



INDIAN SCHOOL SOHAR
TERM I EXAMINATION (2023-2024)
CHEMISTRY (043)

No: of printed pages: 5

CLASS: XI
DATE: 24/09/23

MAX.MARKS: 70
TIME : 3 HOURS

General Instructions:

- There are 33 questions in this question paper with internal choice.
- Section A consists of 16 multiple-choice questions carrying 1 mark each.
- Section B consists of 5 short answer questions carrying 2 marks each.
- Section C consists of 7 short answer questions carrying 3 marks each.
- Section D consists of 2 case-based questions carrying 4 marks each.
- Section E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- 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.

- Which of the following represents the largest number of particles?**
(a) Atoms in 1 mole of CH_4 (b) Atoms in 0.5 mole of SO_3
(c) Atoms in 0.5 mole of CO_2 (d) Atoms in 1 mole of CO
- Among the following, the one having the longest chain is:**
(a) Neopentane (b) Isopentane
(c) 2-Methylpentane (d) 2,2-Dimethylbutane
- The IUPAC symbol for the element with atomic number 119 would be:**
(a) Uuh (b) Uun
(c) Une (d) Uue
- Which of the following 3d-orbital has electron density in all the three axes?**
(a) $3d_{xy}$ (b) $3d_{x^2-y^2}$
(c) $3d_z^2$ (d) $3d_{yz}$
- The IUPAC name of a compound having the formula $(\text{CH}_3)_3\text{C}-\text{CH}=\text{CH}_2$ is:**
(a) 3,3,3-Trimethyl-1-propene (b) 3,3-Dimethyl-1-butene
(c) 1,1,1-Trimethyl-3-propene (d) 1,1-Dimethyl-3-butene
- The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1:4. The ratio of the number of their molecules is:**
(a) 3:16 (b) 1:4
(c) 7:32 (d) 1:8
- The hybrid orbitals that will form the compound $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_2-\text{CH}_3$ are:**
(a) sp, sp^2 (b) sp^3, sp
(c) sp^3, sp^2 (d) sp, sp
- The element with positive electron gain enthalpy is :**
(a) Hydrogen (b) sodium
(c) Oxygen (d) neon
- The number of radial nodes possible for 3d orbital is:**
(a) 3 (b) 1

(c) 2

(d) 0

10. The 4f level is successively filled up in:

(a) alkali metals

(b) rare gases

(c) lanthanides

(d) actinides

11. Three elements X, Y and Z are in the third period of the periodic table. The oxides of X, Y and Z respectively, are basic, amphoteric and acidic. The correct order of the atomic numbers of X, Y and Z is:

(a) $X < Y < Z$

(b) $Z > Y > X$

(c) $X < Z < Y$

(d) $Y > X > Z$

12. Arrange the following in decreasing order of their boiling points.

(A) n-Butane (B) 2-Methylbutane (C) n-Pentane (D) 2,2-Dimethylpropane

(a) $A > B > C > D$

(b) $B > C > D > A$

(c) $C > B > D > A$

(d) $D > C > B > A$

In the following questions (Q. No. 15 to 18) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices:

(a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.

(b) Assertion and reason both are correct statements but the reason is not the correct explanation for assertion.

(c) Assertion is a correct statement but the reason is a wrong statement.

(d) Assertion is a wrong statement but the reason is a correct statement

13. **Assertion:** The standard unit for expressing the mass of atoms is a.m.u.

Reason: a.m.u stands for the mass of 1 atom of carbon.

14. **Assertion:** Methylene has a sextet of electrons.

Reason: Methylene behaves as a nucleophile.

15. **Assertion:** In a given shell the order of screening effect is $s < p < d < f$.

Reason: For the same value of n, the subshell that is closer to the nucleus has more penetrating power.

16. **Assertion:** Hydrogen has one electron in its orbit but it produces several spectral lines.

Reason: There are many excited energy levels available.

SECTION-B

This section contains 5 questions with internal choice in one question. The following questions are very short answer types and carry 2 marks each.

17. What volume of oxygen at S.T.P. is required to effect complete combustion of 200 cm³ of acetylene and what would be the volume of carbon dioxide formed? The chemical equation for the reaction is: $2 C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$ 2

18. (a) What alkyne would you start with and what reagents would use to prepare trans-Pent-2-ene? 2x1
(b) How will you prepare acetaldehyde from acetylene?

OR

(a) How would you convert n-hexane to Benzene?

(b) What is the formula of Teflon? Give one use of Teflon.

19. The wavelength of blue light is 480 nm. Calculate the frequency and wave number of this light. 2

20. (a) Reductive ozonolysis of an alkene (C₇H₁₄) gave ethanal and pentan-3-one. Write the structure of the alkene and its IUPAC name. 2x1

(b) Draw Newman's projection formula for the staggered and the eclipsed form of ethane.

21. Give a reason for the following: 2x1

(a) Halogen act as a good oxidising agent.

(b) Li and Mg show a resemblance in chemical behaviour.

SECTION-C

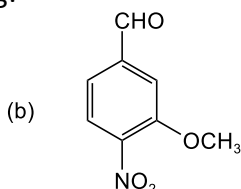
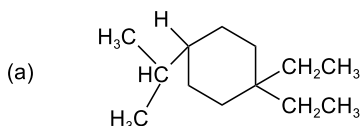
This section contains 7 questions with internal choice in one question. The following are short answer types and carry 3 marks each.

22. (a) State Heisenberg's uncertainty principle.

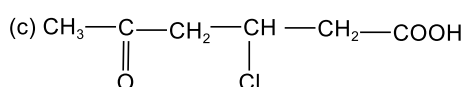
(b) Calculate the uncertainty in the position of an electron if the uncertainty in its velocity is $5.7 \times 10^5 \text{ m s}^{-1}$. ($h = 6.6 \times 10^{-34} \text{ J s}$ and mass of electron = $9.1 \times 10^{-31} \text{ kg}$)

1+2

23. Write the IUPAC name of the following:



3x1



24. (a) Write the chemical equation for the combustion of hexyne.

3x1

(b) Name one test to distinguish propene from propane.

(c) Which salt on treatment with soda-lime gives ethane? Write the reaction involved.

25. A solution is 25% water, 25% ethanol, and 50% acetic acid by mass. Calculate the mole fraction of each component.

3

26. Give the condensed and bond line formulae for the following compounds:

(a) 3-Hydroxy-4-methylpent-1-en-1-ol

3x1

(b) 1,5-Dimethylcyclopent-1-ene

(c) 2,3-Dibromo-1-phenylpentane

27. (a) Assign the position of the element having outer electronic configuration, $(n-2) f^7(n-1) d^1 ns^2$ for $n=6$ in the periodic table.

1+2

(b) Arrange in the increasing order of size: Be^{2+} , Cl^- , S^{2-} , Na^+ , Mg^{2+} , Br^- . Also, give reason.

OR

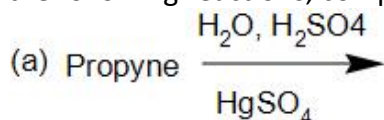
(a) Arrange the following species in the increasing order of ionic radii: N^{3-} , O^{2-} , F^- , Na^+ , Mg^{2+} and Al^{3+}

(b) What is the fundamental difference between electron gain enthalpy and electronegativity?

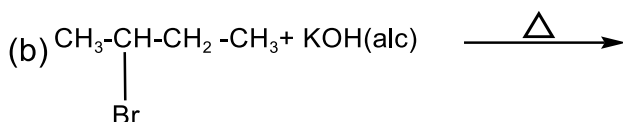
3x1

(c) Predict the formulae of a compound that might be formed by silicon and bromine.

28. For the following reactions, complete and identify the type of reactions:



3x1



SECTION-D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks. Read the passage carefully and answer the questions that follow.

29. Read the passage given below and answer the questions which follow:

Ionization enthalpy, also known as ionization energy, is the energy required to remove an electron from an atom or ion in the gaseous state. It's a measure of an element's tendency to lose electrons and form positive ions. Elements with low ionization enthalpies readily lose electrons, becoming more reactive, while those with high ionization enthalpies are less likely to undergo this process. The ionization enthalpy is influenced by factors such as atomic radius, nuclear charge, shielding effect, electron configuration, and effective nuclear charge. It's a fundamental concept in understanding the periodic trends and reactivity of elements in chemistry.

Answer the following questions:

- (a) How does ionization enthalpy relate to the reactivity of elements?
 (b) Would you expect the first ionization enthalpies for two isotopes of the same element to be the same or different? Justify your answer.
 (c) The first (IE_1) and the second (IE_2) ionization energies (kJ mol^{-1}) of four elements A, B, C, and D are given below:

Elements	IE_1	IE_2
A	2372	5250
B	520	7298
C	899	1758
D	1680	3374

Which of the above elements is likely to be:

- (i) a reactive metal (ii) a noble gas (iii) a reactive non-metal
 (iv) a metal that forms a stable binary halide of the formula AX_2 (X= halogen).

OR

(c) Among the second-period elements, the actual ionization enthalpies are in the order

$Li < B < Be < C < O < N < F < Ne$. Explain why

- (i) Be has higher ionization enthalpy than B?
 (ii) O has lower ionization enthalpy than N and F?

30. Read the passage given below and answer the questions which follow:

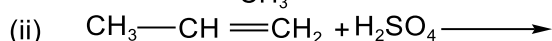
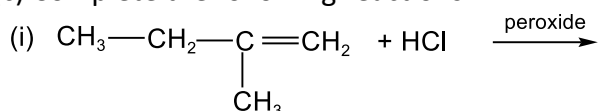
Alkenes are a rich source of loosely held 'pi' electrons, due to which they show addition reactions in which the electrophiles add on to the carbon-carbon double bond to form the addition product. The addition of HX to unsymmetrical alkenes gives two products and follows the Markovnikov rule and anti-Markovnikov rule. The addition occurs through the formation of a carbocation in the Markovnikov rule and free radicals in the anti-Markovnikov rule. The oxidation reaction is also quite prominent in alkenes.

Answer the following questions:

- (a) What intermediates are formed during the addition of HX to unsymmetrical alkenes under the Markovnikov and anti-Markovnikov rules?
 (b) Write the name of the products obtained by the addition of HBr to 2-Methylbut-2-ene in the presence of peroxide.
 (c) Give the mechanism for the addition of HBr to propene.

OR

(c) Complete the following reactions:



SECTION-E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

- 31.** (a) The energy associated with Bohr's first orbit is $-2.18 \times 10^{-18} \text{ J atom}^{-1}$. What is the energy

2+2+1

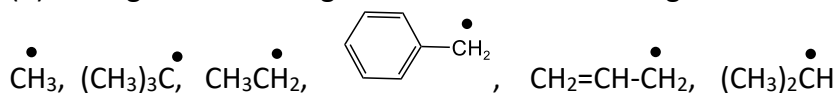
associated with the fourth orbit?

- (b) What is meant by the dual nature of electrons? Calculate the energy and wavelength of the photon emitted by the hydrogen atom when the electron makes a transition from $n=2$ to $n=1$. Given that the ionization potential is 13.6 eV. ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$)
- (c) How many subshells are associated with $n = 4$?

OR

- (a) The wavelength of the first spectral line in the Balmer series is 6561 \AA . Calculate the wavelength of the second spectral line in the Balmer series. 2+3x1
- (b) An atomic orbital has $\ell = 3$, what are the possible values of m_ℓ ?
- (c) Explain giving reasons, which of the following sets of quantum numbers are not possible.
- (i) $n=1, \ell=1, m_\ell=0, m_s=+\frac{1}{2}$
- (ii) $n=2, \ell=1, m_\ell=0, m_s=-\frac{1}{2}$
- (d) Write the electronic configuration of elements of atomic numbers 10, 17, 29 and 37.

32. (a) Draw the resonance structure for phenol. 3x1+2
- (b) Arrange the following free radicals in decreasing order of stability.



- (c) Among the following compounds, draw the isomers of the compound that show geometrical isomerism:
- (i) Pent-1-ene (ii) 2-Methylbut-2-ene (iii) Pent-2-ene
- (d) Explain the following giving example:
- (i) inductive effect (ii) Electromeric effect

OR

- (a) Write structures of different metamers of an ether corresponding to the molecular formula $\text{C}_4\text{H}_{10}\text{O}$ and also write their IUPAC names. 2+3x1
- (b) Arrange the following the following carbocations in the order of decreasing stability:
- $\text{CH}_3-\underset{\text{Cl}}{\text{C}}\text{H}_2-\text{CH}_2-\text{CH}_2^+$, $\text{CH}_3-\underset{\text{CH}_3}{\text{C}}\text{H}_2-\text{CH}_2-\text{CH}_2^+$, $\text{CH}_3-\text{CH}_2-\underset{\text{Cl}}{\text{C}}\text{H}-\text{CH}_2^+$
- (c) Draw the resonance structures of benzaldehyde.
- (d) What is the hyperconjugation effect?

33. (a) An organic compound containing carbon, hydrogen, and oxygen gave the following percentage composition: C = 40.68 %, H = 5.08 %. The vapor density of the compound is 59. Calculate the molecular formula of the compound. 3+2
- (b) Commercially available concentrated hydrochloric acid contains 38% HCl by mass.
- (i) What is the molarity of the solution (density of solution = 1.19 g mL^{-1})?
- (ii) What volume of concentrated HCl is required to make 1.0 L of a 0.10 M HCl?

OR

- (a) The density of the 3 M solution of NaCl is 1.25 g mL^{-1} . Calculate the molality of the solution. 2+3
- (b) Calcium carbonate reacts with aqueous HCl to give CaCl_2 and CO_2 according to the reaction:
- $\text{CaCO}_3 (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{CaCl}_2 (\text{aq}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{l})$
- What mass of CaCl_2 will be formed when 250 mL of 0.76 M HCl reacts with 1000 g of CaCO_3 ? Name the limiting reagent. Calculate the number of moles of CaCl_2 formed in the reaction.