# ARYAN INSTITUTE

**Sample Question Paper (2022-23)**

**SUBJECT: CHEMISTRY**

**CLASS – XI**

Time : 3 Hrs.                                                                                                     M.M. 70

**GENERAL INSTRUCTIONS :-**

Read the following instruction carefully.

**(a)**    There are 35 question paper with internal choice.
**(b)**    SECTION A consists of 18 multiple-choice questions carrying 1 marks each.
**(c)**    SECTION B consists of 7 very short answer questions carrying 2 marks each.
**(d)**    SECTION C consists of 5 short answer questions carrying 3 marks each.
**(e)**    SECTION D consists of 2 case-based questions carrying 4 marks each.
**(f)**    SECTION E consists of 3 Jong answer questions carrying 5 marks each.
**(g)**    All questions are compulsory.
**(h)**    Use of log tables and calculators is not allowed.

## SECTION - A

**Q1.**  An organic compound contains carbon, hydrogen and oxygen. Its analysis gave c, 38.71% and H, 9.67%.

The Empirical formula of the compound would be

(A) CHO              (B) $CHG_4O$              (3) $CH_3O$              (D) $CH_2O$

**Q2.**  Which one of the following sets of ions represents a collection of isoelectronic species ?

(At. Nos :  F=g, cl=17, Na=11, Mg=12, Al=13, K=19, Ca= 20, Sc=21)

(A) $k^+, Ca^{2+}, Sc^{3+}, el^-$          (B) $Na^+, Ca^{2+}, Sc^{3+}, F^-$

(C) $k^+, Cl^-, Mg^{2+}, Sc^{3+}$          (D) $Na^+, Mg^{2+}, Al^{3+}, Cl^-$

**Q3.**  The orbitals are called degenerate when

(a) they have the same wave functions

(b) they have the same wave functions but different energies.

(c) they have different wave functions but same energy

(d) they have the same energy.

**Q4.**  Which of the following elements has the maximum negative election gain enthalpy ?

(a) oxygen                                        (b) chlorine

(c) Fluorine                                       (d) Nitrogen

**Q5.**  In a reversible process the system absorbs 600 KJ heat and performs 250 KJ work on the surroundings. What is the increase in the internal energy the system ?

(a) 850 KJ              (b) 600 KJ              (c) 350KJ              (d) 250kJ.

**Q6.**  The correct relationship between standard free energy change in a reaction and the corresponding equilibrium constant Ke is

(a) $-\Delta G = RT \ln Kc$                    (b) $-\Delta G^o = RT \ln Kc$

(c) $-\Delta G^o = - RT \ln Kc$               (d) $\Delta G = RT \ln Kc$

**Q7.** The configuration $1s^2\, 2s^1\, 2Px^1\, 2Py^1\, 2Pz^1$ represents:

(a) a nitrogen atom      (b) a carbon atom

(c) an excited carbon atom      (d) an excited nitrogen atom

**Q8.** The type of hybrid orbitals used by chloride atom in $clo_3^1$ is :

(a) sp      (b) $Sp^2$

(c) $sp^3$      (d) None of these.

**Q9.** The reaction, $pcl_5 \rightleftharpoons pcl_3 + cl_2$ is in quilibrium. Now an inert gas is added at constant volume :

(a) reaction will proceed in forward direction

(b) reaction will proceed in backward direction

(c) move $pcl_3$ will be formed

(d) there is no effect on the reaction

**Q10.** $A + B \rightleftharpoons C + D$, $Kc = 9$. If the molar concentration of each of A, B, C, D is 0.3 then:

(a) reaction proceed in forward direction

(b) reaction proceed in backward direction

(c) reaction is in equilibrium

(d) None of the above.

**Q11.** To which of the following the Ostwald's dilution law is applicable:

(a) $HNO_3$      (b) HCN

(c) NaOH      (d) $Na_2SO_4$

**Q12.** How many $H^+$ ions are contained in 1 mL of a solution, whose pH is 13 ?

(a) $6.023 \times 10^7$      (b) $6.023 \times 10^{10}$

(c) $6.023 \times 10^{23}$      (d) $10^{13}$

**Q13.** The IUPAC name for the compound is

(a) 1-Fluoro-4-methyl-2-nitrobenzene

(b) 4-fluoro-1-methyl-3-nitrobenzene

(c) 4-methyl-1-fluoro-2-nitrobenzene

(d) 2-fluoro-5-methyl-1-nitrobenzene.
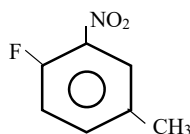


**Q14.** Among the following the aromatic compound is:



**Directions: Each of these questions contain two Statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below. (a) Assertion is correct, reason is correct; reason is correct explanation for assertion.**

**(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion**

**(c) Assertion is correct, reason is incorrect**

**(d) Assertion is incorrect, reason is correct.**

**Q15.** Assertion : Acetylene on treating with $NaNH_2$ gives sodium acetylide and ammonia.

Reason : sp-hybridised carbon atoms of acetylene are considerably electronegative.

**Q16.** Assertion : BF₃ behaves as an electrophile.

Reason : Boron in BF₃ molecule has six octet of electrons.

**Q17.** Assertion : copper sulphate solution is not stored in a zinc vessel

Reason : zinc forms complex with $CuSO_4$

**Q18.** Assertion : molecular nitrogen is less reactive than molecular oxygen.

Reason : The bond length of $N_2$ is shorter than that of oxygen.

<div align="center"><strong>SECTION – B</strong></div>

**Q19.** Which of the following pairs of elements have a more negative electron gain enthalpy ?

(a) O Or F  (b) F or cl

**Q20.** Two elements C and D have atomic no. 36 and 29 respectively. On the basis of electronic configuration predict the following:

(i) the group, period and block to which each element belongs.

**Q21.** Draw the molecular orbital diagram of $N_2^+$.

<div align="center"><strong>OR</strong></div>

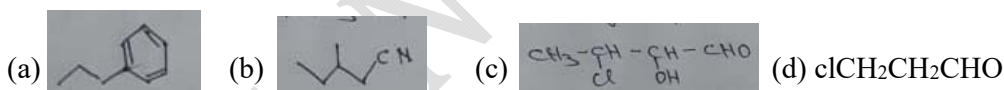Draw the shape of the fallowing molecules using VSEPR theory.

(a) SF₄  (b) NH₃

**Q22.** Calculate the equilibrium constant, K. for the following reaction at 400K ?

$$2NOCl\,(g) \rightleftharpoons 2NO(g) \; + \; Cl_2(g)$$

Given that $\Delta rH° = 80.0$ KJ mol⁻¹ and $\Delta rS° = 120$ JK⁻¹mol⁻¹

**Q23.**

Derive the relationship between $9_p$ and $q_v$.

**Q24.** Give IUPAC names of the following compounds :

(a)   (b)   (c) $CH_3-CH-CH-CHO$ with Cl and OH  (d) $clCH_2CH_2CHO$

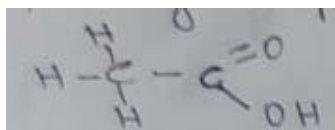**Q25.** (a) State Hess's law of constant heat summation with example.

(b) The reaction of cyanamide, $NH_2CN(S)$ with dioxygen was carried out in a bomb calorimeter, and $\Delta U$ was found to be -742.7 KJ mol⁻¹ at 298k. Calculate the enthalpy change of the reaction of 298 K.

$$NH_2CH\,(S) + 3/2\, O_2(g) \rightarrow N_2(g) \; + CO_2(g) + H_2O(l)$$
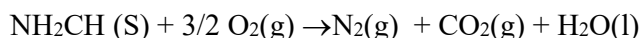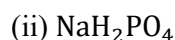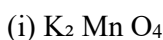
<div align="center"><strong>SECTION – C</strong></div>

**Q26.** (a) How many sigma and pi bonds are present in following compound
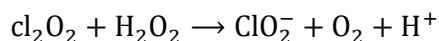


(b) Define intermolecular hydrogen bonding.

(c) Find hybridization of $CO_3^{2-}$.

**Q27.** (a) Assign oxidation number to the underlined elements in each of the fallowing species :

(i) $K_2MnO_4$                                  (ii) $NaH_2\underline{P}O_4$

(b) Balance the following equation in Basic medium by ion election method and oxidation number method.

$$cl_2O_2 + H_2O_2 \rightarrow ClO_2^- + O_2 + H^+$$

**Q28.** (a) An alkene 'A' on ozonalysis gives a mixture of ethanal and pentan-3-one. Write the structure and IUPAC name of 'A'.

(b) What effect does branching of an alkane chain has on its boiling pant ?

**Q29.** (a) out of benzene, m-dinitrobenzene and toluene which will undergo nitrotion most easily and why ?

(b) How will you convert benzene into :

(i) p-nitrobromobenzene                        (ii) acetophenone

(c) An alkene 'A' contains three c-c, eight C-H (sigma bonds) and one C-C TT-bond. 'A' on ozonalysis gives two moles of an aldehyde of molar mass 44 ce. Write IUPAC name of 'A'.

**Q30.** (a) The mass of an electron is $9.1 \times 10^{-31}$ kg. If its K.E is $3.0 \times 10^{-25}$ J, calculate its wavelength.

(b) Table tennis ball has a mass of 10g and a speed of 90 m/s. If speed can be measured with an accuracy of 4%. What will be the uncertainty in speed and position?

## SECTION-D

**Q31.** Read the passage and answer the following questions.

A large number of orbitals are possible in an atom. Qualitatively these orbitals can be distinguished by their size, shape and orientation. An orbital of smaller size means there is more chance of finding the electron near the nucleus. Similarly, Shape and orientation mean that there is more probability of finding the electron along the certain directions than along others. The principal quantum number determines the size and to large extent the energy of the orbital. Azimuthal momentum number, "l" is also known as orbital angular momentum or subsidiary quantum number. It defines the three dimensional shape of the orbital. Each shell consists of one or more sub-shells or sub-levels. The number of sub-shells in a principle shell is equal to the value of n. Magnetic orbital quantum numbers '$m_l$' gives information about the spadial orientation of the orbital with respect to a standard set of coordinate axis. The fourth quantum number is known as the election spin quantum number ($m_s$). An electron spins around its own axis, much in a similar way of the earth spins around its own axis revalving around the sun.

Answer the following -

(a) Arrange s, p, d, f subshells in the increasing order of effective nuclear charge (Zeff) experienced by the electron present in them with season.

(b) What is the significance of the quantum numbers.

### OR

(a) Differentiate between orbit and orbital.

(b) How do Quantum numbers of the shell and Subshells of an atom differ ?

**Q32.** Read the passage and give answers.

Wurtz reaction is used to prepare higher alkanes. Reaction proceeds through the formation of free radicals. Some alkene may also be formed in the reaction. Aromatic compounds undergo substitution reactions rather than addition reactions. Aromaticity is due to delocalisation of TT-electrons. All aromatic compounds contain (4n+2) $\pi$ electrons.

(a) What are the necessary conditions for any system to be aromatic ?

(b) Why is wurtz reaction not preferred for preparation of alkanes containing odd number of carbon atoms ? Illustrate your answer by taking one example.

**OR**

(a) Out of benzone, m-dinitrobenzene and toluene which will undergo nitration most easily and why ?

(b) Why does benzene undergo electrophilic substitution reactions easily and nucleophilic substitutions with difficulty ?

**SECTION-E**

**Q33.** Answer the following-

(a) State Fajan's rule ?

(b) State Heisenberg uncertainty principle.

(c) What are electrophiles and nucleophiles explain with example.

**Q34.** (a) The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3}$ m. what is its pH ?

(b) The pH of a sample of vinegar is 3.76. Calculate the concentration of hydrogen ion in it.

(c) The ionization constant of HF, HCOOH, and HCN at 298 k are $6.8 \times 10^{-4}$, $1.8 \times 10^{-4}$ and $4.8 \times 10^{-9}$ respectively. Calculate the ionization constants of the corresponding corrugate base.

(d) Write conjugate acid for the fallowing Bronsted bases: $NH_2^-$, $NH_3$ and $HCOO^-$.

**Q35.** (a) Explain the law of mass Action.

(b) Calculate the standard enthalpy of formation of $CH_3OH$ from the fallowing data.

$CH_3OH\ (l) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O\ (l)$ ; $\Delta H = -726\ KJ\ mol^{-1}$

$C(graphite) + O_2(g) \rightarrow CO_2(g)$ ; $\Delta H = -393\ KJ\ mol^{-1}$

$M_2\ (g) + 2O_2(g) \rightarrow H_2O\ (l)$ ; $\Delta H = -286\ KJ\ mol^{-1}$