CODE – 043 (E) B

**Time allowed: 3 hours**                                                                 **M.M.: 70**

**General Instructions:**

   a) All the questions are compulsory.
   b) There are 26 questions in total.
   c) Questions 1 to 5 are very short answer type questions and carry one mark each.
   d) Questions 6 to 10 carry two marks each.
   e) Questions 11 to 22 carry three marks each.
   f) Questions 23 is value based question carrying four marks.
   g) Questions 24 to 26 carry five marks each.
   h) Use of calculators is not permitted. However, you may use log tables if necessary.

**Q1.** State the law of Multiple Proportion?

**Q2** How many moles of HCl are present in 100 ml of 12 M HCl solution ?

**Q3** Show by chemical reaction that sodium oxide is basic and chlorine oxide is acidic in nature.

**Q4** $BeCl_2$ is a linear molecule while $SCl_2$ is an angular molecule. Give reason.?

**Q5** Mention the SI unit of universal gas constant (R).

**Q6 a)** Using s, p, d, f notation describe the orbital with the following quantum numbers

   1.) n=1, l=0                    2.) n=2, l=1

   **b)** How many electrons are present in the orbital with n=3 and spin quantum number+1/2.

**Q7.** Write the electronic configuration of $Cu^{2+}$, $Cr^{3+}$

   (Atomic number Cu = 29, Cr = 24)

**Q8** **Account for the following**
   i) $NF_3$ is pyramidal while $BF_3$ is triangular planar.
   ii) Boiling point of water (373 K) is higher than $H_2S$ (221.2 K). Why

**Q9 a)** Account for why the second ionisation enthalpies of alkali metals are very high?

   b) How is sodium carbonate prepared by Solvay process?

**Q10** What happens when        a) Sodium metal is dropped in water

                                             b) Sodium peroxide dissolves in water

                                             OR

**Q10** What happens when        a) Chlorine is heated with slaked lime

                                             b) Calcium nitrate is heated

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**Q11** A welding fuel gas contains Carbon and Hydrogen only. Burning a small sample of it in Oxygen gives 3.38 g of Carbon di oxide, 0.690 g of water. A volume of 10 L of this welding gas is found to weigh 11.6 g. Calculate

a.) Empirical Formula

b.) Molar mass of the gas

c.) Molecular formula

**Q12** Calcium carbonate reacts with aqueous HCl to give Calcium Chloride and Carbon Dioxide according to the reaction

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2 (aq) + CO2 (g) + H_2O (l)$

What mass of Calcium Carbonate is required to react completely with 25 ml of 0.75 M HCl. (Atomic Weight of Ca = 40, C = 12, O = 16, Cl = 35.5 amu)

**Q13** In Rydberg equation a spectral line corresponds to n1=3 and n2=5
  i) Calculate the wavelength and frequency of this spectral line

  ii) To which spectral series does it belong

  iii) In which region of electromagnetic spectrum will this line fall?

**Q14.** Write molecular orbital electronic configuration of the following species

  a.) $N_2$
  b.) $N_2^+$
  c.) $N_2^-$
  d.) $N_2^{2-}$
  1.) Calculate their bond order
  2.) Predict their magnetic behaviour and tell which shows highest paramagnetism

**Q15** a) Explain the concept of hybridization in $PCl_5$ .Why are axial bonds longer as compared to equatorial bonds in $PCl_5$.

  b) Bond angle in $H_2O$ is larger than Bond angle in $H_2S$.

**Q16** a) On the basis VSEPR theory predict the shape of the following molecules $PH_3$, $NH_3$, $H_3O^-$, $NH_2^-$ .

  b) Define Hybridisation?

**Q17** Predict which atom in each of the following pairs has the highest first ionization energy and why.
  a.) B and C          N and O
  b.) F and Ne

**Q18. Among the elements of second period Li to Ne pick out element**
- a.) with highest first ionization energy
- b.) largest atomic radius
- c.) most reactive metal
- d.) highest electro negativity
- e.) most reactive non metal
- f.) with valency 4

**Q19** What do you understand by isoelectronic species? Name a species that will be isoelectronic with each of the following atoms or ions.(i)$F^-$ (ii)Ar (iii)$Mg^{+2}$ (iv)$Rb^+$

**Q20 a)** At 0°C, the density of a certain oxide of a gas at 2 bar is same as that of dinitrogen at 5 bar. What is the molecular mass of the oxide?

b) State Charles Law?

**Q21** **a)** Why are liquids like ether and acetone kept in cool places?

**b)** What will happen to volume of fixed amount of gas at certain T and P if

- a) T is kept constant and pressure is decreased to ¼ th of original value?
- b) Pressure is halved and temperature in Kelvin is doubled?

**Q22 Comment on each of the following observations:**
- a) Lithium forms a nitride directly like magnesium. Give equation involved.
- b) BaO is soluble but BaSO4 is insoluble in water.
- c) Give two properties to show diagonal relationship between Li and Mg.

**Q23** Nita's younger sister was having cold drinks with ice cubes floating over the liquid. The little girl asked Nita ¯Every solid form has higher density than its corresponding liquid form, but why is it that ice alone is lighter and floats on water? Nita tried to explain the reason based on a special type of bonding in water.

a) What is that special bonding Nita is referring to? Draw a pictorial representation of that.

b) Nita also explained the importance of water as a good solvent. What would she have given the reason for its polarity?

c) What value does Nita have towards the subject and towards her sister?

**Q24** a) Establish relationship between wave length and momentum of a material particle

b) Write the rule due to which the following electronic configuration for nitrogen is not possible $1s^2\ 2s^2\ 2px^2\ 2py^1$

c) Calculate the kinetic energy of an electron emitted when the difference in threshold frequency and the frequency of the radiation is $3.0 \times 10^{14}\ s^{-1}$ (h = $6.626 \times 10^{-34}$ Js)

d) Define Paulis Exclusion principal

**Q25** **a)** All the alkali metals impart characteristic colour to flame. Why?

**b)** Alkali metals are kept in kerosene oil why?

**c)** When alkali metals dissolves in liquid ammonia, the solution can acquire different colours. Explain the reason.

**d)** Why lithium shows anomalous behaviour?

**Q26** **a)** Two gases A & B having same volume diffuse through a porous partition in 30 secs. and 20 secs. respectively. The molecular mass of A is 45. Find the molecular mass of B.

**b)** Why do gases deviate from ideal behaviour?

**c)** According to kinetic theory, the forces of attraction between the gas molecules are negligible. Explain

**d)** Explain dipole – induced dipole forces with example.