



FWC

Conducted by Field Work Centre, Thondaimanaru

In Collaboration with Provincial Department of Education

Northern Province

Term Examination, July - 2019

Grade – 12 (2020)

Chemistry I

Time : 1 Hours

Part - I

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

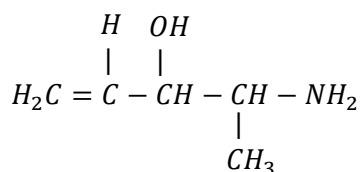
❖ Answer all questions.

- 1) The credit of discovering the charge of the electron and discovering neutron respectively goes to the scientists,
1. Thomson and Chadwick
 2. Rutherford and Chadwick
 3. Chadwick and Thomson
 4. Robert milikan and Thomson.
 5. Robert milikan and chadwick

- 2) Which out of the given set of quantum numbers represent the electron removed in the Third ionization energy of Aluminum?

1. $n = 3$ $l = 1$ $m_l = +1$ $m_s = +\frac{1}{2}$
2. $n = 3$ $l = 1$ $m_l = -1$ $m_s = +\frac{1}{2}$
3. $n = 3$ $l = 1$ $m_l = 0$ $m_s = +\frac{1}{2}$
4. $n = 3$ $l = 0$ $m_l = 0$ $m_s = +\frac{1}{2}$
5. $n = 3$ $l = 0$ $m_l = +1$ $m_s = +\frac{1}{2}$

- 3) The IUPAC name of this compound is,



1. 4 – amine – 1 – pentanol.
 2. 4 – amino – 4 – methyl – 1 – buten – 3 – ol
 3. 4 – amino – 1 – penten – 3 – ol
 4. 2 – amino – 4 – penten – 3 – ol
 5. 2 – amino – 4 – penten – 3 – ol
- 4) The concentration of Mn^{2+} in mol dm^{-3} , If there is no change in volume when 50 cm^3 of 0.08 mol dm^{-3} SnC_2O_4 solution is mixed with 50 cm^3 of 0.12 mol dm^{-3} $\text{H}^+ / \text{KMnO}_4$?
1. 0.032
 2. 0.008
 3. 0.16
 4. 0.016
 5. 0.32
- 5) Which of the following could not be used to distinguish $\text{Ba}(\text{NO}_3)_2$ and $\text{Ba}(\text{OH})_2$?
1. $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$
 2. $\text{AgNO}_3(\text{aq})$
 3. $\text{K}_2\text{CO}_3(\text{aq})$
 4. $\text{Mg}(\text{NO}_3)_2(\text{aq})$
 5. $(\text{NH}_4)_2\text{SO}_4(\text{aq})$

6) In which of the following reactions both ΔH° and ΔS° are positive at 25 °C?

1. $2\text{H}_{2(g)} + \text{O}_{2(g)} \longrightarrow 2\text{H}_2\text{O}_{(l)}$
2. $\text{H}_2\text{O}_{(l)} \longrightarrow \text{H}_2\text{O}_{(g)}$
3. $\text{CO}_{2(g)} + \text{CaO}_{(s)} \longrightarrow \text{CaCO}_{3(s)}$
4. $2\text{SO}_{2(g)} + \text{O}_{2(g)} \longrightarrow 2\text{SO}_{3(g)}$
5. $\text{NH}_{3(g)} + \text{HCl}_{(g)} \longrightarrow \text{NH}_4\text{Cl}_{(s)}$

7) Molecular formula of compound A is C_6H_{12} . It reacts with Br_2 to form compound B with molecular formula $\text{C}_6\text{H}_{12}\text{Br}_2$. When B is heated with alcoholic KOH compound with molecular formula C_6H_{10} is formed, which does not show optical isomerism and reacts with $\text{Cu}_2\text{Cl}_2 / \text{NH}_3$ to give a reddish brown precipitate. The compound A can be,

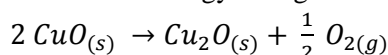
1. $\begin{array}{c} \text{H} \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_2\text{CH}_3 \\ | \\ \text{HC} = \text{CH}_2 \end{array}$
2. $\begin{array}{c} \text{H} \\ | \\ \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2 - \text{C} = \text{CH}_2 \end{array}$
3. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH} = \text{CH} - \text{CH}_3$
4. $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2\text{CH}_2 - \text{C} = \text{CH}_2 \end{array}$
5. $\begin{array}{c} \text{CH}_3\text{CH} = \text{C} - \text{CH}_2\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$

8) The effective nuclear charge felt by the valence electron in sodium (Na) is,

[Na $z = 11$ and relative atomic mass = 23]

1. equal to +11
2. equal to 23
3. less than +11
4. less than 23
5. greater than +11

9) Standard Gibbs energy changes for the reaction



at two different temperatures are given below.

T/ K	$\Delta G^\ominus / \text{kJmol}^{-1}$.
1300	- 80.6
1200	- 60.4

The standard entropy of the reaction is,

1. $202 \text{ J K}^{-1} \text{ mol}^{-1}$
2. $- 202 \text{ J K}^{-1} \text{ mol}^{-1}$
3. $40.2 \text{ J K}^{-1} \text{ mol}^{-1}$
4. $- 242 \text{ J K}^{-1} \text{ mol}^{-1}$
5. $20.2 \text{ J K}^{-1} \text{ mol}^{-1}$

10) A balloon is to be filled with a known amount of hydrogen gas at room temperature. At atmospheric pressure (100 KPa). The gas occupies 2.5 dm^3 volume. What would be the volume of the balloon when the pressure inside is 20 KPa at the same temperature?

1. 12.5 m^3
2. 12.5 dm^3
3. 25 dm^3
4. 50 dm^3
5. 2.5 dm^3

11) Which of the following produces an immediate precipitate with ammonical AgNO_3 ?

1. $\text{CH}_3\text{CH} = \text{CHCl}$
2. $(\text{CH}_3)_3\text{CCl}$
3. $\text{C}_2\text{H}_5\text{Cl}$
4. $(\text{CH}_3\text{CH}_2)_2\text{CHI}$
5. $\text{C}_6\text{H}_5\text{I}$

12) Which of the following statements is false with regard to sulfur and its compounds?

1. Sulfur reacts with $\text{H}_2\text{SO}_{4(l)}$ giving SO_2 as one of the products.
2. dil H_2SO_4 can act as a strong acid and oxidizing agent.
3. SO_2 can act both as an oxidizing agent and as a reducing agent.
4. thiosulfuric acid can decompose to produce a sulphur and SO_2 products in aqueous solutions.
5. Sulfur is a metal with oxidation states in the range -2 to 6 .

13) 0.3 g of a mixture containing NaBr and KBr was dissolved in water and treated. In dil HNO_3 and aqueous AgNO_3 . In the quantitative analysis, if 0.564 g and AgBr was formed, the mass percentage of KBr in the initial mixture is.

[K – 39 Na – 23 Br – 80 Ag – 108]

- | | | |
|------------|------------|------------|
| 1. 22.31 % | 2. 20.40 % | 3. 24.52 % |
| 4. 30.42 % | 5. 21.2 % | |

14) Which of the following statements is false with regard to NH_3 ?

1. NH_3 reacts with Mg to give Mg_3N_2 and H_2 gas.
2. NH_3 gives a blue colour with red litmus paper.
3. NH_3 can act oxidizing agent.
4. NH_3 reacts with CuO to give Cu and H_2 gas.
5. NH_3 can act as acid and base.

15) The kinetic molecular theory equation for an ideal gas is $PV = \frac{1}{3}mN\overline{C^2}$. Which of the following statement is true for a sample of an ideal gas?

1. $\overline{C^2}$ increases with P at constant temperature.
2. PV is independent of the number of moles.
3. $\overline{C^2}$ is independent to temperature.
4. $\overline{C^2}$ increases if more molecules of the gas are introduced into the sample at constant temperature.
5. $\overline{C^2}$ is a constant at constant temperature.

❖ 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 responses / 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) Which of the following statements is / are false regarding the colours of complexes by 3d transition elements?

- a) $[\text{Zn}(\text{NH}_3)_4]^{2+}$ is colourless
- b) $[\text{CuCl}(\text{OH}_2)_5]^+$ is green
- c) $[\text{CrCl}_6]^{3-}$ is blue – violet.
- d) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is yellow – brown.

17) Which of the following statement is / are true.

- a) $\text{CH}_3\text{CH}=\text{CH}_2$ reacts with R_2O_2 / HI and gives the major product $\text{CH}_3\text{CH}_2\text{CH}_2\text{I}$.
- b) Alkenes react with cold, alkaline dilute KMnO_4 solution to produce diols.
- c) Geometrical isomers are diastereomers.
- d) $\text{CH}_3\text{CH}\equiv\text{CH}$ react with NaNH_2 and gives $\text{CH}_3\text{CH}\equiv\text{CNa}$ and H_2 .

18) Which of the following reaction steps is/ are most unlikely to take place, when Cl_2 reacts with CH_4 in the pressure of light?

- a) $\text{CH}_4 + \text{Cl}^\bullet \longrightarrow \text{CH}_3\text{Cl} + \text{H}^\bullet$
 b) $\text{CH}_3\text{Cl} + \text{Cl}^\bullet \longrightarrow \text{CH}_3^\bullet + \text{Cl}_2$
 c) $\text{CH}_3^\bullet + \text{Cl}^\bullet \longrightarrow \text{CH}_3\text{Cl}$
 d) $\text{CH}_3^\bullet + \text{CH}_3^\bullet \longrightarrow \text{C}_2\text{H}_6$

19) $\text{SO}_{2(\text{g})}$ reacts with $\text{O}_{2(\text{g})}$ to produce 0.3 mol $\text{SO}_{3(\text{g})}$ with release of 28.8 kJ of heat. Which of the following statements is/are true for the above system? [S – 32 O – 16]

- a) 96 kJ of heat is required to decompose one mole of $\text{SO}_{3(\text{g})}$ into $\text{SO}_{2(\text{g})}$ and 0.5 mol $\text{O}_{2(\text{g})}$
 b) 1.2 kJ of heat is required to form 8g of $\text{SO}_{3(\text{g})}$.
 c) reactants are more thermal stability than products.
 d) Products are more thermal stability than reactants.

20) Which out of given radius variations is / are incorrect?

- a) $\text{K}^+ > \text{Ca}^{2+}$ b) $\text{O}^{2-} > \text{F}^-$ c) $\text{Mg}^{2+} > \text{S}^{2-}$ d) $\text{N} > \text{N}^{3-}$

❖ 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)	Polarizing power of cation and the polarizability of anion is important in determining the covalent nature of a compound.	Ionic nature $\text{NaF} > \text{LiI}$
22)	All group I salts are soluble in water.	For almost all ionic solids of group I are soluble in water due to the negative Gibbs free energy in the solubility process.
23)	Water is an amphoteric compound.	Water has the ability to accept and release a proton.
24)	In the presence of Hg^{2+} and dilute H_2SO_4 add to an alkyne producing aldehydes or ketones.	Alkyne reacts with $\text{Hg}^{2+} / \text{dil H}_2\text{SO}_4$ gives enol compound.
25)	Standard enthalpy change of sublimation is $\text{Na} < \text{K}$.	When the radii of cations increase, resulting in high metallic bonds strength.



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Chemistry II

Time : 2 Hours

Part - II

A - Structured Essay

❖ Answer all four questions on this paper itself.

01. a) State whether the following statements are true or false. (Reasons are not required)

- i. S_C is considered as a transition element. (.....)
- ii. MnO_4^- react with I^- to not produce IO_3^- in basic medium. (.....)
- iii. $PV = nRT$ equation can't apply to real gas. (.....)
- iv. All group 18 elements have positive electron gain enthalpy. (.....)
- v. Oxidizing ability of halogens decreases down the group. (.....)

(5 x 5 = 25 Marks)

b) i. Draw the most acceptable Lewis structures for CO and CO_2 .

ii. Write the IUPAC name of above compounds.

.....
.....

iii. $CO_{2(g)}$ dissolving with water and give oxoacid of carbon. Write the formula of oxoacid of carbon.

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.....

iv. Write the IUPAC name and draw the most acceptable Lewis structure of above acid.

.....
.....

(v) Draw the resonance structure associated with the compound in (iii) above.

(vi) Complete the table below.
(Consider the above (iv) compound)

	C	O (with H)
1. hybridization		
2. electron pairs shape		
3. shape around the atom		
4. oxidation number		

(vii) Write the formula of oxide of carbon (Don't write above oxide).

.....
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(50 Marks)

c) Arrange the following (i) – (v) in the ascending order of the property as given in parentheses

1) NH_3 , NH_2^- , NH_4^+ , NO_2^+ (electronegativity of nitrogen)

..... < < <

2) Quantum number of electrons in an atom (n , l)

(4, 1), (4, 0), (3, 2), (3, 1) (stability of electron)

..... < < <

3) CH_3Cl , CHBr_3 , CH_2Cl_2 , CBr_4 (volatility)

..... < < <

4) AgCl , AgBr , AgI (Solubility with $\text{NH}_{3(\text{aq})}$)

..... < < <

5) NO^+ , FNO_2 , ClNO , NH_2OH (N – O bond energy)

..... < < <

(5 x 5 = 25 Marks)

02. a) Atomic number of A and B elements are less than 20. A gives a yellow flame in the flame test. A reacts with water liberating gas D and forms the solution of C. B reacts with both dil HCl and dilute KOH separately and gives of the same colourless diaatomic gas. Further B does not react with water and it reacts with the solution C liberating gas D and forms solution E. At gaseous state chloride of B exists as a dimer.

i. Identify A, B, C, D and E.

A - D -
B - E -
C -

ii. Write electron configurations of A and B.

A - B -

iii. Write most stable oxidation states of A and B.

A - B -

iv. Draw the structure of gaseous chloride of B.

v. A burns in the air easily and forms oxides, write the formula of these oxides seperately.

.....
.....
.....

vi. Show how B reacts with air using balanced equations.

.....
.....

vii. Write balanced chemical equations for the reaction taking place between B and following things.

1. dil HCl
2. dil KOH

viii. Write the balanced chemical equation for the reaction of B when heated with KNO_3 and dilute KOH.

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.....
.....

ix. Write the three formulas of the chemical species that the ion of B having the most state oxidation state forms in an aqueous medium.

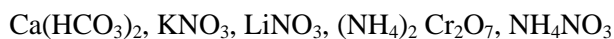
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x. Write one use of each A, B.

.....

(60 Marks)

b) Chemical compounds A to E are contains in test tubes while description about the products obtained by heating them is given below. (They are not in order from A to E)



Chemical compound	Description about the products obtained.
A	Reddish brown gas with a solid residues.
B	Two gaseous products with solid residues.
C	Remain a white solid residues.
D	Does not remains any residue after heating the solid compound.
E	Colourless gas which turns lime water to milky colour and white solid residues.

i. Identify solid substances from A to E.

A –

D -

B –

E -

C -

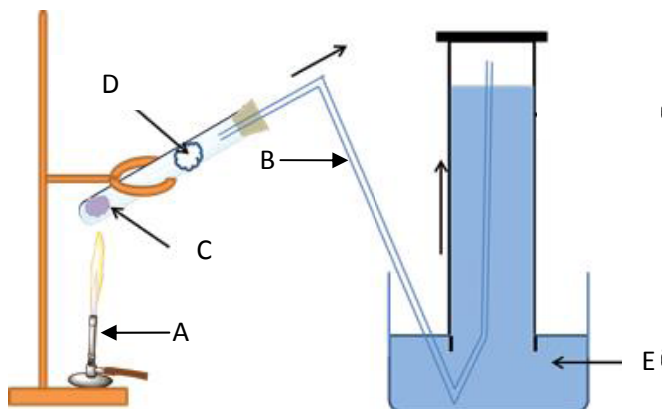
(5 x 3 = 15 Marks)

ii. Write balanced chemical equations for heating of the above chemical substances A to E.

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.....

(5 x 5 = 25 Marks)

03. a) Oxygen gas is collected by displacement of water in the following experimental.



i. Identify the A, B, C, D and E.

A -

D -

B -

E -

C -

Experimental readings is given below.

	Readings
• Weight of the boiling tube and it's content before heating /g.	10.1481
• Weight of the boiling tube and it's content after heating.	10.1000
• Volume of water displaced / cm ³ .	38
• Temperature / °C	27
• Pressure / mmHg	745

ii. Calculate pressure of dry O₂ (vapour pressure of water at 27 °C is 5mmHg).

.....

iii. Convert this pressure from mmHg to Nm⁻².
(760 mmHg = 1.01 x 10⁵ Nm⁻²)

.....
.....

iv. Write the combined gas equation.

.....

v. Calculate the volume of oxygen gas at STP.
(1 mol of has occupies 22.4 l litres at STP)

.....
.....
.....
.....

vi. Calculate the mass of oxygen above experiment.

.....

vii. What is the moles of oxygen. [0 – 16]

.....

.....

viii. Calculate the molar volume of oxygen gas at STP.

.....

.....

.....

ix. Explain

i. Why cotton wool is inserted into the boiling tube.

.....

ii. Why it is important to let boiling tube cool to room temperature before weighing the contents.

.....

.....

(50 marks)

b) i. Explain

1. Entropy

.....

.....

2. Extensive properties.

.....

.....

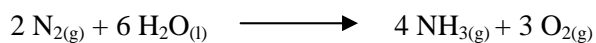
3. State function

.....

.....

(15 Marks)

ii. Consider the following reaction which occurs at 25 °C.



Some thermo chemical data at 25 °C had been given below.

Substance	$\text{N}_{2(\text{g})}$	$\text{H}_2\text{O}_{(\text{l})}$	$\text{NH}_{3(\text{g})}$	$\text{O}_{2(\text{g})}$
$\Delta H_f^\ominus / \text{kJ mol}^{-1}$	0	- 242	- 46	0
$S^\ominus / \text{J mol}^{-1}\text{K}^{-1}$	192	189	193	205

i. Calculate the standard enthalpy change.

.....

.....

.....

ii. Calculate the standard entropy change.

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.....
.....

iii. Calculate the standard Gibbs free energy change at 25 °C.

.....
.....
.....
.....

iv. Find out the minimum temperature above reaction take place spontaneously.

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.....
.....

(35 Marks)

04. a) i. The relative molecular mass of a acyclic hydrocarbon A is 72. Write the molecular formula of A ($C - 12$ $H - 1$).

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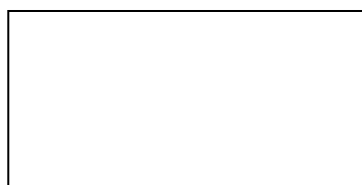
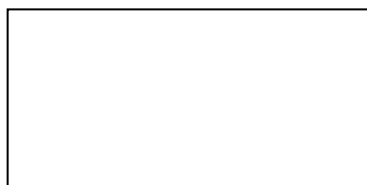
ii. Write possible structures for A.

.....
.....
.....
.....

iii. When one mole of the acyclic hydrocarbon B is subjected to complete catalytic hydrogenation it reacts with 4 moles of hydrogen and gives one mole of A. What is the structure of A?

.....

iv. Write four possible structures for B.



v. One mole B reacts with excess NaNH_2 to give two moles of H_2 . What is the structure of B.

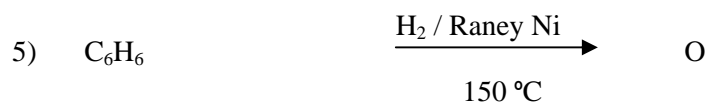
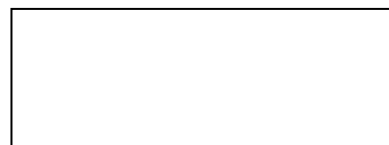
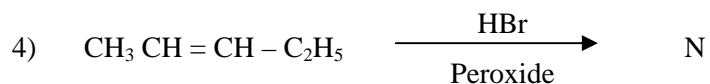
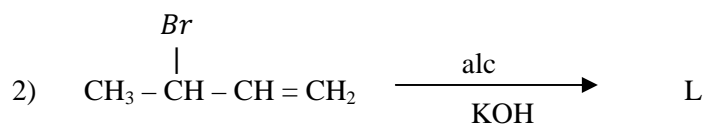
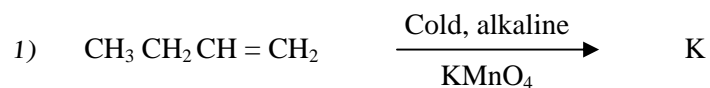
.....

vi. B is containing three SP hybridized carbon atoms. What are the structures of B.

.....

(60 Marks)

b) Draw the structure of the major organic products K, L, M, N and O



(25 Marks)

c) Write the mechanism for the reaction between 2-methyl-1-butene and HCl

(15 Marks)



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Chemistry II

Part – II

Essay Questions - B

Answer only two questions.

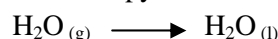
05. a) At 127 °C , Three gases C₃H₈, SiH₄ and CO₂ present in three vessels which are 2 : 3 : 8 volume ratio and 3 : 2 : 1. Pressure ratio respectively. At 127 °C, Three vessels are connected using a tube which volume is negligible. After the connection pressure of the system is 16.628 x 10⁴ Pa. Total mass of gases is 4.07 g in the system. [C – 12, H – 1, Si – 29, O – 16]
- Calculate the total volume of the system?
 - Calculate the partial pressure of CO₂ ?
 - Find the density (gdm⁻³) of gas system?
 - When adding KOH solid only CO₂ gas was absorbed. What is the pressure of the system now?
 - What is the density of system now? (50 Marks)

- b) CO_(g) and H_{2(g)} can be produced by the reaction between CH_{4(g)} and CO_{2(g)} in the presence of sunlight and a catalyst A. The standard enthalpy change for this reactions - 174 kJ mol⁻¹. Above products can also be formed by reacting graphite with water vapour and the relevant enthalpy change is - 125 kJ mol⁻¹

Standard enthalpy of formation of CO_{2(g)} is – 394 kJ mol⁻¹

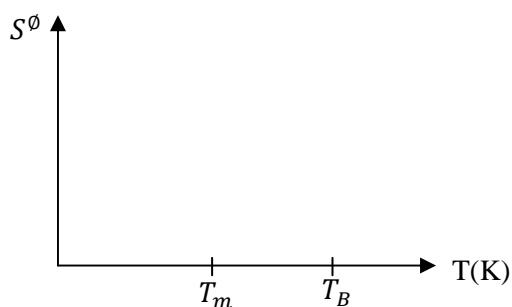
Standard enthalpy of combustion of CH_{4(g)} is – 800 kJ mol⁻¹

- Write balanced chemical equations for the above chemical reactions.
- Calculate the enthalpy of following reaction. Use **the thermo chemical cycles only**.



(75 Marks)

- c) i. The heat of fusion of ice is 6 kJmol⁻¹ . Calculate the entropy change of H₂O_(s) ⇌ H₂O_(l) at 0°C and 1atm.
- ii. Sketch the graph standard entropy and temperature (K) of water.



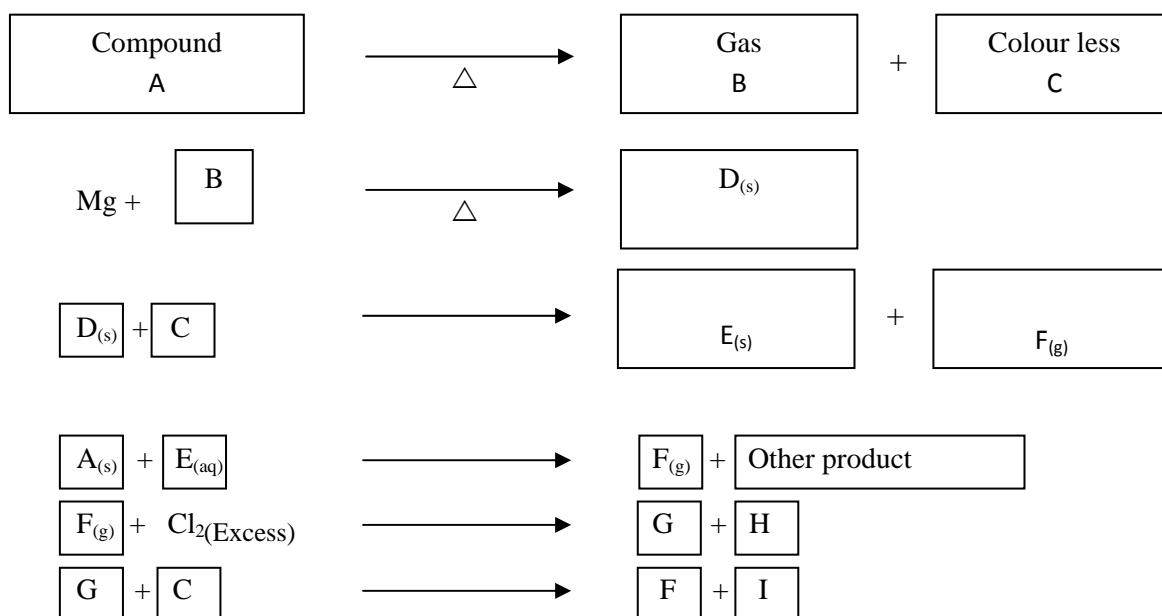
T_m - melting point of water

T_B - boiling point of water

(25 Marks)

06. a) Following Questions is based on the elements of S and P block of the periodic table and iorganic compounds.

Identify chemical species A – I of following reaction given below.



G – is used as a water disinfecting agent.

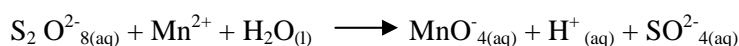
F – Central atom of F gas is sp^3 hybridization.

(9 x 5 = 45 Marks)

- b) The following procedure was used to determine the thickness of a layer of Mn coated on one surface of a rectangular sheet of an inert material.

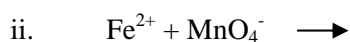
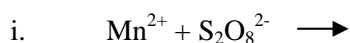
A dilute acid was to dissolve the Mn in a 10 cm x 4 cm rectangular sample of the given sheet. The resulting Mn^{2+} , was oxidized with $S_2O_8^{2-}$ in neutral medium as given below.

($S_2O_8^{2-}$ - peroxydisulfate ion)



After removal of excess $S_2O_8^{2-}$ the solution was acidified and an excess of ferrous ammonium sulphate [$FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$] 2.94g was added. The unreacted Fe^{2+} was then titrated with $0.025 \text{ mol dm}^{-3}$ $KMnO_4$ solution. The volume required was 20 cm^3 .

1. Give balanced chemical equations for the reaction of.

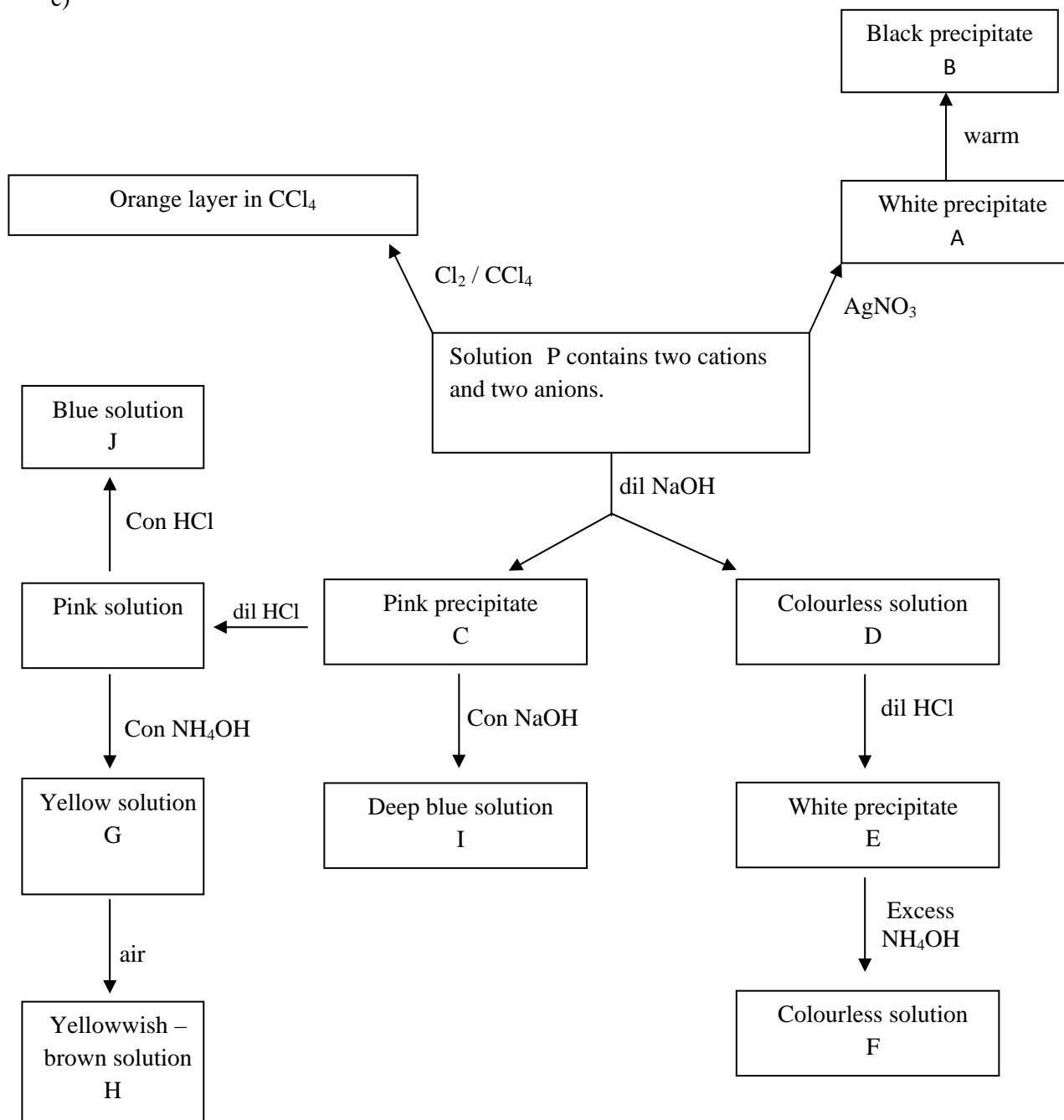


2. Calculate the thickness of Mn layer coated on the sheet.

[Density of Mn 13.75 g cm^{-3} , H – 1, Fe – 56, Mn – 55, S – 32, O – 16, N – 14]

(50 Marks)

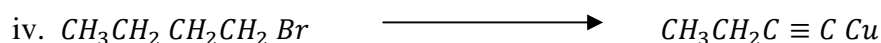
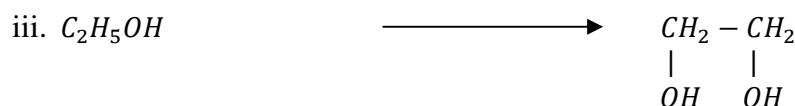
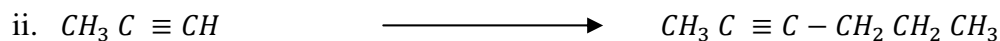
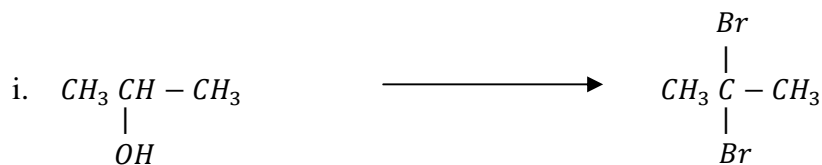
c)



- i. Identify the two anions.
- ii. Identify and write the compound of A – J.
- iii. Write the IUPAC name of J and F.
- iv. Calculate of oxidation number of the central metal ion of I.
- v. What are the factors affecting the colour of the complexes?

(55 Marks)

07. a) Show how you would carry out the following conversions.
[Only use given starting compound for starting organic compound]



(69 Marks)



Only use given reagents.

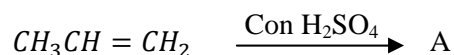
Mg, dry ether, alc KOH, HBr, Con H₂SO₄
Br₂/ CCl₄, H₂O, HgSO₄, dil H₂SO₄

(42Marks)

- c) Compound A exhibits optical isomerism and has the molecular formula C₇H₁₆.
- Draw two possible structures for A which are not enantiomers of each other.
 - State the isomeric relationship between the two structures you have drawn.

(15 Marks)

- d) i. Write the major product of given reaction.



- Write the mechanism for above reaction.
- It has been found that B is also formed above reaction, as a minor product, By considering the mechanism of the reaction. Explain why the major product in above reaction is A and not B.

(24 Marks)