VIKAS BHARATI PUBLIC SCHOOL
SAMPLE PAPER (SESSION 2024-25)
CLASS XI
SUBJECT: CHEMISTRY

Time: 3 hrs **M.M.:70**

General Instructions:

1. There are **33** questions in this question paper with internal choice covered in 5 pages.
2. **SECTION A** consists of 16 multiple-choice questions carrying 1 mark each.
3. **SECTION B** consists of 5 short answer questions carrying 2 marks each.
4. **SECTION C** consists of 7 short answer questions carrying 3 marks each.
5. **SECTION D** consists of 2 case-based questions carrying 4 marks each.
6. **SECTION E** consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Q1. The designation of an orbital with n = 4 and 1 = 3: **(1)**

a) 4s b) 4p c) 4d d) 4f

Q2. According to modern periodic law, the physical and chemical properties of elements are the periodic functions of their? **(1)**

a) Density b) Atomic Number c) Mass Number d) Atomic Mass

Q3. What is the maximum number of water molecules that can attach with one water molecule through intermolecular hydrogen bonds? **(1)**

a) 2 b) 3 c) 4 d) 1

Q4. Number of atoms of He in 100 u of He (Atomic mass of He is 4 u): **(1)**

a) 25 b) 50 c) 100 d) 400

Q5. A thermodynamic state function is a quantity: **(1)**

a) used to determine heat changes b) whose value is independent of the path

c) used to determine pressure-volume work d) whose value depends on temperature only

Q6. The enthalpies of all elements in their standard states are: **(1)**

a) Unity b) Different for every element c) < 0 d) Zero

Q7. If 'p' M is the solubility of $Al_2(SO_4)_3$, then Ksp is equal to: **(1)**

a) p5 b) $4p^4$ c) $108p^5$ d) $4p^3$

Q8. Which of the following molecule has zero dipole moment? **(1)**

a) HF b) H_2O c) BF_3 d) $CHCl_3$

Q9. The oxidation number of X, Y, Z are +2, +5and -2 respectively. The formula of the compound formed by these will be: **(1)**

a) X_2YZ_6 b) XY_2Z_6 c) XY_5 d) X_3YZ_4

Q10. In the reaction: $3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$ **(1)**

a) Bromine is oxidised and carbonate is reduced b) Bromine is reduced and water is oxidised

c) Bromine is neither reduced nor oxidized d) Bromine is both reduced and oxidised

Q11. Which of the following is the correct IUPAC name? **(1)**

a) 3-ethyl-4,4-dimethylheptane b) 4,4- dimethyl-3-ethylheptane

c) 5-ethyl-4,4-dimethylheptane d) 4,4- bis(dimethyl)-3-ethylheptane

Q12. Hyperconjugation is most useful for stabilizing which of the following carbocation? **(1)**

a) Neopentyl b) Tert-butyl c) Iso-propyl d) Ethyl

Question No. 13 to 16 are Assertion Reason type questions:

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

Q13. **Assertion (A):** Though the central atom of both NH_3 and H_2O molecules are sp^3 hybridised, yet H–N–H bond angle is greater than that of H–O–H.

Reason (R): This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs. **(1)**

Q14. **Assertion (A):** Ionic radius of Na^+ is smaller than Na.

Reason (R): Effective nuclear charge of Na^+ is higher than Na. **(1)**

Q15. **Assertion (A):** Spontaneous process is an irreversible process and may be reversed by some external agency.

Reason (R): Decrease in enthalpy is a contributory factor for spontaneity. **(1)**

Q16. **Assertion (A):** H_2SO_4 cannot act as a reducing agent.

Reason (R): Sulphur cannot increase its oxidation number beyond +6. **(1)**

SECTION-B

Q17. Calculate the standard enthalpy of formation of CH_3OH (l) from the following data: **(2)**

$$CH_3OH(l) + 3/2\ O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

a) $CH_3OH(l) + 3/2\ O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (l)$; $\Delta_rH = -726 kj\ mol^{-1}$

b) $C(s) + O_2(g) \rightarrow CO_2\ (g)$; $\Delta_cH = -393\ kj\ mol^{-1}$

c) $H_2(g) + 1/2O_2(g) \rightarrow H_2O\ (l)$; $\Delta_fH = -286\ kj\ mol^{-1}$

Q18. What will be the molarity of a solution, which contains 5.85 g of NaCl(s) per 500 mL? **(2)**

Q19. Calculate the wavenumber for the longest wavelength transition in the Balmer series of atomic hydrogen. **(2)**

Q20. Give the main products of the reaction: **(2)**

(a) $C_6H_6 + CH_3Cl \xrightarrow{\text{Anhydrous } AlCl_3}$

(b) $CH_3Cl + Na \xrightarrow{\text{Dry ether}}$

OR

A hydrocarbon A, adds one mole of hydrogen in presence of platinum catalyst and form n-Hexane. When A is oxidized vigorously with $KMnO_4$, a single carboxylic acid, containing three carbon atoms is isolated. Give the structure of A and write all the possible reaction.

Q21. Identify the redox reactions out of the following reactions and identify the oxidising and reducing agents in them. **(2)**

a) $3HCl + HNO_3 \rightarrow Cl_2 + NOCl + 2H_2O$
b) $HgCl_2 + 2KI \rightarrow HgI + 2KCl$
c) $PCl_3 + 3H_2O \rightarrow 3HCl + H_2PO_3$

SECTION-C

Q22. Write a balanced chemical equation for the following reactions by using ion electron method:

$MnO_4^- + SO_2 \rightarrow Mn^{2+} + HSO_4^-$ (acidic medium) **(3)**

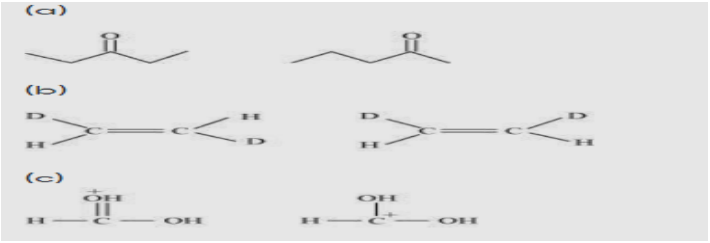
OR

$Fe^{2+} + Cr_2O_7^{2-} + H^+ \rightarrow Fe^{3+} + Cr^{3+} + H_2O$ **(2)**

P.T.O.

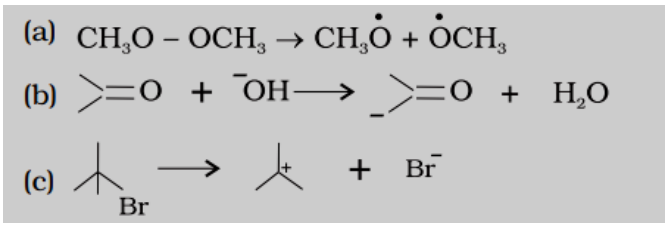
Q23. Write structures along with IUPAC name of all the alkenes which on hydrogenation give 2 -methylbutane. **(3)**

Q24. What is the relationship between the members of the following pairs of structures? Are they structural or geometrical isomers or resonance contributors? **(3)**



OR

For the following bond cleavages, use curved-arrows to show the electron flow and classify each as homolysis or heterolysis. Identify reactive intermediate produced as free radical, carbocation and carbanion.



Q25. A mixture of 1 mole of Al and 3 mole of Cl_2 are allowed to react as: **(3)**

$$2Al + 3Cl_2 \longrightarrow 2AlCl_3$$

a) Which is limiting reagent?
b) How many moles of $AlCl_3$ are formed?
c) Moles of excess reagent left unreacted.

Q26. Attempt any three from the following: **(1*3)**

a) Why is first Ionization Enthalpy of boron is slightly less than berrylium?
b) The atomic radius of elements decreases along the period but Neon has highest size among III period element? Why
c) Arrange the following elements in the increasing order of metallic character: Si, Be, Mg, Na, P.

Q27.a) By using Born-Haber cycle, calculate the enthalpy of formation of NaCl. **(2+1)**
b) Define Hess Law.

Q28. Does the number of moles of reaction products increase, decrease or remain the same when each of the following equilibria is subjected to a decrease in pressure by increasing the volume? **(3)**

a) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
b) $CaO(s) + CO_2(g) \rightleftharpoons CaCO_3(s)$
c) $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$

SECTION -D

Q29. **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 with certain directions than along others. The principal quantum number determines the size and to large extent the energy of the orbital. Azimuthal quantum 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 subshells or sub-levels. The number of sub-shells in a principal shell is equal to the value of n. Magnetic orbital quantum number. 'm_l' gives information about the spatial orientation of the orbital with respect to a standard set of co-ordinate axis. The fourth quantum number is known as the electron spin quantum number (m_s). An electron spins around its own axis, much in a similar way as the earth spins around its own axis while revolving around the sun.

a) Which quantum number tells the three-dimensional shape of the orbital? **(1)**

b) If n+l vale is more than 3 but less than 6 that total no. of orbital is? **(1)**

c) Write a set of quantum numbers for each of the electrons with an n of 3 in aluminium atom. **(2)**

OR

c) Find out what will be the maximum numbers of electrons having same spin, present in an atom for $n + l = 4$?

Q30. **Read the Passage and answer the following questions:**

The rotation of carbon-carbon single bond (s-bond), due to cylindrical symmetry of s-MOs (molecular orbitals) long internuclear axis, in alkanes results into different spatial arrangements of atoms in space that are interconvertible. These arrangements are called conformations. However, weak repulsive interaction are present between the adjacent bonds in alkanes so the rotation of C—C single bond is not completely free and is hindered by a small energy barriers of 1-20 kJ mol^{-1}. The repulsive interaction between the adjacent bond is due to electron cloud, which affects stability of a conformation is termed as torsional strain. The two types of conformations are very common, i.e., staggered and eclipsed. The conformation in which the hydrogen atoms attached to the two carbon atoms are as far apart as possible is called the staggered conformation. The conformations in which the hydrogen atoms attached to the two carbon atoms are as closed as possible is called eclipsed conformation. Any intermediate conformation between the above two is called skew or gauche conformation

a) Why different conformations of ethane cannot be separated and isolated. **(1)**

b) What is the energy gap between the two C-C single bond? **(1)**

c) Draw the staggered and eclipsed conformation of Ethane. **(2)**

OR

c) Why staggered conformation of 1,2-Chloro ethane is more stable than its eclipsed conformation.

SECTION-E

Q31. Draw molecular orbital diagram of N_2, O_2 and Be_2. Arrange them in increasing order of their bond strength and magnetic behaviour. **(5)**

OR

Describe the hybridisation of PCl_5 and SF_6 by using Valence Bond Theory. State the reason axial bonds are longer as compared to the equatorial bond in PCl_5 whereas in SF_6 both axial and equatorial bonds have the same bond length.

Q32. a) An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3- one. Write structure and IUPAC name of 'A'. **(1+2+2)**

b) Explain why the following systems are not aromatic?

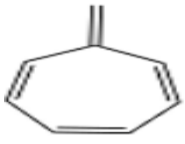


Figure 1 (a)

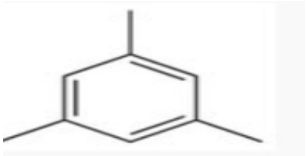


Figure 1(b)

c) What is the effect of alcoholic KOH and Aqueous KOH in Propene.

OR

a) How would you convert Ethyne into benzene? Support your answer with the help of chemical reaction.
b) Alkynes are less reactive than alkenes towards addition reaction even though they contain 2-Pi bond. Give reason.
c) Out of cis and trans structures of hex-2-ene which isomer will have higher b.p. and why?

Q33. a) The equilibrium constant, K_c, for the reaction:

$N_2(g)+3H_2(g) \rightleftharpoons 2NH_3$ at 500 K is 0.061

At a specific time, from the analysis, we can conclude that the composition of the reaction mixture is 3.0 mol L^{-1} N_2, 2.0 mol L^{-1} H_2 and 0.5 mol L^{-1} NH_3. Find out whether the reaction is at equilibrium or not. Find in which direction the reaction proceeds to reach equilibrium. **(3)**

b) What is conjugate acid-base pair? Find the conjugate acid/base of the given: HNO_2, CN^- **(2)**

OR

a) The pH of a sample of vinegar is 3.76. Calculate the concentration of hydrogen ion in it. {log(3.76)= 0.5751 , antilog(-3.76)= 0.000178} **(2)**

b) The ionisation constant of HF, HCOOH and HCN at 298K are 6.8×10^{-4}, 1.8×10^{-4} and 4.8×10^{-9}, respectively. Calculate the ionisation constants of the corresponding conjugate base. **(3)**

XXXXXXX