1. Calculate the number of oxygen atoms in 300 gm of CaCO₃.
   Mol. wt. of CaCO₃ = 100
2. Draw the graph to explain Charle's Law.
4. State Hund's rule of maximum multiplicity.
5. Calculate the radius of He⁺.
6. Arrange the following in order of decreasing size.
   Na⁺, Mg²⁺, K⁺
7. Define the term bond order.
8. What is P–V isotherm? \(8 \times 1 = 8\)
9. Write the expression for the equilibrium constant \(K_c\) for the following reaction:
   (a) \(C(s) + CO_2(g) \rightarrow 2CO(g)\)
   (b) \(FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)\)
10. Chemical equilibrium is dynamic in nature. Explain it with the help of a graph.
12. Density of a gas is found to be 5.46 gm/l at 27°C at 2 bar pressure. What will be its density at STP?
13. Predict whether each of the following molecule is polar or non-polar:
   (a) BF₃  (b) NH₃  (c) H₂O  (d) PCl₅
14. Explain: CO₂ is linear while SO₂ is angular in shape.

P.T.O.
15. Define ionization enthalpy. Second ionization enthalpy is always greater than the first. Explain.

16. Explain:
   (a) Ionization enthalpy of oxygen is smaller than N of group 15.
   (b) Electron gain enthalpy of F is lower than Cl.

17. Draw the shapes of the following orbitals:
   (a) $2p_x$  
   (b) $3d_z^2$  
   (c) $3d_{x^2-y^2}$  
   (d) $3d_{xy}$

18. Calculate the number of molecule in a drop of water weighing 0.05 gm.

\[
(10 \times 2 = 20)
\]

19. A solution contains 25% by mass of CH$_3$OH, 25% by mass of CH$_3$COCH$_3$ and 50% water. Calculate the mole fraction of each component.

20. Given:

\[
4 \text{HCl + MnO}_2 \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}
\]

How many grams of HCl react with 5.0 gm of MnO$_2$?

At mass of Mn = 55, Cl = 35.5

21. Three moles of N$_2$ combine with five moles of H$_2$ to form NH$_3$ by Haber’s process:
   (a) What is the limiting reagent?
   (b) Calculate the weight of reactant left in the container.
   (c) How many moles of NH$_3$ are produced?

22. Write the electronic configuration of the following ions:
   (a) $\text{H}^-$  
   (b) $\text{Na}^+$  
   (c) $\text{O}^{2-}$

23. Explain:
   (a) Energy level of $3d$ orbital is more than $4s$.
   (b) Electronic configuration of Cu is $3d^{10}4s^1$ and not $3d^{9}4s^2$.
   (c) $2d$ orbital is not possible.

24. The mass of an electron is $9.1 \times 10^{-31}$ kg. K.E. = $3.0 \times 10^{-25}$J. Calculate its wavelength.

25. What is the basic difference between the terms electron gain enthalpy and electronegativity?

26. Draw the diagram showing the formation of a double bond and triple bond between carbon atoms in C$_2$H$_4$ and C$_2$H$_2$ molecules. Calculate the number of $\sigma$ and $\pi$ bond present in them write the hybridisation C atom in each.

27. Explain the deviation of real gas behaviour from ideal gas behaviour. Draw the graph.

\[
(9 \times 3 = 27)
\]

28. Write all the assumptions of kinetic energy of gases.

(2)
29. (i) Draw the box structure with orbital representation of the following molecules:
   (a) $\text{H}_2\text{O}$
   (b) Ammonia
   (c) $\text{BF}_3$
(ii) Write the MO configuration of $\text{F}_2$ molecule.

30. What is the frequency and wavelength of a photon emitted during a transition from $n = 5$ state to the $n = 2$. State in the hydrogen atom. \( (5 \times 3 = 15) \)