Gaseous state Assignment

1. Densities of two gases are in the ratio 1 : 2 and their temperatures are in the ratio 2 : 1, then the ratio of their respective pressures is

(a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 4 : 1

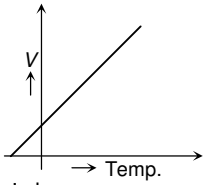
2. If pressure becomes double at the same absolute temperature on 2 *L* CO_2, then the volume of CO_2 becomes

(a) 2 *L* (b) 4 *L* (c) 25 *L* (d) 1 *L*

3. Pressure remaining the same, the volume of a given mass of an ideal gas increases for every degree centigrade rise in temperature by definite fraction of its volume at

(a) 0^oC (b) Its critical temperature (c) Absolute zero (d) Its Boyle temperature

4. The following graph illustrates



(a) Dalton's law (b) Charle's law (c) Boyle's law (d) Gay-Lussac's law

5. A certain sample of gas has a volume of 0.2 *litre* measured at 1 *atm.* pressure and 0^oC. At the same pressure but at 273^oC, its volume will be

(a) 0.4 *litres* (b) 0.8 *litres* (c) 27.8 *litres* (d) 55.6 *litres*

6. 300 *ml* of a gas at 27^oC is cooled to -3^oC at constant pressure, the final volume is

(a) 540 *ml* (b) 135 *ml* (c) 270 *ml* (d) 350 *ml*

7. 400 cm^3 of oxygen at 27^oC were cooled to -3^oC without change in pressure. The contraction in volume will be

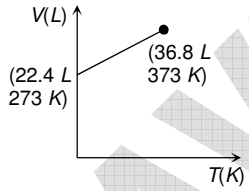
(a) 40 cm^3 (b) 30 cm^3 (c) 44.4 cm^3 (d) 360 cm^3

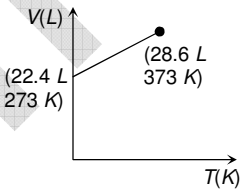
8. The pressure *p* of a gas is plotted against its absolute temperature *T* for two different constant volumes, V_1 and V_2. When $V_1 > V_2$, the

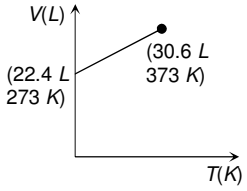
(a) Curves have the same slope and do not intersect (b) Curves must intersect at some point other than $T = 0$

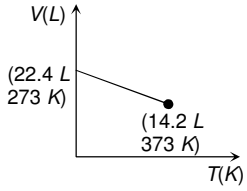
(c) Curve for V_2 has a greater slope than that for V_1 (d) Curve for V_1 has a greater slope than that for V_2

9. Which of the following volume (*V*) – temperature (*T*) plots represents the behaviour of one mole of an ideal gas at one atmospheric pressure

(a)


(b)


(c)


(d)


10. Two closed vessels of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow tube. If the temperature in one of the vessels is now maintained at T_1 and that in the other at T_2, what will be the pressure in the vessels

(a) $\frac{2P_1T_1}{T_1+T_2}$ (b) $\frac{T_1}{2P_1T_2}$ (c) $\frac{2P_1T_2}{T_1+T_2}$ (d) $\frac{2P_1}{T_1+T_2}$

11. Two separate bulbs contain ideal gases *A* and *B*. The density of gas *A* is twice that of gas *B*. The molecular mass of *A* is half that of gas *B*. The two gases are at the same temperature. The ratio of the pressure of *A* to that of gas *B* is

(a) 2 (b) 1/2 (c) 4 (d) 1/4

12. 16 *g* of oxygen and 3 *g* of hydrogen are mixed and kept at 760 *mm* pressure and 0^oC. The total volume occupied by the mixture will be nearly

(a) 22.4 *litres* (b) 33.6 *litres* (c) 448 *litres* (d) 44800 *ml*

13. Pure hydrogen sulphide is stored in a tank of 100 *litre* capacity at 20^oC and 2 *atm* pressure. The mass of the gas will be

(a) 34 *g* (b) 340 *g* (c) 282.4 *g* (d) 28.24 *g*

14. At N.T.P. the volume of a gas is found to be 273 *ml*. What will be the volume of this gas at 600 *mm Hg* and 273^oC

(a) 391.8 *mL* (b) 380 *ml* (c) 691.6 *ml* (d) 750 *ml*

15. One *litre* of a gas weighs 2 *g* at 300 *K* and 1 *atm* pressure. If the pressure is made 0.75 *atm*, at which of the following temperatures will one *litre* of the same gas weigh one *gram*

(a) 450 *K* (b) 600 *K* (c) 800 *K* (d) 900 *K*

16. A wheather balloon filled with hydrogen at 1 *atm* and 27^oC has volume equal to 12000 *litres*. On ascending it reaches a place where the temperature is -23^oC and pressure is 0.5 *atm*. The volume of the balloon is

(a) 24000 *litres* (b) 20000 *litres* (c) 10000 *litres* (d) 12000 *litres*

17. The density of a gas at 27^oC and 1 *atm* is *d*. Pressure remaining constant at which of the following temperatures will its density become 0.75 *d*

(a) 20^oC (b) 30^oC (c) 400 *K* (d) 300 *K*

18. A sample of gas occupies 100 *ml* at 27^oC and 740 *mm* pressure. When its volume is changed to 80 *ml* at 740 *mm* pressure, the temperature of the gas will be

(a) 21.6^oC (b) 240^oC (c) -33^oC (d) 89.5^oC

19. In an experiment during the analysis of a carbon compound, 145 cm^3 of H_2 was collected at 760 *mm Hg* pressure and 27^oC temperature. The mass of H_2 is nearly

(a) 10 *g* (b) 12 *g* (c) 24 *g* (d) 6 *g*

20. Same mass of CH_4 and H_2 is taken in container. The partial pressure caused by H_2 is

(a) $\frac{8}{9}$ (b) $\frac{1}{9}$ (c) $\frac{1}{2}$ (d) 1

21. Equal amounts of two gases of molecular weight 4 and 40 are mixed. The pressure of the mixture is 1.1 *atm.* The partial pressure of the light gas in this mixture is

(a) 0.55 *atm* (b) 0.11 *atm* (c) 1 *atm* (d) 0.12 *atm*

22. A bottle of ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends, the white ammonium chloride ring first formed will be

(a) At the centre of the tube (b) Near the hydrogen chloride bottle
(c) Near the ammonia bottle (d) Throughout the length of the tube

23. Which of the following pairs will diffuse at the same rate through a porous plug

(a) *CO*, NO_2 (b) NO_2, CO_2 (c) NH_3, PH_3 (d) *NO* C_2H_6

24. If 4 *g* of oxygen diffuse through a very narrow hole, how much hydrogen would have diffused under identical conditions

(a) 16 *g* (b) 1 *g* (c) 1/4 *g* (d) 64 *g*

25. A gas diffuse at a rate which is twice that of another gas *B*. The ratio of molecular weights of *A* to *B* is

(a) 1.0 (b) 0.75 (c) 0.50 (d) 0.25

26. Two grams of hydrogen diffuse from a container in 10 *minutes*. How many *grams* of oxygen would diffuse through the same container in the same time under similar conditions

(a) 0.5 *g* (b) 4 *g* (c) 6 *g* (d) 8 *g*

27. If some *moles* of O_2 diffuse in 18 *sec* and same *moles* of other gas diffuse in 45 *sec* then what is the molecular weight of the unknown gas

(a) $\frac{45^2}{18^2}\times 32$ (b) $\frac{18^2}{45^2}\times 32$ (c) $\frac{18^2}{45^2\times 32}$ (d) $\frac{45^2}{18^2\times 32}$

28. The ratio of rates of diffusion of SO_2, O_2 and CH_4 is

(a) $1:\sqrt{2}:2$ (b) 1 : 2 : 4 (c) $2:\sqrt{2}:1$ (d) $1:2:\sqrt{2}$

29. The rate of diffusion of methane at a given temperature is twice that of *X*. The molecular weight of *X* is

(a) 64.0 (b) 32.0 (c) 40.0 (d) 80.0

30. *X ml* of H_2 gas effuses through a hole in a container in 5 *seconds*. The time taken for the effusion of the same volume of the gas specified below under identical condition is

(a) 10 *seconds* : *He* (b) 20 *seconds* : O_2 (c) 25 *seconds* : *CO* (d) 55 *seconds* : CO_2

31. At what temperature, the rate of effusion of N_2 would be 1.625 times that of SO_2 at 50^oC

(a) 110 *K* (b) 173 *K* (c) 373 *K* (d) 273 *K*

32. Given the reaction $C(s)+H_2O(l)\rightarrow CO(g)+H_2(g)$ calculate the volume of the gases produced at STP from 48.0 *g* of carbon

(a) 179.2 *L* (b) 89.6 *L* (c) 44.8 *L* (d) 22.4 *L*

33. Helium atom is two times heavier than a hydrogen molecule at 298 *K*, the average kinetic energy of helium is

(a) Two times that of a hydrogen molecule (b) Same as that of a hydrogen molecule
(c) Four times that of a hydrogen molecule (d) Half that of a hydrogen molecule

34. Which of the following is valid at absolute zero

(a) Kinetic energy of the gas becomes zero but the molecular motion does not become zero
(b) Kinetic energy of the gas becomes zero and molecular motion also becomes zero
(c) Kinetic energy of the gas decreases but does not become zero
(d) None of the above

35. If a gas is expanded at constant temperature
(a) The pressure increases
(b) The kinetic energy of the molecules remains the same
(c) The kinetic energy of the molecules decreases
(d) The number of molecules of the gas increases

36. The average *K.E.* of an ideal gas in *calories* per mole is approximately equal to
(a) Three times the absolute temperature
(b) Absolute temperature
(c) Two times the absolute temperature
(d) 1.5 times the absolute temperature

37. According to kinetic theory of gases, for a diatomic molecule
(a) The pressure exerted by the gas is proportional to the mean velocity of the molecules
(b) The pressure exerted by the gas is proportional to the root mean square velocity of the molecules
(c) The root mean square velocity is inversely proportional to the temperature
(d) The mean translational kinetic energy of the molecules is proportional to the absolute temperature

38. At STP, 0.50 *mol* H_2 gas and 1.0 *mol He* gas
(a) Have equal average kinetic energies
(b) Have equal molecular speeds
(c) Occupy equal volumes
(d) Have equal effusion rates

39. Which of the following expressions correctly represents the relationship between the average molar kinetic energy, $\overline{K.E.}$, of *CO* and N_2 molecules at the same temperature
(a) $\overline{KE}_{CO} = \overline{KE}_{N_2}$
(b) $\overline{KE}_{CO} > \overline{KE}_{N_2}$
(c) $\overline{KE}_{CO} < \overline{KE}_{N_2}$
(d) Cannot be predicted unless the volumes of the gases are given

40. Indicate the correct statement for a 1-*L* sample of $N_2(g)$ and $CO_2(g)$ at 298 *K* and 1 *atm* pressure
(a) The average translational *KE* per molecule is the same in N_2 and CO_2
(b) The *rms* speed remains constant for both N_2 and CO_2
(c) The density of N_2 is less than that of CO_2
(d) The total translational *KE* of both N_2 and CO_2 is the same

41. Among the following gases which one has the lowest root mean square velocity at 25^oC
(a) SO_2 (b) N_2 (c) O_2 (d) Cl_2

42. The root mean square velocity of an ideal gas in a closed container of fixed volume is increased from $5\times10^4\ cm\ s^{-1}$ to $10\times10^4\ cm\ s^{-1}$. Which of the following statement correctly explains how the change is accomplished
(a) By heating the gas, the temperature is doubled
(b) By heating the gas, the pressure is quadrupled (*i.e.* made four times)
(c) By heating the gas, the temperature is quadrupled
(d) By heating the gas, the pressure is doubled

43. The *rms* velocity at NTP of the species can be calculated from the expression
(a) $\sqrt{\frac{3P}{d}}$ (b) $\sqrt{\frac{3\,PV}{M}}$ (c) $\sqrt{\frac{3\,RT}{M}}$ (d) All the above

44. Root mean square velocity of a gas molecule is proportional to
(a) $m^{1/2}$ (b) m^0 (c) $m^{-1/2}$ (d) m

45. At constant volume, for a fixed number of moles of a gas, the pressure of the gas increases with increase in temperature due to
(a) Increase in the average molecular speed
(b) Increased rate of collision amongst molecules
(c) Increase in molecular attraction
(d) Decrease in mean free path

46. The root mean square speeds at STP for the gases H_2, N_2, O_2 and *HBr* are in the order

(a) $H_2 < N_2 < O_2 < HBr$ (b) $HBr < O_2 < N_2 < H_2$ (c) $H_2 < N_2 = O_2 < HBr$ (d) $HBr < O_2 < H_2 < N_2$

47. Molecular velocities of the two gases at the same temperature are u_1 and u_2. Their masses are m_1 and m_2 respectively. Which of the following expressions is correct

(a) $\frac{m_1}{u_1^2} = \frac{m_2}{u_2^2}$ (b) $m_1 u_1 = m_2 u_2$ (c) $\frac{m_1}{u_1} = \frac{m_2}{u_2}$ (d) $m_1 u_1^2 = m_2 u_2^2$

48. At low pressure, the Vander Waal's equation is reduced to

(a) $Z = \frac{pV_m}{RT} = 1 - \frac{ap}{RT}$ (b) $Z = \frac{pV_m}{RT} = 1 + \frac{b}{RT}p$ (c) $pV_m = RT$ (d) $Z = \frac{pV_m}{RT} = 1 - \frac{a}{RT}$

49. At high temperature and low pressure, the Vander Waal's equation is reduced to

(a) $\left(p + \frac{a}{V_m^2}\right)(V_m) = RT$ (b) $pV_m = RT$ (c) $p(V_m - b) = RT$ (d) $\left(p + \frac{a}{V_m^2}\right)(V_m - b) = RT$

50. At 100^oC and 1 *atm*, if the density of liquid water is 1.0 $g\ cm^{-3}$ and that of water vapour is 0.0006 $g\ m^{-3}$, then the volume occupied by water molecules in 1 *litre* of steam at that temperature is

(a) 6 cm^3 (b) 60 cm^3 (c) 0.6 cm^3 (d) 0.06 cm^3