EXERCISE-I

Gas Laws

1. To double the volume of a given mass of an ideal gas at 27°*C* keeping the pressure constant, one must raise the temperature in degree centigrade to

(A) 54° (B) 270°
(C) 327° (D) 600°

2. Which of the following statements about kinetic theory of gases is wrong

(A) The molecules of a gas are in continuous random motion
(B) The molecules continuously undergo inelastic collisions
(C) The molecules do not interact with each other except during collisions
(D) The collisions amongst the molecules are of short duration

3. If a Vander-Waal's gas expands freely, then final temperature is

(A) Less than the initial temperature
(B) Equal to the initial temperature
(C) More than the initial temperature
(D) Less or more than the initial temperature depending on the nature of the gas

4. In Vander Waal's equation $\left[P+\frac{a}{V^2}\right](V-b)=RT$, the dimensions of *a* are

(A) $M^1L^5T^{-2}$ (B) $M^0L^2T^{-3}$
(C) $M^1L^3T^{-2}$ (D) $M^1L^1T^{-2}$

5. At NTP, sample of equal volume of chlorine and oxygen is taken. Now ratio of No. of molecules

(A) 1 : 1 (B) 32 : 27
(C) 2 : 1 (D) 16 : 14

6. A gas at the temperature 250 *K* is contained in a closed vessel. If the gas is heated through 1*K*, then the percentage increase in its pressure will be

(A) 0.4% (B) 0.2%
(C) 0.1% (D) 0.8%

7. A cylinder of 5 *litre* capacity, filled with air at N.T.P. is connected with another evacuated cylinder of 30 *litres* of capacity. The resultant air pressure in both the cylinders will be

(A) 38.85 *cm* of *Hg* (B) 21.85 *cm* of *Hg*
(C) 10.85 *cm* of *Hg* (D) 14.85 *cm* of *Hg*

8. Volume of gas become four times if

(A) Temperature become four times at constant pressure
(B) Temperature become one fourth at constant pressure
(C) Temperature becomes two times at constant pressure
(D) Temperature becomes half at constant pressure

9. The relationship between pressure and the density of a gas expressed by Boyle's law, *P* = *KD* holds true

(A) For any gas under any conditions
(B) For some gases under any conditions
(C) Only if the temperature is kept constant
(D) Only if the density is constant

10. Kinetic theory of gases provide a base for

(A) Charle's law
(B) Boyle's law
(C) Charle's law and Boyle's law
(D) None of these

11. The number of molecules in a gas at pressure 1.64×10^{-3} atmospheres and temperature 200 *K* having the volume 1 *cc* are

(A) 6.02×10^{16} (B) 2.63×10^{16}
(C) 3.01×10^{19} (D) 12.04×10^{19}

12. The pressure *P*, volume *V* and temperature *T* of a gas in the jar *A* and the other gas in the jar *B* at pressure 2*P*, volume *V*/4 and temperature 2*T*, then the ratio of the number of molecules in the jar *A* and *B* will be

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

13. We write the relation for Boyle's law in the form $PV = C$ when the temperature remains constant. In this relation, the magnitude of C depends upon

(A) The nature of the gas used in the experiment

(B) The magnitude of g in the laboratory

(C) The atmospheric pressure

(D) The quantity of the gas enclosed

14. If a given mass of gas occupies a volume of 10 *cc* at 1 atmospheric pressure and temperature of 100°*C*(373.15 *K*). What will be its volume at 4 atmospheric pressure; the temperature being the same

(A) 100 *cc* (B) 400 *cc*

(C) 2.5 *cc* (D) 104 *cc*

15. A sample of an ideal gas occupies a volume V at a pressure P and absolute temperature T, the mass of each molecule is m. The expression for the density of gas is (k = Boltzmann's constant)

(A) mkT (B) P/kT

(C) P/kTV (D) Pm/kT

16. The product of the pressure and volume of an ideal gas is

(A) A constant

(B) Approx. equal to the universal gas constant

(C) Directly proportional to its temperature

(D) Inversely proportional to its temperature

17. A balloon contains $500\,m^3$ of helium at 27°*C* and 1 atmosphere pressure. The volume of the helium at – 3°*C* temperature and 0.5 atmosphere pressure will be

(A) $500\,m^3$ (B) $700\,m^3$

(C) $900\,m^3$ (D) $1000\,m^3$

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

(A) $P/8$ (B) P

(C) $2P$ (D) $8P$

19. 1 mole of gas occupies a volume of 100 *ml* at 50 *mm* pressure. What is the volume occupied by two moles of gas at 100 *mm* pressure and at same temperature

(A) 50 *ml* (B) 100 *ml*

(C) 200 *ml* (D) 500 *ml*

20. For ideal gas, which statement is not true

(A) It obeys Boyle's law

(B) It follows $PV = RT$

(C) Internal energy depends on temperature only

(D) It follows Vander-Waal's equation

21. Two thermally insulated vessels 1 and 2 are filled with air at temperatures (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2) respectively. If the valve joining the two vessels is opened, the temperature inside the vessel at equilibrium will be

(A) $T_1 + T_2$ (B) $(T_1 + T_2)/2$

(C) $\frac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_2 + P_2V_2T_1}$ (D) $\frac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_1 + P_2V_2T_2}$

22. For matter to exist simultaneously in gas and liquid phases

(A) The temperature must be 0 *K*

(B) The temperature must be less than $0^o C$

(C) The temperature must be less than the critical temperature

(D) The temperature must be less than the reduced temperature

23. The value of critical temperature in terms of Vander Waal's constant a and b is

(A) $T_c = \frac{8a}{27Rb}$ (B) $T_c = \frac{a}{2Rb}$

(C) $T_c = \frac{8}{27Rb}$ (D) $T_c = \frac{27a}{8Rb}$

24. In Vander Waal's equation a and b represent

$$\left(P + \frac{a}{V^2}\right)(v - b) = RT$$

(A) Both a and b represent correction in volume

(B) Both a and b represent adhesive force between molecules

(C) a represents adhesive force between molecules and b correction in volume

(D) a represents correction in volume and b represents adhesive force between molecules

25. The gas in vessel is subjected to a pressure of 20 atmosphere at a temperature 27°*C*. The pressure of the gas in a vessel after one half of the gas is released from the vessel and the temperature of the remainder is raised by 50°*C* is

(A) 8.5 *atm* (B) 10.8 *atm*

(C) 11.7 *atm* (D) 17 *atm*

26. At 0°*C* the density of a fixed mass of a gas divided by pressure is *x*. At 100°*C*, the ratio will be

(A) x (B) $\frac{273}{373}x$

(C) $\frac{373}{273}x$ (D) $\frac{100}{273}x$

27. 2 *gm* of O_2 gas is taken at 27°*C* and pressure 76 *cm*. Of *Hg*. Then find out volume of gas (in litre)

(A) 1.53 (B) 2.44

(C) 3.08 (D) 44.2

28. An electron tube was sealed off during manufacture at a pressure of 1.2×10^{-7} *mm* of mercury at 27°*C*. Its volume is 100 cm^3. The number of molecules that remain in the tube is

(A) 2×10^{16} (B) 3×10^{15}

(C) 3.86×10^{11} (D) 5×10^{11}

29. If the pressure of an ideal gas contained in a closed vessel is increased by 0.5%, the increase in temperature is 2*K*. The initial temperature of the gas is

(A) 27°*C* (B) 127°*C*

(C) 300°*C* (D) 400°*C*

30. Air is filled in a bottle at atmospheric pressure and it is corked at 35°*C*. If the cork can come out at 3 atmospheric pressure than upto what temperature should the bottle be heated in order to remove the cork

(A) 325.5°*C* (B) 851°*C*

(C) 651°*C* (D) None of these

Speed of Gas

31. At room temperature, the *r.m.s.* speed of the molecules of certain diatomic gas is found to be 1930 m/s. The gas is

(A) H_2 (B) F_2

(C) O_2 (D) Cl_2

32. Moon has no atmosphere because

(A) The *r.m.s.* velocity of all gases is more than the escape velocity from moon's surface

(B) Its surface is not smooth

(C) It is quite far away from the earth

(D) It does not have population and plants

33. Speed of sound in a gas is *v* and *r.m.s.* velocity of the gas molecules is *c*. The ratio of *v* to *c* is

(A) $\frac{3}{\gamma}$ (B) $\frac{\gamma}{3}$

(C) $\sqrt{\frac{3}{\gamma}}$ (D) $\sqrt{\frac{\gamma}{3}}$

34. The molecules of a given mass of a gas have a *r.m.s.* velocity of 200 *m*/*sec* at 27°*C* and $1.0\times10^5\ N/m^2$ pressure. When the temperature is 127°*C* and pressure is $0.5\times10^5\ N/m^2$, the *r.m.s.* velocity in *m*/*sec* will be

(A) $\frac{100\sqrt{2}}{3}$ (B) $100\sqrt{2}$

(C) $\frac{400}{\sqrt{3}}$ (D) None of the above

35. Which of the following statement is true

(A) Absolute zero degree temperature is not zero energy temperature

(B) Two different gases at the same temperature pressure have equal root mean square velocities

(C) The root mean square speed of the molecules of different ideal gases, maintained at the same temperature are the same

(D) Given sample of 1 cc of hydrogen and 1 cc of oxygen both at NTP; oxygen sample has a large number of molecules

36. The average speed v and $r.m.s.$ speed $\overline{v}$ of the molecules are related as

(A) $\overline{v} = 0.92\,v$ (B) $\overline{v}^2 = 0.29\,v^2$

(C) $\overline{v} = v$ (D) $C = 0.92\overline{C}$

37. The respective speeds of five molecules are 2, 1.5, 1.6, 1.6 and 1.2 km/sec. The most probable speed in km/sec will be

(A) 2 (B) 1.58

(C) 1.6 (D) 1.31

38. At which temperature the velocity of O_2 molecules will be equal to the velocity of N_2 molecules at 0°C

(A) 40°C

(B) 93°C

(C) 39°C

(D) Cannot be calculated

39. The respective speeds of the molecules are 1, 2, 3, 4 and 5 km/sec. The ratio of their $r.m.s.$ velocity and the average velocity will be

(A) $\sqrt{11}:3$ (B) $3:\sqrt{11}$

(C) 1 : 2 (D) 3 : 4

40. Two vessels having equal volume contains molecular hydrogen at one atmosphere and helium at two atmospheres respectively. If both samples are at the same temperature, the mean velocity of hydrogen molecules is

(A) Equal to that of helium

(B) Twice that of helium

(C) Half that of helium

(D) $\sqrt{2}$ times that of helium

41. The speeds of 5 molecules of a gas (in arbitrary units) are as follows : 2, 3, 4, 5, 6. The root mean square speed for these molecules is

(A) 2.91 (B) 3.52

(C) 4.00 (D) 4.24

42. At a given temperature the ratio of $r.m.s.$ velocities of hydrogen molecule and helium atom will be

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

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

43. If the oxygen (O_2) has root mean square velocity of $C\ ms^{-1}$, then root mean square velocity of the hydrogen (H_2) will be

(A) $C\,ms^{-1}$ (B) $\frac{1}{C}ms^{-1}$

(C) $4C\,ms^{-1}$ (D) $\frac{C}{4}ms^{-1}$

44. To what temperature should the hydrogen at room temperature (27°C) be heated at constant pressure so that the R.M.S. velocity of its molecules becomes double of its previous value

(A) 1200°C (B) 927°C

(C) 600°C (D) 108°C

45. The temperature of an ideal gas is reduced from 927°C to 27°C. The $r.m.s.$ velocity of the molecules becomes

(A) Double the initial value

(B) Half of the initial value

(C) Four times the initial value

(D) Ten times the initial value

46. The $r.m.s.$ speed of the molecules of a gas in a vessel is 400 ms^{-1}. If half of the gas leaks out, at constant temperature, the $r.m.s.$ speed of the remaining molecules will be

(A) 800 ms^{-1} (B) $400\sqrt{2}\,ms^{-1}$

(C) 400 ms^{-1} (D) 200 ms^{-1}

47. Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will

(A) Increase

(B) Decrease

(C) Remain same

(D) Decrease for some, while increase for others

48. At a given temperature if V_{rms} is the root mean square velocity of the molecules of a gas and V_s the velocity of sound in it, then these are related as $\left(\gamma = \frac{C_P}{C_v}\right)$

(A) $V_{rms} = V_s$ (B) $V_{rms} = \sqrt{\frac{3}{\gamma}} \times V_s$

(C) $V_{rms} = \sqrt{\frac{\gamma}{3}} \times V_s$ (D) $V_{rms} = \left(\frac{3}{\gamma}\right) \times V_s$

49. The root mean square speed of hydrogen molecules at 300 K is 1930 m/s. Then the root mean square speed of oxygen molecules at 900 K will be

(A) $1930\sqrt{3}\ m/s$ (B) $836\,m/s$

(C) $643\,m/s$ (D) $\frac{1930}{\sqrt{3}}\,m/s$

50. Let A and B the two gases and given: $\frac{T_A}{M_A} = 4.\frac{T_B}{M_B}$; where T is the temperature and M is molecular mass. If C_A and C_B are the $r.m.s.$ speed, then the ratio $\frac{C_A}{C_B}$ will be equal to

(A) 2 (B) 4

(C) 1 (D) 0.5

51. For a gas at a temperature T the root-mean-square velocity v_{rms}, the most probable speed v_{mp}, and the average speed v_{av} obey the relationship

(A) $v_{av} > v_{rms} > v_{mp}$ (B) $v_{rms} > v_{av} > v_{mp}$

(C) $v_{mp} > v_{av} > v_{rms}$ (D) $v_{mp} > v_{rms} > v_{av}$

52. If V_H, V_N and V_O denote the root-mean square velocities of molecules of hydrogen, nitrogen and oxygen respectively at a given temperature, then

(A) $V_N > V_O > V_H$ (B) $V_H > V_N > V_O$

(C) $V_O = V_N = V_H$ (D) $V_O > V_H > V_N$

53. If mass of He atom is 4 times that of hydrogen atom then mean velocity of He is

(A) 2 times of H-mean value

(B) 1/2 times of H-mean value

(C) 4 times of H-mean value

(D) Same as H-mean value

54. The $r.m.s.$ speed of a group of 7 gas molecules having speeds (6, 4, 2, 0, – 2, – 4, – 6) m/s is

(A) 1.5 m/s (B) 3.4 m/s

(C) 9 m/s (D) 4 m/s

55. If the ratio of vapour density for hydrogen and oxygen is $\frac{1}{16}$, then under constant pressure the ratio of their rms velocities will be

(A) $\frac{4}{1}$ (B) $\frac{1}{4}$

(C) $\frac{1}{16}$ (D) $\frac{16}{1}$

56. Molecular motion shows itself

(A) Temperature (B) Internal Energy

(C) Friction (D) Viscosity

57. According to the kinetic theory of gases, at absolute temperature

(A) Water freezes

(B) Liquid helium freezes

(C) Molecular motion stops

(D) Liquid hydrogen freezes

58. The $r.m.s.$ speed of gas molecules is given by

(A) $2.5\sqrt{\frac{RT}{M}}$ (B) $1.73\sqrt{\frac{RT}{M}}$

(C) $2.5\sqrt{\frac{M}{RT}}$ (D) $1.73\sqrt{\frac{M}{RT}}$

59. What is the velocity of wave in monoatomic gas having pressure 1 *kilopascal* and density $2.6\,kg/m^3$

(A) $3.6\,m/s$ (B) $8.9\times10^3\ m/s$

(C) Zero (D) None of these

60. When temperature of an ideal gas is increased from $27°C$ to $227°C$, its $r.m.s.$ speed changed from 400 *metre*/*sec* to V_s. The V_s is

(A) 516 *metre*/*sec* (B) 450 *metre*/*sec*

(C) 310 *metre*/sec (D) 746 *metre*/*sec*

Degree of Freedom and Specific Heat

61. The following sets of values for C_V and C_P of a gas has been reported by different students. The units are *cal*/*gm-mole-K*. Which of these sets is most reliable

(A) $C_v = 3, C_p = 5$ (B) $C_V = 4, C_P = 6$

(C) $C_v = 3, C_p = 2$ (D) $C_V = 3, C_P = 4.2$

62. The specific heat at constant volume for the monoatomic argon is 0.075 *kcal/kg-K*, whereas its gram molecular specific heat C_V = 2.98 *cal/mole/K*. The mass of the argon atom is (Avogadro's number $= 6.02\times 10^{23}$ *molecules / mole*)

(A) $6.60\times 10^{-23}\, gm$ (B) $3.30\times 10^{-23}\, gm$

(C) $2.20\times 10^{-23}\, gm$ (D) $13.20\times 10^{-23}\, gm$

63. Supposing the distance between the atoms of a diatomic gas to be constant, its specific heat at constant volume per mole (gram mole) is

(A) $\frac{5}{2}R$ (B) $\frac{3}{2}R$

(C) R (D) $\frac{1}{2}R$

64. For a certain gas, the ratio of specific heats is given to be $\gamma = 1.5$. For this gas

(A) $C_v = \frac{3R}{J}$ (B) $C_p = \frac{3R}{J}$

(C) $C_p = \frac{5R}{J}$ (D) $C_V = \frac{5R}{J}$

65. The specific heats at constant pressure is greater than that of the same gas at constant volume because

(A) At constant pressure work is done in expanding the gas

(B) At constant volume work is done in expanding the gas

(C) The molecular attraction increases more at constant pressure

(D) The molecular vibration increases more at constant pressure

66. The specific heat of a gas

(A) Has only two values C_p and C_v

(B) Has a unique value at a given temperature

(C) Can have any value between 0 and ∞

(D) Depends upon the mass of the gas

67. The molar specific heat at constant pressure for a monoatomic gas is

(A) $\frac{3}{2}R$ (B) $\frac{5}{2}R$

(C) $\frac{7}{2}R$ (D) $4\,R$

68. For a gas if $\gamma = 1.4$, then atomicity, C_p and C_v of the gas are respectively

(A) Monoatomic, $\frac{5}{2}R, \frac{3}{2}R$

(B) Monoatomic, $\frac{7}{2}R, \frac{5}{2}R$

(C) Diatomic, $\frac{7}{2}R, \frac{5}{2}R$

(D) Triatomic, $\frac{7}{2}R, \frac{5}{2}R$

69. Which of the following formulae is wrong

(A) $C_V = \frac{R}{\gamma - 1}$ (B) $C_P = \frac{\gamma R}{\gamma - 1}$

(C) $C_p / C_v = \gamma$ (D) $C_P - C_V = 2R$

70. In gases of diatomic molecules, the ratio of the two specific heats of gases C_P / C_V is

(A) 1.66 (B) 1.40

(C) 1.33 (D) 1.00

71. The temperature of argon, kept in a vessel, is raised by $1°C$ at a constant volume. The total heat supplied to the gas is a combination of translational and rotational energies. Their respective shares are

(A) 60% and 40% (B) 40% and 60%

(C) 50% and 50% (D) 100% and 0%

72. On giving equal amount of heat at constant volume to 1 *mol* of a monoatomic and a diatomic gas the rise in temperature (ΔT) is more for

(A) Monoatomic

(B) Diatomic

(C) Same for both

(D) Can not be predicted

73. The kinetic energy, due to translational motion, of most of the molecules of an ideal gas at absolute temperature T is

(A) kT (B) k/T

(C) T/k (D) $1/kT$

74. The number of translational degrees of freedom for a diatomic gas is

(A) 2 (B) 3

(C) 5 (D) 6

75. The value of the gas constant (R) calculated from the perfect gas equation is 8.32 *joules/gm* mole K, whereas its value calculated from the knowledge of C_P and C_V of the gas is 1.98 *cal/gm* mole K. From this data, the value of J is

(A) $4.16\ J/cal$ (B) $4.18\ J/cal$

(C) $4.20\ J/cal$ (D) $4.22\ J/cal$

76. For a gas if ratio of specific heats at constant pressure and volume is γ then value of degrees of freedom is

(A) $\frac{3\gamma-1}{2\gamma-1}$ (B) $\frac{2}{\gamma-1}$

(C) $\frac{9}{2}(\gamma-1)$ (D) $\frac{25}{2}(\gamma-1)$

77. The ratio of specific heat of a mixture of one mole of helium and one mole of hydrogen gas will be

(A) 1 (B) 1.5

(C) 1.53 (D) 1.33

78. For a gas $\gamma = 7/5$. The gas may probably be

(A) Helium (B) Hydrogen

(C) Argon (D) Neon

79. If a gas has n degrees of freedom ratio of specific heats of gas is

(A) $\frac{1+n}{2}$ (B) $1+\frac{1}{n}$

(C) $1+\frac{n}{2}$ (D) $1+\frac{2}{n}$

80. 5 moles of oxygen is heated at constant volume from 10°C to 20°C. The change in the internal energy of the gas is (the gram molecular specific heat of oxygen at constant pressure, $C_p = 8$ *cal/mole* °C and R = 8.3 *cal/mole* °C)

(A) 200 *cal* (B) 300 *cal*

(C) 100 *cal* (D) None of these

Pressure and Energy

81. The ratio of mean kinetic energy of hydrogen and oxygen at a given temperature is

(A) 1 : 16 (B) 1 : 8

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

82. The ratio of mean kinetic energy of hydrogen and nitrogen at temperature 300 K and 450 K respectively is

(A) 3 : 2 (B) 2 : 3

(C) 2 : 21 (D) 4 : 9

83. According to the kinetic theory of gases, total energy of a gas is equal to

(A) Potential energy (B) Kinetic energy

(C) Both (A) and (B) (D) None of the above

84. The average kinetic energy of a gas molecule can be determined by knowing

(A) The number of molecules in the gas

(B) The pressure of the gas only

(C) The temperature of the gas only

(D) None of the above is enough by itself

85. Mean kinetic energy (or average energy) per *gm* molecule of a monoatomic gas is given by

(A) $\frac{3}{2}RT$ (B) $\frac{1}{2}KT$

(C) $\frac{1}{2}RT$ (D) $\frac{3}{2}KT$

86. A sealed container with negligible coefficient of volumetric expansion contains helium (a monoatomic gas). When it is heated from 300 K to 600 K, the average K.E. of helium atoms is

(A) Halved

(B) Unchanged

(C) Doubled

(D) Increased by factor $\sqrt{2}$

87. The time average of the kinetic energy of one molecule of a gas taken over a long period of time

(A) Is proportional to the square root of the absolute temperature of the gas

(B) Is proportional to the absolute temperature of the gas

(C) Is proportional to the square of the absolute temperature of the gas

(D) Does not depend upon the absolute temperature of the gas

88. The kinetic energy per *gm mol* for a diatomic gas at room temperature is

(A) 3 RT (B) $\frac{5}{2}RT$

(C) $\frac{3}{2}RT$ (D) $\frac{1}{2}RT$

89. At which of the following temperature would the molecules of a gas have twice the average kinetic energy they have at 20°*C*

(A) 40°*C* (B) 80°*C*

(C) 313°*C* (D) 586°*C*

90. The kinetic energy of translation of 20 *gm* of oxygen at 47°*C* is (molecular wt. of oxygen is 32 *gm*/*mol* and R = 8.3 *J*/*mol*/*K*)

(A) 2490 *joules* (B) 2490 *ergs*

(C) 830 *joules* (D) 124.5 *joules*

91. Vessel *A* is filled with hydrogen while vessel *B*, whose volume is twice that of *A*, is filled with the same mass of oxygen at the same temperature. The ratio of the mean kinetic energies of hydrogen and oxygen is

(A) 16 : 1 (B) 1 : 8

(C) 8 : 1 (D) 1 : 1

92. Energy of all molecules of a monoatomic gas having a volume *V* and pressure *P* is $\frac{3}{2}PV$. The total translational kinetic energy of all molecules of a diatomic gas as the same volume and pressure is

(A) $\frac{1}{2}PV$ (B) $\frac{3}{2}PV$

(C) $\frac{5}{2}PV$ (D) $3PV$

93. On absolute temperature, the kinetic energy of the molecules

(A) Becomes zero

(B) Becomes maximum

(C) Becomes minimum

(D) Remains constant

94. The temperature of a gas is – 68°*C*. At what temperature will the average kinetic energy of its molecules be twice that of at – 68°*C*

(A) 137°*C* (B) 127°*C*

(C) 100°*C* (D) 105°*C*

95. The average kinetic energy of a helium atom at 30^oC is

(A) Less than 1 *eV* (B) A few *keV*

(C) 50-60 *eV* (D) 13.6 *eV*

96. Two gases are at absolute temperatures 300 *K* and 350 *K* respectively. Ratio of average kinetic energy of their molecules is

(A) 7 : 6 (B) 6 : 7

(C) 36 : 49 (D) 49 : 36

97. A gas mixture consists of molecules of type 1, 2 and 3, with molar masses $m_1 > m_2 > m_3$. V_{rms} and $\overline{K}$ are the *r.m.s.* speed and average kinetic energy of the gases. Which of the following is true

(A) $(V_{rms})_1 < (V_{rms})_2 < (V_{rms})_3$ and $(\overline{K})_1 = (\overline{K})_2 = (\overline{K}_3)$

(B) $(V_{rms})_1 = (V_{rms})_2 = (V_{rms})_3$ and $(\overline{K})_1 = (\overline{K})_2 > (\overline{K})_3$

(C) $(V_{rms})_1 > (V_{rms})_2 > (V_{rms})_3$ and $(\overline{K})_1 < (\overline{K})_2 > (\overline{K}_3)$

(D) $(V_{rms})_1 > (V_{rms})_2 > (V_{rms})_3$ and $(\overline{K})_1 < (\overline{K})_2 < (\overline{K})_3$

98. On colliding in a closed container the gas molecules

(A) Transfer momentum to the walls

(B) Momentum becomes zero

(C) Move in opposite directions

(D) Perform Brownian motion

99. The mean kinetic energy of a gas at 300 *K* is 100 J. The mean energy of the gas at 450 K is equal to

(A) 100 *J* (B) 3000 *J*

(C) 450 *J* (D) 150 *J*

100. The capacity of a vessel is 3 *litres*. It contains 6 *gm* oxygen, 8 *gm* nitrogen and 5 *gm* CO_2 mixture at 27°*C*. If *R* = 8.31 *J*/*mole* × *kelvin*, then the pressure in the vessel in N/m^2 will be (approx.)

(A) 5×10^5 (B) 5×10^4

(C) 10^6 (D) 10^5

101. Vapour is injected at a uniform rate in a closed vessel which was initially evacuated. The pressure in the vessel

(A) Increase continuously

(B) Decreases continuously

(C) First increases and then decreases

(D) First increase and then becomes constant

102. In the absence of intermolecular force of attraction, the observed pressure P will be

(A) P (B) $< P$

(C) $> P$ (D) Zero

103. The total momentum of the molecules of 1 *gm mol* of a gas in a container at rest of 300 K is

(A) $2\times\sqrt{3R\times 300}\ gm\times cm/\sec$

(B) $2\times 3\times R\times 300\ gm\times cm/\sec$

(C) $1\times\sqrt{3\times R\times 300}\ gm\times cm/\sec$

(D) Zero

104. Two ideal gases at absolute temperature T_1 and T_2 are mixed. There is no loss of energy. The masses of the molecules are m_1 and m_2 and the number of molecules in the gases are n_1 and n_2 respectively. The temperature of mixture will be

(A) $\frac{T_1+T_2}{2}$ energy (B) $\frac{T_1+T_2}{n_1 n_2}$

(C) $\frac{n_1T_1+n_2T_2}{n_1+n_2}$ (D) (T_1+T_2)

105. The molecules of an ideal gas at a certain temperature have

(A) Only potential energy

(B) Only kinetic energy

(C) Potential and kinetic energy both

(D) None of the above

106. Mean kinetic energy per degree of freedom of gas molecules is

(A) $\frac{3}{2}kT$ (B) kT

(C) $\frac{1}{2}KT$ (D) $\frac{3}{2}RT$

107. The temperature at which the average translational kinetic energy of a molecule is equal to the energy gained by an electron in accelerating from rest through a potential difference of 1 *volt* is

(A) $4.6\times 10^3\,K$ (B) $11.6\times 10^3\,K$

(C) $23.2\times 10^3\,K$ (D) $7.7\times 10^3\,K$

108. The kinetic energy of one gm-mole of a gas at normal temperature and pressure is (R = 8.31 *J/Mole-K*)

(A) $0.56\times 10^4\,J$ (B) $1.3\times 10^2\,J$

(C) $2.7\times 10^2\,J$ (D) $3.4\times 10^3\,J$

109. The average kinetic energy of hydrogen molecules at 300 K is E. At the same temperature, the average kinetic energy of oxygen molecules will be

(A) $E/4$ (B) $E/16$

(C) E (D) $4E$

110. The average translational kinetic energy of a hydrogen gas molecules at NTP will be [Boltzmann's constant $k_B = 1.38\times 10^{-23}\,J/K$]

(A) 0.186×10^{-20} *Joule* (B) 0.372×10^{-20} *Joule*

(C) 0.56×10^{-20} *Joule* (D) 5.6×10^{-20} *Joule*