CHAPTERS : State of Matter, Chemical Bonding, Atomic Structure, Periodic Properties

CLASS : XI

TIME = 3 hrs. **Maximum marks =70**

Section - 1 **[1 mark each]**

1. Write Van der Waal's equation for 'n' moles of real gas.
2. How many sigma and pi bonds are present in the following

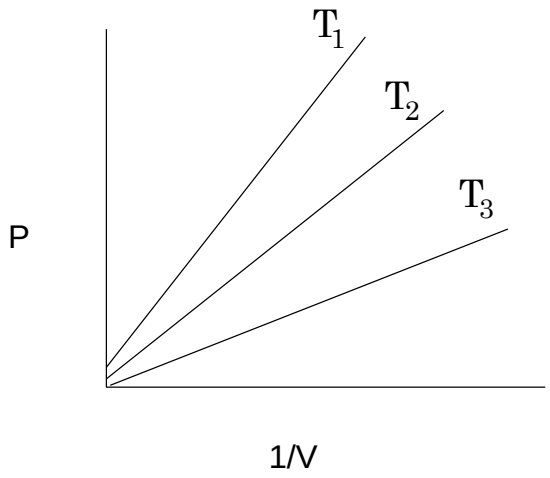
   $H_3C - CH_2 - C \equiv C - HC = CH - CH_3$
3. What is the function of salt bridge?
4. Why does the 1st I.E. increases as we go from left to right along a given period of periodic table?
5. How many atoms of calcium are there in 2g of Ca.

   [At Mass of Ca = 40]

Section - 2 **[2 marks each]**

6. On the basis of VSEPR theory predict the shape of the following :
   (i) BF_3 (ii) NH_3 Give reason also.
7. State Heisenberg's uncertainty Principle. Why is it significant for macroscopic objects?
8. Calculate the oxidation number of Mn in $KMnO_4$ and S in $Na_2S_2O_6$.
9. Among the elements of second period Li to Ne, pick out element :
   (i) with the highest first ionization energy
   (ii) with highest electro negativity.
   (iii) with largest atomic radius.
   (iv) that is most reactive metal.

10. Consider the graph shown under.



Which law is graphically represented in this graph? Also arrange the temperature T_1, T_2, and T_3 in increasing order.

Section - 3 **[3 marks each]**

11. Balance the following equation using any method :

$H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + H_2O$ (acidic medium)

12. Consider the elements N, P, O and S arrange them in order of :

(a) Increasing first ionisation enthalpy

(b) Increasing negative electron gain enthalpy

(c) Incresing non-metallic character

13. (a) State Aufbau Principle

(b) Write the electronic configuration of

(a) Ne [10] (ii) Cu [29]

14. A compound contains 4.07% hydrogen, 24.27% carbon 71.65 chlorine. Its molecular mass is 98.96. What are its empirical and molecular formula.

15. Give reason for the following.
    (a) Electron gain enthalpy of fluorine is less negative than that of chlorine
    (b) Ionization enthalpy of N is always more than that of O.
    (c) Anionic radius is always more than that of neutral atom.
16. (a) Calculate the volume occupied by 2 mol of an ideal gas at 2.5×10^5 N m^{-2} pressure and 300K [R = 8.314 JK^{-1} J mol^{-1}]
    (b) State Gay Lussac's Law.
17. (i) Write the molecular orbital electronic configuration of the following species:
    (a) N_2
    (b) N_2^+
    (ii) Calculate their bond orders.
18. (a) Calculate the amount of water in grams produced by combustion of 16g of methane (CH_4).
    (b) State the no. of significant figures in the following :
    (i) 650.00 (ii) 8.90×10^5
19. (a) An atomic orbital has n = 3. What are the possible values of 'l' and 'm'
    (b) List the quantum numbers (n and l) of electrons for 3d orbitals.
    (c) Which of the following orbitals are possible? 1s, 2p, 3p, 4f, 3d.
20. (a) In terms of Charles' Law, explain why –273°C is lowest temperature.

(b) Calculate the total pressure in a mixture of oxygen and 4g of hydrogen confined in a vessel of 1 dm^3 at 27°C.

[R = 0.083 bar dm^3 K^{-1} mol^{-1}]

21. Compressibility factor, Z of a gas is given as $Z = \frac{PV}{nRT}$

(i) What is the value of Z for an ideal gas ?

(ii) For real gas what will be the effect on value of Z above Boyle's temperature?

(iii) What is Boyle's temperature?

22. Give reason:

(i) Water molecule has bent structure whereas CO_2 molecule is linear.

(ii) BF_3 molecule has zero dipole moment although B – F bonds are polar.

(iii) Axial bonds in PCl_5 are longer compared to equatorial bond.

Section - 4 **[4 marks each]**

23. Rohit takes an open pan to cook vegetables and pulse at a hill station while Sohan cook pulses and vegetables in pressure cooker at the same place. The gas cylinder of Sohan lasts for only 15 days whereas Rohit uses one gas cylinder per month.

(i) Who will cook vegetable and pulse faster and why?

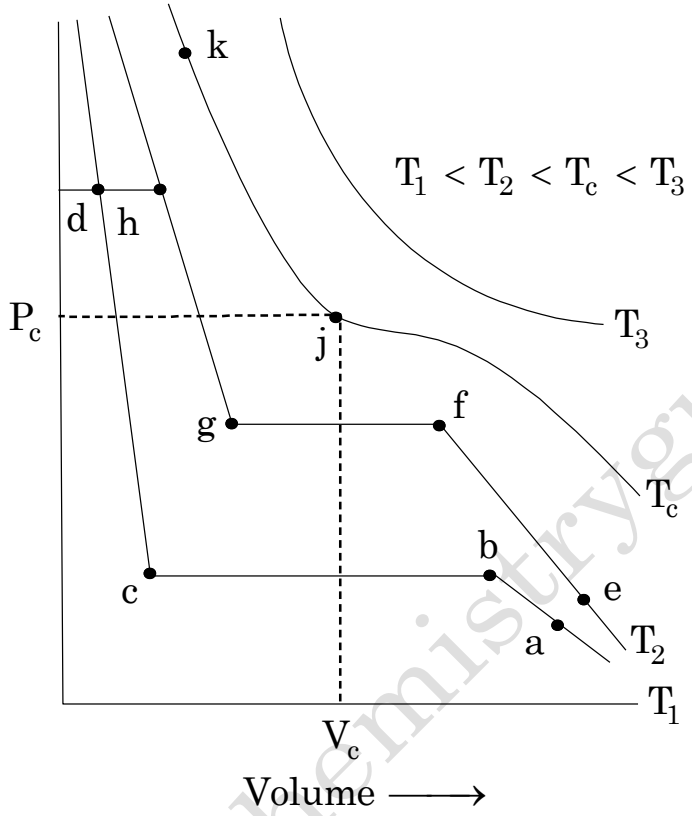
(ii) What is the advantage of using a pressure cooker?

(iii) What value is possessed by Sohan ?

(iv) How boiling point is affected by rise in altitude?

Section - 5 **[5 marks each]**

24. Isotherms of CO_2 at various temperature are represented in the figure shown below :



Answer the following questions based on the figure :

(i) In which state will CO_2 exist between the points a and b at temperature T_1?

(ii) At what point will CO_2 start liquefying when temperature is T_1?

(iii) At what point will CO_2 be completely liquefied when temperature is T_2?

(iv) Will condensation take place when temperature is T_3?

(v) What portion of the isotherm at T1 represent liquid and gaseous CO_2 at equilibrium?

OR

(a) Calculate the density of ammonia at 30° C and 5 bar pressure.

(b) Ice floats on water. Why?

25. (a) What is hybridization? Discuss the shape of C_2H_4 on the basis of hybridization?

(b) What is resonance? Draw the resonating structure of CO_2.

OR

(a) Define Hydrogen bond.

(b) Discuss the shape of NF_3 and PCl_5 on the basis of VSEPR theory.

(c) Why is σ bond stronger than π bond?

26. (a) What do you mean by Dual nature of particle?

(b) If the velocity of electron in Bohr's first orbit is $2.19 \times 10^6 ms^{-1}$; calculate the de Broglie wavelength associated with it. [$h = 6.63 \times 10^{-34}$ Js; $m_e = 9.11 \times 10^{-31}$ kg]

(c) A 100 watt bulb emits electromagnetic radiation of wavelength 400nm. Calculate the number of photons emitted per second.

OR

(a) What is photoelectric effect.

(b) The work function for Ce atom is 1.9eV. Calculate :

(i) Threshold wavelength (ii) energy of the photon

($1eV = 1.6 \times 10^{-19}$J, $h = 6.63 \times 10^{-34}$Js)

(c) (i) How many subshells are associated with n=4.

(ii) When is the energy of an electron taken as zero.