QUESTIONS FROM COMPETITIVE EXAMS

3.1 Introduction

(MHT-CET 2001)

1. An ideal gas is that which can
   a) be solidified b) be liquefied c) not be liquefied d) not be solidified

(MHT-CET 2003)

2. Energy supplied to convert unit mass of substance from solid to liquid state at its melting point is called
   a) latent heat of fusion b) evaporation
   c) solidification d) latent heat of fission

(MHT-CET 2006)

3. Internal latent heat of ice is
   a) greater than latent heat b) less than latent heat
   c) equal to latent heat d) equal to half that of latent heat

(MHT-CET 2007)

4. If the pressure of an ideal gas decreases by 10% isothermally, then its volume will
   a) decrease by 9% b) increase by 10%
   c) increase by 11.6% d) increase by 9%

5. For an ideal gas, Cv/Cp is
   a) < 1 b) > 1 c) $= 1$ d) ≥ 1

6. Internal latent heat is defined as
   a) amount of heat needed to do work against external pressure
   b) amount of heat needed to do to work against intermolecular force
   c) amount of heat needed to increase the K.E. of the molecules
   d) heat needed to change the state of a substance

(MHT-CET 2011)

7. When 1gm of water at 100°C is completely converted to steam at 100°C, it occupies 1650cc. The increase in the internal energy of the molecules is (Atm. press. = 10^5 Pa L = 540 cal/gm and J = 4.2 J/cal)
   a) 2103 J b) 2310 J c) 210 J d) 375 J

(MH-CET 2015)

8. In the expression for Boyle's law, the product 'PV' has dimensions of
   a) force b) impulse c) energy d) momentum

(MHT-CET 2020)

9. An ideal gas occupies a volume 'V' at a pressure 'P' and absolute temperature 'T'. The mass of each molecule is 'm'. If 'K_B' is the Boltzmann's constant, then the density of gas is given by expression
   a) $\frac{P \cdot m}{2K_B \cdot T}$ b) $\frac{K_B \cdot T}{P \cdot m}$ c) $\frac{P \cdot m}{K_B \cdot T}$ d) $\frac{3K_B \cdot T}{2P \cdot m}$

(MHT-CET 2022)

10. By what percentage should the pressure of a given mass of a gas be increased so as to decrease its volume by 10% at a constant temperature ?

a) 10.1% b) 11.1% c) 8.1% d) 9.1%

3.2 Behaviour of Gas

(MHT-CET 2002)

11. PV/3 = RT, V represents volume of

a) any amount of gas
b) 2 moles of gas
c) 3 moles of gas
d) 4 moles of gas

3.3 Ideal and Real gases

(MHT-CET 2003)

12. A gas which obeys all the assumptions of kinetic theory of gases at all conditions of temperatures and pressures is called

a) ideal or perfect gas
b) real gas
c) diatomic gas
d) polyatomic gas

3.4 Mean Free Path

(MHT-CET 2005)

13. The mean free path is inversely proportional to

a) molecular diameter
b) square of the molecular diameter
c) square root of the molecular diameter
d) fourth power of the molecular diameter

(MHT-CET 2007)

14. The expression for mean free path (λ) of molecules is given by
[where n is no of molecules per unit volume and d molecular diameter of the gas]

a) $\frac{\sqrt{2}}{\pi \text{nd}^2}$ b) $\frac{1}{\pi \text{nd}^2}$ c) $\frac{1}{\sqrt{2}\pi \text{nd}^2}$ d) $\frac{1}{\sqrt{2}\pi \text{nd}}$

(MHT-CET 2009)

15. Mean free path of a gas molecule in a container depends upon

a) temperature of the gas molecule only
b) diameter of the gas molecule only
c) density of the gas molecule only
d) temperature, diameter and density of the gas molecule

3.5 Pressure of Ideal Gas
3.6 Root Mean Square (rms) Speed
3.7 Interpretation of Temperature in Kinetic Theory

(MHT-CET 2001)

16. Calculate the RMS velocity of molecules of a gas of which the ratio of two specific heats is 1.42 and velocity of sound in the gas is 500 m/s

a) 727 m/s b) 527 m/s c) 927 m/s d) 750 m/s

29. At what temperature does the average translational K.E. of a molecule in a gas become equal to K.E. of an electron accelerated from rest through potential difference of V volts? All symbols have their usual meanings.

a) $\frac{2eVN}{3R}$ b) $\frac{3R}{2eVN}$ c) $\frac{NeV}{R}$ d) $\frac{2NeV}{R}$

(MHT-CET 2014)

30. Gases exert pressure on the walls of the container because the gas molecules

a) have finite volume
b) obey Boyle's law
c) possess momentum
d) collide with one another

31. A gas is compressed isothermally. The r.m.s. velocity of its molecules

a) increases
b) decreases
c) first increases and then decreases
d) remains the same

(MH-CET 2016)

32. Assuming the expression for the pressure exerted by the gas on the walls of the container, it can be shown that pressure is

a) $\left[\frac{1}{3}\right]^{rd}$ kinetic energy per unit volume of a gas

b) $\left[\frac{2}{3}\right]^{rd}$ kinetic energy per unit volume of a gas

c) $\left[\frac{3}{4}\right]^{th}$ kinetic energy per unit volume of a gas

d) $\frac{3}{2}$ × kinetic energy per unit volume of a gas

(MHT-CET 2020)

33. The r.m.s. velocity of hydrogen molecules at temperature T is seven times the r.m.s. velocity of nitrogen molecules at 300 K. This temperature T is
(Molecular weights of hydrogen and nitrogen are 2 and 28 respectively)

a) 1350 K b) 1700 K c) 1050 K d) 2100 K

3.8 Degrees of Freedom and Law of Equipartition of Energy

(MHT-CET 2001)

34. 5 gm of air is heated from 273 K to 275 K. The change in internal energy of air will be
[C_v = 172 cal/kg K and J = 4.2 J/cal]

a) 7.22 J b) 5.22 J c) 8.16 J d) 3.5 J

(MHT-CET 2002)

35. What is true for 3 moles of a gas ?

a) $3(C_p - C_v) = R$ b) $\frac{(C_p - C_v)}{3} = R$ c) $C_p - C_v = R$ d) $C_p - 3C_v = R$

(MHT-CET 2004)

36. A gas expands adiabatically at constant pressure such that its temperature $T \propto 1/\sqrt{V}$. The value of C_p/C_v of the gas is

a) 1.30 b) 1.50 c) 1.67 d) 2.00

(MH-CET 2016)

45. For a gas $\frac{R}{C_v} = 0.4$, where 'R' is the universal gas constant and 'C_v' is molar specific heat at constant volume. The gas is made up of molecules which are

a) rigid diatomic
b) monoatomic
c) non-rigid diatomic
d) polyatomic

(MH-CET 2017)

46. For a rigid diatomic molecule, universal gas constant $R = nC_p$ where 'C_p' is the molar specific heat at constant pressure and 'n' is a number. Hence n is equal to

a) 0.2257 b) 0.4 c) 0.2857 d) 0.3557

(MH-CET 2018)

47. The molar specific heats of an ideal gas at constant pressure and constant volume are 'C_p' and 'C_v' respectively. If 'R' is the universal gas constant and the ratio of 'C_p' to 'C_v' is 'γ', then C_v =

a) $\frac{1-\gamma}{1+\gamma}$ b) $\frac{1+\gamma}{1-\gamma}$ c) $\frac{\gamma-1}{R}$ d) $\frac{R}{\gamma-1}$

(MHT-CET 2019)

48. If 'C_p' and 'C_v' are molar specific heats of an ideal gas at constant pressure and volume respectively and if 'γ' is ratio of two specific heats and 'R' is universal gas constant, then 'C_p' is equal to

a) $\frac{R\gamma}{\gamma-1}$ b) $\frac{1+\gamma}{1-\gamma}$ c) γR d) $\frac{R}{\gamma-1}$

(MHT-CET 2021)

49. The molar specific heat at constant pressure of an ideal gas is $\left(\frac{7}{2}\right)$ R. The ratio of specific heat at constant pressure to that at constant volume of the gas is

a) $\frac{5}{6}$ b) $\frac{6}{5}$ c) $\frac{7}{5}$ d) $\frac{5}{7}$

(MHT-CET 2022)

50. If R is universal gas constant then the amount of heat needed to raise the temperature of 2 moles of an ideal monoatomic gas from 273 K to 373 K when no work is done is

a) 500 R b) 300 R c) 150 R d) 100 R

3.10 Absorption, Reflection and Transmission of Heat Radiation

(MHT-CET 2003)

51. If a = 0.72, r = 0.24, then value of t is

a) 0.02 b) 0.04 c) 0.4 d) 0.2

(MHT-CET 2005)

52. Coefficient of transmission and coefficient of reflection for a given body are 0.22 and 0.74 respectively. Then, at a given temperature, the coefficient of emission for the body is

a) 0.4 b) 0.04 c) 0.96 d) 0.22

3.13 Kirchhoff's law of heat radiation
3.14 Spectrum of a black body radiation interms of wavelength

(MHT-CET 2002)

63. The wavelength of maximum energy released during an atomic explosion was 2.93×10^{-10} m. The maximum temperature attained must be (Wein's constant = 2.93×10^{-3} mK)

a) 5.86×10^{7} K b) 10^{-13} K c) 10^{-7} K d) 10^{7} K

(MHT-CET 2005)

64. A body cools from 100°C to 70°C in 8 minutes. If the room temperature is 15°C and assuming Newton's law of cooling holds good, then time required for the body to cool from 70°C to 40°C is

a) 14 min b) 10 min c) 8 min d) 5 min

(MHT-CET 2008)

65. SI unit of Wein's constant is

a) m K b) Cal/m^2 c) J/m^2 d) K/m

(MH-CET 2016)

66. A black rectangular surface of area 'A' emits energy 'E' per second at 27°C. If length and breadth are reduced to $\frac{1}{3}^{rd}$ of initial values and temperature is raised to 327°C, then energy emitted per second becomes

a) $\frac{4E}{9}$ b) $\frac{7E}{9}$ c) $\frac{10E}{9}$ d) $\frac{16E}{9}$

(MHT-CET 2019)

67. The original temperature of a black body is 727°C. The temperature to which the black body must be raised so as to double the total radiant energy is

a) 2000°C b) 1454°C c) 1190°C d) 917°C

(MHT-CET 2020)

68. Three black discs 'x', 'y', 'z' have radii 1 m, 2 m and 3 m respectively. The wavelengths corresponding to maximum intensity are 200, 300 and 400 nm respectively. The relation between emissive powers 'E_x', 'E_y' and 'E_z' is

a) $E_x > E_y > E_z$ b) $E_x < E_y < E_z$ c) $E_x = E_y = E_z$ d) $E_x < E_y > E_z$

(MHT-CET 2021)

69. The energy spectrum of a black body exhibits a maximum around a wavelength 'λ'. The temperature of the black body is now changed such that the energy is maximum around a wavelength $\frac{3\lambda}{4}$. The power radiated by the black body will now increase by a factor

a) $\frac{5}{3}$ b) $\frac{256}{81}$ c) $\frac{128}{27}$ d) $\frac{86}{9}$

(MHT-CET 2022)

70. The radiation energy density per unit wavelength at temperature T is maximum at a wavelength λ_0. At temperature 2T, it will have a maximum at a wavelength

a) $2\lambda_0$ b) $\frac{\lambda_0}{2}$ c) $\frac{\lambda_0}{4}$ d) $4\lambda_0$