

**DAV BR PUBLIC SCHOOL, BINA**  
Class: XI  
**Annual Examination**  
**CHEMISTRY SAMPLE PAPER (THEORY-043)**  
Session (2023- 24)

**Time Allowed: 3 hours**

**Maximum Marks: 70**

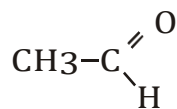
**General Instructions:-**

- (i) Paper consist of two sections:-**Section A and Section B**
- (ii) Section A is objective type and Section B is subjective type
- (iii) There is one case based question contains four marks question
- (iv) This is a sample question paper for practicing types of questions ,original qp may differ in blue print

**SECTION-A**

1. Predict which of the following reaction proceeds nearly to completion,with reason : 1
- (a)  $\text{H}_2 (\text{g}) + \text{Cl}_2 (\text{g}) \rightleftharpoons 2\text{HCl} (\text{g})$  at 300 K with  $K_C = 4 \times 10^{31}$
- (b)  $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$  at 298 K with  $K_C = 4.8 \times 10^{-31}$
2. Isomerism exhibited by (i) m-cresol and o-cresol (ii) Ethanol and Methoxy methane is respectively. 1
- a) Functional group isomers and chain isomers
- a) Position isomer and chain isomers
- b) Position isomers and Functional group isomers
- c) Functional group isomers and Metamers.
3. Which is most stable carbocation? 1
- (a)  $(\text{CH}_3)_3 \text{C}^+$  (b)  $\text{CH}_3\text{CH}_2\text{CH}_2^+$
- (c)  $\text{CH}_3^+$  (d)  $(\text{CH}_3)_2\text{CH}^+$
4. Number of angular nodes for 4d orbital is \_\_\_\_\_. 1
- (a) 4 (b) 3 (c) 2 (d) 1
5. Considering the elements B, C, N, F, and Si, the correct order of their non-metallic character is : 1
- a)  $\text{B} > \text{C} > \text{Si} > \text{N} > \text{F}$  b)  $\text{Si} > \text{C} > \text{B} > \text{N} > \text{F}$
- c)  $\text{F} > \text{N} > \text{C} > \text{B} > \text{Si}$  d)  $\text{F} > \text{N} > \text{C} > \text{Si} > \text{B}$

6. Which of the following angle corresponds to  $sp^2$  hybridisation? 1  
 (a)  $90^\circ$  (b)  $120^\circ$  (c)  $180^\circ$  (d)  $109^\circ$
7. Write the IUPAC name and symbol for the element with atomic number 114 1
8. Identify the electrophilic centre in 1



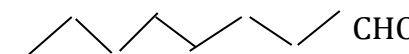
Support your answer with appropriate reason.

In questions 6 to 10 a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

- (i) A and R both are correct, and R is the correct explanation of A.  
 (ii) A and R both are correct, but R is not the correct explanation of A.  
 (iii) A is true but R is false.  
 (iv) A is false but R is true.
9. **Assertion (A):** Spontaneous process is an irreversible process and may be reversed by some external agency. 1  
**Reason (R):** Decrease in enthalpy is a contributory factor for spontaneity.
10. **Assertion (A) :** Though the central atom of both  $\text{NH}_3$  and  $\text{H}_2\text{O}$  molecules are  $sp^3$  hybridised, yet H–N–H bond angle is greater than that of H–O–H. 1  
**Reason (R) :** This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs.
11. **Assertion (A) :**The first ionisation energy of Be is greater than that of B 1  
**Reason (R):**2p orbital is lower in energy than 2s orbital.
12. **Assertion (A) :** Enthalpy of formation of graphite is zero but of diamond it is not zero. 1  
**Reason(R) :** Enthalpy of formation of the most stable allotrope is taken as zero..
13. **Assertion (A) :** The bond order of helium is always zero. 1  
**Reason (R):** The number of electrons in bonding molecular orbital and antibonding molecular orbital is equal.

### SECTION-B

14. Which of the two  $\text{O}_2\text{NCH}_2\text{CH}_2\text{O}^-$ . Or  $\text{CH}_2\text{CH}_2\text{OH}^-$  is expected to be more stable? 2
15. Define hydrogen bond. Is it weaker or stronger than the van der Waals forces? 2  
 Explain its two types with one example of each

16. (a) State Heisenberg's uncertainty principle. 2  
 (b) Calculate the uncertainty in position of a dust particle with mass equal to 1mg, if uncertainty in its velocity is  $5.5 \times 10^{-20}$  m/s.
17. A compound contains 84.9% mercury and 15.1% chlorine. If molar mass of the compound is 471, then find its empirical and molecular formula (Hg = 200, Cl = 35.5) 2
18. Calculate the standard enthalpy of formation of CH<sub>3</sub>OH. from the following data: 2  
 (i)  $\text{CH}_3\text{OH}(\text{l}) + 3/2 \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}); \Delta_r H^\circ = -726 \text{ kJ mol}^{-1}$   
 (ii)  $\text{C}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g}); \Delta_c H^\circ = -393 \text{ kJ mol}^{-1}$   
 (iii)  $\text{H}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{l}); \Delta_f H^\circ = -286 \text{ kJ mol}^{-1}$
19. (i) State the hybridisation of N in NH<sub>3</sub> and NH<sub>4</sub><sup>+</sup> 2  
 (ii) Arrange the following in decreasing order of stability O<sub>2</sub>, O<sub>2</sub><sup>-</sup> (superoxide), O<sub>2</sub><sup>2-</sup> (peroxide)
20. Calculate the enthalpy change for the process: CCl<sub>4</sub>(g) → C(g) + 4Cl(g) And Calculate bond Enthalpy of C-Cl in CCl<sub>4</sub>(g) Δ<sub>vap</sub>H° (CCl<sub>4</sub>) = 30.5 KJ/mol Δ<sub>f</sub>H° (CCl<sub>4</sub>) = -135 KJ/mol Δ<sub>a</sub>H°(c) = 715.0 KJ/mol Δ<sub>a</sub>H°(CCl<sub>2</sub>) = 242 KJ/mol. 2
21. When electromagnetic radiation of wavelength 306 nm falls on a surface of sodium metal, electrons are emitted with a kinetic energy of  $1.7 \times 10^5$  Jmol<sup>-1</sup>. What is the minimum energy needed to remove an electron from the metal. What is the maximum wavelength that will cause a photoelectron to be emitted? 2
22. (i) Write IUPAC names of following: (i)  CHO 2  
 (ii) Write bond line formula of isopropyl alcohol.
23. Why is wurtz reaction not preferred for the preparation of alkanes containing odd number of carbon atoms? Illustrate your answer by taking an example. 2
24. i) Draw the resonance structure for: - CH<sub>3</sub>-CH=CH-CH<sub>3</sub>, C<sub>6</sub>H<sub>5</sub>NO<sub>2</sub>, C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub> (any one) Using curve arrow notation. 3  
 ii) Name the best and latest technique for isolation, purification and Separation of organic compounds

25. (i) Find the oxidation state of P in  $\text{NaH}_2\text{PO}_4$ . 3  
(ii) What is the function of salt bridge in electrochemical-cell?

**OR**

Complete and balance the following equation.  $\text{MnO}_4^- + \text{H}_2\text{S} \rightarrow \text{Mn}^{2+} + \text{S}$  (acidic medium)

26. a) Convert the following 3  
i) Phenol to Benzene  
ii) Benzene to Benzene hexachloride  
b) Draw conformation of ethane by Newmann Projection.

**OR**

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

27. Equilibrium constant  $K_c$  for the reaction:  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$  at 500K is 0.061. 3  
At particular time analysis shows that composition of the reaction mixture is 3.0 mo/L  $\text{N}_2$  2.0 mol/L  $\text{NH}_3$ . Is the reaction at equilibrium? If not in which direction does the reaction tend to proceed to equilibrium and why?

28. Explain. Explain in brief for the following: 3  
a) Anions are bigger in size than their parent atom.  
b) Oxygen has lesser first ionization enthalpy than nitrogen  
c) Fluorine has less negative electron gain enthalpy than chlorine

29. Addition of HBr to propene yields 2-bromopropane. Explain and give mechanism. 3  
**OR**

Explain the following reactions with an example

- a) Wurtz reaction  
b) Friedel Craft Acylation  
c) Beta Elimination.

30. Chemical energy stored by molecules can be released as heat during chemical reactions when a fuel like methane, cooking gas or coal burns in air. The chemical energy may also be used to do mechanical work when a fuel burns in an engine or to provide electrical energy through a galvanic cell like dry cell. The study of these energy transformations forms the subject matter of thermodynamics. Thermodynamics deals with energy changes in chemical or physical processes and enables us to study these changes quantitatively and to make useful predictions. For these purposes, we divide the universe into the system and the surroundings. Chemical or physical processes lead to evolution or absorption of heat ( $q$ ), part of which may be converted into work ( $w$ ). These quantities are related through the first law of thermodynamics. The heat absorbed at constant volume is equal to change in the internal energy i.e.,  $\Delta U = q_V$ . But most of chemical reactions are carried out not at constant volume, but in flasks or test tubes under constant atmospheric pressure is equal to change in the enthalpy,  $\Delta H = q_p$ , heat absorbed by the system at constant pressure. There are varieties of enthalpy changes. Changes of phase such as melting, vaporization and sublimation usually occur at constant temperature and can be characterized by enthalpy changes which are always positive. Enthalpy of formation, combustion and other enthalpy changes can be calculated using Hess's law.

Based on the above information, answer the following questions:-

- i) In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?
- ii) Define extensive properties. Give one example.
- iii) In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?
- iv) The enthalpy of atomisation for the reaction  $\text{CH}_4(\text{g}) \rightarrow \text{C}(\text{g}) + 4\text{H}(\text{g})$  is 1665 kJ mol<sup>-1</sup>. What is the bond energy of C-H bond?

31. (a) Account for the following: 5
- (i) Although ammonia and water both have distorted tetrahedral geometry, the bond angle in water is less than that of ammonia.
  - (ii) All carbon to oxygen bonds in  $\text{CO}_3^{2-}$  are equivalent.
  - (iii)  $\text{BF}_3$  has zero dipole moment although the B-F bond is polar.
- (b) Write the molecular orbital configuration of  $\text{O}_2^+$ . Also calculate its bond order and magnetic nature.

**OR**

- (a) On the basis of VSEPR theory, predict the shape of  $\text{BF}_3$ .
- (b) Name the molecular orbital formed by the combination of the following atomic orbitals (assume Z axis as the internuclear axis)
- (i)  $2p_x + 2p_x$
  - (ii)  $2p_z - 2p_z$
- (c) In the molecule of ethene ( $\text{C}_2\text{H}_4$ )
- (i) How many sigma and pi bonds are present?
  - (ii) Draw the orbital overlap diagram showing the double bond formation in ethene.
32. (a) How many radial and angular nodes will be there in 5f orbital? 5

(b) The unpaired electrons in Al and Si are present in 3p orbital. Which electron will experience more effective charge from the nucleus? Give reason for your answer.

(c) A tennis ball of mass  $6 \times 10^{-2}$  kg is moving with a speed of 62 m/sec. Calculate the wavelength associated with this moving tennis ball. Will the movement of this ball exhibit a wave character? Explain. Planck's constant  $h = 6.626 \times 10^{-34}$  Js

**OR**

- (a) State Heisenberg's Uncertainty Principle. How does it contradict the Bohr's Model of Atom?
- (b) Calculate the frequency and wavelength of the radiation in nanometers emitted when an electron in the hydrogen atom jumps from the third orbit to the ground state. (Rydberg constant  $(R) = 109,677 \text{ cm}^{-1}$ ).
33. a) What effect does branching of an alkane chain have on its boiling point? 5
- b) Define Ozonolysis Reaction?
- c) Define cracking?
- d) Why is benzene extra-ordinarily stable though it contains three double bonds?
- e) Why does nitrobenzene not undergo Friedel-Crafts alkylation?

**OR**

Explain the mechanism of electrophilic substitution reaction in benzene by the process of chlorination.

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**BEST WISHES**