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SET	A
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**INDIAN SCHOOL MUSCAT
FINAL EXAMINATION 2023
CHEMISTRY(043)**



CLASS : X1
DATE: 16-02-2023

TIME ALLOTTED : 3 HRS.
MAXIMUM MARKS:70

GENERAL INSTRUCTIONS:

- (i) There are 35 questions in this question paper with internal choice.
- (ii) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- (iii) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- (iv) SECTION C consists of 5 short answer questions carrying 3 marks each.
- (v) SECTION D consists of 2 case-based questions carrying 4 marks each.
- (vi) SECTION E consists of 3 long answer questions carrying 5 marks each.

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.

1. How many moles of magnesium phosphate $\text{Mg}_3(\text{PO}_4)_2$ will contain 0.25 mole of oxygen atoms? 1
 (a) 1.25×10^{-2} (b) 2.5×10^{-2} (c) 0.02 (d) 3.125×10^{-2}
2. The shortest wavelength of the line in Lyman series of hydrogen spectrum when $R_H = 109678 \text{ cm}^{-1}$ is 1
 (a) 1002.7 \AA (b) 911 \AA (c) 1215.6 \AA (d) 1127.3 \AA
3. The number of unpaired electrons in a chromium atom is (Given: Atomic number of Cr = 24) 1

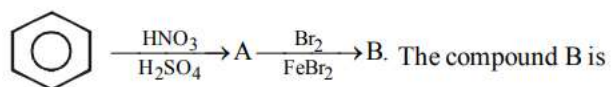
- (a) 4 (b) 5 (c) 6 (d) 7

4. Which transition in the hydrogen atomic spectrum will have the same wavelength as the transition, $n=4$ to $n=2$ of He^+ spectrum? 1
- (a) $n=4$ to $n=3$ (b) $n=3$ to $n=2$ (c) $n=2$ to $n=1$ (d) $n=3$ to $n=1$
5. The correct order of increasing covalent character of the following is: 1
- (a) $\text{SiCl}_4 < \text{AlCl}_3 < \text{MgCl}_2 < \text{NaCl}$
 (b) $\text{NaCl} < \text{MgCl}_2 < \text{AlCl}_3 < \text{SiCl}_4$
 (c) $\text{AlCl}_3 < \text{MgCl}_2 < \text{NaCl} < \text{SiCl}_4$
 (d) $\text{MgCl}_2 < \text{AlCl}_3 < \text{SiCl}_4 < \text{NaCl}$
6. Which of the following species has tetrahedral geometry? 1
- (a) BH_4^- . (b) NH_2^- . (c) CO_3^{2-} . (d) H_3O^+
7. The intramolecular hydrogen bond is present in 1
- (a) phenol (b) o-nitrophenol (c) p-nitrophenol (d) toluene
8. Oxidation number of P in PO_4^{3-} , S in SO_4^{2-} and that of Cr in $\text{Cr}_2\text{O}_7^{2-}$ are respectively: 1
- (a) +3, +6 and +5
 (b) -3, +6 and +6
 (c) +5, +3 and +6
 (d) +5, +6 and +6
9. Homolytic fission of a covalent bond leads to the formation of: 1
- (a) electrophile (b) nucleophile (c) free radical (d) carbocation
10. Identify the electrophile from the following set: 1
- (i) NH_3 (ii) BF_3 (iii) NO_2^+ (iv) H_2O
- (a) (i) and (ii)
 (b) (ii) and (iii)
 (c) (iii) and (iv)

(d) (i) and (iv)

11. In the following reaction,

1



12. Which of the following is not o- and p- directing group?

1

- (a) -Cl (b) -NH₂ (c) -CH₃ (d) -CHO

13. Number of angular nodes present in 5f orbital is

1

- (a) 2 (b) 3 (c) 0 (d) 4

14. Which of the following chemical species is most stable?

1

- (a) O₂ (b) O₂⁺ (c) O₂⁻ (d) O₂²⁻

In the following questions, (Q.No15 to 18) consist of two statements –Assertion (A) and Reason (R). Choose the correct answer out of the following choices.

- (a) Assertion and reason both are correct and reason is the correct explanation for assertion.
(b) Assertion and reason both are correct and reason is not the correct explanation for assertion
(c) Assertion is correct but reason is wrong.
(d) Assertion is wrong but reason is correct.
(e) Both Assertion and reason are wrong.

15. Assertion : Bonding molecular orbital are more stable than antibonding molecular orbital.

1

Reason : Electrons placed in Bonding molecular orbitals tend to hold the nuclei more together as compared to electrons placed in Antibonding molecular orbitals.

16. Assertion: Toluene on Friedel crafts methylation gives o- and p- xylene.

1

Reason: CH₃ group bonded to benzene ring increases electron density at o- and p- position

17. Assertion: Among halogens fluorine is the best oxidant. 1
Reason : Fluorine undergoes disproportionation reaction.
18. Assertion : Ethyl propanoate and Propyl ethanoate are functional isomers. 1
Reason : Functional isomers differ in the nature of functional group.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. A compound contains 4.07% hydrogen ,24.27%carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formula? [C=12, H=1 Cl=35.5u] 2
20. 3g of H_2 react with 29g of O_2 yield H_2O 2
(i) Calculate the maximum amount of H_2O that can be formed.
(ii) Calculate the amount of reactant left unreacted.
21. Explain why? 2
(a) Nitrogen has higher first ionization enthalpy than oxygen.
(b) IE of Na^+ is almost double that of Ne.

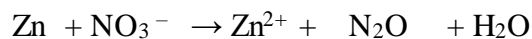
OR

Arrange the following according to the property mentioned in bracket:

- (a) N, O, F (increasing order of electron gain enthalpy)
(b) N^{3-} , O^{2-} , F^- (increasing order of effective nuclear charge)
22. Write the electronic configuration of N_2 molecule using MO theory and comment on its magnetic property and bond order. 2

OR

- (a) How do you account for equal bond lengths in ozone.
(b) Give one difference between bond enthalpy and bond dissociation enthalpy.
23. Balance the following redox reaction in acidic medium by ion electron method. 2



24. (a) Write the bond line formula of 2-Bromo-3-Chlorobutanal 2
- (b) Arrange the following in the increasing order of stability and explain the reason
 $(\text{CH}_3)_2\text{CH}^+$, $\text{CH}_3\text{-CH}_2^+$, CH_3^+ , $(\text{CH}_3)_3\text{C}^+$.

25. (a) Propanal and pentan-3-one are the ozonolysis product of an alkene. What is the structural formula of alkene? 2
- (b) State whether the following compound is aromatic or not. Explain



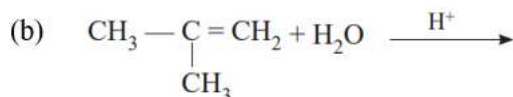
SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each

26. A photon of wavelength $4 \times 10^{-7}\text{m}$ strikes on a metal surface, the work function of the metal being 2.13 eV, calculate 3
- (i) The energy of the photon
- (ii) Kinetic Energy of the emission ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$)
27. Balance the following redox reaction using ion-electron method in basic medium: 3
- $$\text{Cr}(\text{OH})_3 + \text{IO}_3^- \rightarrow \text{I}^- + \text{CrO}_4^{2-}$$
28. How will you bring about the following conversions? 3
- (a) Propene to 1-bromopropane
- (b) Ethyne to acetaldehyde
- (c) Phenol to Benzene

OR

Complete the following :



29. Give equations for :

3

(a) Wurtz reaction

(b) Friedel crafts alkylation

(c) Kolbe's electrolysis.

30. Commercially available H_2SO_4 acid(molar mass 98 g/mol) contains 98% acid by mass and has a density of 1.84g mL^{-1} . Calculate

3

(i) the molarity of the solution

(ii) volume of concentrated acid required to prepare 2.5 L of 0.50 M H_2SO_4 .

SECTION D

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

31. The capacities of shells with a given principal quantum number are fixed by (1) the rules governing the permitted values of the quantum numbers and (2) the Pauli Exclusion Principle. A total of four quantum numbers are used to describe completely the movement and trajectories of each electron within an atom. The combination of all quantum numbers of all electrons in an atom is described by a wave function that complies with the Schrödinger equation. Each electron in an atom has a unique set of quantum numbers; according to the Pauli Exclusion Principle, no two electrons can share the same combination of four quantum numbers. Quantum numbers are important because they can be used to determine the electron configuration of an atom and the probable location of the atom's electrons. Quantum numbers are also used to understand other characteristics of atoms, such as ionization energy and the atomic radius.

4

- (a) Write the $(n + l)$ value for 14th electron in an atom.
- (b) Increasing order of filling electron in 4f, 5p and 6d subshells.
- (c)
- (i) 'm' and 'l' value for last electron of Mg atom. (Given atomic number of Mg is 12)
- (ii) Subshell in which the last electron is present in Ga. (Given Atomic number of Ga is 31)

OR

Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if the uncertainty in its velocity is $5.5 \times 10^{-20} \text{ ms}^{-1}$

32. A period is a horizontal row in the periodic table. Although groups generally have more significant periodic trends, there are regions where horizontal trends are more significant than vertical group trends, such as the f-block, where the lanthanides and actinides form two substantial horizontal series of elements. Elements in the same period show trends in atomic radius, ionization energy, electron affinity, and electronegativity. Moving left to right across a period, atomic radius usually decreases. This occurs because each successive element has an added proton and electron, which causes the electron to be drawn closer to the nucleus. This decrease in atomic radius also causes the ionization energy to increase when moving from left to right across a period. The more tightly bound an element is, the more energy is required to remove an electron. Electronegativity increases in the same manner as ionization energy because of the pull exerted on the electrons by the nucleus. Electron affinity also shows a slight trend across a period. Metals (left side of a period) generally have a lower electron affinity than non-metals (right side of a period), with the exception of the noble gases.

- (a) Write the general outer electronic configuration of d block elements?
- (b) An element is placed in 5th period and 3rd group, what is its atomic number?
- (c) What is the atomic number of an element whose symbol is Unq? What is its IUPAC name?

OR

Element 'A' in group 17(2nd period) , 'B' in group 16 (2nd period), 'C' in group 15 (2nd period) , Arrange 'A', 'B' and 'C' in their decreasing order of electro-negativity and ionisation enthalpy.

SECTION E

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

33. (a) Draw the Lewis dot structure of NO_2^- . 5
- (b) Calculate the formal charge on S in SO_4^{2-}
- (c) Give an example of polyatomic species having zero dipole moment
- (d) Draw the shape of following molecules according to VSEPR theory;
- i) PF_5 ii) XeO_2F_2

OR

- (a) Give two examples for compounds with expanded octet.
- (b) Write one point of difference between bonding and antibonding molecular orbitals.
- (c) Discuss the conditions for the combination of atomic orbitals to form molecular orbitals.
- (d) Explain the hybridization in H_2O .
34. (a) Write chemical equations for the following : 5
- (i) Bromocyclohexane is treated with alcoholic KOH.
- (ii) Propene is treated with dilute KMnO_4 at 273K
- (iii) Anisole is treated with chlorine in presence of anhydrous AlCl_3 .
- (b) Arrange ethane, ethene, and ethyne in decreasing order of acidic behavior and justify your answer.

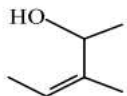
OR

- (a) Out of benzene, m-nitrobenzene and toluene which will undergo nitration most easily and why?
- (b) Give a chemical test to distinguish between but-1-yne and but-2-yne.
- (c) Draw the Newman's projection formula of eclipsed and staggered conformations of ethane.

(d) An alkene on reaction with acidified KMnO_4 at 373 K gives Ethanoic acid and butan-2-one as products. Write the IUPAC name of the alkene.

35. (a) Write the structure for two functional isomers having the molecular formula $\text{C}_4\text{H}_{10}\text{O}$. 5

(b) Write the IUPAC name of the following compound:



(c) Draw the bond line structure of 2-formyl-4-methylhexanoic acid.

(d) Explain positive resonance effect and draw the resonating structures of phenol.

******END OF THE QUESTION PAPER******

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- (v) SECTION D consists of 2 case- based questions carrying 4 marks each.
- (vi) SECTION E consists of 3 long answer questions carrying 5 marks each.

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.

1. A neutral molecule XF_3 has zero dipole moment . The element X is most likely. 1
(a) Chlorine (b) Boron (c) Nitrogen (d) Bromine
2. The intramolecular hydrogen bond is present in 1
(a) phenol (b) o-nitrophenol (c) p-nitrophenol (d) toluene
3. The oxidation number of Mn is maximum in: 1
(a) MnO_2 (b) K_2MnO_4 (c) Mn_3O_4 (d) KMnO_4
4. Homolytic fission of a covalent bond leads to the formation of : 1

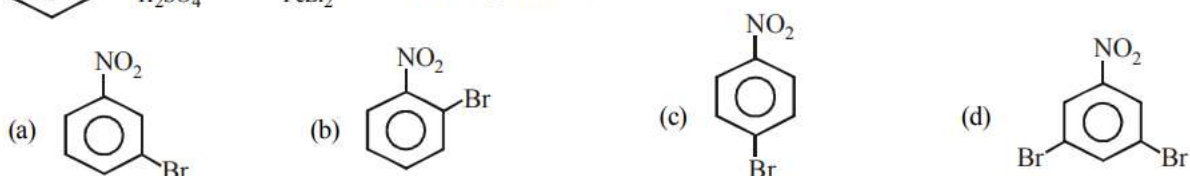
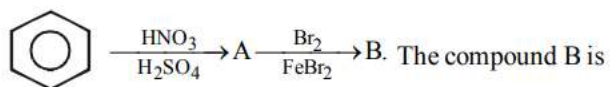
- (a) electrophile (b) nucleophile (c) free radical (d) carbocation

5. Identify the electrophile from the following set: 1

- (a) NH_3 (b) BF_3 (c) NO_2^+ (d) H_2O

- (a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

6. In the following reaction, 1



7. Which of the following is not o- and p- directing group? 1

- (a) $-\text{Cl}$ (b) $-\text{NH}_2$ (c) $-\text{CH}_3$ (d) $-\text{NO}_2$

8. Number of angular nodes present in 5s orbital is 1

- (a) 2 (b) 1 (c) 0 (d) 4

9. Which of the following chemical species is most stable? 1

- (a) O_2 (b) O_2^+ (c) O_2^- (d) O_2^{2-}

10. How many moles of magnesium phosphate $\text{Mg}_3(\text{PO}_4)_2$ will contain 0.15 mole of oxygen atoms? 1

- (a) 1.875×10^{-2} (b) 2.55×10^{-2} (c) 0.02 (d) 3.125×10^{-2}

11. The shortest wavelength of the line in Lyman series of Hydrogen spectrum when 1

$R_H = 109678 \text{ cm}^{-1}$ is:

- (a) 1002.7 \AA (b) 911 \AA (c) 1215.6 \AA (d) 1127.3 \AA

12. Maximum number of unpaired electrons in chromium is (Given: Atomic number of Cr = 24) 1

- (a) 4 (b) 5 (c) 6 (d) 7

13. Which transition in the hydrogen atomic spectrum will have the same wavelength as the transition, $n=4$ to $n=2$ of He^+ spectrum? 1
- (a) $n=4$ to $n=3$ (b) $n=3$ to $n=2$ (c) $n=2$ to $n=1$ (d) $n=3$ to $n=1$
14. Among the following, the compound that contains, ionic, covalent and Coordinate linkage is : 1
- (a) NH_4Cl (b) NH_3 (c) NaCl (d) CO_2

In the following questions, (Q.No15 to 18) consist of two statements –Assertion (A) and Reason (R). Choose the correct answer out of the following choices.

- (a) Assertion and reason both are correct and reason is the correct explanation for assertion.
- (b) Assertion and reason both are correct and reason is not the correct explanation for assertion
- (c) Assertion is correct but reason is wrong.
- (d) Assertion is wrong but reason is correct.
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15. Assertion : Ethyl propanoate and Propyl ethanoate are functional isomers. 1
- Reason : Functional isomers differ in the nature of functional group
16. Assertion : Bonding molecular orbital are more stable than antibonding molecular orbital. 1
- Reason : Electrons placed in Bonding molecular orbitals tend to hold the nuclei more together as compared to electrons placed in Antibonding molecular orbitals
17. Assertion: Toluene on Friedel crafts methylation gives o- and p- xylene. 1
- Reason: CH_3 group bonded to benzene ring increases electron density at o- and p- position
18. Assertion: Among halogens fluorine is the best oxidant. 1
- Reason : Fluorine undergoes disproportionation reaction.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. Write the electronic configuration of N_2 molecule using MO theory and comment on its magnetic property and bond order. 2

OR

- (a) How do you account for equal bond lengths in ozone.
- (b) Give one difference between bond enthalpy and bond dissociation enthalpy.
20. Balance the following redox reaction in acidic medium by ion electron method. 2



21. (a) Write the bond line formula of 2-Bromo-3-Chloro-butan-1-ol 2
- (b) Arrange the following in the increasing order of stability and explain the reason
- $(CH_3)_2CH^+$, $CH_3-CH_2^+$, CH_3^+ , $(CH_3)_3C^+$.

22. (a) Propanal and pentan-3-one are the ozonolysis product of an alkene. What is the structural formula of alkene? 2
- (b) State whether the following compound is aromatic or not. Explain.



23. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formula? [C=12, H=1, Cl=35.5u] 2
24. 3g of H_2 react with 29g of O_2 to yield H_2O 2
- (i) Calculate the maximum amount of H_2O that can be formed.
- (ii) Calculate the amount of reactant left unreacted.
25. Explain why? 2

(a) Nitrogen has first ionization enthalpy than oxygen.

(b) IE of Na^+ is almost double that of Ne.

OR

Arrange the following according to the property mentioned in bracket:

(a) N, O, F (increasing order of electron gain enthalpy)

(b) N^{3-} , O^{2-} , F^- (increasing order of effective nuclear charge)

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each

26. How will you bring about the following conversions? 3

(a) Propene to 2-bromopropane

(b) Ethene to formaldehyde

(c) Ethyne to Benzene

OR

Complete the following

(a) $\text{CH}\equiv\text{CH} + \text{Na} \rightarrow$

(b) $\text{CH}_3 - \underset{\text{CH}_3}{\underset{|}{\text{C}}} = \text{CH}_2 + \text{H}_2\text{O} \xrightarrow{\text{H}^+}$

(c) $\text{CH}_2\text{Br}-\text{CH}_2\text{Br} + \text{Zn} \xrightarrow{\Delta}$

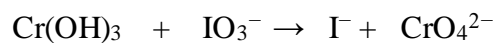
27. Give equations for the following: 3

(a) Decarboxylation

(b) Wurtz reaction

(c) Friedel crafts alkylation

28. Commercially available H_2SO_4 (molar mass 98g/mol) acid contains 98% acid by mass and has a density of 1.84g mL^{-1} . Calculate 3
- (i) the molarity of the solution
 - (ii) volume of concentrated acid required to prepare 2.5 L of 0.50 M H_2SO_4 .
29. A photon of wavelength $4 \times 10^{-7}\text{m}$ strikes on a metal surface, the work function of the metal being 2.13 eV, calculate 3
- (i) The energy of the photon
 - (ii) Kinetic Energy of the emission (1 eV = $1.6 \times 10^{-19}\text{ J}$)
30. Balance the following redox reaction using ion-electron method in basic medium: 3



SECTION D

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

31. The capacities of shells with a given principal quantum number are fixed by (1) the rules governing the permitted values of the quantum numbers and (2) the Pauli Exclusion Principle. A total of four quantum numbers are used to describe completely the movement and trajectories of each electron within an atom. The combination of all quantum numbers of all electrons in an atom is described by a wave function that complies with the Schrödinger equation. Each electron in an atom has a unique set of quantum numbers; according to the Pauli Exclusion Principle, no two electrons can share the same combination of four quantum numbers. Quantum numbers are important because they can be used to determine the electron configuration of an atom and the probable location of the atom's electrons. Quantum numbers are also used to understand other characteristics of atoms, such as ionization energy and the atomic radius. 4
- (i) Write the $(n + l)$ value for 14th electron in an atom.
 - (ii) Increasing order of filling electron in 4f, 5p and 6d subshells.
 - (iii)

(a) ' m_l ' and ' l ' value for last electron of Mg atom. (Given atomic number of Mg is 12)

(b) Subshell in which the last electron is present in Ga. (Given Atomic number of Ga is 31)

OR

Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if the uncertainty in its velocity is $5.5 \times 10^{-20} \text{ ms}^{-1}$

32. A period is a horizontal row in the periodic table. Although groups generally have more significant periodic trends, there are regions where horizontal trends are more significant than vertical group trends, such as the f-block, where the lanthanides and actinides form two substantial horizontal series of elements. Elements in the same period show trends in atomic radius, ionization energy, electron affinity, and electronegativity. Moving left to right across a period, atomic radius usually decreases. This occurs because each successive element has an added proton and electron, which causes the electron to be drawn closer to the nucleus. This decrease in atomic radius also causes the ionization energy to increase when moving from left to right across a period. The more tightly bound an element is, the more energy is required to remove an electron. Electronegativity increases in the same manner as ionization energy because of the pull exerted on the electrons by the nucleus. Electron affinity also shows a slight trend across a period. Metals (left side of a period) generally have a lower electron affinity than non-metals (right side of a period), with the exception of the noble gases.

(a) Write the general outer electronic configuration of d block elements?

(b) An element is placed in 5th period and 3rd group, what is its atomic number?

(c) What is the atomic number of an element whose symbol is Unq? What is its IUPAC name?

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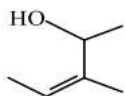
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SECTION E

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

33. (a) Write the structure for two functional isomers having the molecular formula $C_4H_{10}O$. 5

(b) Write the IUPAC name of the following compound;



(c) Draw the bond line structure of 2-Formyl-4-methylhexanal

(d) Explain negative resonance effect and draw the resonating structures of nitrobenzene.

34. (a) Draw the Lewis dot structure of NO_2^- . 5

(b) Calculate the formal charge on S in SO_4^{2-}

(c) Give an example of polyatomic species having zero dipole moment.

(d) Draw the shape of following molecules according to VSEPR theory;

i) AsF_5 ii) XeO_2F_2

OR

(a) Give two examples for compounds with expanded octet.

(b) Write one point of difference between bonding and antibonding molecular orbitals.

(c) Discuss the conditions for the combination of atomic orbitals to form molecular orbitals.

(d) Explain the hybridization in H_2O .

35. (a) Write chemical equations for the following : 5

(i) Bromocyclohexane is treated with alcoholic KOH.

(ii) Propene is treated with dilute $KMnO_4$ at 273 K.

(iii) Benzene is treated with chlorine in presence of UV light.

(b) Arrange ethane, ethene, and ethyne in decreasing order of acidic behavior and justify your answer.

OR

- (a) Out of benzene, m-nitrobenzene and toluene which will undergo nitration most easily and why?
- (b) Give a chemical test to distinguish between but-1-yne and but-2-yne.
- (c) Draw the Newman's projection formula of eclipsed and staggered conformations of ethane.
- (d) An alkene on reaction with acidified KMnO_4 at 373 K gives Ethanoic acid and butan-2-one as products. Write the IUPAC name of the alkene.

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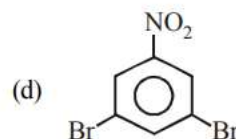
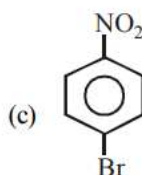
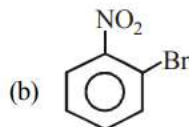
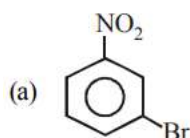
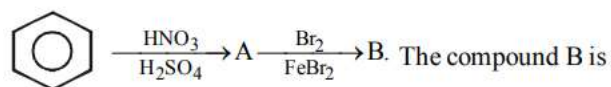
- (i) There are 35 questions in this question paper with internal choice.
- (ii) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- (iii) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- (iv) SECTION C consists of 5 short answer questions carrying 3 marks each.
- (v) SECTION D consists of 2 case- based questions carrying 4 marks each.
- (vi) SECTION E consists of 3 long answer questions carrying 5 marks each.

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.

1. In the following reaction,

1



2. Which of the following is not o- and p- directing group?

1

- (a) -CHO (b) -NH₂ (c) -CH₃ (d) -Cl

3. Number of angular nodes present in 5d orbital is: 1
 (a)2 (b)1 (c)0 (d)4
4. Which of the following chemical species is most stable? 1
 (a) O₂ (b) O₂⁺ (c) O₂⁻ (d) O₂²⁻
5. How many moles of magnesium phosphate Mg₃(PO₄)₂ will contain 0.5 mole of oxygen atoms? 1
 (a) 1.25 x 10⁻² (b) 6.25 x 10⁻² (c) 0.02 (d) 3.125 x 10⁻²
6. The shortest wavelength of the line in the Lyman series of hydrogen atom when $R_H = 109678\text{cm}^{-1}$ is: 1
 (a) 1002.7 Å⁰ (b) 911 Å⁰ (c) 1215.6 Å⁰ (d) 1127.3 Å⁰
7. Maximum number of unpaired electrons in copper is (Given: Atomic number of Cu = 29): 1
 (a) 1 (b) 9 (c) 0 (d) 4
8. Which transition in the hydrogen atomic spectrum will have the same wavelength as the transition, n=4 to n=2 of He⁺ spectrum? 1
 (a) n=4 to n=3 (b) n=3 to n=2 (c) n= 2 to n=1 (d) n=3 to n=1
9. Homolytic fission of a covalent bond leads to the formation of : 1
 (a) electrophile (b) nucleophile (c) free radical (d) carbocation
10. In which of the following, the geometry is not correctly given? 1
 (a) PH₃: Trigonal pyramidal
 (b) SiH₄: Tetrahedral
 (c) ClF₃: Trigonal planar
 (d) SF₄: See-saw
11. The intramolecular hydrogen bond is present in: 1
 (a) phenol (b) o-nitrophenol (c) p-nitrophenol (d) toluene
12. Oxidation number of P in PO₄³⁻, S in SO₄²⁻ and that of Cr in Cr₂O₇²⁻ are respectively: 1
 (a) +3, +6 and +5

- (b) -3, +6 and +6
- (c) +5, +3 and +6
- (d) +5, +6 and +6

13. A neutral molecule XF_3 has zero dipole moment . The element X is most likely 1

- (a) Chlorine (b) Boron (c) Nitrogen (d) Bromine

14. Identify the electrophile from the following set: 1

- (a) NH_3 (b) BF_3 (c) NO_2^+ (d) H_2O

- (a) (i) and (ii)
- (b) (ii) and (iii)
- (c) (iii) and (iv)
- (d) (i) and (iv)

In the following questions,(Q.No15 to 18) consist of two statements –Assertion (A) and Reason (R).Choose the correct answer out of the following choices.

- (a) Assertion and reason both are correct and reason is the correct explanation for assertion.
- (b) Assertion and reason both are correct and reason is not the correct explanation for assertion
- (c) Assertion is correct but reason is wrong.
- (d) Assertion is wrong but reason is correct.
- (e) Both Assertion and reason are wrong.

15. Assertion: Among halogens fluorine is the best oxidant. 1

Reason : Fluorine undergoes disproportionation reaction.

16. Assertion : Bonding molecular orbital are more stable than antibonding molecular orbital. 1

Reason : Electrons placed in Bonding molecular orbitals tend to hold the nuclei more together as compared to electrons placed in Antibonding molecular orbitals.

17. Assertion: Toluene on Friedel crafts methylation gives o- and p- xylene. 1

Reason: CH_3 group bonded to benzene ring increases electron density at o- and p- position

18. Assertion : Ethyl propanoate and Propyl ethanoate are functional isomers. 1

Reason : Functional isomers differ in the nature of functional group .

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. (a) Ethanal and pentan-3-one are the ozonolysis product of an alkene. What is the structural formula of alkene? 2

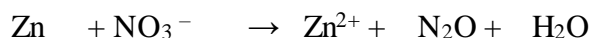
(b) State whether the following compound is aromatic or not. Explain.



20. (a) Write the bond line formula of 2-Bromo-3-Chloro-butan-1-ol 2
- (b) Arrange the following in the increasing order of stability and explain the reason .



21. Balance the following redox reaction in acidic medium by ion electron method. 2



22. Write the electronic configuration of N_2 molecule using MO theory and comment on its magnetic property and bond order. 2

OR

(a) How do you account for equal bond lengths in ozone.

(b) Give one difference between bond enthalpy and bond dissociation enthalpy

23. Explain why? 2

(a) Nitrogen has first ionization enthalpy than oxygen.

(b) IE of Na^+ is almost double that of Ne.

OR

Arrange the following according to the property mentioned in bracket:

(a) N, O, F (increasing order of electron gain enthalpy)

(b) N^{3-} , O^{2-} , F^- (increasing order of effective nuclear charge)

24. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 2

98.96 g. What are its empirical and molecular formula? [C=12, H=1 Cl=35.5u]

25. 3g of H_2 react with 29g of O_2 yield H_2O 2

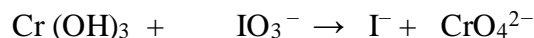
(i) Calculate the maximum amount of H_2O that can be formed.

(ii) Calculate the amount of reactant left unreacted.

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each

26. Balance the following redox reaction using ion-electron method in basic medium: 3



27. How will you bring about the following conversions? 3

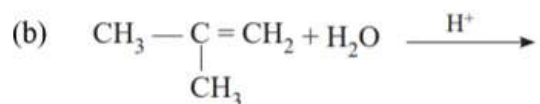
(a) Propene to 1-bromopropane

(b) Ethyne to methanal

(c) Propyne to propanone

OR

Complete the following:



28. Give equations for

3

(a) Wurtz reaction

(b) Friedel crafts acylation

(c) Decarboxylation

29. Commercially available H_2SO_4 acid(molar mass 98g/mol) contains 98% acid by mass and has a density of 1.84gmL^{-1} . Calculate

3

(i) the molarity of the solution

(ii) volume of concentrated acid required to prepare 2.5 L of 0.50 M H_2SO_4

30. A photon of wavelength $4 \times 10^{-7}\text{m}$ strikes on a metal surface, the work function of the metal being 2.13 eV, calculate

3

(i) The energy of the photon

(ii) Kinetic Energy of the emission (1 eV= 1.6×10^{-19} J)

SECTION D

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

31. The capacities of shells with a given principal quantum number are fixed by (1) the rules governing the permitted values of the quantum numbers and (2) the Pauli Exclusion Principle. A total of four quantum numbers are used to describe completely the movement and trajectories of each electron within an atom. The combination of all quantum numbers of all electrons in an atom is described by a wave function that complies with the Schrödinger equation. Each electron in an atom has a unique

4

set of quantum numbers; according to the Pauli Exclusion Principle, no two electrons can share the same combination of four quantum numbers. Quantum numbers are important because they can be used to determine the electron configuration of an atom and the probable location of the atom's electrons. Quantum numbers are also used to understand other characteristics of atoms, such as ionization energy and the atomic radius.

- (i) Write the $(n + l)$ value for 14th electron in an atom.
- (ii) Increasing order of filling electron in 4f, 5p and 6d subshells.
- (iii)
 - (a) 'm' and 'l' value for last electron of Mg atom. (Given atomic number of Mg is 12)
 - (b) Subshell in which the last electron is present in Ga. (Given Atomic number of Ga is 31)

OR

Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if the uncertainty in its velocity is $5.5 \times 10^{-20} \text{ ms}^{-1}$

32. A period is a horizontal row in the periodic table. Although groups generally have more significant periodic trends, there are regions where horizontal trends are more significant than vertical group trends, such as the f-block, where the lanthanides and actinides form two substantial horizontal series of elements. Elements in the same period show trends in atomic radius, ionization energy, electron affinity, and electronegativity. Moving left to right across a period, atomic radius usually decreases. This occurs because each successive element has an added proton and electron, which causes the electron to be drawn closer to the nucleus. This decrease in atomic radius also causes the ionization energy to increase when moving from left to right across a period. The more tightly bound an element is, the more energy is required to remove an electron. Electronegativity increases in the same manner as ionization energy because of the pull exerted on the electrons by the nucleus. Electron affinity also shows a slight trend across a period. Metals (left side of a period) generally have a lower electron affinity than non-metals (right side of a period), with the exception of the noble gases.
- (a) Write the general outer electronic configuration of d block elements?
 - (b) An element is placed in 5th period and 3rd group what is its atomic number?
 - (c) What is the atomic number of an element whose symbol is Unq? What is its IUPAC name?

OR

Element 'A' in group 17(2nd period), 'B' in group 16(2nd period) , 'C' in group 15 (2nd period),

Arrange 'A', 'B' and 'C' in their decreasing order of electro-negativity and ionisation enthalpy.

SECTION E

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

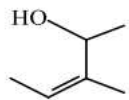
33. (a) Draw the Lewis dot structure of NO_2^- . 5
- (b) Calculate the formal charge on S in SO_4^{2-}
- (c) Give an example of polyatomic species having zero dipole moment
- (d) Draw the shape of following molecules according to VSEPR theory;
- i) AsF_5 ii) XeO_2F_2

OR

- (a) Give two examples for compounds with expanded octet.
- (b) Write one point of difference between bonding and antibonding molecular orbitals.
- (c) Discuss the conditions for the combination of atomic orbitals to form molecular orbitals.
- (d) Explain the hybridization in H_2O .
34. (a) Write chemical equations for the following : 5
- (i) Bromocyclohexane is treated with alc KOH
- (ii) Propene is treated with dilute KMnO_4 at 273K
- (iii) Benzene is treated with chlorine in presence of UV light.
- (b) Arrange ethene, ethane, and ethyne in decreasing order of acidic behavior and justify your answer.

OR

- (a) Out of benzene, m-nitrobenzene and toluene which will undergo nitration most easily and why?
- (b) Give a chemical test to distinguish between but-1-yne and but-2-yne.
- (c) Draw the Newman's projection formula of eclipsed and staggered conformations of ethane.
- (d) An alkene on reaction with acidified KMnO_4 at 373 K gives Ethanoic acid and butan-2-one as products. Write the IUPAC name of the alkene.
35. (a) Write the structure for two functional isomers having the molecular formula $\text{C}_4\text{H}_{10}\text{O}$. 5
- (b) Write the IUPAC name of the following compound;



- (c) Draw the bond line structure of 2-formyl-4-methylhexanoic acid.
- (d) Explain positive resonance effect and draw the resonating structures of phenol.

******END OF THE QUESTION PAPER******