CHEMISTRY

BOOKS - V PUBLICATION

STATES OF MATTER

Question Bank

1. What will be the minimum pressure required to compress 500 dm^3 of air at 1 Bar to 200 dm^3 at 30ºC ?

2. A vessel of 120 mL capacity contains a certain amount of gas at 35ºC and 1.2 Bar pressure. The gas is transferred to another vessel of volume 180 mL at 35º C. What would be its pressure?

3. Using the èquation of state 'P V .eq n R T', show that at a given temperature density of a gas is proportional to gas pressure 'P'.

4. At $0°C$, the density of a certain oxide of a gas at 2 bar is the same as that of N_2 at 5 bar. What is the molecular mass of the oxide?

5. Pressure of 1 g an ideal gas A at $27°C$ is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature, the pressure becomes 3 bar. Find the relationship between the molecular masses of A and B

6. The drain cleaner, Drainex, contains aluminium which reacts with caustic soda to

produce H_2. What volume of H_2 at $20°C$ and 1 bar will be increased when 0.15 g of Al reacts?

7. What will be pressure exerted by a mixture of '3.2 g' of methane and '4.4 g' of carbon dioxide contained in a '9 dm^3' flask at '27^circ C' ?

8. What will be the pressure of the gaseous mixture when '0.5 ~L' of 'H_2' at '0.8' bar and '2.0' L of dioxygen at '0.7' bar are introduced in a '1 L' vessel at '27^circ C' ?

9. The density of a gas is found to by 5.46 g/ d m^3 at 27° C and under 2 Bar pressure . What will be its density at STP .

10. 34.05 mL' of phosphorus vapour weighs '0.0625 g' at '546^degree C' and '0.1' bar pressure. What is the molar mass of phosphorus?

11. A student forgot to add the reaction mixture to the round bottomed flask at '27^circ C', but he/she placed the flask on the flame. After a lapse of time, he realised his

mistake, using a pyrometer, he found the temperature of the flask was '477^circ C'. What fraction of the air would have been expelled out?

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12. Calculate the temperature of '4.0' omoles of a gas occupying '5 dm^3' at '3.32' bar '[R=0.083bar dm^3 K^(-1) mol^(-1)]'

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13. Calculate the total number of electrons present in '1.4 g' of nitrogen gas.

14. How much time would it take to distribute one Avogadro number of wheat grains, if '10^10' grains are distributed each second?

15. Calculate the 'total pressire in a mixture of 8gm of dioxygen and '4 g' of dihydrogen confined in a vessel of '1 dm^3' at '27^circ C . R=0.083' bar 'dm^3 K^(-1) mol^(-1)'

16. Pay load is defined as the difference between the mass of displaced air. and the mass : of the balloon. Calculate the pay load when a balloon of radius '10 m', mass '100 kg' is

filled with helium at '1.66' bar at '27^circ C' (Density of air '=1.2 kg m^(-3), R=0.083' bar '.d m^3 K^(-1) m o l^(-1))'

17. Calculate the volume occupied by 8.8 g of CO_2 at 31.1ºC and 1 Bar pressure (R= 0.083 Bar $L K^{-1} mol^{-1}$)

18. 2.9g of a gas $95°C$ occupied the same volume as 0.184g of H_2 at $17°C$ at the same pressure. What is the molar mass of the gas?

19. A mixture of dihydrogen and dioxygen at one bar pressure contains '20 %' ' by weight of dihydrogen. Calculate the partial pressure of dihydrogen.

20. What wóuld be the SI unit for the quantity PV^2T^2/n ?

21. In terms of Charles' law explain why $-273^\circ C$ is the lowest possible temperature.

22. Critical temperature for CO_2 and CH_4 are $30.98°C$ and $-81.9°C$ respectively. Which of these has stronger intermolecular forces. Why?

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23. Explain the significance of van der Waal parameters

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24. Liquid ammonia bottle is cooled before opening the seal. Why?

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25. Why are aerated water bottles kept under water during summer?

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26. Why are vegetables cooked with difficulty at a hill station ?

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27. Why are, liquids like ether and acetone kept in cool places?

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28. Tea or Coffee is sipped from a sáucer when it is hot. Why?

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29. How will you account for the observation that automobile tyres is inflated with lesser air in summer than in winter?

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30. The șize of weather balloon becomes' larger and larger as it ascends. Why?

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31. Liquid drops attains spherical shape. Which property of liquids is responsible for this ?

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32. Boiling point of H_2O (373K) is very much higher than that of H_2S (213 K). Give reason.

33. Two flasks ' A' and ' B ' have equal volumes. Flask ' A ' contains 'H_2' and is maintained at '300 K' while 'B' contains equal mass of 'CH_4' gas and is maintained at '600 K'.

i. Which flask contains greater number of molecules? How many times more?

ii. In which flask pressure is greater? How many times more?

iii. In which flask molecules are moving faster?

iv. In which flask the number of collisions with walls are greater?

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34. An astronaut in an orbiting space-ships spilled a few drops of his drink, and the liquid floated around the cabin. In what geometric

shape is each drop most likely to be found? Explain.

35. Certain properties of liquids are given below: Classify them on the basis of effect of temperature on them.

a) Evaporation b) Vapour pressure c) Surface tension d) Viscosity

36. Why is it not possible to cool a gas to '0 K' ?

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37. At what temperature will oxygen molecule have the same kinetic' energy. as ozone molecule at '30^0 C ?'

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38. Explain the significance of van der Waal parameters

39. Molecule 'A' is twice as heavy as the molecule 'B .' Which of these has higher kinetic energy at any temperature?

40. Out of NH_3 and N_2, which one will have greater value of the van dar Waal's constant 'a'

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41. Why are the gases helium and hydrogen not liquified at room temperature by applying very high pressure?

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42. Both 'N_2O' and 'CO_2' have similar rates of diffusion under similar conditions of temperature and pressure. Explain.

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43. An LPG cylinder when full contains '14.2 kg' gas and exerts a pressure of '2.5 atm .' If half of its gas is consumed what will be the pressure of the gas inside the cylinder ?

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44. Why hydrogen and helium show positive deviations only with increase in the value of 'P'.?

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45. Mercury drops are spherical in shape .

a) Which property is responsible for the spherical shape of drops? Explain the property.

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46. Thé total pressure of a mixture of O_2 and CO_2, in a container is given by the formúla,

$$P_{Total} = P_{O_2} + P_{CO_2}$$

a. Which law is used here? State the law.

b. Can the total pressure of a mixture of $'NH_3(g)$ and $HCl(g)$ taken in a container be determined using the formula.

$$P_{Total} = P_N H_3 + P_H Cl. \text{ Why?}$$

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47. The density of gas was found to be 2.92 g L^(-1) at 27º C and 2.0 atm . Calculate the molar mass of the gas.

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48. How does temperature influence the viscosity of a liquid?

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49. Why are the gases more compressible than liquids?

50. Indicate whether the following statement is true or false. Justify your answer. In the van der Waal's equation. $\left[p + \dfrac{n^2 a}{V^2}\right](V - nb) = nRT$ the constant a reflects the actual volume of the gas molecules.

51. How will you account for the observation that automobile tyres is inflated with lesser air in summer than in winter?
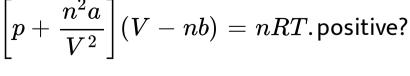
52. Although the molecules in a gas are moving about rapidly, a closed vessel of negligible weight containing the gas does not move.

53. How does an ideal gas differ from a real gas?

54. Why is the correction term $\dfrac{n^2 a}{V^2}$ in the van der Waal's equation $\left[p + \dfrac{n^2 a}{V^2}\right](V - nb) = nRT$. positive?

55. Why are the liquid drops spherical?

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56. Explain why Boyle's law cannot be used to calculate the volume of a real gas which is changed from its initial state to its final state by an adiabatic expansion.

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57. Real gases deviate from ideal behaviour .

a) What are the two wrong postulates of kinetic theory of gases, responsible for deviation of real gases from ideal behaviour?

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58. A vessel of '120 mL' capacity contains a certain mass of a gas at '20^circ C' and '750 mm' pressure. The gas was trànsferred to a vessel whose volume is '180 mL .' Calculate the pressure of the gas at '20^circ C'.

59. If the pressure of a certain amount of a gas is doubled keeping the temperature constant, what would be the volume of, the gas?

60. A gas occupies a volume of '250 m L' at '700 mm' of 'Hg' at '25^circ C'. What is the

additional pressure required to reduce the gas

volume to '200 mL' at the same temperature?

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61. Calculate the pressure exerted by $4.4g$ of

CO_2 gas which is kept in a $1litre$ flask at $0°C$.

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62. Calculate the 'total pressire in a mixture of

8gm of dioxygen and '4 g' of dihydrogen

confined in a vessel of '1 dm^3' at '27^circ C .

R=0.083' bar 'dm^3 K^(-1) mol^(-1)'

63. Consider a gas at 0° C. At what temperature will the volume be doubled if the pressure is kept constant?

64. 70 g' of a gas at '300 K' and 1 atmospheric pressure occupies a volume of '4.1' litres. What is the molecular mass of gas?

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65. The Compressibility factor for one mole of a van der Waal's gas at '0^circ C' and '100 atm' pressure is found to be '0.5 .' Assuming that the volume of gas molecule is negligible, calculate the van der Waal's constant 'a'?

66. A '1.28 g' sample of a colourless liquid was vapourised in a '250 ml' flask at '121^circ C' and '786 mm Hg'. What is the molar mass of this substance?

67. Calculate the total preśsure in a '10 L' cylinder which contains '0: 4 g' of helium, '1.6 g' of oxygen and '1.4 g' of nitrogen at '27^circ C'.

Also calculate the partial pressure of helium gas. in the cylinder. Assume ideal behaviour.for gases?

68. Measurement of the amount of dry gas collected over water from volume of moist gas is based on:

A. Gay Lussac's law

B. Dalton's law of partial pressures

C. Boyle's law

D. Avogadro's hypothesis

Answer: B

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69. Weight of '2 L' of nitrogen at NTP is:

A. 28g

B. 1.25g

C. 2.33g

D. 14.0g

Answer: C

70. On absolute temperature scale, -10 degree celsius is: 283K, 310K,263K,290K.

A. 283K

B. 310K

C. 263K

D. 290K

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71. The temperature of a gas in a closed container is '27^circ C'. If the temperature is raised to '327^circ C' the pressure exerted is:

A. Reduced to half

B. doubled

C. reduced to one-third

D. Cannot be calculated from the given information

Answer: B

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72. Whích of the following represents the value of gas constant, 'R' in joules/degree/mole? (a)1.987 (b)8.31*10^7 (c)0.082 (d)8.314

A. 1.987'

B. '8.31 xx 10^7'

C. 0.082'

D. '8.314'

Answer: D

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73. A gas at '10^circ C' occupies a volume of '283 ~mL .' If it is heated to '20^circ C'. keeping the pressure constant the new volume will be

A. 283mL

B. 293mL

C. 566mL

D. cannot be calculated from the given information

Answer:

74. At constant temperature, the pressure of VmL of a dry gas was increased from 1 atm to '2 ~atm .' The new volume will be

A. 2V

B. V/2

C. V^2'

D. V/4

Answer: B

75. The ratio of r.m.s. velocity and average velocity of a gas molecule at a particular temperature is

A. 1.086: 1'

B. 1: 1.086'

C. 2: 1.086'

D. 1,086: 2'

Answer: A

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76. What are the conditions under which real gases approach ideal behaviour?

A. low pressure and low temperature

B. low pressure and high temperature

C. high pressure and low temperature

D. high pressure and high temperature

Answer: B

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77. Equal masses of 'CH_4' and 'H_2' are mixed in an empty chamber. The partial pressure of hydrogen in this chamber expressed as fraction of total pressure is:

A. $1/2$'

B. $8/(19)$'

C. $1/9$'

D. $8/9$'

Answer: D

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78. The Van der Waal's equation accountś for:

(1)The intermolecular forces only (2)The actual volume of the molecules only (3)Both the intermolecular forces and the molecular volume

    A. The intermolecular forces only

    B. The actual volume of the molecules only

    C. Both the intermolecular forces and the molecular volume

    D.

Answer: C

79. The compressibility of factor for an ideal gas is:

A. Unity at all temperatures

B. Unity at Boyle's temperature

C. Zero

D. Decreases with pressure

Answer: A

80. According to kinetic theory of gases,

(1)Molecules attract each other (2) Energy is lost during molecular collisions (3)Molecules possess appreciable volume (4)The absolute temperature is a measure of the kinetic energy of the molecules.

A. molecules attract each other

B. energy is lost during molecular collisions

C. molecules possess appreciable volume

D. the absolute temperature is a measure

of the kinetic energy of the molecules.

Answer: D

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81. Liquids diffuse slowly as compared to gases

because;- liquids have no definite śhape , the

molecules of liquid are heavy, the molecules of

liquid move fast, the molecules are held together by strong intermolecular forces

A. liquids have no definite śhape

B. the molecules of liquid are heavy

C. the molecules of liquid move fast

D. the molecules are held together by strong intermolecular forces

Answer: D

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82. What is the relation between temperature of a liquid and its viscosity?

A. Increases

B. Decreases

C. Remains same

D. Is reduced to zero

Answer: B

83. Át high altifudes, the boiling point of water gets lowered because

    A. temperature is low

    B. atmosphėric pressure is low

    C. atmospheric pressure is high

    D. None of these

Answer: B

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84. For a given mass of a gas at constant temperature, if the volume 'V' becomes three times, then the pressure (p) will become

A. 3p

B. p/3

C. 3p/T

D. 9p^2'

Answer: B

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85. The heats of vaporisation of H_2O, C_2H_5OH and CS_2 are 40.6, 38.6 and $26.8kJ \ mol^{-1}$ respectively. The ordèr of decreåsing intermolecular forces in these liquids is $H_2O > C_2H_5OH > CS_2$, $CS_2 > C_2H_5OH > H_2O$, $H_2O > CS_2 > C_2H_5OH$, $CS_2O > H_2O > C, H_5OH$,

A. H_2 OgtC_2 H_5 OHgtCS_2^^*'

B. CS_2gtC_2 H_5 O HgtH_2 O'

C. H_2 OgtCS_2gtC_2 H_5 OH'

D. $CS_2 OgtH_2 OgtC, H_5 OH'$

Answer: A

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86. An open vessel at '37^circ C' is heated until '3 / 5' of the air in it has been expelled. Assuming that the volume of the vessel remains constant, the temperature to which the vessel 'is heated is

A. 502^circ C'

B. 502 K'

C. 243.67^circ C'

D. 92.5^circ C'

Answer: A

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87. In Van der Waals equation for a non-ideal gas, the term which accounts for the intermolecular forces is: $\dfrac{a}{V^2}$, b, RT, $\dfrac{1}{RT}$

A. aV^2'

B. b

C. RT

D. '1 /(R T)'

Answer: A

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88. A cylinder of 'V' litre capacity containing 'NH_3' gas is inverted over another vessel of 'V' litre capacity containing 'HCl'.gas at same

temperature and pressure. After some time the pressure in cylinder will

A. become double

B. remains same

C. drop considerably

D. become '3 / 2' of original pressure

Answer: C

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89. If air contains 'N_2' and 'O_2 in^prime' vòlume ratio '4: 1', the average vapour density of air is

A. 14.4

B. 15.5

C. 16.5

D. 29

Answer: A

90. The ratio of average speed of an oxygen molecule to the r.m.s. speed of a 'N_2' molecule at the same temperature is

A. $((3\pi)/7)^{(1/2)}$'

B. $(7/(3\pi))^{(1/2)}$'

C. $(3/(7\pi))^{(1/2)}$'

D. $((7\pi)/3)^{(1/2)}$'

Answer: B

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91. The gasés 'H_2, N_2, O_2' and 'NH_3' will diffuse in the order

    A. $H_2gtN_2gtO_2gtNH_3$'

    B. $NH_3gtO_2gtN_2gtH_2$'

    C. $H_2gtN_2gtNH_3gtO_2$'

    D. $H_2gtNH_3gtN_2gtQ_5$'

Answer: D

92. For an ideal gas, number of moles per litre in terms of its pressure 'P', gas constamt 'R' and temperature 'T' is

A. PT/R

B. PRT

C. P/(RT)

D. (RT)/P

Answer: C

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93. If volume containing gas' is compressed to half, moles of gas remained in the vessel will be:

A. Just double

B. just half

C. same

D. more than double

Answer: C

94. At higher pressure van der Waals' equation becomes, $PV = R,$ $PV = RT + \dfrac{a}{V},$ $PV = RT - \dfrac{a}{V}, PV = RT + Pb$

    A. PV=RT'

    B. PV=RT+a/V'

    C. PV=RT-a/V'

    D. PV=RT+Pb'

Answer: D

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95. When temperature is increased, surface tension of water

    A. increases

    B. decreases

    C. remains constant

    D. shows irregular behaviour

Answer: B

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96. The 'CO_2' gas does not follow gas laws at all ranges of pressure and temperature because,

A. its internal energy is quite high

B. It is triatomic gas

C. there is attraction between its molecules.

D. it solidify at low temperature

Answer: C

97. Liquor ammonia bottles are opened only after cooling. This is because, (a)It is a mild explosive. (b)it generates high vapour pressure, (c)It is lachrymatory, (d)Both (a) and (b)

A. It is a mild explosive.

B. It generates high vapour pressure.

C. It is lachrymatory

D. Both (a) and (b)

Answer: D

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