Delhi Public School, Howrah

PERIODIC TEST - III (2024-2025)
CLASS-XI

Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

SUBJECT: CHEMISTRY (CODE-043)

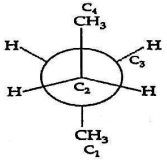
TIME: 3 HOURS **F.M.: 70**

General Instructions:

Read the following instructions carefully.

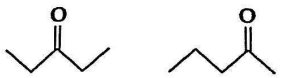
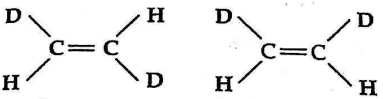
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) SECTION D consists of 2 case - based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
(h) Use of log tables and calculators is not allowed.

	SECTION: A **The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.**	**MARKS**
1.	Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons? a. Pauli's exclusion principle. b. Heisenberg's uncertainty principle. c. Hund's rule of maximum multiplicity. d. Aufbau principle	1
2.	The exhibition of various oxidation states by an element is also related to the outer orbital electronic configuration of its atom. Atom(s) having which of the following outermost electronic configurations will exhibit more than one oxidation state in its compounds. a. $3s^1$ b. $3d^24s^2$ c. $3d^14s^2$ d. $1s^12p^2$	1
3.	When hydrochloric acid is added to cobalt nitrate solution at room temperature, the following reaction takes place and the reaction mixture becomes blue. On cooling the mixture it becomes pink. On the basis of this information mark the correct answer. $[Co(H_2O)_6]^{3+}(aq) + 4Cl^-(aq) \rightleftharpoons [CoCl_4]^{2-}(aq) + 6H_2O(l)$ (pink) (blue) a. $\Delta H > 0$ for the reaction. b. $\Delta H < 0$ for the reaction. c. $\Delta H = 0$ for the reaction. d. The sign of AH cannot be predicted on the basis of this information.	1
4.	MX_6 is a molecule with octahedral geometry. How many X – M – X bonds are at 180°? a. four b. two c. three d. six	1

5.	The values of x and y in the following reaction, $xCl_2 + 6OH^-$ (hot & conc.) $\rightarrow ClO_3^- + yCl^- + 3H_2O$ are a. x = 2, y = 4 b. x = 5, y = 3 c. x = 3, y = 5 d. x = 4, y = 2	1
6.	Which of the following solutions have the same concentration? i. 20 g of NaOH in 200 mL of solution. ii. 40 g of NaOH in 100 mL of solution iii. 20 g of KOH in 200 mL of solution iv. 0.5 mol of KCl in 200 mL of solution a. (ii) and (iii) b. (i) and (ii) c. (i) and (iv) d. (ii) and (iv)	1
7.	The structure of IF_7 is a. Pentagonal bipyramid b. Square pyramid c. Trigonal bipyramid d. Octahedral	1
8.	In the given conformation C_2 is rotated about C_2-C_3 bond anticlockwise by an angle of 120°, then the conformation obtained is:  a. Fully eclipsed conformation b. Gauche conformation c. Partially eclipsed conformation d. Staggered conformation	1
9.	Which of the following CANNOT be represented by resonance structures? a. Dimethyl ether b. Nitrate anion c. Carboxylate anion d. Toluene	1
10.	The electronic configuration of an element X is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$. Which element is present below X in the same group in periodic table? a. As b. Se c. Sb d. Sn	1
11.	The IUPAC name of CH_3-$CHBr$-CH_2OH is: a. 2-bromo-1-propanol. b. 3-hydroxy-2-bromopropane. c. 3-hydroxy isopropyl bromide. d. 2-bromo-3-propanol.	1
12.	The symbol of element with atomic number Z = 109 is a. Unp b. Uns c. Uno d. Une	1

	Q. no 13 to 16 are Assertion - Reasoning based questions. **These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:** (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true and R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	
13.	Assertion (A): Among the two O-H bonds in H_2O molecule, the energy required to break the first O-H bond and the other O-H bond is the different. Reason (R): This is because the electronic environment around oxygen is the same even after breakage of one O-H bond.	**1**
14.	Assertion (A): Work and internal energy of a system are state functions. Reason (R): The sum of q+w is a state function.	**1**
15.	Assertion (A): Pent-1-ene and pent-2-ene are position isomers. Reason (R): Position isomers differ in the position of functional group or substituent.	**1**
16.	Assertion (A): Cyclobutane is less stable than cyclopentane. Reason (R): In cyclobutane, presence of bonds with bond angle less than 90° causes internal strain.	**1**
	SECTION: B **This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.**	
17.	Molecular formula is more informative than empirical formula as it gives the exact number of atoms present in the compound. Then explain the significance of using empirical formula with example.	**2**
18.	Observe the following species and arrange them in the order of increasing ionic radii with proper explanation. O^{2-}, N^{3-}, F^-, Na^+, Mg^{2+}, Al^{3+}	**2**
19.	Draw the shape of the following compounds and identify the hybridisation involved in the central atom: **a.** C_2H_2 **b.** SF_6	**2**
20.	Dipole moment of carbon dioxide is zero but water is a polar compound even though both are triatomic in nature. Justify. **OR** Draw the molecular orbital diagram of N_2^+ and calculate the bond order.	**2**
21.	How will you convert ethyne to but-2-yne? Write the chemical equation of the reaction involved.	**2**
	SECTION: C **This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.**	
22.	a. Using *s,p,d* notation designate the orbitals with the help of the following data. ***i. n=3, l=1, m=0*** ***ii. n=1, l=0*** b. List magnetic and azimuthal quantum numbers for 3d-orbitals.	**3**
23.	Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles. a. $CH_3COOH + \mathbf{HO^-} \rightarrow CH_3COO^- + H_2O$ b. $CH_3COCH_3 + \mathbf{CN^-} \rightarrow (CH_3)_2C(CN)(OH)$ c. $C_6H_6 + \mathbf{^+CN(CH_3)} \rightarrow C_6H_5COCH_3$	**3**
24.	Explain the following with the help of E^0 values of metals. a. $FeSO_4(aq) + Cu(s) \rightarrow$ No reaction b. Zinc displaces copper from aqueous $CuSO_4$ solution but Ag does not. c. Solution of $AgNO_3$ turns blue when copper rod is immersed in it.	**3**

25.	Two moles of an ideal gas initially at 27°C and 1 atm pressure are compressed isothermally andreversibly till the final pressure of the gas is 10 atm. Calculate the values of q, W and ΔU for this process. **OR** If water vapour is assumed to be a perfect gas, molar enthalpy change for vaporisation of 1 mol of water at 1 bar and 100°C is 41 kJ mol^{-1}. Calculate the internal energy change when, a. 1 mol of water is vapourised at 1 bar pressure and 100°C. b. 1 mol of water is converted into ice.	3
26.	Why do alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reaction? Describe with proper examples and necessary diagrams.	3
27.	How do you account for the formation of ethane during chlorination of methane? Elucidate with proper mechanism.	3
28.	Arrange the following in the decreasing order of acidic character with proper explanation. • C_2H_4, C_2H_6, C_2H_2 • $CH_3—C\equiv CH$, C_2H_2, $CH_3—C\equiv C—CH_3$.	3
	SECTION: D **The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.**	
29.	Dramatically increased CO_2 concentration from several point sources is perceived to cause severe greenhouse effect toward the serious ongoing global warming with associated climate destabilization, inducing undesirable natural calamities, melting of glaciers, and extreme weather patterns. CO_2 capture and utilization (CCU) has received tremendous attention due to its significant role intensifying global warming. Their industrial applications in pre- and post-combustion CO_2 capture as well as utilization were systematically discussed and compared. With our great effort, this review would be of significant importance for academic researchers for obtaining an overall understanding to the current developments and future trends of CCU. This work is bound to benefit researchers in fields relating to CCU and facilitate the progress of significant breakthroughs in both fundamental research and commercial applications to deliver perspective views for future scientific and industrial advances in CCU. (a) Calculate the amount of carbon dioxide produced when 3 tonnes of carbon is burnt in air. (b) Calculate the number of atoms of oxygen present in that much of carbon dioxide. **OR** (a) CO_2 is considered as greenhouse gas. Explain how it works as greenhouse gas. (b) What would happen if the amount of carbon dioxide & oxygen would have been reversed?	4
30.	The first (Δ_iH_1) and the second (Δ_iH_2) ionization enthalpies in $kJmol^{-1}$ and the electron gain enthalpy ($\Delta_{eg}H$) in $kJmol^{-1}$ of a few elements are given below: **Elements** | Δ_iH_1 | Δ_iH_2 | $\Delta_{eg}H$ I | 520 | 7300 | −60 II | 419 | 3051 | −48 III | 1681 | 3374 | −328 IV | 1008 | 1846 | −295 V | 2372 | 5251 | +48 VI | 738 | 1451 | −40	4

	Which of the above element is likely to be (Answer any two of the following, stating explanation): (a) The least reactive element. (b) The most reactive metal. (c) The most reactive non-metal. (d) The metal which can form a stable binary halide of the formula MX_2 (X = halogen)?	
	SECTION: E **The following questions are long answer type and carry 5 marks each. All questions have an internal choice.**	
31.	a. Expansion of a gas in vacuum is called free expansion. Calculate the work done and the change in internal energy when 1 litre of ideal gas expands isothermally into vacuum until its total volume is 5 litre? b. The reaction enthalpy for the following reaction is: **$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ is $\Delta_rH^\circ = -572 kJmol^{-1}$** What will be standard enthalpy of formation of H_2O (l)? c. Draw the Born Haber cycle of NaCl. **OR** a. The difference between C_P and C_V can be derived using the empirical relation H =U + PV. Starting from the given relation, derive the relation between C_P & C_V & then calculate the difference between C_P and C_V for 10 moles of an ideal gas. b. Hydrogen, iodine, and hydrogen iodide have bond energies of 218, 107, and 299 kJ respectively. Calculate the enthalpy of the formation of hydrogen iodide. State whether the reaction is exothermic or endothermic. c. Write the Hess's law of Thermodynamics.	5
32.	a. What is the maximum number of emission lines when the excited electron of an H atom in n = 6 drops to the ground state? b. Can we apply Heisenberg's uncertainty principle to a stationary electron? Explain your answer. c. Out of electrons and protons which one will have a higher velocity to produce matter waves of the same wavelength? Explain it. **OR** a. Calculate the mass and charge of one mole of electrons. What is the significance of the term? b. The distance traversed by an electron is numerically equal to its de Broglie wavelength. Calculate the velocity of the electron. c. Calculate the total number of angular nodes and radial nodes present in the 5f orbital.	5
33.	(a) What is the relationship between the members of following pairs of structures? (i)  (ii)  (b) What is electromeric effect? Compare it with hyperconjugation effect. **OR** (a) Why 3° carbocation are more stable than 1° carbocation? (b) Explain why Benzene is not considered as cyclohexatriene. (c) Is the name 'Organic Chemistry' justified for the branch of carbon chemistry? Explain your answer.	5