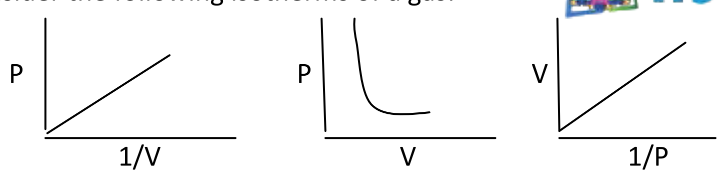
PREVIOUS HSE QUESTIONS FROM THE CHAPTER "STATES OF MATTER"

1. 'R' is the universal gas constant in the ideal gas equation.
   a) Write down the values of R in two different units. (1)
   b) Calculate the mass of 500 ml of O_2 at 27^0c and 740 mm of Hg. (2) [June 2008]
2. Mercury drops are spherical in shape.
   a) Which property is responsible for the spherical shape of drops? Explain the property. (2)
   b) How does the above property depend on temperature? (2) [March 2009]
3. The theory that attempts to explain the behaviour of gases is known as kinetic molecular theory.
   a) On the basis of this theory, explain the compressible nature of gases and the temperature dependence on kinetic energy. (2)
   b) Liquid drops assume spherical shape. Why? (1)
   c) How does temperature influence the viscosity of a liquid? (1) [March 2010]
4. It is found that real gases do not obey ideal gas equation perfectly under all conditions.
   a) Write the ideal gas equation and mention the terms? (1)
   b) Why do real gases deviate from ideal behaviour? (2)
   c) What are the conditions under which real gases approach ideal behaviour? (1) [Sept. 2010]
5. In the celsius scale, melting point of ice is 0^0C. Another scale of temperature is based on absolute zero.
   a) Identify the scale. (1)
   b) What is the volume of a gas at absolute zero of temperature? (1)
   c) Draw a graph showing the relationship between volume and temperature of an ideal gas at constant pressure. (1)
   d) Consider a gas at 0^0C.at what temperature will the volume be doubled if the pressure is kept constant? (1) [March 2011]
6. Consider the following isotherms of a gas:



   a) Which gas law is illustrated by these diagrams? (1)
   b) Draw the diagram when PV is plotted against P. (1)
   c) An air filled balloon has a volume of 125L at 760 mm of mercury and 25^0C. What will be its volume when the pressure is 670 mm of mercury and temperature is 18^0C? (2) [Oct. 2011]
7. Gas laws are relationships between the measurable properties of gases.
   a) Name the gas law which gives the relationship between the pressure and temperature of a fixed amount of gas at constant volume. (1)
   b) Draw the graph to illustrate the above gas law. (1)
   c) A definite quantity of an ideal gas is confined in a container of constant volume. When the container is immersed in a bath of melting ice, the pressure of the gas is 800 mm of Hg. Find the temperature when the gas pressure is 400 mm of Hg. (2) [March 2012]
8. a) The combonation of Boyle's law, Charle's law and Avogadro's law is known as ideal gas equation. But real gases deviate from ideal behaviour.
   i) Write the modified gas law equation. (1)

ii) Name the above equation. (1)

b) Give reason for the following:

i) At hill station, pressure cooker is used for cooking. (1)

ii) Window panes of the old buildings become thicker at the bottom than at the top. (1) [Sept. 2012]

9. Real gases behave ideally only at certain conditions.

a) What is Boyle point of a gas. (1)

b) Write the expression for compressibility factor. What is its value for an ideal gas? (1)

c) Density of a gas was found to be 5.5 g/L at 2 bar pressure and at 25^0C. Calculate its molar mass. (R=0.083 L bar/K/mol) (2) [March 2013]

10. a) What is the thermodynamic scale of temperature. (1)

b) Viscosity of liquids decreases as the temperature increases. Why? (1)

c) Gases deviate from ideal behaviour due to the faulty assumptions of Kinetic theory of gases. State those faulty assumptions. (2) [Oct. 2013]

11. a) van der Waals equation of state explains the behaviour of real gases. What does the van der Waal constant 'a' indicate? (1)

b) What is the critical temperature of a gas? (1)

c) At 25^0C and 760 mm of Hg pressure, a gas occupies 600 ml volume. What will be its pressure at a height where temperature is 10^0C and volume of the gas is 640 ml. (2) [Oct. 2013]

12. What is Boyle point or Boyle temperature? (1)

b) At high altitudes, a pressure cooker is used for cooking food. Why? (1)

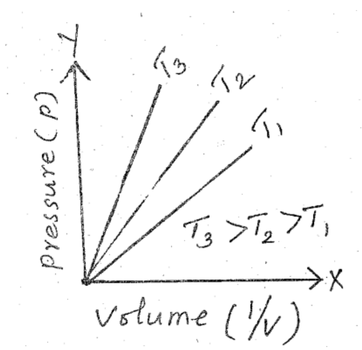
c) A neon-dioxygen mixture contains 70.6g dioxygen and 167.5g neon. If the pressure of the mixture of gases in the cylinder is 25 bar, what are the partial pressures of O_2 and Ne in the mixture? (2) [March 2014]

13. Particles of soil at the bottom of a river remain separated, but they stick together when taken out. Name the property behind this. (2)

b) Critical temperatures of ammonia and CO_2 are 405.5 K and 304 K respectively. On cooling these gases from 500 K, which gas will liquify first? (1)

c) van der Waals' forces are attractive inter molecular forces. Write the names of any two types of van der Waals' forces. (2) [March 2014]

14.



a) Name the gas law shown by the above graph. (1)

b) State the gas law. (1)

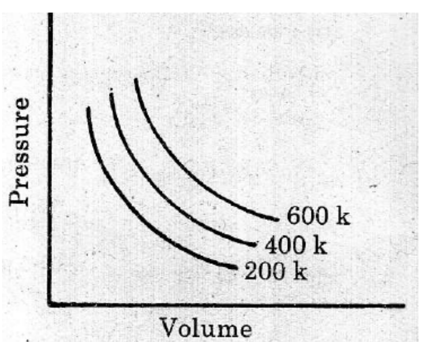
c) At 35^0C and 700mm of Hg pressure, a gas occupies 500 ml volume. What will be its pressure when the temperature is 15^0C and the volume of the gas is 450 mL. (2) [August 2014]

15. The gases which obey Gas Laws at all temperatures and pressure are called ideal gases.

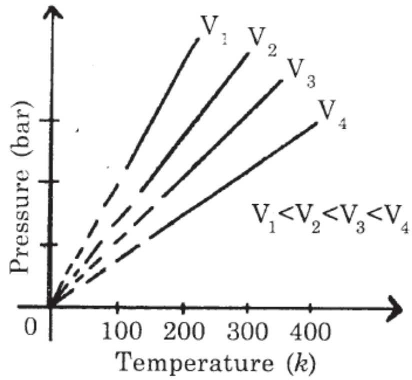
a) Give reason for the deviation of real gases from the ideal behaviour. (2)
b) Calculate the minimum pressure required to compress 500 mL of air at 1 atm pressure to 300 mL at the same temperature. (2) [March 2015]

16. 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 regard to the gaseous state?
        i) Molecules have fixed positions.
        ii) Molecules are in constant random motion
        iii) All molecules have same speed at a given temperature
        iv) The average kinetic energy of the gas molecules is inversely proportional to the absolute temperature. (1)
    b) A sample of hydrogen gas occupies a volume of 300 ml at 1.2 bar pressure and 5^0 C. Calculate its volume at 0.45 bar pressure and 70^0 C. (3) [October 2015]
17. Ideal gas equation is true for ideal gases only. There is a modified form of ideal gas equation applicable to all gases.
    a) Give the name of the modified form of ideal gas equation and write down it. (2)
    b) Name the phenomenon behind cleansing action of soap. (1)
    c) What do you know about Dalton's law of partial pressures? (1) [March 2016]
18. An ideal gas is one which obeys gas laws.
    a) Derive an ideal gas equation. (2)
    b) At 27^0C 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? (1)
    c) Liquid drops assume spherical shape. Why? (1) [September 2016]
19. a) Give the reason behind the following:
    i) The glass window panels of old buildings are thicker at the bottom than at the top. (1)
    ii) Sharp glass edges are heated for making them smooth. (1)
    b) Maxwell and Boltzmann have shown that actual distribution of molecular speeds depends on temperature and molecular mass.
        i) What do you mean by most probable velocity? (1)
        ii) At the same temperature which will move faster, N_2 or Cl_2? (1) [March 2017]

20. a)



        i) Identify the law represented by the graph given above.
        ii) State the law. (2)
    b) Write down the ideal gas equation and explain the terms. (2)
21. Examine the following graph and name the gas law corresponding to it.



(1)

22. a) Define 'normal boiling point' of a liquid.

    b) Give a reason for the use of pressure cooker to cook food, at high altitudes. (2)

23. Write the postulates of kinetic molecular theory of gases. (3) [August 2018]

24. The critical temperatures of some gases are given in the following table :

Gas	H_2	He	O_2	N_2
Critical Temperature (K)	33.2	5.3	154.3	126

    If the samples of the above given gases are cooled from 298 K, which one will liquify first by applying pressure? (1)

25. Derive an equation relating molar mass of an ideal gas with its density. (2)

26. Calculate the total pressure in a mixture of 3.5 g of dinitrogen and 16 g of dioxygen confined in a vessel of 2 dm^3 at 27^0C. (R = 0.083 bar dm^3 $K^{-1}mol^{-1}$). (3) [March 2018]

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