ALLEN CAREER INSTITUTE
KOTA (RAJASTHAN)
path to success

PRE-MEDICAL

PHYSICS

ENTHUSIAST | LEADER | ACHIEVER

EXERCISE

Thermal Physics

ENGLISH MEDIUM

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°

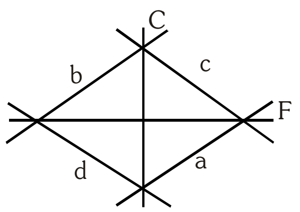
HT0001

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

HT0002

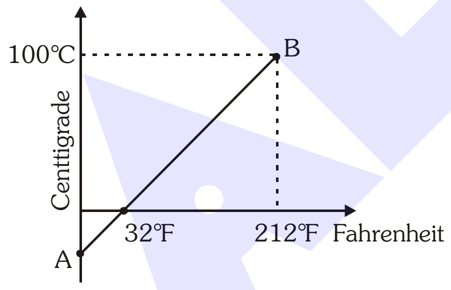
3. Which of the curves in figure represents the relation between Celsius and Fahrenheit temperature?



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

HT0003

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

HT0004

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

(1) –329℉ (2) –261℉
(3) –215℉ (4) –297℉

HT0005

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

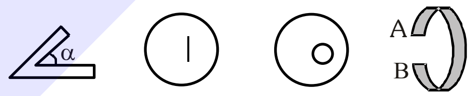
HT0006

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°

HT0007

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.

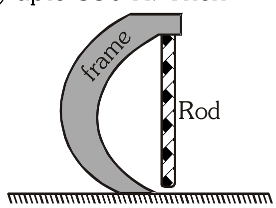


(i) The angle α in figure (1) will not change.
(ii) The length of line in figure (2) will decrease.
(iii) The radius of inner hole will decrease.
(iv) The distance AB will increase.

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

HT0008

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

HT0009

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

HT0011

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

HT0012

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

HT0014

13. An iron bar (Young's modulus = 10^{11} N/m^2, α = 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

HT0015

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

HT0016

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

HT0017

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

HT0018

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

HT0019

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

HT0020

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

HT0021

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

HT0022

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

HT0023

22. 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

HT0025

23. 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

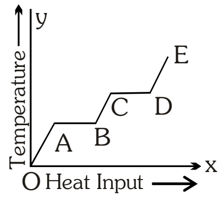
HT0026

24. 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

HT0027

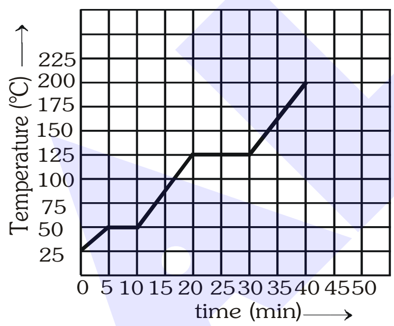
25. A solid material is supplied with heat at a constant rate. The temperature of material is changing with heat input as shown in the figure. What does slope DE represent.



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

HT0028

26. The graph shown in the figure represent change in the temperature of 5 kg of a substance as it abosrbs heat at a constant rate of 42 kJ min^{-1}. The latent heat of vapourazation 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}

HT0029

27. 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) $\frac{mL}{5g}$

HT0030

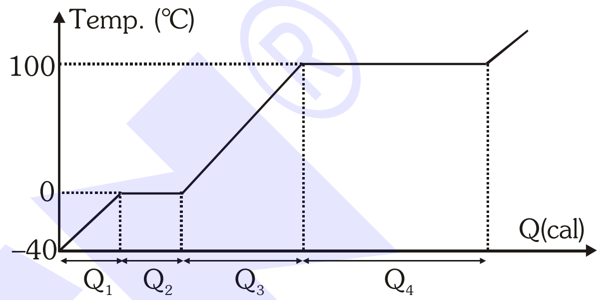
28. 10 g of ice at 0°C is kept in a calorimeter of water equivalent 10 g. How much heat should be supplied to the apparatus to evaporate the water thus formed? (Neglect loss of heat)

(1) 6200 cal (2) 7200 cal
(3) 13600 cal (4) 8200 cal

HT0031

29. 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

HT0032

30. 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

HT0033

31. 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

HT0034

32. 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

HT0036

CONDUCTION AND CONVECTION

33. 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

HT0038

34. 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) $Q_1 = 4Q_2$

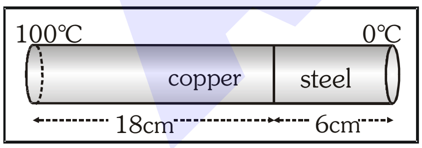
HT0039

35. 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

HT0040

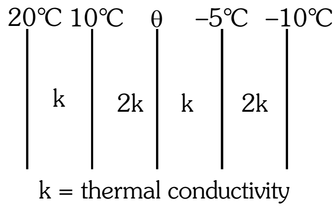
36. The coefficient of thermal conductivity of copper is nine times that of steel. In the composite cylindrical bar shown in the figure what will be the temperature at the junction of copper and steel ?



(1) 75°C (2) 67°C (3) 33°C (4) 25°C

HT0041

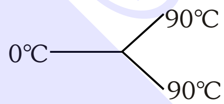
37. The figure shows the face and interface temperature of a composite slab containing of four layers of two materials having identical thickness. Under steady state condition, find the value of temperature θ.



(1) 5°C (2) 10°C (3) –15°C (4) 15°C

HT0043

38. 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

HT0044

39. 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

HT0046

40. 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

HT0047

41. Gravitational force is required for –

(1) Stirring of liquid (2) Convection

(3) Conduction (4) Radiation

HT0048

42. The layers of atmosphere are heated through -

(1) Convection

(2) Conduction

(3) Radiation

(4) 2 and 3 both

HT0049

43. 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

HT0050

44. 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) $\frac{K_1}{\ell_1^2} = \frac{K_2}{\ell_2^2}$

HT0051

45. 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

HT0052

46. Consider a compound slab consisting of two different materials in series 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

HT0053

47. 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

HT0054

48. The area of the glass of a window of a room is $10m^2$ 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

HT0055

49. If the coefficient of conductivity of aluminium is 0.5cal/cm-sec-°C, then in order to conduct 10cal/sec-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

HT0056

50. The dimensional formula for thermal resistance is

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

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

HT0057

51. 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

HT0058

52. 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

HT0059

53. 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

HT0060

54. The ratio of the diameters of two metallic rods of the same metarial 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

HT0061

55. 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

HT0063

56. 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) $\frac{K_1d_1T_1 + K_2d_2T_2}{K_1d_1 + K_2d_2}$

HT0064

57. 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 furance

HT0065

58. In natural convection, a heated portion of a liquid moves because :

(1) Its molecular motion becomes aligned
(2) Of moleuclar collisions within it
(3) Its density is less than that of the surrounding fluid
(4) Of currents of the surrounding fluid

HT0066

59. 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

HT0067

RADIATION

60. 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) $1.0\ \sigma AT^4$

HT0068

61. 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

HT0069

62. 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

HT0070

63. 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%

HT0072

64. The rectangular surface of area $8\text{cm} \times 4$ 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

HT0073

65. 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

HT0075

66. 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

HT0076

67. 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

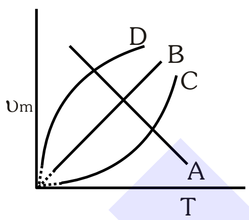
(3) Specific heat of liquids

(4) Latent heat of liquids

HT0077

68. 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

HT0078

69. 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

HT0079

70. The temperature of a furnace is 2324°C and the intensity is maximum in its radiation spectrum nearly at 12000 A^0. If the intensity in the spectrum of a star is maximum nearly at 4800 A^0, then the surface temperature of star is

(1) 8400°C (2) 7200°C

(3) 6219.5°C (4) 5900°C

HT0080

71. 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

HT0081

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

(1) Weight (2) Distance

(3) Temperature (4) Size

HT0082

73. If a carved black utensil having some part with white carving on it, 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

HT0083

74. 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.

HT0084

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

(1) 971 K (2) 1190 K

(3) 2001 K (4) 1458 K

HT0085

76. 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

HT0087

77. The ideal black body is :

(1) Hot coal at high temperature

(2) Surface of glass printed with coaltar

(3) Metal surface

(4) A hollow container painted with black colour

HT0088

78. 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

HT0090

79. 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

HT0091

80. 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

HT0092

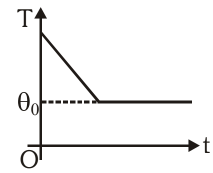
81. Star S_1 emits maximum radiation of wavelength 420 nm and the star S_2 emits maximum radiation of wavelength 560 nm, what is the ratio of the temperature of S_1 and S_2 :

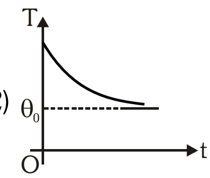
(1) 4/3 (2) $(4/3)^{1/4}$

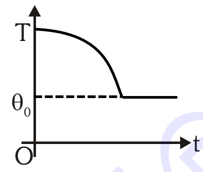
(3) 3/4 (4) $(3/4)^{1/2}$

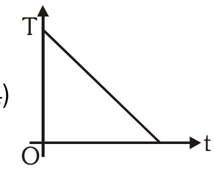
HT0093

82. 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) 

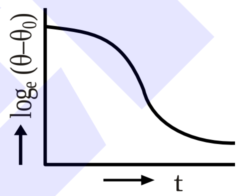
(2) 

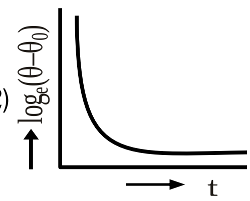
(3) 

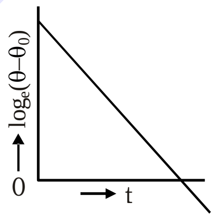
(4) 

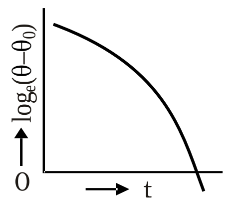
HT0094

83. 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) 

HT0095

84. 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) $T_1 > T_2 < T_3$

HT0096

85. 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

HT0097

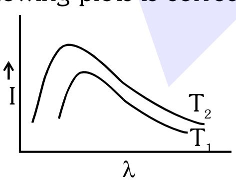
86. Four indentical calorimeters painted in different colours, are heated to same temperature and then allowed to cool in vacuum. Which will cool fastest ?
(1) One which is painted bright
(2) One which is painted thick white
(3) One which is painted thick black
(4) One which is painted bright white
HT0098

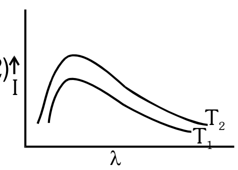
87. A body cools from 60°C to 50°C in 10 minutes. If the room temperature is 25°C and assuming Newotn's cooling law holds good, the temperature of the body at the end of next 10 minutes is :
(1) 45°C (2) 42.85°C (3) 40°C (4) 38.5°C
HT0099

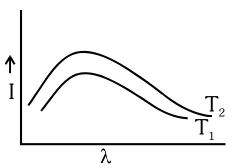
88. As compared to the person with white skin, the person with black skin will experience
(1) Less heat and more cold
(2) More heat and more cold
(3) More heat and less cold
(4) Less heat and less cold
HT0100

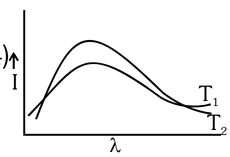
89. We consider the radiation emitted by the human body. Which of the following statements is true ?
(1) The radiation is emitted during the summers and absorbed during the winters
(2) The radiation emitted lies in the ultraviolet region and hence is not visible
(3) The radiation emitted is in the infra-red region
(4) The radiation is emitted only during the day
HT0101

90. 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)


HT0102

91. 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
HT0103

92. 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) $E \propto T^5$; $E_{\lambda max} \propto T^4$
HT0104

93. 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) $e_\lambda = E_\lambda / a_\lambda$
HT0105

94. 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.
HT0106

95. If λ_m denotes the wavelength at which the radiation emission from a black body at a temperature T K is maximum then :
(1) $\lambda_m \alpha T$ (2) $\lambda_m \alpha T^2$
(3) $\lambda_m \alpha T^{-1}$ (4) $\lambda_m \alpha T^{-2}$
HT0108

96. A body is in thermal equillbrium 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
HT0109

97. 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
HT0110

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

HT0111

99. 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.

HT0112

100. A solid cube and sphere are made of same substance and both have same surface area. If the temperature of both bodies 120^0 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

HT0113

101. 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

HT0114

102. 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

HT0115

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

HT0116

104. The temperature of a perfect black body is 727℃ 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

HT0117

105. 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

HT0118

106. In solar spectrum fraunhoffer'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.

HT0119

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

HT0121

KTG & GAS LAWS AND IDEAL GAS EQUATION

108. Find the approximate number of molecules contained in a vessel of volume 7 litres at 0℃ at 1.3×10^5 pascals
(1) 2.4×10^{23} (2) 3×10^{23}
(3) 6×10^{23} (4) 4.8×10^{23}

HT0122

109. 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

HT0123

110. 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) $P_aV_a = P_bV_b$

HT0125

111. 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

HT0126

112. 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

HT0128

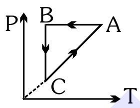
113. An ideal gas mixture filled inside a balloon expands according to the relation $PV^{2/3}$ = constant. The temperature inside the balloon is

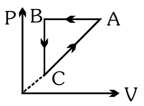
(1) increasing (2) decreasing

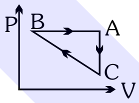
(3) constant (4) can't be said

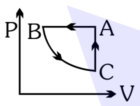
HT0129

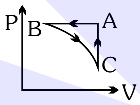
114. A cyclic process ABCA is shown in P–T diagram. When presented on P–V, it would



(1) 

(2) 

(3) 

(4) 

HT0132

115. During an experiment an ideal gas obeys an addition 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

HT0135

116. 250 litre of an ideal gas is heated at constant pressure from 27^0C such that its volume becomes 500 liters. The final temperature is :

(1) 54^0C (2) 300^0C (3) 327^0C (4) 600^0C

HT0136

117. A balloon contains 500 m^3 of helium at 27^0C and 1 atmosphere pressure. The volume of the helium at -3^0C temperature and 0.5 atmosphere pressure will be-

(1) 500 m^3 (2) 700 m^3

(3) 900 m^3 (4) 1000 m^3

HT0137

118. 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

HT0138

119. 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

HT0139

120. 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 .5 m (3) 2 . 0 m (4) 3/4 m

HT0140

121. 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

HT0141

122. 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) $\frac{1}{2}$

HT0142

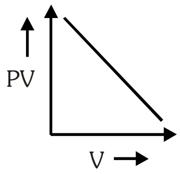
123. On increasing the temperature of a gas filled in a closed container by 1^0C its pressure increases by 0.4%, then initial temperature of the gas is-

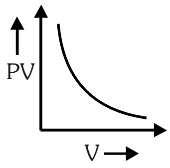
(1) 25^0C (2) 250^0C

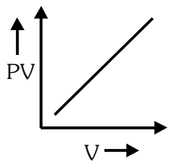
(3) 250 K (4) 2500^0C

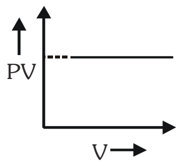
HT0143

124. 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) 

HT0144

125. 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 :

(Boltzmaan's constant $k = 1.38 \times 10^{-23}$ JK^{-1})

(1) 6.23×10^{26}

(2) 0.33×10^{28}

(3) 3.3×10^{21}

(4) None of these

HT0145

126. 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

HT0146

127. 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

HT0147

128. 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

HT0148

129. 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

HT0149

130. 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

HT0150

131. 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

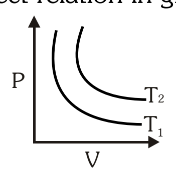
HT0151

132. 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.

HT0152

133. 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) $T_1 \lessgtr T_2$

HT0154

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

134. 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) $\sqrt{RT / 3M_w}$

HT0157

135. 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

HT0158

136. 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}

HT0159

137. 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) $\langle C_H \rangle = \frac{\langle C_{He} \rangle}{2}$

HT0160

138. 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

HT0161

139. 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

HT0162

140. 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

HT0163

141. 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) 273^0C (2) 273 K (3) 546^0C (4) 844 K

HT0165

142. 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

HT0166

143. 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 negiligible

(4) None of the above

HT0167

144. The speeds of 5 molecules of a gas (in arbitary units) are as follows 2,3,4,5,6. The root mean square speed for these moecules is -

(1) 2.91 (2) 3.52 (3) 4.00 (4) 4.24

HT0168

145. 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

HT0169

146. At 0^0C 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

HT0170

147. 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 atomsphere

(3) 2.0 atmosphere (4) 3.0 atomsphere

HT0171

148. 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
HT0172

149. 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) $\frac{1}{\sqrt{m}}$
HT0173

150. 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) $v_{mp} > v_{rms} > v_{av}$
HT0174

151. 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
HT0175

152. 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) $4P_0$
HT0176

153. 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
HT0177

154. 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
HT0179

155. According to Maxwell's law of distribution of velocites 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
HT0180

156. 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
HT0181

157. 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
HT0182

158. 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
HT0183

159. The average kinetic energy of a gas molecule at 27^0C is 6.21×10^{-21} J. Its average kinetic energy at 227^0C 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
HT0184

160. 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) $P_A = \left(\frac{m_A}{m_B}\right) P_B$
HT0185

161. 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

HT0186

(162–163) ***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***

162. The equivalent molar mass of the mixture is

(1) 6g (2) $\frac{13g}{7}$ (3) $\frac{18g}{7}$ (4) $\frac{24g}{7}$

HT0187

163. The equivalent value of γ in the above question is

(1) 1.59 (2) 1.53 (3) 1.56 (4) none

HT0188

164. 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) $\frac{n_1T_1 + n_2T_2}{n_1 + n_2}$

HT0189

165. The total kinetic energy of 1 mole of N_2 at 27^0C will be approximately :-

(1) 1500 J (2) 1500 calorie

(3) 1500 kilo calorie (4) 1500 erg.

HT0190

166. 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

HT0191

167. Relation between the ratio of specific heats (γ) of gas and degree of freedom 'f' will be

(1) γ = f + 2 (2) $\frac{1}{\gamma} = \frac{1}{f} + \frac{1}{2}$

(3) f = 2 / (γ–1) (4) f = 2(γ–1)

HT0192

168. 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

HT0193

169. 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

HT0194

170. 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

HT0195

171. 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

HT0196

172. 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

HT0197

173. At which of the following temperature any gas has average moleculer kinetic energy double that of at 20^0C

(1) 40^0C (2) 80^0C (3) 313^0C (4) 586^0C

HT0198

174. When temperature is increased from 0℃ to 273℃, what will be the ratio of final to initial the average kinetic energy of molecules ?

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

HT0199

175. 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) 3 kT/2

HT0200

176. 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.

HT0202

177. 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.

HT0203

178. 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

HT0204

179. 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

HT0205

180. 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

HT0206

181. 22 g of CO_2 at 27^0C is mixed with 16 g of O_2 at 37^0C. 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) 31.16^0C (2) 27^0C (3) 37^0C (4) 30^0C

HT0207

182. 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

HT0209

183. 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) $\frac{5}{2}kT$

HT0210

184. A diatomic molecule has
(1) 1 degree of freedom (2) 3 degree of freedom
(3) 5 degree of freedom (4) 6 degree of freedom

HT0211

185. 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

HT0212

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

186. 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

HT0213

187. 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

HT0214

188. 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

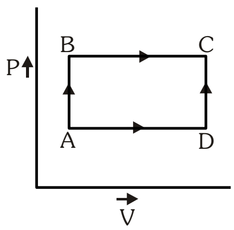
HT0215

189. 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

HT0220

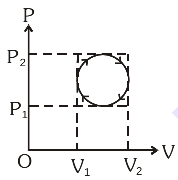
190. As shown in the figure the amount of heat absorbed along the path ABC is 90J and the amount of work done by the system is 30 J. If the amount of work done along the path ADC is 20 J then amount of heat absorbed will be :-



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

HT0221

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

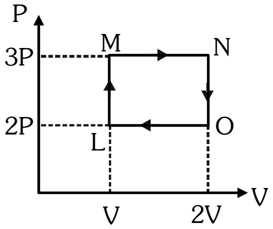


(1) $\pi\left(\frac{P_2 - P_1}{2}\right)^2$ (2) $\pi\left(\frac{V_2 - V_1}{2}\right)^2$

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

HT0222

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



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

HT0223

193. 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

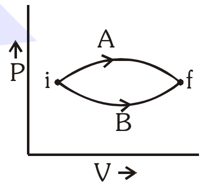
HT0224

194. 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

HT0225

195. 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) $Q_A > Q_B$; $\Delta U_A = \Delta U_B$

HT0226

196. 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

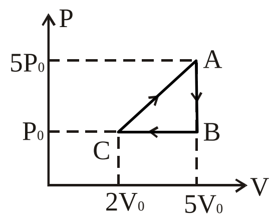
HT0227

197. 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.

HT0228

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

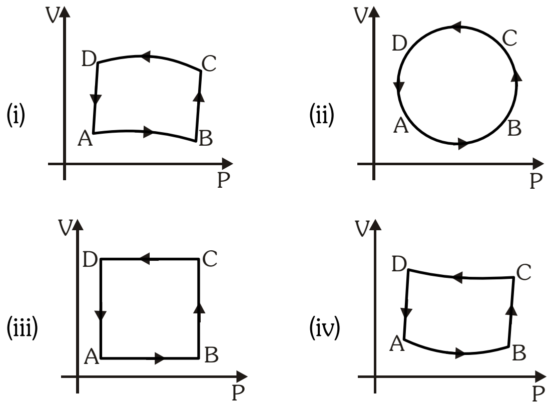


(1) $6P_0V_0$ (2) $4P_0V_0$ (3) P_0V_0 (4) zero

HT0229

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

199. 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

HT0231

200. The temperature of 5 moles of a gas which was held at constant volume was changed from 100^0C to 120^0C. 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

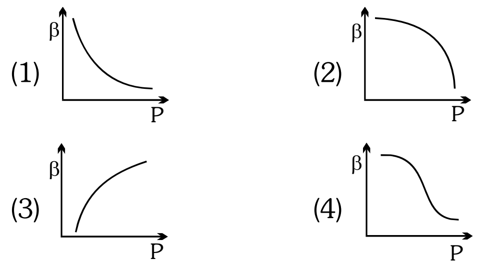
HT0232

201. 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.

HT0233

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



HT0234

203. 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}

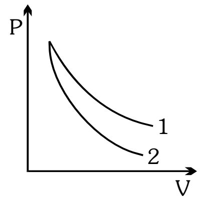
HT0235

204. 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

HT0236

205. 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

HT0237

206. 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) $-\gamma^2\ \Delta V/V$

HT0239

207. An ideal gas at 27^0C 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

HT0240

208. 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) $\frac{5}{2}$

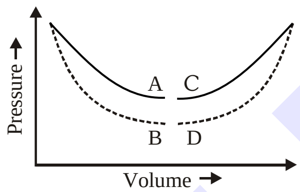
HT0241

209. 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%

HT0242

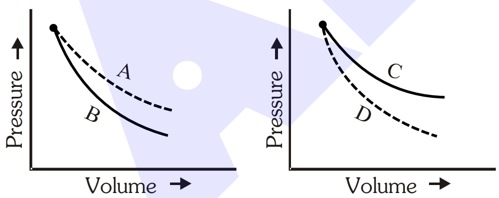
210. In which of the figure no heat exchange between the gas and the surroundings will take place, if the gas is taken along curve:
(curves are isothermal and adiabatic)



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

HT0243

211. 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

HT0244

212. 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

HT0245

213. 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) $\frac{2}{3}Q$

HT0246

214. 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) $\frac{1}{5}R(T_2 - T_1)$

HT0247

215. 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

HT0248

216. 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

HT0249

217. 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

HT0250

218. 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

HT0251

219. 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 contant volume
(3) The molecular attraction incrcase under constant pressure
(4) The vibration of molecules increases under constant pressure

HT0252

220. 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

HT0253

221. 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

HT0254

222. Specific heat of a gas undergoing adiabatic change is :
(1) Zero (2) Infinite
(3) Positive (4) Negative

HT0255

223. A quantity of air ($\gamma = 1.4$) 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

HT0256

224. A gas speciman in one vessel is expanded isothermally to double its volume and a simillar 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

HT0257

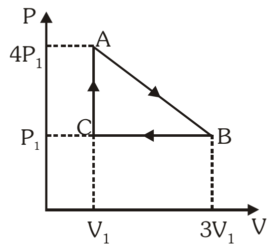
225. If an ideal gas is compressed during isothermal process then :-
(1) No work is done against gas
(2) heat is rejected by gas
(3) It's internal energy will increase
(4) Pressure does not change

HT0258

226. 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)

HT0259

227. 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

HT0260

228. 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

HT0261

229. In an isometric change :

(1) $\delta Q = dU$ (2) $\delta W = dU$

(3) $\delta Q + \delta W = dU$ (4) None of these

HT0262

230. 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

HT0263

231. 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

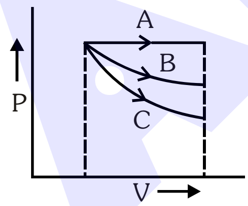
HT0264

232. 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

HT0265

233. 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

HT0266

234. In an adiabatic process the quantity which remains constant is :-

(1) Temperature

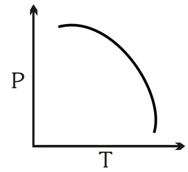
(2) Pressure

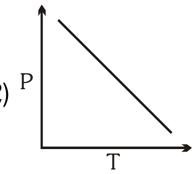
(3) Total heat content of the system

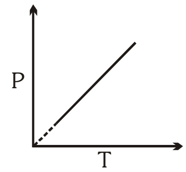
(4) Volume

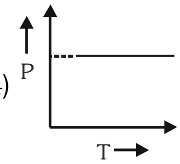
HT0267

235. Graph of isometric process is :-

(1) 

(2) 

(3) 

(4) 

HT0268

236. 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

HT0269

237. 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

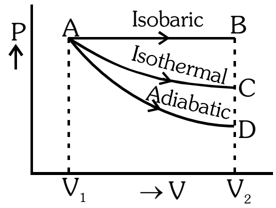
(2) 0.6 calories

(3) 1.2 calories

(4) 6.0 calories

HT0270

238. A gas is expanded from volume V_1 to volume V_2 in three processes, shown in the figure. If U_A, U_B, U_C and U_D represent the internal energies of the gas in state A,B, C and D respectively, the which of the following is not correct



(1) $U_B - U_A > 0$

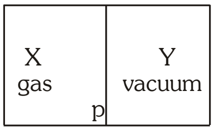
(2) $U_C - U_A = 0$

(3) $U_D - U_A < 0$

(4) $U_B = U_C = U_D$

HT0271

239. 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

HT0272

SECOND LAW OF THE THERMODYNMAMICS, HEAT ENGINES AND REFRIGERATORS

240. 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

HT0273

241. "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

HT0274

242. 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

HT0275

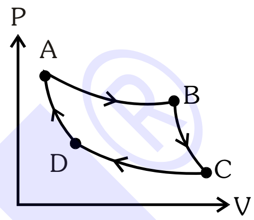
243. A reversible refrigerator operates between a low temperature reservoir at T_C and a high temperature reservoir at T_H. Its coefficient of performance is given by :

(1) $(T_H - T_C)/T_C$ (2) $T_C/(T_H - T_C)$

(3) $(T_H - T_C)/T_H$ (4) $T_H/(T_H - T_C)$

HT0276

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



(1) AB and CD (2) AB and AD

(3) AD and BC (4) BC and CD

HT0277

245. In the above question, the curve for which the heat is absorbed from the surroundings is :–

(1) AB (2) BC (3) CD (4) DA

HT0278

246. 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

HT0279

247. 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

HT0281

248. 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

HT0282

249. 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

HT0280

250. A refrigerator works between temperature –10°C and 27°C, the coefficient of performance is :

(1) 7.1 (2) 1

(3) 8.1 (4) 15.47

HT0285

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

EXERCISE-II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. A black body emits radiation of maximum intensity at 5000 Å when its temperature is 1227° C. If its temperature is increased by 1000° C then the maximum intensity of emitted radiation will be at:

(1) 2754.8 Å (2) 3000 Å
(3) 3500 Å (4) 4000 Å

HT0286

2. The translational kinetic energy of molecules of one mole of a monoatomic gas is U=3NkT/2. The value of molar specific heat of gas under constant pressure will be :

(1) $\frac{3}{2}R$ (2) $\frac{5}{2}R$ (3) $\frac{7}{2}R$ (4) $\frac{9}{2}R$

HT0287

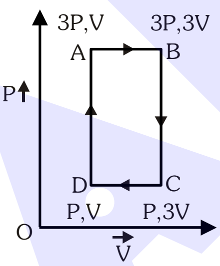
3. The molar specific heat at constant pressure of an ideal gas is (7/2)R. The ratio of specific heat at constant pressure to that at constant volume is:

(1) $\frac{7}{5}$ (2) $\frac{8}{7}$ (3) $\frac{5}{7}$ (4) $\frac{9}{7}$

HT0288

AIPMT 2007

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



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

HT0291

5. The $\left(\frac{W}{Q}\right)$ of a carnot-engine is $\frac{1}{6}$, now the temperature of sink is reduced by 62°C, then this ratio becomes twice, therefore the initial temperature of the sink and source are respectively:-

(1) 33°C, 67°C (2) 37°C, 99°C
(3) 67°C, 33°C (4) 97 K, 37 K

HT0292

AIPMT 2008

6. A new scale of temperature (which is linear) called the W scale, the freezing and boiling points of water are 39°W and 239°W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39°C on the Celsius scale ?

(1) 200° W (2) 139° W
(3) 78° W (4) 117°W

HT0293

7. At 10°C the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At 110°C this ratio is :-

(1) $\frac{10}{110}x$ (2) $\frac{283}{383}x$
(3) x (4) $\frac{383}{283}x$

HT0294

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

(1) E = 0 (2) Q = 0
(3) W=0 (4) Q=W=0

HT0295

AIPMT 2009

9. The two ends of a rod of length L and a uniform cross sectional area A are kept at two temperatures T_1 and T_2($T_1 > T_2$). The rate of heat transfer $\frac{dQ}{dt}$, through the rod in a steady state is given by :–

(1) $\frac{dQ}{dt}=\frac{kA(T_1-T_2)}{L}$

(2) $\frac{dQ}{dt}=\frac{kL(T_1-T_2)}{A}$

(3) $\frac{dQ}{dt}=\frac{k(T_1-T_2)}{LA}$

(4) $\frac{dQ}{dt}=kLA(T_1-T_2)$

HT0296

10. A black body, at a temperature of 227°C radiates heat at a rate of 7 cal cm^{-2} s^{-1}. At a temperature of 727°C, the rate of heat radiated in the same units will be :–

(1) 80 (2) 60 (3) 50 (4) 112

HT0297

11. In thermodynamic processes which of the following statement is not true :-

(1) In an adiabatic process PV^{γ} = constant
(2) In an adiabatic process the system is insulated from the surroundings
(3) In an isochoric process pressure remains constant
(4) In an Isothermal process the temperature remains constant

HT0298

12. The change in internal energy in a system that has absorbed 2 Kcals of heat and 500 J of work done is :-

(1) 7900J (2) 8900J
(3) 6400J (4) 5400J

HT0299

AIPMT (Pre) 2010

13. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t ?

(1) $\frac{Q}{2}$ (2) $\frac{Q}{4}$ (3) $\frac{Q}{16}$ (4) 2Q

HT0300

14. Total radiant energy per unit area, per unit time normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T Kelvin is given by :-

(1) $\frac{4\pi\sigma r^2T^4}{R^2}$ (2) $\frac{\sigma r^2T^4}{R^2}$

(3) $\frac{\sigma r^2T^4}{4\pi r^2}$ (4) $\frac{\sigma r^4T^4}{r^4}$

(Where σ is Stefan's Constant)

HT0301

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

(1) ΔU = –ΔW, in a isothermal process
(2) ΔU = –ΔW, in a adiabatic process
(3) ΔU = ΔW, in a isothermal process
(4) ΔU = ΔW, in a adiabatic process

HT0302

AIPMT (Mains) 2010

16. If c_p and c_v denote the specific heats (per unit mass) of an ideal gas of molecular weight M, then :-

(1) $c_p - c_v = R$ (2) $c_p - c_v = \frac{R}{M}$

(3) $c_p - c_v = MR$ (4) $c_p - c_v = \frac{R}{M^2}$

where R is the molar gas constant

HT0303

17. A monoatomic gas at pressure P_1 and volume V_1 is compressed adiabatically to 1/8th its original volume. What is the final pressure of the gas :-

(1) P_1 (2) $16P_1$ (3) $32\ P_1$ (4) $64\ P_1$

HT0304

AIPMT (Pre) 2011

18. During an isothermal expansion, a confined ideal gas does +150 J of work against its surroundings. This implies that :-

(1) 150 J of heat has been removed from the gas
(2) 300 J of heat has been added to the gas
(3) No heat is transferred because the process is isothermal
(4) 150 J of heat has been added to the gas

HT0305

19. A mass of diatomic gas (γ = 1.4) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C. The pressure of the gas in the final state is :-

(1) 8 atm (2) 28 atm
(3) 68.7 atm (4) 256 atm

HT0306

20. When 1kg of ice at 0°C melts to water at 0°C, the resulting change in its entropy, taking latent heat of ice to be 80 cal/g, is -

(1) 273 cal/K (2) 8×10^4 cal/K
(3) 80 cal/K (4) 293 cal/K

HT0307

AIPMT (Pre) 2012

21. If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q ?

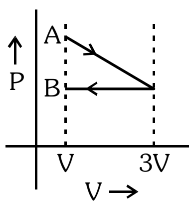
(1) $(4\pi R^2 Q/\sigma)^{1/4}$ (2) $(Q/4\pi R^2\sigma)^{1/4}$

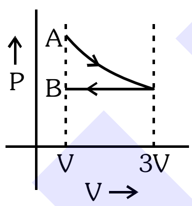
(3) $Q/4\pi R^2\sigma$ (4) $(Q/4\pi R^2\sigma)^{-1/2}$

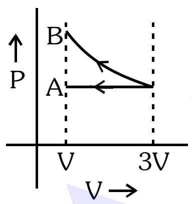
(σ stands for Stefan's constant.)

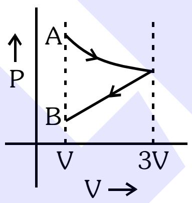
HT0308

22. One mole of an ideal gas goes from an initial state A to final state B via two processes. It firstly undergoes isothermal expansion from volume V to 3V and then its volume is reduced from 3V to V at constant pressure. The correct P-V diagram representing the two processes is :-

(1) 

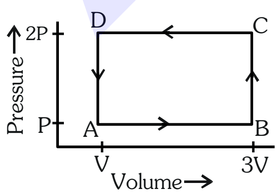
(2) 

(3) 

(4) 

HT0309

23. A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is :-

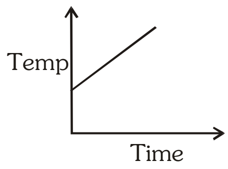


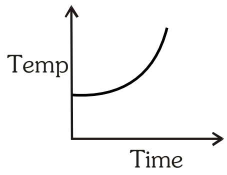
(1) $\frac{1}{2}$PV (2) PV

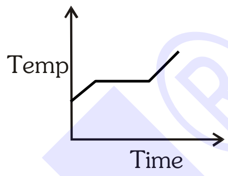
(3) 2PV (4) 4PV

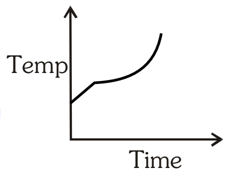
HT0310

24. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time?

(1) 

(2) 

(3) 

(4) 

HT0311

AIPMT (Mains) 2012

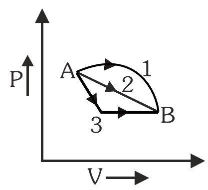
25. A slab of stone of area 0.36 m^2 and thickness 0.1 m is exposed on the lower surface to steam at 100°C. A block of ice at 0°C rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is : (Given latent heat of fusion of ice 3.36×10^5 J kg^{-1})

(1) 2.05 J/m/s/°C (2) 1.02 J/m/s/°C

(3) 1.24 J/m/s/°C (4) 1.29 J/m/s/°C

HT0312

26. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram



If Q_1 , Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and ΔU_1, ΔU_2, ΔU_3 indicate the change in internal energy along the three processes respectively, then :-

(1) $Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

(2) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

(3) $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(4) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

HT0313

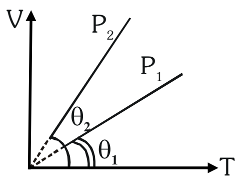
NEET-UG 2013

27. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using :-

(1) Newton's Law of cooling
(2) Stefan's Law
(3) Wein's displacement Law
(4) Kirchoff's Law

HT0319

28. In the given (V – T) diagram, what is the relation between pressure P_1 and P_2 ?



(1) Cannot be predicted (2) $P_2 = P_1$
(3) $P_2 > P_1$ (4) $P_2 < P_1$

HT0320

29. The amount of heat energy required to raise the temperature of 1 g of Helium at constant volume, from T_1 K to T_2 K is :-

(1) $\frac{3}{4} N_a k_B \left(\frac{T_2}{T_1}\right)$ (2) $\frac{3}{8} N_a k_B (T_2 - T_1)$

(3) $\frac{3}{2} N_a k_B (T_2 - T_1)$ (4) $\frac{3}{4} N_a k_B (T_2 - T_1)$

HT0321

30. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_P and C_V respectively. If $\gamma = \frac{C_P}{C_V}$ and R is the universal gas constant, then C_V is equal to :

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

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

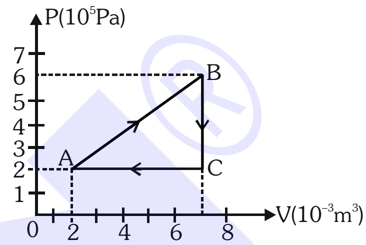
HT0322

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

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

HT0323

32. A gas is taken through the cycle A→B→C→A, as shown, What is the net work done by the gas?



(1) –2000 J (2) 2000 J
(3) 1000 J (4) Zero

HT0324

AIPMT 2014

33. 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

HT0330

34. 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

HT0331

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

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

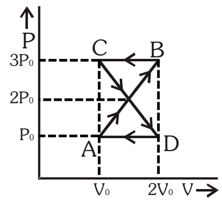
HT0332

36. A monoatomic gas at a pressure P, having a volume V expands isothermally to volume 2V and then adibatically 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

HT0333

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

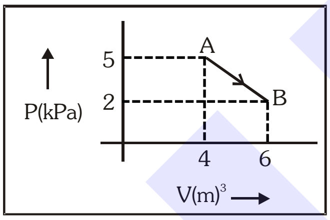


(1) P_0V_0 (2) $2P_0V_0$ (3) $\frac{P_0V_0}{2}$ (4) Zero

HT0334

AIPMT 2015

38. 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

HT0338

39. 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) $T_P > T_Q > T_R$

HT0339

40. 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

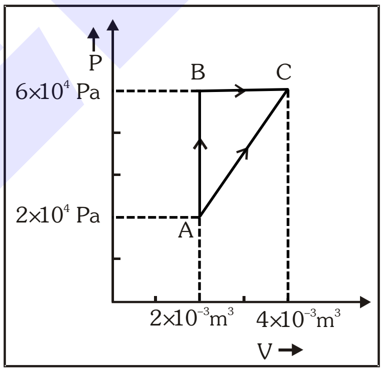
HT0340

41. 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) $\left(1+\frac{1}{n}\right)$

HT0341

42. 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

HT0342

43. The two ends of a metal rod are matainted 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

HT0343

Re-AIPMT 2015

44. 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

HT0344

45. 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}

HT0345

46. 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

HT0346

47. 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

HT0347

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

(1) 0.010 (2) 0.015

(3) 0.020 (4) 0.025

HT0348

NEET-I 2016

49. 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

HT0353

50. 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 nmK. Which of the following is correct?

(1) $U_1 = 0$ (2) $U_3 = 0$

(3) $U_1 > U_2$ (4) $U_2 > U_1$

HT0354

51. 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) $\alpha_1\ell_1 = \alpha_2\ell_2$

HT0355

52. 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) $\frac{100}{3}$

HT0356

53. 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.

HT0357

54. 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

HT0358

NEET-II 2016

55. 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

HT0359

56. 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) $\frac{3}{2}T$

HT0360

57. 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) $\frac{5}{2}R$

HT0361

58. 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) $\frac{t_1+273}{t_1-t_2}$

HT0362

59. 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 ?

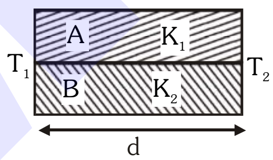
(1) P/(kTV) (2) mkT

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

HT0363

NEET(UG)-2017

60. 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:-

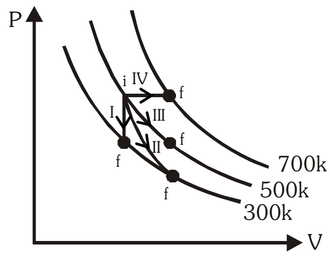


(1) $\frac{3(K_1+K_2)}{2}$ (2) $K_1 + K_2$

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

HT0369

61. 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) $P \to a,\ Q \to c,\ R \to d,\ S \to b$

HT0370

62. 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

HT0371

63. 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

HT0372

64. 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

HT0373

NEET(UG)-2018

65. 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

HT0378

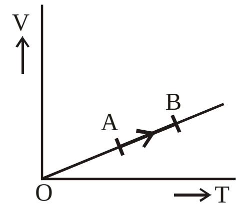
66. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $\frac{3}{4}\lambda_0$, the power radiated by it becomes nP. The value of n is :-

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

(3) $\frac{256}{81}$ (4) $\frac{81}{256}$

HT0379

67. 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) $\frac{2}{7}$

HT0380

68. 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%

HT0381

69. 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

HT0382

NEET(UG) 2019

70. In which of the following processes, heat is neither absorbed nor released by a system ?

(1) isothermal (2) adiabatic

(3) isobaric (4) isochoric

HT0496

71. 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

HT0497

72. 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

HT0498

73. The unit of thermal conductivity is :

(1) $J\ m\ K^{-1}$ (2) $J\ m^{-1}\ K^{-1}$
(3) $W\ m\ K^{-1}$ (4) $W\ m^{-1}\ K^{-1}$

HT0499

NEET(UG) 2019 (Odisha)

74. 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

HT0500

75. 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/ρr(L–4s) (2) $26K/(\rho x^2 - L)$
(3) 26K/(ρxL) (4) 26K/ρr(L+4s)

HT0501

76. 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) $\frac{7}{5}, \frac{5}{3}, \frac{7}{5}$

HT0502

77. 1g of water, of volume 1 cm^3 at 100°C, is converted into steam at same temperature under normal atmospheric pressure $(\simeq 1 \times 10^5 Pa)$. 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

HT0503

NEET(UG) 2020

78. 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) $\frac{5}{2}k_BT$

HT0504

79. The mean free path for a gas, with molecular diameter d and number density n can be expressed as :

(1) $\frac{1}{\sqrt{2}\, n^2\pi^2 d^2}$ (2) $\frac{1}{\sqrt{2}\, n\pi d}$
(3) $\frac{1}{\sqrt{2}\, n\pi d^2}$ (4) $\frac{1}{\sqrt{2}\, n^2\pi d^2}$

HT0505

80. 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) $\frac{3}{2}$

HT0506

81. 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

HT0507

82. 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

HT0508

NEET(UG) 2020 (COVID-19)

83. 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

HT0509

84. 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) $\ell \propto \frac{1}{d}$

HT0510

85. 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

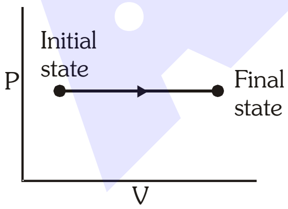
(2) number density, molar mass

(3) mass density, molar mass

(4) number density, mass of the gas

HT0511

86. 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

HT0512

87. 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) $T_A > T_C > T_B$

HT0513

NEET(UG) 2021

88. 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) $\frac{5}{13}t$

HT0514

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

Column-I		Column-II	
(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)

HT0515

NEET (UG) 2021(Paper-2)

90. When an ideal gas is heated at constant pressure, the fraction of heat energy supplied which increases the internal energy of the gas are α, β and δ for CO_2, He and N_2 respectively, then

(1) $\alpha = \beta = \delta$ (2) $\alpha > \beta > \delta$

(3) $\beta > \delta > \alpha$ (4) $\alpha > \delta > \beta$

HT0516

91. Choose the wrong pair.

	Process	**Work done**
(1)	Adiabtic	$\frac{nR(T_2 - T_1)}{\gamma - 1}$
(2)	Isobaric	$nR(T_2 - T_1)$
(3)	Isothermal	$nRT\ln\left(\frac{P_1}{P_2}\right)$
(4)	Isochoric	Zero

HT0517

92. A black body of surface area 20 cm^2 is heated to 227° and is suspended in a room at temperature 27°C. The initial rate of loss of heat from the body at the room temperature will be (take emissivity = 0.5, Stefan's constant $\sigma = 6 \times 10^{-8}$ W/m^2k^4)

(1) 1.6 W (2) 3.2 W
(3) 4.8 W (4) 6.4 W

HT0518

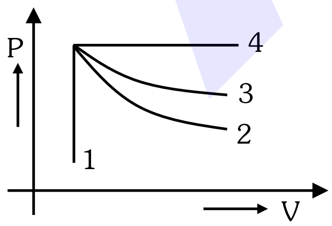
93. When 10 g of water at 0°C and 10^5 N/m^2 pressure is converted into ice of volume 11 cm^3, the external work done will be

(1) 0.1 J (2) 0.2 J (3) 1 J (4) 2 J

HT0519

NEET (UG) 2022

94. 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

HT0520

95. 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

HT0521

96. 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

HT0522

NEET (UG) 2022 (Overseas)

97. A gas undergoes an isothermal process. The specific heat capacity of the gas in the process is:

(1) 0.5 (2) zero
(3) 1 (4) infinity

HT0523

98. The temperature at which the rms speed of atoms in neon gas is equal to the rms speed of hydrogen molecules at 15°C is:
(Atomic mass of neon = 20.2 u, molecular mass of H_2 = 2 u)

(1) 2.9 K
(2) 0.15×10^3 K
(3) 0.29×10^3 K
(4) 2.9×10^3 K

HT0524

Re-NEET (UG) 2022

99. 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 $V_1 > V_2$

HT0525

100. Three vessels of equal capacity have gases at the same temperature and pressure. The first vessel contains helium (monoatomic), the second contains fluorine (diatomic) and the third contains sulfur hexafluoride (polyatomic). The correct statement, among the following is:

(1) All vessels contain unequal number of respective molecules

(2) The root mean square speed of molecules is same in all three cases

(3) The root mean square speed of helium is the largest

(4) The root mean square speed of sulfur hexafluoride is the largest

HT0526

101. 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 385 J s^{-1} K^{-1} m^{-1} and 50 J s^{-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

HT0527

EXERCISE-II (Previous Year Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**2**	**2**	**1**	**3**	**2**	**4**	**2**	**1**	**1**	**4**	**3**	**1**	**3**	**2**	**2**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**2**	**3**	**4**	**4**	**4**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**4**	**2**	**3**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**1**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**1**	**2**	**2**	**2**	**3**	**3**	**2**
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	**2**	**2**	**3**	**3**	**4**	**4**	**2**	**2**	**3**	**4**	**4**	**2**	**4**	**4**	**4**
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	**1**	**3**	**1**	**3**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**4**	**4**	**4**	**3**
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	**1**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**4**	**2**	**3**	**4**
Que.	91	92	93	94	95	96	97	98	99	100	101				
Ans.	**1**	**2**	**1**	**1**	**4**	**3**	**4**	**4**	**3**	**3**	**4**				

EXERCISE-III (Analytical Questions)

Master Your Understanding

1. Two rods one of aluminium of length l_1 having coefficient of linear expansion α_a, and other steel of length l_2 having coefficient of linear expansion α_s are joined end to end. The expansion in both the rods is same on variation of temperature. Then the value of $\frac{l_1}{l_1+l_2}$ is

(1) $\frac{\alpha_s}{\alpha_a+\alpha_s}$ (2) $\frac{\alpha_s}{\alpha_a-\alpha_s}$

(3) $\frac{\alpha_a+\alpha_s}{\alpha_s}$ (4) None of these

HT0395

2. An ideal gas is expanding such that PT^2 = constant. The coefficient of volume expansion of the gas is :

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

(3) $\frac{3}{T}$ (4) $\frac{4}{T}$

HT0396

3. Steam at 100°C is added slowly to 1400 g of water at 16°C until the temperature of water is raised to 80°C. The mass of steam required to do this is (L_V = 540 cal/g) :

(1) 160 g (2) 125 g

(3) 250 g (4) 320 g

HT0397

4. 50 g of ice at 0° C is mixed with 50 g of water at 100° C. The final temperature of mixture is :–

(1) 0° C

(2) Between 0°C to 20°C

(3) 20°C

(4) Above 20°C

HT0398

5. Spheres P and Q are uniformly constructed from the same material which is a good conductor of heat and the radius of Q is thrice of radius of P. The rate of fall of temperature of P is x times that of Q when both are at the same surface temperature. The value of x is :

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

(3) 3 (4) 4

HT0400

6. A sphere, a cube and a thin circular plate all made of same substance and all have same mass. These are heated to 200°C and then placed in a room, then the :

(1) Temperature of sphere drops to room temperature at last.

(2) Temperature of cube drops to room temperature at last

(3) Temperature of thin circular plate drops to room temperature at last

(4) Temperature of all the three drops to room temperature at the same time

HT0401

7. The power radiated by a black body is P and it radiates maximum energy around the wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy around wavelength $3/4\lambda_0$, the power radiated by it will increase by a factor of

(1) 4/3 (2) 16/9 (3) 64/27 (4) 256/81

HT0402

8. A slab consists of two parallel layers of copper and brass of the same thickness and having thermal conductivities in the ratio 1 : 4. If the free face of brass is at 100°C and that of copper at 0°C, the temperature of interface is -

(1) 80°C (2) 20°C (3) 60°C (4) 40°C

HT0403

9. Out of the metal balls of same diameter one is solid and other is hollow. Both are heated to the same temperature at 300°C and then allowed to cool in the same surroundings then rate of loss of heat will be:

(1) More for hollow sphere

(2) More for solid sphere

(3) Same for both

(4) None of the above

HT0404

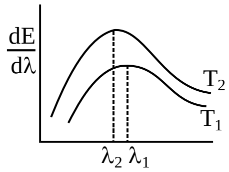
10. For a black body at temperature 727°C, its radiating power is 60 watt and temperature of surrounding is 227°C. If temperature of black body is changed to 1227°C then its radiating power will be :-

(1) 304 W (2) 320 W

(3) 240 W (4) 120 W

HT0405

11. The spectral emissive power E_λ for a body at temperature T_1 is plotted against the wavelength and area under the curve is found to be A. At a different temperature T_2, the area is found to be 9A. Then λ_1/λ_2 =



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

HT0408

12. Consider a gas with density ρ and $\bar{c}$ as the root mean square velocity of its molecules contained in a volume. If the system moves as whole with velocity v, then the pressure exerted by the gas is

(1) $\frac{1}{3}\rho\ (\bar{c})^2$ (2) $\frac{1}{3}\rho(\bar{c}+v)^2$

(3) $\frac{1}{3}\rho(\bar{c}\ -v)^2$ (4) $\frac{1}{3}\rho(c^{-2}-v)^2$

HT0409

13. Air is filled at 60°C in a vessel of open mouth. The vessel is heated to a temperature T so that $1/4^{th}$ part of air escapes. The value of T is :

(1) 80°C (2) 444°C (3) 333°C (4) 171°C

HT0410

14. Root mean square velocity for a certain di-atomic gas at room temperature 27°C is found to be 1930 m/sec. The gas is -

(1) H_2 (2) O_2 (3) F_2 (4) Cl_2

HT0411

15. An ideal gas expands in such a way that PV^2 = constant throughout the process.

(1) The graph of the process of T-V diagram is a parabola.

(2) The graph of the process of T-V diagram is a straight line.

(3) Such an expansion is possible only with heating.

(4) Such an expansion is possible only with cooling.

HT0413

16. A gas has volume V and pressure P. The total translational kinetic energy of all the molecules of the gas is:–

(1) $\frac{3}{2}$PV only if the gas is monoatomic.

(2) $\frac{3}{2}$PV only if the gas is diatomic.

(3) $>\frac{3}{2}$PV if the gas is diatomic.

(4) $\frac{3}{2}$PV in all cases.

HT0415

17. N molecules of an ideal gas at temperature T_1 and presseure P_1 are contained in a closed box. If the molecules in the box gets doubled, Keeping total kinetic energy same. If new pressure is P_2 and temperature is T_2, Then :

(1) $P_2 = P,\ T_2 = T_1$

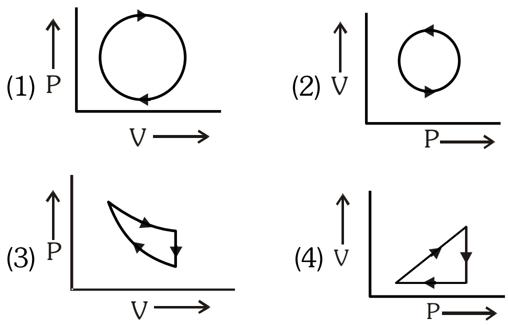
(2) $P_2 = P_1,\ T_2 = T_1 / 2$

(3) $P_2 = 2\ P_1,\ T_2 = T_1$

(4) $P_2 = 2P_1,\ T_2 = T_1 / 2$

HT0416

18. The following are the P–V diagrams for cyclic processes for a gas. In which of these processes heat is released by the gas ?



HT0417

19. A gas mixture contain 1 g H_2 and 1 g He if temperature of gas mixture is increased from 0°C to 100° C at isobaric process. Then find given heat of gas mixture

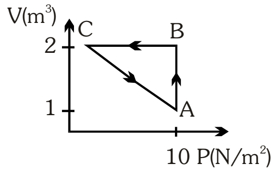
[γ_{He} = 5/3, γ_{H_2} = 7/5, R = 2 cal/mol-K]

(1) 124 cal (2) 327 cal

(3) 218 cal (4) 475 cal

HT0418

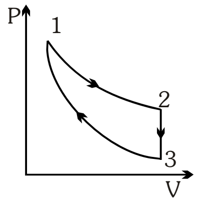
20. An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown in the figure. If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process $C \rightarrow A$ is



(1) –5J (2) –10 J (3) –15 J (4) –20 J

HT0420

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



(1) –40J (2) –20J (3) +40J (4) +20J

HT0422

22. The molar specific heat under constant pressure of oxygen is C_P = 7.03 cal/mol K. The quantity of heat required to raise the temperature from 10^0C to 20^0C of 5 moles of oxygen under constant volume will approximately be :-

(1) 25 cal (2) 50 cal

(3) 250 cal (4) 500 cal

HT0423

23. If the ratio of specific heat of a gas at constant pressure to that at constant volume is γ, the change in internal energy of a mass of gas, when the volume changes from V to 2 V at constant pressure P, is :-

(1) $R/(\gamma - 1)$ (2) PV

(3) $PV/(\gamma - 1)$ (4) $\gamma PV/(\gamma - 1)$

HT0424

EXERCISE-III (Analytical Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**1**	**3**	**1**	**2**	**3**	**1**	**4**	**1**	**3**	**2**	**4**	**1**	**4**	**1**	**4**
Que.	16	17	18	19	20	21	22	23							
Ans.	**4**	**2**	**4**	**4**	**1**	**1**	**3**	**3**							