Conducted by Field Work Centre, Thondaimanaru

In Collaboration with Provincial Department of Education

Northern Province

FWC

Term Examination, November - 2019

Grade – 12 (2021)	Chemistry - I	Time :- 3 hours 10 minutes

Part - I

$N_A = 6.022 \times 10^{23} mol^{-1}$ $h = 6.626 \times 10^{-34}$ Js $C = 3 \times 10^{8}$ ms^{-1} $R = 8.314$ J mol^{-1} K^{-1}

❖ **Answer all questions.**

1) Among the scientists who put forward the theories related to atomic structure, the one whose contribution is least is

1. Thomson *2.* Rutherford *3.* Niels Bohr
4. Dalton *5.* Marsden

2) The process which has dipole – induced dipole interaction as the secondary interactive attraction is

1. dissolution of iodine solid in water
2. dissolution of $NH_{3(g)}$ in water
3. dissolution of $KCl_{(s)}$ in water
4. mixing of methanol with water
5. none of the above

3) Which one of the following species is not iso electronic with the others?

1. CO 2. CN^- 3. NO^+ 4. N_2 5. O_2

4) 12 moldm^{-3} HCl solution has 36.5 % (mass percentage) of HCl. The density of this solution is

1. 1.2 g cm^{-3} 2. 36.5 g cm^{-3} 3. 3.65 g cm^{-3} 4. 24g cm^{-3} 5. 4.4g cm^{-3}

5) An alloy contains Mg, Al and Cu only. When 0.60 g of a sample of the alloy was allowed to react with dilute $NaOH_{(aq)}$, the H_2 gas liberated occupied a volume of 336 cm^3 under STP conditions. The mass percent of Al in the alloy (Mg – 24, Al – 27, Cu – 64)

[**Hint :-** $2\,Al + 2\,NaOH + 2\,H_2O \rightarrow 2NaAlO_2 + 3H_2$]

1. 50% 2. 40 % 3. 45% 4. 60% 5. 35%

6) Which one of the following statements regarding some properties of atoms is true?

1. The charge felt by a valence electron of a Na atom is equal to 11
2. In a particular period, the first ionization energy of an element having higher atomic radius is always less than that with lower atomic radius.
3. According to Pauling's scale, electronegativity of N is greater than that of O.
4. Electron gain enthalpy of Li atom has a higher negative value than that of a Na atom.
5. Electronegativity is a measure of the ability of an isolated atom to attract the electrons towards it self.

7) When $100\ cm^3$ of an organic compound which contains C, H and O only was subjected to complete combustion in $700\ cm^3$ of excess O_2 gas, $400\ cm^3$ water vapour and $400\ cm^3$ of $CO_{2(g)}$ were obtained and $200\ cm^3$ of $O_{2(g)}$ was remaining as unreacted. Assuming that all the measurements were taken under same temperature and pressure, the formula of the compound

1. $C_4H_8O_2$ 2. $C_3H_5O_2$ 3. C_4H_8O
4. C_3H_8O 5. C_5H_8O

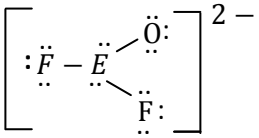
8) $25\ cm^3$ of a 0.01 $moldm^{-3}$ $K_2Cr_2O_7$ solution required $25\ cm^3$ of a FeI_2 solution for complete reaction. The concentration of FeI_2 solution is

1. 0.01 $moldm^{-3}$ 2. 0.02 $moldm^{-3}$ 3. 0.03 $moldm^{-3}$
4. 0.06 $moldm^{-3}$ 5. 0.5 $moldm^{-3}$

9) Which one of the following is not a disproportionation reaction?

1. $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$
2. $2H_2O_2 \rightarrow 2H_2O + O_2$
3. $2NO_2 + H_2O \rightarrow HNO_2 + HNO_3$
4. $3S + 6\,NaOH \rightarrow 2Na_2S + Na_2SO_3 + 3H_2O$
5. $Na_2S_2O_3 + 2\,HCl \rightarrow 2NaCl + S + SO_2 + H_2O$

10)



According to the given Lewis structure of the ion, the group to which the element E belongs is

1. Group 15 2. Group 16
3. Group14 4. Group *17*
5. Group *18*

11) The correct statement regarding the overlapping and hybridization of orbitals.

1. An orbital with a paired electron may overlap with an empty orbital
2. Linear overlap of two P – orbitals will result in the formation of a πbond.
3. An atomic orbital will always overlap with another atomic orbital only.
4. Orbitals of different atoms may undergo hybridization to form hybrid orbitals
5. Overlapping of hybrid orbitals may form π bond

12) The descending order of the radii of Na, B, Si, S, Br^-

1. Na > B > Si > S > Br^- 2. Br^- > S > Na > Si > B
3. Na > Br^- > Si > S > B 4. Br^- > Na > Si > S > B
5. Br^- > Na > S > Si > B

13) The oxidation state, valency and the hybridization of N atom in NO_2F molecule are respectively.

1. +5, 5, SP^2 2. +3, 3, SP^2 3. +5, 4, SP^3
4. +4, 4, SP^3 5. +5, 4, SP^2

14) The incorrect statement regarding ionic compounds

1. Ionic compounds are solids at room temperature
2. When an ionic solid is dissolved in water, the atoms in it are converted to ions and thereby the solution conducts electricity by the movement of ions
3. All the ionic solids do not dissolve in water.
4. There are ionic solids formed by the combination of non – metals without the contribution of any metal.
5. Ionic solids conduct electricity in molten state.

15) The skeletal structure of hydrogen azide (HN_3) is given below.

$$H - N - N - N$$

The number of resonance structures that can be drawn for this is

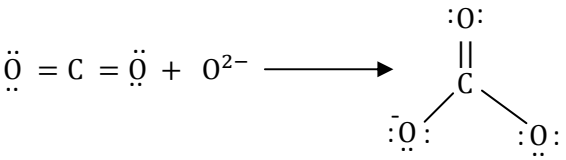
1. 2 2. 3 3. 4 4. 5 6. 6

❖ **For each of the question 16 to 20 one or more response out of four responses (a), (b), (c) and (d) given is / are correct. Select the correct response / responses. In accordance with the instruction given on your answer sheet mark.**

1	2	3	4	5
Only (a) (b) are correct	Only (b) (c) are correct	Only (c) (d) are correct	Only (a) (d) are correct	The other numbers correct

16) $Na_2O + CO_2 \rightarrow Na_2CO_3$

The structure of the species involved in the above change are given below



The correct statement / s regarding the above change is / are

a) The hybridization of C atom changes from SP^2 to SP^3
b) The bond length between C, O increases.
c) In the product CO_3^{2-}, all the three $O - C - O$ bonds are equal with a value of 120^0 each.
d) The oxidation state of C atom changes.

17) The correct statement / statements regarding sub – atomic particles of an atom is / are

a) Electrons behave as waves and particles simultaneously.
b) Positive rays are produced from anode electrode.
c) Electrons can travel in vacuum with the speed of electromagnetic radiations
d) All the atoms have at least one proton

18) The quantum number / s which are not involved in determining the energy of electrons in an atom

a) Principal quantum number
b) azimuthal quantum number
c) magnetic quantum number associated with a particular azimuthal quantum number
d) Spin quantum number

19) The correct statement / statements regarding H – spectrum

a) The energy difference between first two lines in each of the series in the increasing order of frequency will increase.
b) The first ionization energy of hydrogen corresponds to the energy associated with Lyman series.
c) Each line of the spectrum represents the energy of a particular energy level.
d) Hydrogen spectrum is a line spectrum

20) Which of the following statements is / are false?

a) The electron pair geometry around Cl atom in ClO_2^- and ClO_3^- are the same.
b) The electron pair geometry around I atom in IF_4^- is octahedral
c) ICl_3 is a polar, T – shaped molecule.
d) In each of SCl_4, ICl_3, XeF_4 four atoms are in the same plane

❖ **Instructions for questions 21 – 25.**

Response	First statement	Second statement
1)	True	True and correctly explains the first statement.
2)	True	True, but not explain the first statement correctly
3)	True	False
4)	False	True
5)	False	False

	First Statement	Second statement
21)	Although the electro negativities of C and S have equal values according to Pauling's scale, the electro negativity of S in SO_2 is greater than that of C in CH_4	In general, when S character of a hybrid orbital and the oxidation number of an atom increase, electro negativity will increase.
22)	Boiling point of SO_2 is greater than that of CO_2	Intermolecular attractions in polar substances are always greater than those in non – polar substances.
23)	Covalent character of Li_3N is greater than that of Li_2O	When the charge and size of an anion increase, its polanizability will increase.
24)	Deflection of α particles in an electric field is greater than the deflection of β particles in the same.	The magnitude of the charge on a α particle is greater than the magnitude of charge on a β particle.
25)	Under similar conditions, the electron gain enthalpy of an element has a value same in magnitude but has an opposite sign of the electron affinity of the same element	In group 17 elements, electron affinities of F, Cl, and Br follow the order F > Cl > Br

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Term Examination, November - 2019

Grade – 12 (2021)	**Chemistry - II**	

Part - II
Structure Questions- A

- **Answer all questions.**
- **Each question carries 100 marks)**

01. a) Consider the following chemical species given in the list and answer the following questions.

SF_6 , NH_4Cl, SiO_2, $HClO_4$, H_3O^+, CO_3^{2-}

i. Identify the species which has a shape similar to the shape of NCl_3 (.....)

ii. Identify the species which has the heighest number of lone pair (.....)

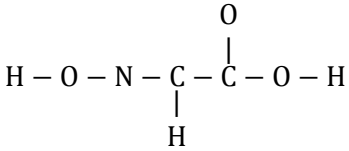
iii. Identify the species which exhibits both ionic and covalent character (.....)

iv. Identify the species which has the highest melting point (.....)

v. Identify the species which has the bond angle 120^0 (.....)

vi. Identify the species which has the highest oxidation number +7 in the central atom (.....)

b) i. Draw the most acceptable Lewis dot – dash structure for the molecule $C_2H_3O_3N$. Its skelton is given below.



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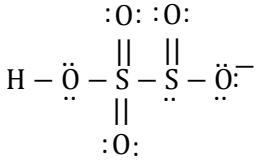
ii. The most stable Lewis dot – dash structure for the ion $[HS_2O_5]^-$ is shown below.

Draw three more Lewis dot – dash structures (Resonance structures) for this ion .



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iii. Based on Lewis dot – dash structure given below. State the following regarding the C, N and O atoms given in the table.

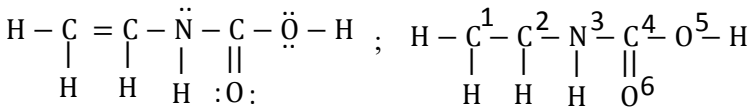
I. VSEPR pair around the atoms

II. electron pair geometry around the atom

III. Shape around the atom.

IV. hybridization around the atom

The atoms are numbered as follows.



	C^1	N^3	C^4	O^5
I. VSEPR pair				
II. Electron pair geometry				
III. Shape				
IV. Hybridization				

iv. Identify the atomic / hybride orbitals involved in the formation of the following σ bonds in the Lewis dot – dash structure given in part (iii) above.

I. $C^1 - C^2$ C^1 ..... C^2 .....

II. $C^2 - N^3$ C^2 ..... N^3 .....

III. $N^3 - C^4$ N^3..... C^4.....

IV. $C^4 - O^5$ C^4..... O^5.....

V. $C^4 - O^6$ C^4..... O^6.....

(v) Identify the atomic orbitals involved in the formation of the following π bonds in the Lewis dot – dash structure give in part (iii) above

I. $C^1 - C^2$ C^1 ..... C^2 .....

II. $C^4 - O^6$ C^4..... O^6.....

c) (i) Select two polar species from the list given below.

$$I_3^-,\ CCl_4,\ SF_4,\ SO_3,\ CO$$

…….and ……

(ii) State the type(s) of intermolecular forces that exist between the molecules in each of the following.

1. $NaCl_{(s)}$ and excess water .....

2. $Br_{2(l)}$/ $CCl_{4(l)}$ .....

3. $KI_{(aq)}$ and $I_{2(s)}$ .....

4. $Cl_{2(g)}$ and water .....

02. a)

i. A 1.500 g sample of an organic compound containing only C, H, and O was burned completely. The only combustion products were 1.738 g CO_2 and 0.711 g H_2O. What is the empirical formula of the compound. (C = 12, H = 1, O = 16)

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ii. Relative molar mass of the sample A is 152, Write the molecular formula of the sample A.

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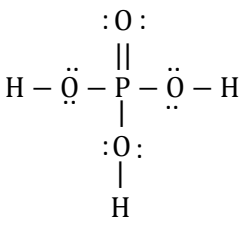
b) i. Consider the Lewis dot – dash structure of H_3PO_4 to answer the following questions from. (I) to (IV).



deduce the shapes around the following atoms using the VSEPR theory.

I. P

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II. O attached to H.

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III. Sketch the shape of the Lewis structure given above (i) showing approximate bond angle.

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IV. Calculate the charge of phosphorus (P) in the structure H_3PO_4 given above (i)

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c) (i) A is an element of Third period in the periodic table. Its first eight lonization energies in $kJmol^{-1}$ are 1260, 2300, 3850, 5150, 6540, 9330, 11000, 33600 respectively.

1. Identify the element A.

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2. Write the electronic configuration of A

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3. Write the common oxidation states of A in its compounds. (need not write compounds)

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4. Give the example of a compound 'A' which has lowest oxidation number.

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03. a The following question is regarding the reaction between $KMnO_4$and FeC_2O_4solutions in acidic medium.

(i) Write the half ionic equation for the reduction.

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(ii) Write the half ionic equation / s for oxidation.

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(iii) Write the complete ionic reaction.

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(iv) Using the complete ionic reaction, write the chemical reaction between $KMnO_{4(aq)}$ and $FeC_2O_{4(aq)}$ using dilute H_2SO_4

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(v) A solution was prepared by dissolving 0.948 g of $KMnO_4$ in dilute H_2SO_4. At proper temperature, calculate the volume of $0.2\ moldm^{-3} FeC_2O_4$ solution needed to react completely with the above $KMnO_4$ solution.

(K – 39, Mn – 55, O – 16)

Note – Assume that the Fe^{2+} in FeC_2O_4 solution does not get oxidized in the FeC_2O_4 solution at ordinary condition

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b) Balance the following equations and state which of the elements in the reactant underlined, changes it's oxidation state. (From which oxidation state to which oxidation)

i. $H^+ + \underline{IO_3^-} + \underline{I^-} \longrightarrow I_2 + H_2O$

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ii. $Mg + \underline{HNO_3} \longrightarrow Mg(NO_3)_2 + NH_4NO_3 + H_2O$

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iii. $NaOH + \underline{Cl_2} \longrightarrow NaCl + NaClO_3 + H_2O$

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iv. $\underline{H_2S} + \underline{SO_2} \longrightarrow S + H_2O$

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04. a) i. What do you understand by empirical formula?

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ii. A compound contains C - 53.93 %, H – 12.35 %, O – 17.97% and N – 15.73%. If the mass of the empirical formula is 89. Find the empirical formula.

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iii. If the empirical formula and molecular formula are equal, find the molar mass

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b) In the laboratory, you are provided with solid dried Na_2CO_3 and other apparatus. $250\ cm^3$ of $0.1\ moldm^{-3} Na_2CO_3$ solution is to be prepared.

i. Write the list of chemicals and apparatus needed

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i. Using proper calculations, state how $250\ cm^3$ of $0.1\ moldm^{-3} Na_2CO_3$ could be prepared.

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Term Examination, November - 2019

Grade – 12 (2021)	**Chemistry II**	

Part –II

Structure Question –B

Answer two questions only.

05.

i. Give four evidences to show that cathode rays have energy.

ii. Give three observations in Rutherford's gold leaf experiment.

iii. What is electromagnetic spectrum?

iv. State the four types of quantum numbers and Explain what each of them indicate.

v. State three characteristics of resonance.

vi. State two informations each that could be obtained directly and that cannot be obtained directly from Lewis structures.

vii. State the ionic properties of $MgCl_2, CaCl_2, SrCl_2$ and $BaCl_2$ and give reasons.

viii. State the electro negativities of sulphur in H_2S, SO_3^{2-}, SO_4^{2-} in descending order and give reason.

06. a) i. Find the mole fraction of NaOH in a 10% of NaOH solution by mass?
[Na – 23 $gmol^{-1}$, O - 16 $gmol^{-1}$, H - 1 $gmol^{-1}$]

ii. 4 mg of Na_3PO_4 present in 2 kg of sea water. Give the composition of Na_3PO_4 in ppm.

iii. Give four characteristic features of primary standard solution.

iv. Find the mass of O in 32 g of Fe_2O_3
[Molar mass of Fe and O are 56 $gmol^{-1}$and16 $gmol^{-1}$]

b) An organic compound containing C, H and O only, It contains C = 54.55%. If the molar mass of this compound is 88$gmol^{-1}$, find the molecular formula
[molar masses of C, H and O are 12 $gmol^{-1}$,1 $gmol^{-1}$,16 $gmol^{-1}$respectively]

c) Using calculation, explain how 600 cm^3, 2.3 $moldm^{-3}$, H_2SO_4 solution could be prepared using concentrated H_2SO_4 solution having 98% ($^W/_W$) by mass and density 1.84 gcm^{-3}
[molar mass of H_2SO_4 is 98 $gmol^{-1}$]

07.

i) Boiling point of NO is higher than that of O_2. Explain

ii) State three factors that contributes to the strength of metallic bond.

iii) 0.48 g Mg and 0.14 g N_2 reacts to form Mg_3N_2. Identify the limiting reactant with calculation.

[molar masses of Mg and N are $24 gmol^{-1}$, $14 gmol^{-1}$ respectively]

iv) 100 cm^3 of $Ba(OH)_2$ is added to 100 cm^3 of $20 \times 10^{-3} moldm^{-3}$ HCl to completely react. To the resulting solution Cl^- ions were completely precipitated by the addition of $AgNO_3$

a) Write balanced equations for the reactions that take place.

b) Find the concentration of $Ba(OH)_2$ needed.

c) Calculate the mass of AgCl formed.

[Ag –108 $gmol^{-1}$,Cl- 35.5$gmol^{-1}$]

v) 1.25 g of powdered limestone was reacted with 30 cm^3 1 $moldm^{-3}$HCl. Then remaining HCl was reacted with 1 $moldm^{-3}$ NaOH. Volume of NaOH needed to completely react is 10 cm^3. Find the mass percentage of $CaCO_3$ in limestone

[Molar mass of Ca, C and O are 40, 12 and 16 $gmol^{-1}$]

Hint :-

$CaCO_3$ + HCl ⟶ $CaCl_2$ + CO_2 + H_2O not balanced