{1}{d^2}$ (2) $\ell \propto d$
(3) $\ell \propto d^2$ (4) $\ell \propto \frac{1}{d}$

PTM344

53. An ideal gas equation can be written as $P = \frac{\rho RT}{M_0}$ where ρ and M_0 are respectively,
(1) mass density, mass of the gas
(2) number density, molar mass
(3) mass density, molar mass
(4) number density, mass of the gas

PTM345

54. The P-V diagram for an ideal gas in a piston cylinder assembly undergoing a thermodynamic process is shown in the figure. The process is



(1) adiabatic (2) isochoric
(3) isobaric (4) isothermal

PTM346

55. Three stars A, B, C have surface temperatures T_A, T_B, T_C respectively. Star A appears bluish, star B appears reddish and star C yellowish. Hence,
(1) $T_A > T_B > T_C$ (2) $T_B > T_C > T_A$
(3) $T_C > T_B > T_A$ (4) $T_A > T_C > T_B$

PTM347

NEET(UG) 2021

56. A cup of coffee cools from 90°C to 80°C in t minutes, when the room temperature is 20°C. The time taken by a similar cup of coffee to cool from 80°C to 60°C at a room temperature same at 20°C is: -
(1) $\frac{13}{10}t$ (2) $\frac{13}{5}t$ (3) $\frac{10}{13}t$ (4) $\frac{5}{13}t$

PTM348

57. Match **Column-I** and **Column-II** and choose the **correct** match from the given choices.

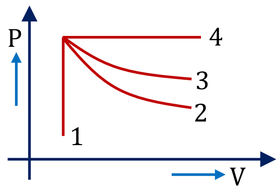
	Column-I		Column-I
(A)	Root mean square speed of gas molecules	(P)	$\frac{1}{3}nm\bar{v}^2$
(B)	Pressure exerted by ideal gas	(Q)	$\sqrt{\frac{3RT}{M}}$
(C)	Average kinetic energy of a molecule	(R)	$\frac{5}{2}RT$
(D)	Total internal energy of 1 mole of a diatomic gas	(S)	$\frac{3}{2}k_BT$

(1) (A) - (R), (B) - (P), (C) - (S), (D) - (Q)
(2) (A) - (Q), (B) - (R), (C) - (S), (D) - (P)
(3) (A) - (Q), (B) - (P), (C) - (S), (D) - (R)
(4) (A) - (R), (B) - (Q), (C) - (P), (D) - (S)

PTM349

NEET(UG) 2022

58. An ideal gas undergoes four different processes from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1,2,3 and 4 is: -



(1) 2 (2) 3 (3) 4 (4) 1

PTM350

59. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is: -
(1) 36×10^4 J (2) 36×10^5 J
(3) 1×10^5 J (4) 36×10^7 J

PTM351

60. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is: -

(1) 5.6×10^{3} m^3 (2) 5.6×10^{-3} m^3
(3) 5.6 m^3 (4) 5.6×10^{6} m^3

PTM352

RE-NEET(UG) 2022

61. An ideal gas follows a process described by the equation $PV^2 = C$ from the initial (P_1, V_1, T_1) to final (P_2, V_2, T_2) thermodynamics states, where C is a constant. Then: -

(1) If $P_1 > P_2$ then $T_1 < T_2$
(2) If $V_2 > V_1$ then $T_2 > T_1$
(3) If $V_2 > V_1$ then $T_2 < T_1$
(4) If $P_1 > P_2$ then $V_1 > V_2$

PTM353

62. Two rods one made of copper and other made of steel of the same length and same cross-sectional area are joined together. The thermal conductivity of copper and steel are 385Js^{-1}K^{-1} m^{-1} and 50 Js^{-1}K^{-1}m^{-1} respectively. The free ends of copper and steel are held at 100°C and 0°C respectively. The temperature at the junction is, nearly:

(1) 12°C (2) 50°C
(3) 73°C (4) 88.5°C

PTM354

NEET(UG) 2023

63. The temperature of a gas is –50°C. To what temperature the gas should be heated so that the rms speed is increased by 3 times?

(1) 3295°C (2) 3097 K
(3) 223 K (4) 669°C

PTM382

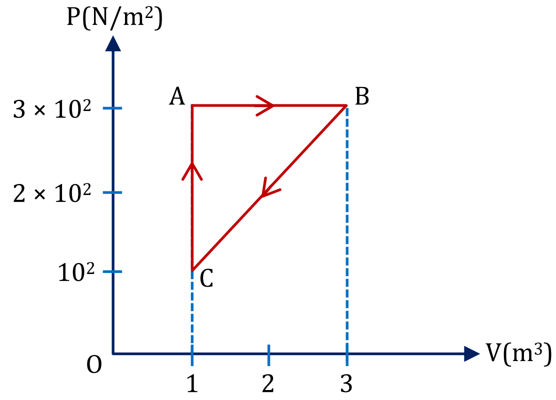
64. A Carnot engine has an efficiency of 50% when its source is at a temperature 327° C. The temperature of the sink is :-

(1) 15°C (2) 100°C
(3) 200°C (4) 27°C

PTM383

RE-NEET(UG) 2023

65. For the given cycle, the work done during isobaric process is :



(1) 200 J (2) Zero
(3) 400 J (4) 600 J

PTM384

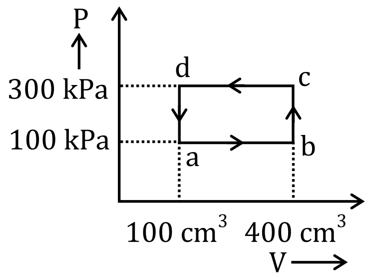
66. A container of volume 200 cm^3 contains 0.2 mole of hydrogen gas and 0.3 mole of argon gas. The pressure of the system at temperature 200 K (R = 8.3 JK^{-1} mol^{-1}) will be:-

(1) 6.15×10^5 Pa (2) 6.15×10^4 Pa
(3) 4.15×10^5 Pa (4) 4.15×10^6 Pa

PTM385

NEET(UG) 2024

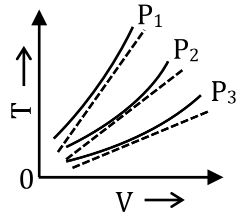
67. A thermodynamic system is taken through the cycle abcda. The work done by the gas along the path bc is :



(1) zero (2) 30 J
(3) –90 J (4) –60 J

PTM386

68. The following graph represents the T-V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1, P_2 and P_3 compared with those of Charles's law represented as dotted lines.



Then the correct relation is :

(1) $P_3 > P_2 > P_1$ (2) $P_1 > P_3 > P_2$

(3) $P_2 > P_1 > P_3$ (4) $P_1 > P_2 > P_3$

PTM387

RE-NEET(UG) 2024

69. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : Houses made of concrete roofs overlaid with foam keep the room hotter during summer.

Reason R : The layer of foam insulation prohibits heat transfer, as it contains air pockets.

In the light of the above statements, choose the **correct** answer from the options given below:

(1) **A** is true but **R** is false.

(2) **A** is false but **R** is true.

(3) Both **A** and **R** are true and **R** is the correct explanation of **A**.

(4) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**.

PTM388

70. Water is used as a coolant in a nuclear reactor because of its :

(1) high thermal expansion coefficient

(2) high specific heat capacity

(3) low density

(4) low boiling point

PTM389

71. The equilibrium state of a thermodynamic system is described by :

A. Pressure B. Total heat

C. Temperature D. Volume

E. Work done

Choose **the most appropriate** answer from the options given below :

(1) A, B and E only (2) B, C and D only

(3) A, B and C only (4) A, C and D only

PTM390

72. According to the law of equipartition of energy, the number of vibrational modes of a polyatomic gas of constant $\gamma = \frac{C_p}{C_v}$ is (where C_p and C_v are the specific heat capacities of the gas at constant pressure and constant volume, respectively) :

(1) $\frac{4+3\gamma}{\gamma-1}$ (2) $\frac{3+4\gamma}{\gamma-1}$

(3) $\frac{4-3\gamma}{\gamma-1}$ (4) $\frac{3-4\gamma}{\gamma-1}$

PTM391

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	1	2	3	4	1	1	2	2	2	3	3	2	2	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	3	4	4	2	2	3	4	4	2	4	4	4	1	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	1	3	2	3	1	1	2	2	2	4	4	4	3	1	2
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	3	2	3	3	2	1	3	3	4	2	3	1	4	3
Question	61	62	63	64	65	66	67	68	69	70	71	72			
Answer	3	4	1	4	4	4	1	4	2	2	4	3			

Exercise - III (Analytical Questions) Master Your Understanding

THERMAL EXPANSION

1. Match the column with scale of temperature and its range -

	Column-1		**Column-2**
(A)	Celsius scale	(P)	32° to 212°
(B)	Fahrenheit scale	(Q)	x° to y°
(C)	Kelvin scale	(R)	0° to 100°
(D)	Unknown scale	(S)	273.15 to 373.15

(1) A → P, B→ Q, C→ R, D→ S
(2) A → R, B→ P, C→ S, D→ Q
(3) A → R, B→ S, C→ P, D→ Q
(4) A → R, B→ Q, C→ S, D→ P

PTM355

2. Choose the correct statement: -
(a) When a bimetallic strip is heated it bends in the form of an arc.
(b) It is used in thermostat
(c) In bimetallic strip the material having lower temperature expansion co-efficient always goes on outer side.
(d) A bimetallic strip on heating bends in the form of helix

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

PTM356

3. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : A brass disc is just fitted in a hole in steel plate. The system must be cooled to loosen the disc from the hole.

Reason (R) : The coefficient of linear expansion for brass is greater than the coefficient of linear expansion for steel.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).
(2) Both (A) and (R) are true and (R) is NOT the correct explanation of (A).
(3) (A) is true but (R) is false.
(4) (A) is false but (R) is true.

PTM357

CALORIMETRY

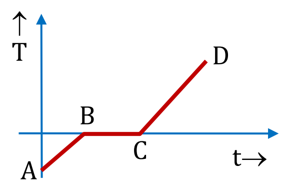
4. If heat is supplied to a solid, its temperature:-
(A) must increase
(B) may increase
(C) may remain constant
(D) may decrease
Choice the correct statement: -
(1) A (2) B,D (3) B,C,D (4) B,C

PTM358

5. A good cooking utensil should have: -
(A) low specific heat
(B) high specific heat
(C) low thermal capacity
(D) high coefficient of thermal conductivity
Which statement are correct: -
(1) A,C,D (2) B,C,D (3) A,B,D (4) B,C

PTM359

6. Heat is supplied to a ice at a constant rate temperature variation with time is as shown in figure, then –



(A) During AB volume of substance increases
(B) During BC volume of substance decreases
(C) Specific heat of substance in liquid phase is proportional to reciprocal of slope of portion AB of graph
(D) Latent heat of fusion of substance is independent of portion AB of graph.
Then correct option is -
(1) A,C (2) B,C (3) A,C,D (4) B,D

PTM360

7. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : In change of state from solid to liquid the temperature decrease until the entire amount of the solid substance melts.

Reason (R) : The phenomenon of refreezing is called melting.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) Both **(A)** and **(R)** are false.

PTM361

8. Match the column :-

	Column-1		Column-2
(A)	Heat	(P)	Degree of hotness or coolness of a substance
(B)	Internal energy	(Q)	Amount of heat required to rise the temperature of unit mass of a substance by 1°C
(C)	Temperature	(R)	Energy in transit
(D)	Specific heat	(S)	The sum of energy due to attractive force between molecules and due to random motion

(1) $A \to R, B \to S, C \to P, D \to Q$

(2) $A \to R, B \to P, C \to S, D \to Q$

(3) $A \to R, B \to Q, C \to P, D \to S$

(4) $A \to R, B \to S, C \to Q, D \to P$

PTM362

HEAT TRANSFER

9. Assume transmittivity t = 0 for all the cases - Which of the following statement is correct -

(A) Bad absorber is bad emitter

(B) Bad absorber is good reflector

(C) Bad reflector is good emitter

(D) Bad emitter is good absorber

(1) A, B, C, D (2) A, C, D

(3) A, B, D (4) A, B, C

PTM363

10. Match the column in which column-1 gives the statement and column-2 its explanation by which law.

	Column-1		Column-2
(A)	When a person enters in an A.C. room then he feels cooler	(P)	Newtons law of cooling
(B)	Good absorber are good emitter of heat	(Q)	Wein's law
(C)	Colour of a star is an indication of temperature	(R)	Kirchhoff's law
(D)	A hot cup of tea when placed in a room is cooled in some time	(S)	Prevost theory of mutual heat exchange

(1) $A \to P, B \to Q, C \to R, D \to S$

(2) $A \to Q, B \to S, C \to P, D \to R$

(3) $A \to S, B \to R, C \to Q, D \to P$

(4) $A \to R, B \to P, C \to S, D \to Q$

PTM364

11. A spherical black body of radius r radiates power P and its rate of cooling is R then -

(a) $P \propto r$ (b) $P \propto r^2$

(c) $R \propto r^2$ (d) $R \propto \frac{1}{r}$

Choice the correct one :-

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

PTM365

12. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : For a given amount of an ideal gas, at constant temperature, the product of pressure and volume is constant.

Reason (R) : The root mean square velocity of the molecules is inversely proportional to molecular weight.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) Both **(A)** and **(R)** are false.

PTM366

13. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : For higher temperature, the peak emission wavelength of a black body shifts to lower wavelengths.

Reason (R) : Peak emission wavelength of a black body is proportional to the fourth power of temperature.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PTM367

KTG

14. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The rms speed of helium gas is equal to rms speed of hydrogen gas when absolute temperature of helium is twice that of hydrogen gas.

Reason (R) : RMS speed of gas depends only on the temperature of gas.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PTM368

15. In a mixture of nitrogen and helium kept at room temperature, as compared to a helium molecule nitrogen molecule strikes into the wall –

(a) with greater average speed

(b) with smaller average speed

(c) with greater average kinetic energy

(d) with smaller average kinetic energy

Choose the correct statements :-

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

PTM369

16. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : An ideal gas is enclosed within a container fitted with a piston. When volume of this enclosed gas is increased at constant temperature. The pressure exerted by gas on piston decreases.

Reason (R) : In the above situation, the rate of molecules per unit area striking on the piston decreases.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PTM370

17. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Evaporation has a cooling effect.

Reason (R) : At the surface of liquid, some of the faster upward moving molecules have enough kinetic energy to overcome the attraction from other molecules and escape from the liquid. With these faster molecules the average kinetic energy left behind is reduced.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PTM371

18. For a monoatomic gas at temperature T, match the following column –

	Column-1		Column-2
(A)	Speed of sound	(P)	$\sqrt{\frac{2RT}{M_w}}$
(B)	RMS speed of gas molecule	(Q)	$\sqrt{\frac{8}{\pi}\frac{RT}{M_w}}$
(C)	Average speed of gas molecule	(R)	$\sqrt{\frac{3RT}{M_w}}$
(D)	Most probable speed of gas molecule	(S)	$\sqrt{\frac{\gamma RT}{M_w}}$

(1) $A \to P, B \to Q, C \to R, D \to S$

(2) $A \to Q, B \to S, C \to P, D \to R$

(3) $A \to R, B \to P, C \to S, D \to Q$

(4) $A \to S, B \to R, C \to Q, D \to P$

PTM372

THERMODYNAMICS

19. Match the following column –

	Column-1		Column-2
(A)	Adiabatic bulk modulus	(P)	$-P/V$
(B)	Slope of PV curve in isothermal process	(Q)	$\frac{2}{\gamma-1}$
(C)	Degree of freedom	(R)	γP
(D)	Molar heat capacity at constant pressure divide by R	(S)	$\frac{\gamma}{\gamma-1}$

(1) $A \to R, B \to P, C \to Q, D \to S$

(2) $A \to P, B \to R, C \to S, D \to Q$

(3) $A \to Q, B \to S, C \to P, D \to R$

(4) $A \to S, B \to Q, C \to R, D \to P$

PTM373

20. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : In an adiabatic process, change in internal energy of a gas is equal to work done on the gas in the process.

Reason (R) : Temperature of gas remains constant in a adiabatic process.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

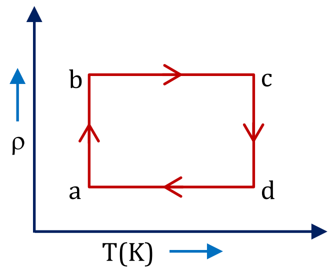
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PTM374

21. In the ρ – T graph (for fixed mass of an ideal gas), shown in the figure match the following ($\rho \to$ density, T $\to$ temperature)



	Column-1		Column-2
(A)	Process ab	(p)	isochoric process
(B)	Process bc	(q)	$\Delta U = 0$
(C)	Process cd	(r)	P increasing
(D)	Process da	(s)	P decreasing

(1) A → q,s, B → p,q, C → p,s, D → r,q
(2) A → q,r, B → p, C → q,s, D → p
(3) A → p,s, B → q,r, C → r,s, D → s,r
(4) A → p,q, B → q,r, C → r,s, D → s,p

PTM375

22. Match the column –

	Column-1		Column-2
(A)	$dU = nC_VdT$ is valid for	(P)	Adiabatic process
(B)	Temperature of the system can change in	(Q)	Isothermal process
(C)	$Q = dU + W$ is valid for	(R)	Polytopic process
(D)	The process in which heat exchange between the system and surrounding is zero.	(S)	Free expansion of ideal gas

(1) A→P,Q,R,S; B→P,R,S; C→P,Q,R,S; D→P,S
(2) A→P,Q,R,S; B→P,Q; C→P,Q,R,S; D→Q,R
(3) A→P,Q,R,S; B→P,S; C→P,Q,R,S; D→Q,R
(4) A→P,Q,R,S; B→Q,S; C→P,Q,R,S; D→Q,R

PTM376

23. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : For an ideal gas $C_P > C_V$.

Reason (R) : Work is done in expansion of the gas at constant pressure.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PTM377

24. The internal energy of a system remains constant when it undergoes –

(a) a cyclic process
(b) an isothermal process
(c) an adiabatic process
(d) any process in which heat released by the system is equal to the work done on the system.

Choose the correct statements :-

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

PTM378

25. The molar heat capacity for an ideal gas -

(a) is zero for adiabatic process.
(b) is infinite for an isothermal process
(c) depends on the nature of gas for a process in which either volume or pressure is constant
(d) is equal to the product of the molecular weight and gram specific heat capacity for any process.

Choose the correct statements :-

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

PTM379

26. Match the following column –

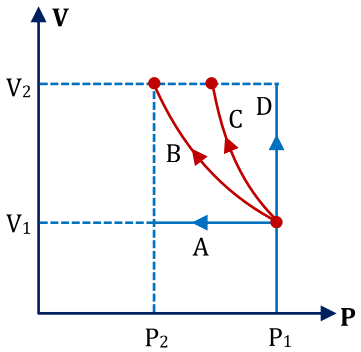
	Column-1		Column-2
(A)	Adiabatic expansion	(P)	No work done
(B)	isobaric expansion	(Q)	Constant internal energy
(C)	Isothermal expansion	(R)	Increase in internal energy
(D)	Isochoric process	(S)	Decrease in internal energy

(1) A → S, B → R, C → Q, D → P
(2) A → P, B → Q, C → R, D → S
(3) A → Q, B → P, C → S, D → R
(4) A → R, B → S, C → P, D → Q

PTM380

27. Volume versus pressure curves for one mole of an ideal gas are given for four processes as shown in figure.

(B $\rightarrow$ Adiabatic process, C $\rightarrow$ Isothermal process)



	Column-I		Column-II
(A)	For process A	(P)	Work done by the gas is positive.
(B)	For process B	(Q)	Temperature will increase.
(C)	For process C	(R)	Heat supplied is positive.
(D)	For process D	(S)	Change in internal energy is negative.

The correct option is :-

(1) (A) – S, (B) – PS, (C) – PQ, (D) – PQR

(2) (A) – PS, (B) – P, (C) – PR, (D) – PQQ

(3) (A) – PS, (B) – S, (C) – PR , (D) – PQ

(4) (A) – S, (B) – PS, (C) – PR, (D) – PQR

PTM381

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	1	4	1	4	4	1	4	3	3	2	3	3	4
Question	16	17	18	19	20	21	22	23	24	25	26	27			
Answer	1	1	4	1	3	2	1	1	4	3	1	4			