CHEMISTRY

BOOKS - MAXIMUM PUBLICATION

STATES OF MATTER

Example

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1. The unit of 'b' in Vander Waals equation of state.

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2. Most probable velocity, average velocity, and root mean square velocity are related by

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3. The volume of 2.8g of CO at 27ºC and 0.821 atm pressure is (R = 0.0821 l atm Km^-ol^-)

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4. The density of gas at 27°C and 1 atm is d. Pressure remaining constant at which of the following temp will its density become 0.75d?

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5. The rms velocity of an ideal gas at 27° is 0.3 m/s. Its rms velocity at 927° C in m/s is

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6. Find out the relation between the first pair and complete the second pair.

a) Boyle's law : Temperature

Charles' law : ....

7. Find out the relation between the first pair and complete the second pair.

Avagadro's law : $V \propto n$

Ideal gas eqation : ....

8. Which statement is true

(i) Complete the following table by finding $a_1, a_2, a_3, a_4, a_5, a_6, a_7$ and $b_1, b_2, b_3, b_4, b_5, b_6, b_7$

θ	120°	330°	240°	420°	390°	450°	300°
sine	a_1	a_2	a_3	a_4	$\cdot a_5$	a_6	a_7
cosine	b_1	$\cdot b_2$	b_3	$.b_4$	b_5	b_6	b_7

9. The rate of diffusion of hydrogen is less than that of oxygen.

a) Do you agree?

10. The rate of diffusion of hydrogen is greater than that of oxygen.

Which law is applied here?

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11. The rate of diffusion of hydrogen is greater than that of oxygen.

State the law.

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12. The ideal gas equation has been modified for real gases by applying pressure and volume corrections.

a) What is the corrected eqution known as?

13. The ideal gas equation has been modified for real gases by applying pressure and volume corrections.

Write the equation and explain the terms.

14. Moist soil grains are pulled together '

a) Name the related phenomenon

15. Moist soil grains are pulled together '

b) Justify.

16. What is aqueous tension?

17. What is the significance of aqueous tension in the determination of pressure of a dry gas?

18. A balloon filled with air, when kept in sunlight bursts after some time.

a) Name the related law.

19. A balloon filled with air, when kept in sunlight bursts after some time.

b) Justify.

20. Define surface energy. What is its SI unit?

21. Based on Boyle's law how will you show that at a constant temperature, pressure is directly proportional to the density of a fixed mass of the gas?
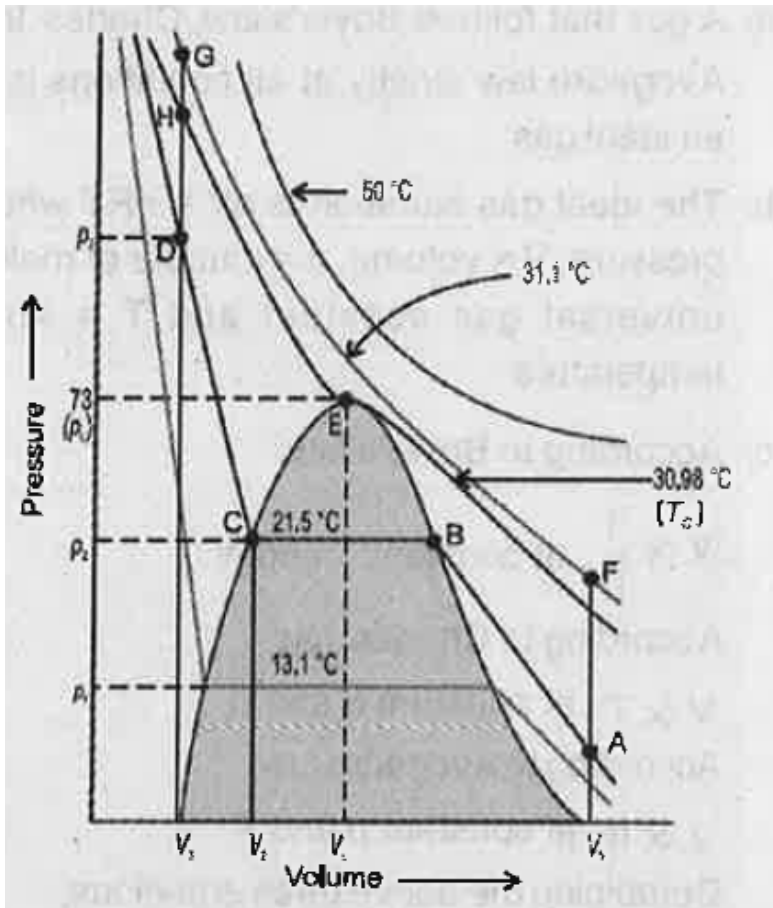
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22. Give the relation between density and molar mass of a gaseousl substance.
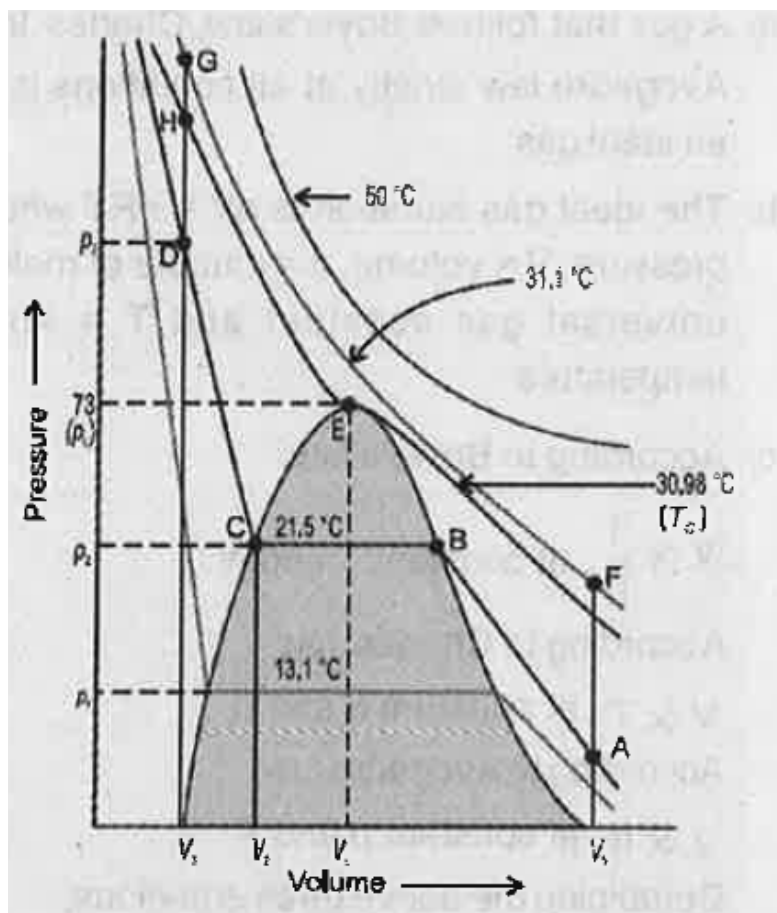
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23. The isotherm of carbon dioxide at various temperatures is given below:

a) What is the significance of the shaded area?

24. The isotherm of carbon dioxide at various temperatures is given below:

Identify the pressure at which liquid CO_2 appears for the first time when temperature is 30.98°C. What is this pressure called?

25. 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

26. The size of the water bubbles increases on moving to the surface.

a) Name the law responsible for this.

27. The size of the water bubbles increases on moving to the surface.

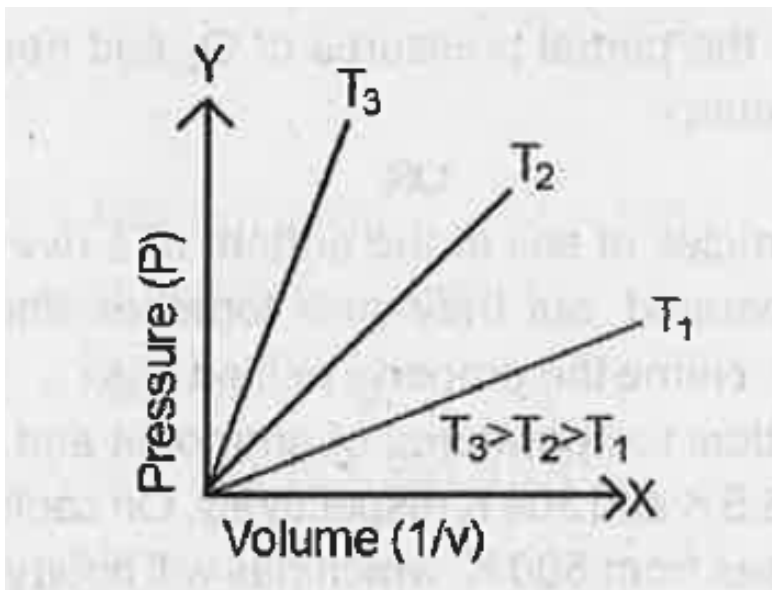b) What is your justification?

28. What are the properties of liquid state?

T3

T2

T1

Pressure (P)

$T_3>T_2>T_1$

Volume (1/v)

29.

b) State the gas law.

Y

T₃

T₂

T₁

Pressure (P)

T₃>T₂>T₁

Volume (1/v)

X
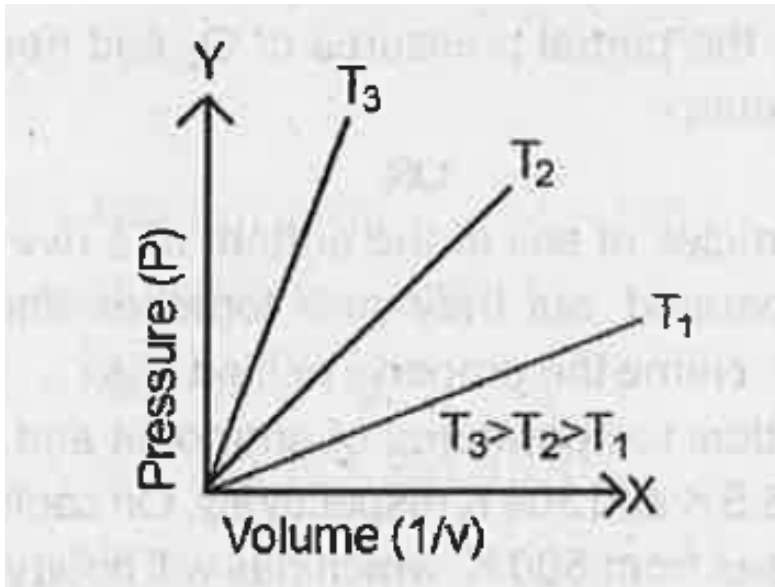
30.

b) State the gas law.

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31. Give the mathematical expression of charles law.

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32. What are van der Waals' forces?

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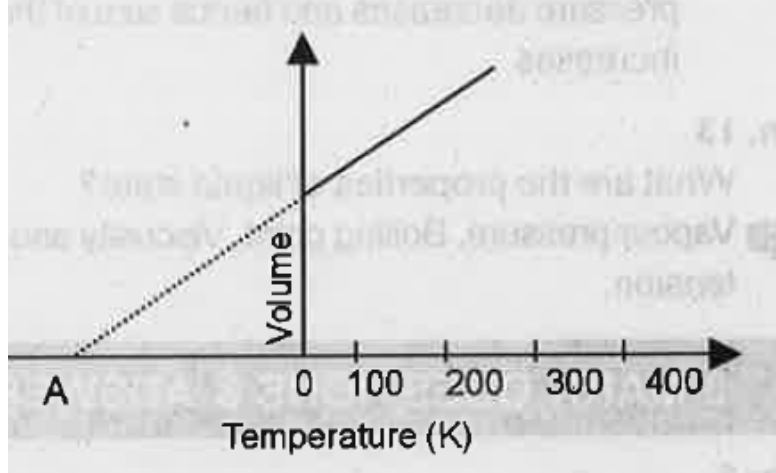**33.** Which are the different types of van der Waals' forces?

34. Arrange the van der Waal's forces in the increasing order of their strength.
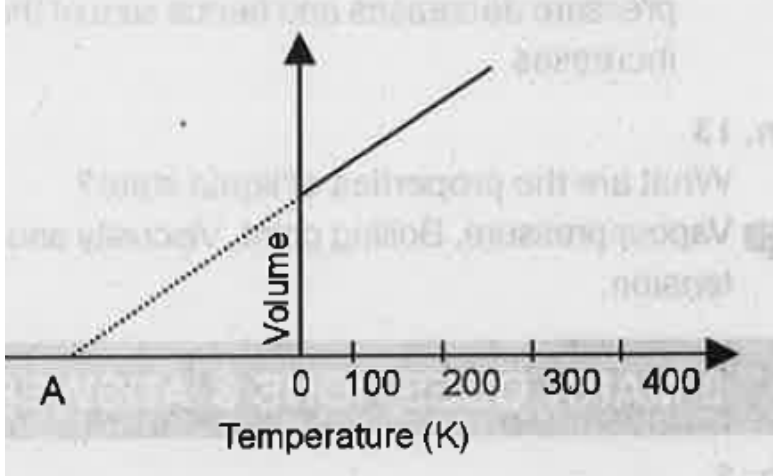
35. A graphical representation of Charles' law is given below:

a) What is the temperature corresponding to the point 'A' called?

36. A graphical representation of Charles' law is given below:

Temperature (K)

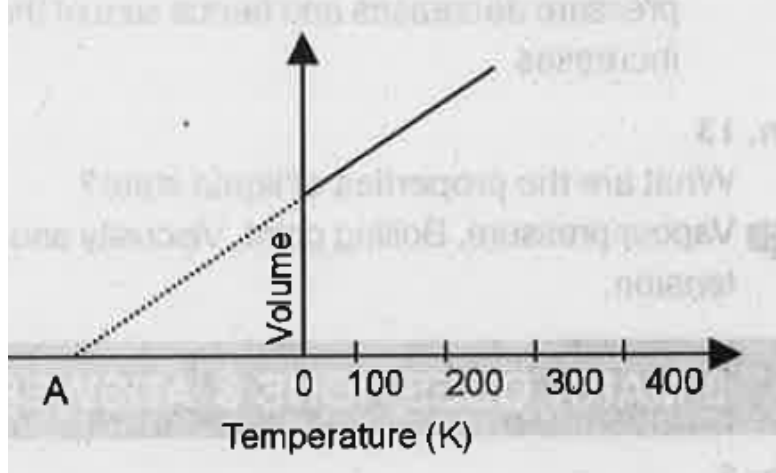b)What will be the temperature at that point 'A' in degree celsius?

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37. A graphical representation of Charles' law is   given   below:

c) What is the significance of this temperature?

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38. Assume that two gases X and Y at the same temperature and pressure have the same volume.

a) Which of the following is correct?

No. of moles of X = No. of moles of Y

No. of moles of X $\neq$ No. of moles of Y.

39. Assume that two gases X and Y at the same temperature and pressure have the same volume.

b) Which law helped you to find the answer ?

40. Assume that two gases X and Y at the same temperature and pressure have the same volume.

c) State the law

41. During a seminar session in the class , the presenter argued that equal amounts of both H_2 and N_2 on heating at constant pressure will expand in the same rate. Another student objected this argument by saying that they

will expand differently since their molecular

masses are different .

a)Who is correct in your opinion ?

42. During a seminar session in the class , the

presenter argued that equal amounts of both

H_2 and N_2 on heating at constant pressure

will expand in the same rate. Another student

objected this argument by saying that they

will expand differently since their molecular

masses are different .

b) Which law helped you to reach the answer ?

43. During a seminar session in the class , the presenter argued that equal amounts of both H_2 and N_2 on heating at constant pressure will expand in the same rate. Another student objected this argument by saying that they will expand differently since their molecular masses are different .

c)State the law and give its mathematical expresssion.

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44. What is an ideal gas?

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45. Give the ideal gas equation and explain the terms .

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46. Derive the ideal gas equation.

47. Partial pressure of a vessel containing Cl_2, CO_2 and CO is the sum of the partial pressure of Cl_2, O_2 and CO .

a) If so, is it correct to say partial pressure of a vessel containing NH_3 and HCl gases is the sum of their partial pressures? Justify

48. Partial pressure of a vessel containing Cl_2 CO_2 and CO is the sum of the partial pressure of Cl_2, O_2 and CO .

b) Which law helped you to answer this?

49. Partial pressure of a vessel containing Cl_2, CO_2 and CO is the sum of the partial pressure

of Cl_2, O_2 and CO .

State the law.

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50. The average kinetic energy of the gas molecules is directly proportional to the absolute temperature .

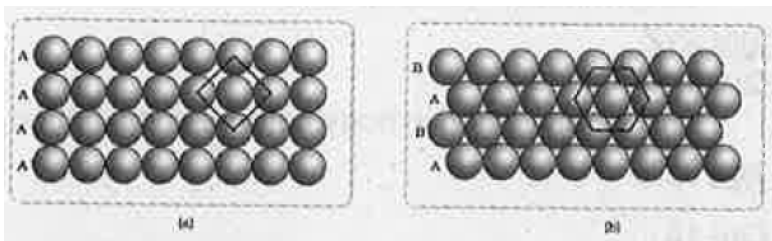a) Which theory is related to this assumption?

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51. The average kinetic energy of the gas molecules is directly proportional to the absolute temperature .

b) Write the other postulates of this theory.

52.

Explain them.

53.

Explain them.

54. Alll the postulates of the kinetic molecular

theory of gases are correct '

a) Do you agree with the statement?

55. Alll the postulates of the kinetic molecular theory of gases are correct '

b) If no, write the wrong postulates of this theory.

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56. Alll the postulates of the kinetic molecular theory of gases are correct '

c) Give justification

57. Two gases with equal molecular mass will have the same rate of diffusion'

Do you agree?

58. Two gases with equal molecular mass will have the same rate of diffusion'

Substantiate your answer with an example .

59. Two gases with equal molecular mass will have the same rate of diffusion'

Substantiate your answer with an example .

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60. Water can be boiled more quickly on the top of a mountain.

a)Do you agree?

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61. Water can be boiled more quickly on the top of a mountain.

What is the reason?

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62. Water can be boiled more quickly on the top of a mountain.

What is called boilling point of a liquid ?

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63. Water can be boiled more quickly on the top of a mountain.

How normal boilling point and standard boilling point differ?

64. Ethanol flows faster than honey.

a) Name the related phenomenon.

65. Ethanol flows faster than honey.

Explain the phenomenon.

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66. Ethanol flows faster than honey.

What is the effect of temperature on this ?

> ▶ **Watch Video Solution**

67. Liquid drops attain spherical shape .

Which property of liquids is responsible for this ?

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68. Liquid drops attain spherical shape .

b) Explain the phenomenon and justify.

▶ **Watch Video Solution**

69. Liquid drops attain spherical shape .

c) Suggest another consequence of this phenomenon.

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70. Vapour pressure is an important property of liquids .

a) What is vapour pressure?

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71. Vapour pressure is an important property of liquids .

How boiling point and vapour pressure are related ?

72. Vapour pressure is an important property of liquids .

Pressure cooker is used for cooking food at higher altitudes. Give reason.

73. Assume that 'A' , 'B' and 'C' are three non-reacting gases kept in a vessel at a constant temperature. Then, $P_{Total} = P_A + P_B + P_C$

a) Name the related law.

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74. Assume that 'A' , 'B' and 'C' are three non-reacting gases kept in a vessel at a constant temperature. Then, $P_{Total} = P_A + P_B + P_C$

How can you explain the above law on the basis of kinetic molecular theory of gases?

75. Write the general equation which relates the different variables of a gas used to describe the state of any ideal gas.

76. A flask at 295 K contains a gaseous mixture of N_2 and O_2 at a total pressure of 1.8 atm. If 0.2 moles of N_2 and 0.6 moles of O_2 are present, find the partial pressure on N_2 and O_2.

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77. What is meant by Boyle temperature or Boyle point?

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78. Liquid tries to rise or fall in the capillary.

Name the related phenomenon.

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79. What is the Si unit of pressure?

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80. Define critical temperature (T_c)

81. CO_2 cannot be liquified above 31.1ºC. Why?

82. The critical temperatures of ammonia and carbon dioxide are 405.5K and 304.10 K respectively. On cooling, which of these gases will liquify first? Justify.

83. Will water boils at higher temperature at sea level or at top of a mountain. Explain.

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

85. 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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86. Real gases deviate from ideal behaviour .

b) When do real gases deviate from ideal behaviour?

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87. What is meant by compressibillity factor, Z?

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88. What is the significance of compressibility factor?

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89. What is the difference between gas and vapour?

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

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

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92. A sample of gas occupies 250mL at 27ºC. What volume will it occupy at 35ºC if there is no change in pressure?

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93. Real gases behave ideally at low temperature and high pressure.

a) Is the above statement correct or not?

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94. Real gases behave ideally at low temperature and high pressure.

b) Justify.

▶ **Watch Video Solution**

95. Real gases behave ideally at low temperature and high pressure.

c)Write the van der Waals' equation for 1 mole of a real gas.

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96. Distinguish between real gas and ideal gas.

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97. Explain the deviation of the following gases from ideal behaviour on the basis of the pV vs. p plot . CO, CH_4, H_2 and He.

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98. What is meant by laminar flow?

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99. Derive the expression for the force responsible for flow of layers of a liquid.

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100. What are London forces?

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101. What is the relation between London forces and the distance between the particles?

102. What is meant by thermal energy and thermal motion?

103. Can oxygen exist as a gas at -273.15°C ? Write the significance of this temperature.

104. Molecules of a gas are in a state of continuous motion

a)What is most probable speed?

105. Molecules of a gas are in a state of continuous motion

b) Give the equation for average speed of molecules.

106. State the Avogadro law .

107. Give the mathematical expression of avogadro's law.

108. What is the value of molar volume of an ideal gas at 273.15 K and 1 atm?

109. Show that, at constant temperature and pressure , the density of an ideal gas is proportional to its molar volume.

110. The speed of molecules is a measure of their average kinetic energy .

a) What is root mean square speed?

111. The speed of molecules is a measure of their average kinetic energy .

b) Give the equation for root mean square speed .

112. The speed of molecules is a measure of their average kinetic energy .

c) Calculate the following:

i) Root mean square speed of methane molecule at 27ºC

113. The speed of molecules is a measure of their average kinetic energy .

c) Calculate the following:

ii)Most probable speed of nitrogen molecule at 25ºC.

114. Give the equation for combined gas law.

115. A baloon occupies volume of 700 mL at 25° C and 760 mm of pressure. What will be its volume at higher attitude when temperature when temperature is 15°C and pressure is 600 mm Hg.

116. Give the relationship among the three types of molecular speeds.

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117. Draw the Maxwell- Boltzmann distribution showing all the molecular speeds.

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118. Which of the following molecules will have the higher value of most probable speed at

the same temperature , N_2 or Cl_2? Justify.

Exercise

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. Using the equation of state pV=nRT show that at a given temperature , the density of the gas is proportional to the gas pressure p.

3. 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 .

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

5. Explain the significance of van der Waal parameters

6. Mercury drops are spherical in shape .

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

7. How surface tension depends on temperature?

8. The theory that attempts to explain the behaviour of gases is known as kinetic molecular theory.

On the basis of this theory, explain the compressible nature of gases and the temperature dependence on kinetic energy.

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

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

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11. Write the ideal gas eqation and mention the terms.

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12. It is found that real gases do not obey ideal gas equation perfectly under all conditions.

b) Why do real gases deviate from ideal behaviour?

13. It is found that real gases do not obey ideal gas equation perfectly under all conditions.

c) What are the conditions under which real gases approach ideal behaviour?

14. In the Celsius scale, melting point of ice is 0°C . Another scale of temperature is based on absolute zero .

a) Identify the scale.

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15. What is the volume of ideal gas at absolute zero of temperature?

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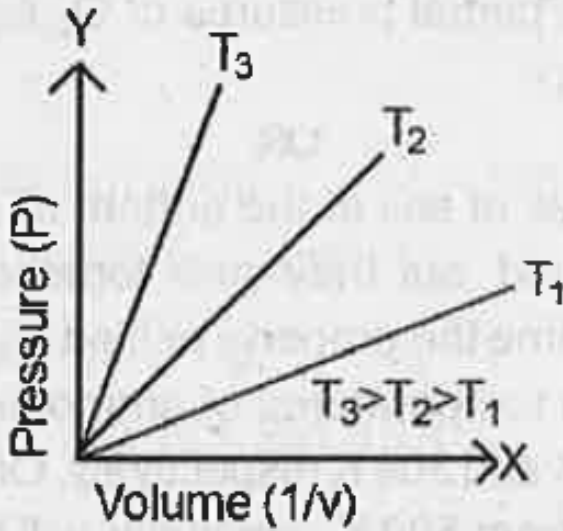**16.** Draw a graph showing the relationship between volume and temperature of an ideal gas at a constant pressure.

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17. Consider a gas at 0° C. At what temperature will the volume be doubled if the pressure is kept constant?
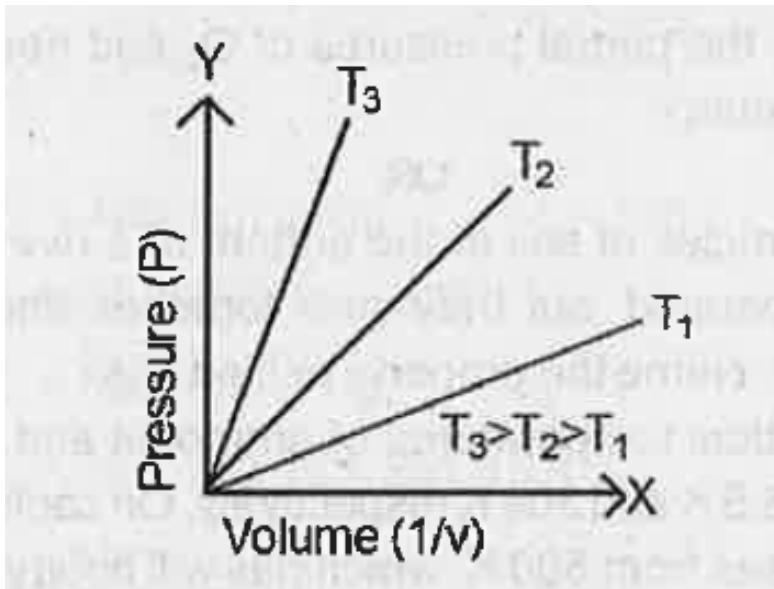
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Graph with Pressure (P) on the Y-axis and Volume (1/v) on the X-axis, showing lines for T_3, T_2, T_1 with $T_3 > T_2 > T_1$

18.

a) Name the gass law shown by the above graph.

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19.

b) State the gas law.

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Pressure (P) vs Volume (1/v) graph showing lines T_3, T_2, T_1 with $T_3 > T_2 > T_1$
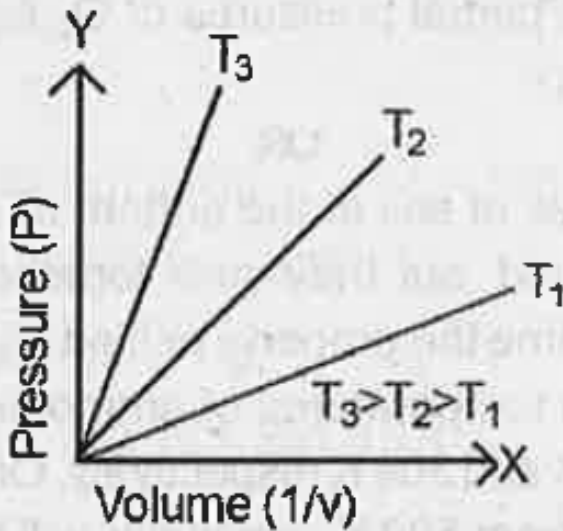
20.

a) At 35°C and 700 mm of Hg pressure , a gas occupies a 500 mL volume . What wil be its pressure when the temperature is 15° C and the volume of the gas is 450 ml?

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21. Give reasons for the deviation of real gases from the ideal gas behaviour.

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22. Calculate the minimum pressure required to compress 500 ml of air at 1 atm to 300 mL at the same temperature.

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23. The kinetic molecular theory provides a theoretical basis to experimentally observed facts related to gases.

a) Which one of the following statements is CORRECT with regards to the gaseous state?

A. Molecules have fixed positions

B. Molecules are in constant random motion

C. All molecules have same speed at a given temperature

D. The average kinetic energy of the gas molecules is inversely proportional to the absolute temperature.

Answer:

24. A sample of hydrogen gas occupies a volume of 300 ml at 1.2 Bar pressure and 5° C. Calculate its volume at 0.45 bar pressure and 70° C.

25. Give the name of the modified form of ideal gas equation and write down it.

26. Name the phenomenon behind cleansing action of soap.

27. What do you know about Dalton's law of partial pressures?

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28. An ideal gas is one which obeys gas laws.

a) Derive an ideal gas equation

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29. An ideal gas is one which obeys gas laws.

b) At 27° C a gas was compressed to half of its volume. To what temperature it must be heated, so that it would occupy double its original volume?

    A. 54° C

    B. 327K

    C. 600K

    D. 300K

Answer:

30. Liquid drops attain spherical in shape. Which property of liquid is responsible for this ?

31. Give the reason behind the following.

i) The glass window pannels of old buildings are thicker at the bottom than at the top.

32. Give the reason behind the following.

Sharp glass edges are heated for making them

smooth.

33. The speed of molecules is a measure of

their average kinetic energy. a) What is root

mean square speed

34. Maxwell and Boltzmann have shown that actual distribution of molecular speeds depends on temperature and molecular mass. At the same temperature which will move faster, N_2 or Cl_2 ?

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