

RK VISION ACADEMY

PHYSICS

XI – KINETIC THEORY OF GASES

SECTION A

- 1. A perfect gas at 27°C is heated at constant pressure so as to triple its volume. The temperature of the gas will be
 - (1) 81°C
 - (2) 900°C
 - (3) 627°C
 - (4) 450°C
- 2. The mean free path of gas molecules depends on (d = molecular diameter)
 - (1) d
 - (2) d^2
 - $(3) d^{-2}$
 - (4) d⁻¹
- 3. If pressure of a gas contained in a closed vessel is increased by 0.4% when heated by 1°C, the initial temperature must be (1) 250 K
 - (2) 250°C
 - (3) 2500 K
 - (4) 25°C
- 4. Which of the following statements about kinetic theory of gases is wrong

(1) The molecules of a gas are in continuous random motion

(2) The molecules continuously undergo

inelastic collisions

(3) The molecules do not interact with each other except during collisions

(4) The collisions amongst the molecules are of short duration

- 5. At NTP, sample of equal volume of chlorine and oxygen is taken. Now ratio of No. of molecules
 - (1) 1 : 1
 - (2) 32 : 27
 - (3) 2 : 1
 - (4) 16 : 14

6. Volume of gas become four times if

(1) Temperature become four times at constant pressure

(2) Temperature become one fourth at constant pressure

(3) Temperature becomes two times at constant pressure

(4) Temperature becomes half at constant pressure

7. The equation for an ideal gas is PV = RT, where V represents the volume of

- (1) 1 gm gas
- (2) Any mass of the gas
- (3) One gm mol gas
- (4) One litre gas
- 8. The number of molecules in a gas at pressure 1.64×10⁻³ atmospheres and temperature 200 K having the volume 1 cc are

- (1) 6.02×10¹⁶
- (2) 2.63×10⁶
- (3) 3.01×10^{^9}
- (4) 12.04×10¹⁹

9. For ideal gas, which statement is not true

- (1) It obeys Boyle's law
- (2) It follows PV = RT
- (3) Internal energy depends on temperature only
- (4) It follows Vander-Waal's equation
- 10. When volume of system is increased two times and temperature is decreased half of its initial temperature, then pressure becomes
 - (1) 2 times
 - (2) 4 times
 - (3) 1/4 times
 - (4) 1/2 times
- 11. The equation of state corresponding to 8 g of O₂ is
 - (1) PV = 8RT
 - (2) PV = RT/4
 - (3) PV = RT
 - (4) PV = RT/2
- 12. If the molecular weight of two gases are M_1 and M_2 , then at a temperature the ratio of root mean square velocity v_1 and v_2 will be
 - (1) $\sqrt{(M_1/M_2)}$
 - (2) $\sqrt{(M_2/M_1)}$
 - (3) $\sqrt{((M_1+M_2)/(M_1-M_2))}$

- (4) $\sqrt{((M_1-M_2)/(M_1+M_2))}$
- 13. At what temperature is the root mean square velocity of gaseous hydrogen molecules is equal to that of oxygen molecules at 47°C
 - (1) 20 K
 - (2) 80 K
 - (3) 73 K
 - (4) 3 K

14. For a gas, the r.m.s. speed at 800 K is

- (1) Four times the value at 200 K
- (2) Half the value at 200 K
- (3) Twice the value at 200 K
- (4) Same as at 200 K
- 15. At a certain temperature, the r.m.s. velocity for O₂ is 400 m/sec. At the same temperature, the r.m.s. velocity for H₂ molecules will be
 - (1) 100 m/sec
 - (2) 25 m/sec
 - (3) 1600 m/sec
 - (4) 6400 m/sec
- 16. 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
 - (1) 2
 - (2) 1.58
 - (3) 1.6
 - (4) 1.31

17. A gas is allowed to expand isothermally.

The root mean square velocity of the molecules

- (1) Will increase
- (2) Will decrease
- (3) Will remain unchanged
- (4) Depends on the other factors

18. Moon has no atmosphere because

- (1) The r.m.s. velocity of all gases is more than the escape velocity from moon's surface
- (2) Its surface is not smooth
- (3) It is quite far away from the earth
- (4) It does not have population and plants
- 19. 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
 - (1) 3/y
 - (2) y/3
 - (3) $\sqrt{(3/\gamma)}$
 - (4) $\sqrt{(\gamma/3)}$

20. Which of the following statement is true

 Absolute zero degree temperature is not zero energy temperature

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

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

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

- 21. The value of densities of two diatomic gases at constant temperature and pressure are d₁ and d₂, then the ratio of speed of sound in these gases will be
 - (1) $d_1 d_2$ (2) $\sqrt{(d_2/d_1)}$
 - (3) $\sqrt{(d_1/d_2)}$
 - (4) $\sqrt{(d_1 d_2)}$
- 22. According to the kinetic theory of gases, at absolute temperature
 - (1) Water freezes
 - (2) Liquid helium freezes
 - (3) Molecular motion stops
 - (4) Liquid hydrogen freezes
- 23. For a gas at a temperature T the rootmean-square velocity v_{rms} , the most probable speed v_{mp} , and the average speed v_{av} obey the relationship
 - (1) $v_{av} > v_{rms} > v_{mp}$
 - (2) $v_{rms} > v_{av} > v_{mp}$
 - (3) $v_{mp} > v_{av} > v_{rms}$
 - (4) $v_{mp} > v_{rms} > v_{av}$
- 24. The r.m.s. speed of a certain gas is V at 400K. The temperature at which the r.m.s. speed becomes two times, will be
 - (1) 800 K
 - (2) 1600 K
 - (3) 1200 K
 - (4) None of these

25. For a gas $R/C_V = 0.67$. This gas is made up

of molecules which are

(1) Diatomic

(2) Mixture of diatomic and polyatomic molecules

- (3) Monoatomic
- (4) Polyatomic
- 26. The value of C_V for one mole of neon gas
 - is
 - (1) 1/2 R
 - (2) 3/2 R
 - (3) 5/2 R
 - (4) 7/2 R
- 27. If the degree of freedom of a gas are f, then the ratio of two specific heats C_P/C_V is given by
 - (1) 2/f+1
 - (2) 1-2/f
 - (3) 1+1/f
 - (4) 1-1/f
- 28. A cylinder rolls without slipping down an inclined plane, the number of degrees of freedom it has, is

(1) 2
 (2) 3
 (3) 5

- (4) 1
- 29. The degrees of freedom of a triatomic gas
 - is
 - (1) 2
 - (2) 4
 - (3) 6

(4) 8

- 30. For a gas if γ=1.4, then atomicity, C_p and C_v of the gas are respectively
 (1) Monoatomic, 5/2 R, 3/2 R
 - (2) Monoatomic, 7/2 R, 5/2 R
 - (3) Diatomic, 7/2 R, 5/2 R
 - (4) Triatomic, 7/2 R, 5/2 R
- 31. The specific heat relation for ideal gas is
 - (1) $C_P+C_V=R$ (2) $C_P-C_V=R$ (3) $C_P/C_V=R$ (4) $C_V/C_P=R$
- 32. A gaseous mixture consists of 16g of helium and 16g of oxygen. The ratio C_P/C_V of the mixture is
 - (1) 1.4
 - (2) 1.54
 - (3) 1.59
 - (4) 1.62
- 33. The relation between the gas pressure P and average kinetic energy per unit volume E is
 - (1) P=1/2 E
 (2) P = E
 (3) P=3/2 E
 - (4) P=2/3 E
 - (+) I 2/3 L
- 34. The ratio of mean kinetic energy of hydrogen and nitrogen at temperature
 300 K and 450 K respectively is

 (1) 3 : 2

- (2) 2 : 3
- (3) 2: 21
- (4) 4 : 9
- 35. The kinetic energy per gm mol for a diatomic gas at room temperature is
 - (1) 3 RT
 - (2) (5/2)RT
 - (3) (3/2)RT
 - (4) (1/2)RT

SECTION B

- 36. At what temperature is the kinetic energy of a gas molecule double that of its value of 27°C
 - (1) 54°C
 - (2) 300 K
 - (3) 327°C
 - (4) 108°C
- 37. A polyatomic gas with n degrees of freedom has a mean energy per molecule given by
 - (1) nkT/N
 - (2) nkT/2N
 - (3) nkT/2
 - (4) 3kT/2
 - (N is Avogadro's number)

38. The graph which represent the variation of mean kinetic energy of molecules with temperature $t^{\circ}C$ is



39. The adjoining figure shows graph of pressure and volume of a gas at two temperatures T_1 and T_2 . Which of the following interferences is correct



- (1) T₁ > T₂
 (2) T₁ = T₂
 (3) T₁ < T₂
 (4) No interference can be drawn
- 40. The velocities of 4 molecules are 2 m/s, 4 m/s, 5 m/s and 6 m/s respectively. What is their mean square velocity?
 - (1) $51/4 \text{ m}^2/\text{s}^2$ (2) $61/4 \text{ m}^2/\text{s}^2$
 - (3) $71/4 \text{ m}^2/\text{s}^2$
 - (4) $81/4 \text{ m}^2/\text{s}^2$
- 41. The temperature of an ideal gas is increased from 100K to 400K. If x is he R.M.S. velocity of its molecules at 100K,

then at 400K, it becomes

- (1) 4 x
- (2) x/4
- (3) 2x
- (4) 3x
- 42. The value of $\gamma = Cp/Cv$ for a gas is given by $\gamma = 1 + 2/f$ where f is the number of degrees of freedom of a molecule of a gas. What is the ratio of $\gamma_{monoatomic} / \gamma_{diatomic}$?
 - (1) 25/21
 - (2) 21/25
 - (3) 5/7
 - (4) 3/5
- 43. The speed of sound in a gas at S.T.P. is330 m/s and the density of the gas is 1.3 kg/m3 what is the number of degrees of freedom of the molecule of the gas?
 - (1) 2
 - (2) 3
 - (3) 4
 - (4) 5
- 44. A gaseous mixture consists of 16 g of helium and 16 g of oxygen. What is the ratio Cp / C_V of the mixture
 - (1) 1.62
 - (2) 1.55
 - (3) 1.81
 - (4) 1.45
- 45. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is:

- (1) 5.6×10³ m³
 (2) 5.6×10⁻³ m³
 (3) 5.6 m³
- (4) $5.6 \times 10^6 m^3$
- 46. The temperature of a gas is -50 °C. To what temperature the gas should be heated so that the rms speed is increased by 3 times?
 - (1) 223 *K*
 - (2) 669°C
 - (3) 3295°C
 - (4) 3097 K
- 47. The mean free path of molecules of a gas, (radius r) is inversely proportional to:
 - $(1) r^3$
 - (2) r^2
 - (3) r
 - (4) √r
- 48. 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
- 49. A gas mixture consists of 2 moles of O2 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

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(4) 4 RT
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- 50. 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)

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/. 5 9 1	42. 1
	43. 3
3. 4 10 3	44. 1
10. 5	45. 3
11. 2 12. 2	46. 3
	47. 2
14. 3	48. 2
15.3	49. 3
16. 3	50. 4
17. 3	
18. 4	
19. 4	
20. 1	
21. 2	
22. 3	
23. 2	
24. 2	
25. 3	
26. 2	
27. 1	
28. 1	

31.	2
32.	3
33.	4
34.	2
35.	2
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40.	4
41.	3
42.	
43.	3
44.	1
45.	3
46.	3
47.	2
48.	2
49.	3
50.	4