වයඹ පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව

Provincial Department of Education - NWP

02 | E | I

First Term Test - Grade 13 - 2020

Index No : .... **Chemistry I** Two Hours

Important

- **Periodic Table is provided.**
- **Answer all the questions.**
- **Use of calculator is not allowed.**
- **Write your Index number in the space provided in the answer sheet.**
- **In each of the questions 1 to 50, pick one of the alternatives form (1), (2), (3), (4), (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (x) in accordance with the instructions given on the back of the answer sheet.**

Universal gas constant $R = 8.314\ J\ K^{-1}\ mol^{-1}$ | Avogadro constant $N_A = 6.022 \times 10^{23}\ mol^{-1}$
Planck's constant $h = 6.626 \times 10^{-34}\ J\ s$ | Velocity of light $C = 3 \times 10^{8}\ m\ s^{-1}$

---

1. Consider the following findings / hypothesis related to an atomic structure.
   I − Atomic nucleus was surrounded by electrons moving in orbit, like planets revolving around the sun.
   II − The number of positive charges on the nucleus increases in atoms by single electron units.
   The two scientists who presented above findings / hypothesis in I and II respectively are,
   1. Eugen Goldstein, J.J. Thomson
   2. Niels Henrik David Bohr , Henry Gwynn Jeffery Mosely.
   3. Neils Henrik David Bohr, J.J. Thomson
   4. J.J. Thomson, Eugen Goldstein.
   5. James Chadwick, Henry Gwynn Jeffery Mosely.

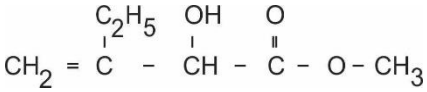
2. The number of electrons relevant to the quantum numbers $l = 1$ and $m_l = 0$ in Cu atom $(Cu\ ,\ Z = 29)$ respectively are,
   1. 6 , 7 2. 12 , 7 3. 12 , 14
   4. 12 , 8 5. 10 , 14

3. The total number of stable resonance Lewis structures can be drawn for the HSO_4^- ion respectively is,
   (Skeleton of HSO_4^- is
```
          O
          |
H – O  –  S  –  O
          |
          O
```
)
   1. 2 2. 3 3. 4 4. 5 5. 6

These papers were printed, packed and distributed under the strict sanitary regulations approved by the Ministry of Health.

4. When considering the hydrides of 2nd period of the periodic table, the element which forms the hydride with the highest dipole moment is ?

1. Li 2. Be 3. C 4. O 5. F

5. What is the IUPAC name of the following compound. 

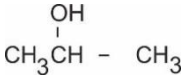
1. methyl 2 – hydroxy – 3 – ethylbut – 3 – enoate
2. methyl 2–hydroxy – 3 – ethylbut – 4 – enoate
3. methyl 3 – ethyl – 2 – hydroxybut – 3 – enoate
4. methyl 3– ethyl – 2 – hydroxy – 4 – enoate
5. 3 – ethyl – 2 – hydroxy – 1 – methylbut – 3 – enoic acid

6. The increasing order of radius of the species N^{3-} , Ne , Mg^{2+} , Ca^{2+} , S^{2-} and Cl^{-} respectively are,

1. $Mg^{2+} < N^{3-} < Ne < S^{2-} < Cl^{-} < Ca^{2+}$
2. $Mg^{2+} < Ne < N^{3-} < Ca^{2+} < Cl^{-} < S^{2-}$
3. $N^{3-} < Ne < Mg^{2+} < S^{2-} < Cl^{-} < Ca^{2+}$
4. $N^{3-} < Ne < Mg^{2+} < Ca^{2+} < Cl^{-} < S^{2-}$
5. $Ne < Mg^{2+} < N^{3-} < Cl^{-} < S^{2-} < Ca^{2+}$

7. $n_1\ mol$ of gas A_2 in a rigid vessel of $V_1\ dm^3$ at $T_1\ K$ temperature and $P_1\ P_a$ pressure. $n_2\ mol$ of gas B_2 in a rigid vessel of $V_2\ dm^3$ at $T_2\ K$ temperature and $P_2\ P_a$ pressure. What is the pressure P of the system when above two vessels were jointed hrough a tubes with negligible volume and the temperature of the system was taken to $T_3\ K$ temperature? (A_2 and B_2 do not react with each other.)

1. $\left(\frac{P_1V_1}{T_3} + \frac{P_2V_2}{T_3}\right)\frac{(V_2 + V_1)}{T_1T_2}$
2. $\left(\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2}\right)\frac{(T_1 + T_2)}{T_3}$
3. $\left(\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2}\right)\frac{(V_2 + V_1)}{T_3}$
4. $\left(\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_3}\right)\frac{T_3}{(V_2 + V_1)}$
5. $\left(\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2}\right)\frac{(T_1 + T_2)T_3}{(V_1 + V_2)}$

8. The number of electrons exchanged according to the balanced chemical equation when  is oxidized by $KMnO_4$ in the acidic medium to CH_3COCH_3.

1. 8 2. 6 3. 2 4. 10 5. 5

9. Which of the following reaction is not a nucleophilic substitution reaction.

1. $CH_3CH_2OH + NaOH\ (aq) \longrightarrow$
2. $CH_3Br + CH_3CH_2O^-Na^+ \longrightarrow$
3. $CH_3CH_2Br + CH_3C \equiv C^-Na^+ \longrightarrow$
4. $CH_3-\overset{O}{\overset{\|}{C}}-CH3 + \xrightarrow{CH_3MgBr}$
5. $CH_3-\overset{O}{\overset{\|}{C}}-Cl + C_6H_5OH \longrightarrow$

10. The rate of consumption of $NO\ (g)$ when the reaction $2\,NO(g) + 2H_2(g) \rightarrow N_2(g) + 2\,H_2O\ (g)$ taken place inside a rigid vessel of $V\ dm^3$ at TK temperature is 2.0×10^{-3} moldm^{-3}. The rates of consumption of $H_2\ (g)$, formation of $N_2(g)$ and formation of $H_2O(g)$ respectively are,
(Rate / $mol\ dm^{-3}s^{-1}$)

	$H_2(g)$	$N_2\ (g)$	$H_2O(g)$
1.	2×10^{-3}	2×10^{-3}	1×10^{-3}
2.	1×10^{-3}	2×10^{-3}	2×10^{-3}
3.	2×10^{-3}	1×10^{-3}	2×10^{-3}
4.	1×10^{-3}	2×10^{-3}	2×10^{-3}
5.	1×10^{-3}	1×10^{-3}	2×10^{-3}

11. The correct increasing order of the boiling points of following compounds respectively are,
A = HCO_2H B = CH_3CH_2OH C = CH_3CHO
D = CH_3CO_2H E = CH_3OCH_3

1. E < C < B < A < D 2. E < C < B < D < A 3. B < C < E < A < D
4. B < C < E < D < A 5. E < B < A < C < D

12. The correct increasing order of ionic property of the $NaCl$, $MgCl_2$, $AlCl_3$, KCl and $RbCl$ is,
1. NaCl < $MgCl_2$ < $AlCl_3$ < KCl < $RbCl$
2. KCl < $RbCl$ < NaCl < $MgCl_2$ < $AlCl_3$
3. $RbCl$ < KCl < NaCl < $MgCl_2$ < $AlCl_3$
4 $AlCl_3$ < $MgCl_2$ < NaCl < KCl < $RbCl$
5. NaCl < $MgCl_2$ < $AlCl_3$ < $RbCl$ < KCl

13. Standard combustion enthalpy of propyne gas $(CH_3C \equiv C-H)$ is $-1953\ kJ\ mol^{-1}$ while standard combustion enthalpy of propane gas $(CH_3CH_2CH_3)$ is $-2228\ kJ\ mol^{-1}$. The standard combustion enthalphy of $H_2(g)$ is $-286\ kJ\ mol^{-1}$.
The standard enthalpy change of the following reaction in $kJ\ mol^{-1}$ is?
$CH_3C \equiv C-H\ (g) + 2H_2\ (g) \rightarrow CH_3CH_2CH_3(g)$

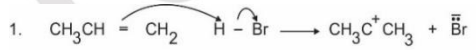
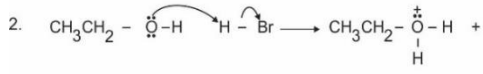
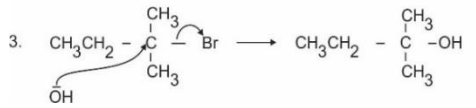
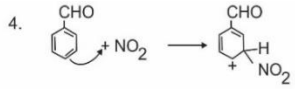
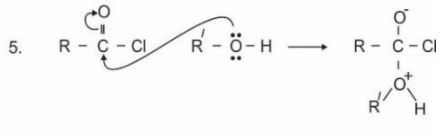
1. 295 2. +11 3. -297 4. +297 5. -11

14. The products obtained when $Cl_2(g)$ was allowed to react with hot conc. KOH are KCl, $KClO_3$ and H_2O. The limiting reagent and the remaining mass of excess reagent when $8.0\ mol$ of $Cl_2(g)$ react with $8.0\ mol$ of KOH respectively are, (K = 39, Cl = 35.5, O = 16, H = 1)
1. Cl_2 and $213\ g$ 2. Cl_2 and $224\ g$ 3. KOH and $825\ g$
4. KOH and $142\ g$ 5. KOH and $284\ g$

15. The density of a gaseous mixture containing $O_2(g)$ and $CH_4(g)$ at $127^0\ C$ and 8.314×10^4 Pa pressure is $0.25\ kg\ m^{-3}$. The mole fraction of the O_2 gas in this gaseous mixture is?

1. $\frac{1}{4}$ 2. $\frac{3}{4}$ 3. $\frac{1}{3}$ 4. $\frac{2}{3}$ 5. $\frac{1}{2}$

16. Which of the following mechanism step is not correct?

1. 
2. 
3. 
4. 
5. 

17. Particular reaction is not spontaneous at $1000^0\ C$ and $1\ atm$ pressure. While spontaneous at $25^0\ C$ and $1\ atm$ pressure. True regarding the reaction in $1000^0\ C$ is? (Assume that ΔH and ΔS are not change on the temperature and pressure.)

	ΔG	ΔH	ΔS
1.	Negative	Positive	Negative
2.	Positive	Positive	Positive
3.	Positive	Negative	Negative
4.	Negative	Negative	Negative
5.	Negative	Negative	Positive

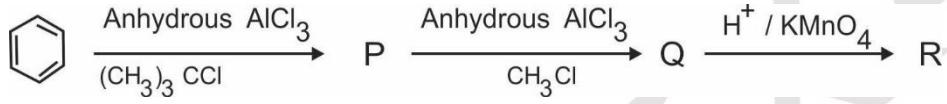
18. $50\ cm^3$ of $0.10\ mol\ dm^{-3}\ HCl\ (aq)$ solution and $50\ cm^3$ of $0.10\ mol\ dm^{-3}\ Ba(OH)_2\ (aq)$ solution were mixed at $298\ K$. Solution obtained was diluted till $500\ cm^3$ by adding water. Calculate the OH^- concentration of the solution in ppm, by assuming the density of the solution is equal to the density of water. $(O = 16,\ H = 1)$

1. 17 2. 170 3. 0.01 4. 100 5. 10000

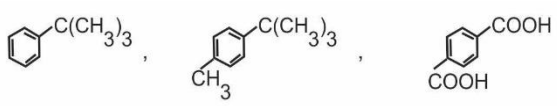
19. Kinetic energy of an electron moving in $v\ m\ s^{-1}$ velocity is $E\ \left(E = \frac{1}{2}mv^2\right)$. What is the De-Broglie wave length of the above electron when the speed increased by nine times.

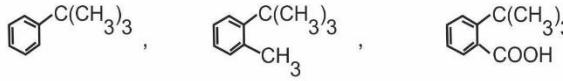
1. $\frac{h}{\sqrt{18}\ mv}$ 2. $\frac{h}{3\sqrt{mv}}$ 3. $\frac{h}{3\ mv}$ 4. $\frac{h}{18\ m\epsilon}$ 5. $\frac{h}{9m\epsilon}$

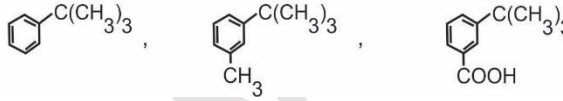
20. Consider the following sequence of reactions.

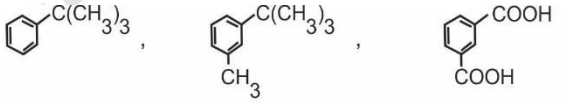


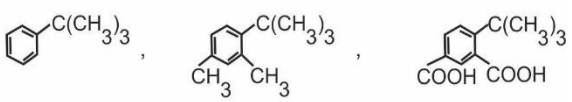
P, Q and R respectively are,

1. 

2. 

3. 

4. 

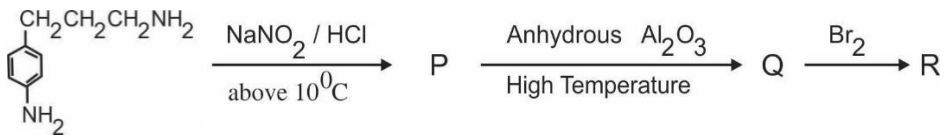
5. 

21. $1.8g$ of metal oxide XO was dissolve in excess dilute H_2SO_4. What is the relative atomic mass of the metal X, If $25.0\ cm^3$ of $0.2\ moldm^{-3}\ KMnO_4$ of solution was required to oxidize all the X^{2+} to X^{3+} in the above solution.

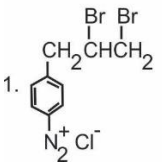
1. 20 2. 28 3. 40 4. 56 5. 72

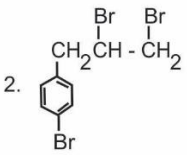
22. Standard enthalpy change and standard entropy change of the reaction $2MO\ (g) + O_2(g) \rightleftharpoons 2MO_2(g)$ are $-476.0\ kJ\ mol^{-1}$ and $-173.0\ kJ\ mol^{-1}$ respectively. The temperature at which this reaction exist in the equilibrium is? (Assume ΔH^θ and ΔS^θ do not change on the temperature.)

1. $2751.4\ ^0C$ 2. $2478.4\ ^0C$ 3. $2478.4\ K$ 4. $2.75\ K$ 5. $2.75\ ^0C$

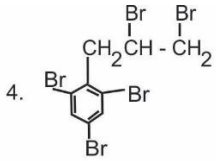
23. 

The structure of R would be?

1. 

2. 

3. 

4. 

5. 

24. $X(g) + Y(g) \rightarrow Z(g)$ is an elementary reaction $n\,mol$ of $X(g)$ and $n\,mol$ of $Y(g)$ was allowed to react inside a $V\,dm^3$ rigid vessel at $T\,K$ temperature at the beginning. After t seconds pressure inside the vessel was $P\,Pa$ while at $T\,K$ temperature rate constant of the reaction is k. What is the rate of reaction at t second?

1. $k\left(\frac{RT}{P}-\frac{n}{V}\right)$ 2. $k\left(\frac{RT}{P}-\frac{n}{V}\right)^2$ 3. $k\left(\frac{P}{RT}-\frac{n}{V}\right)^2$ 4. $k\left(\frac{p\times10^{-3}}{RT}-\frac{n}{V}\right)^2$ 5. $k\left(\frac{nRT}{P}-\frac{V}{n}\right)^2$

25. Experiments done to identify an metal cation of d block and observation of them are given below.
I Precipitate obtained when adding NH_4OH was dissolved in the presence of excess NH_4OH and give blue colour solution.
II Give yellow colour solution in the presence of conc. HCl.
III Give red colour precipitate with dimethyl glayoxime. (DMG)
The metal cation would be,
1. Cu^{2+} 2. CO^{2+} 3. Ni^{2+} 4. Cr^{3+} 5. Fe^{2+}

26. Which of the following statement is false.
1. When going along a period (not belong to d block) from left to right strong basic nature of oxides changes to strong acidic nature.
2. When going along a period which not belong to the d block, from left to right, strong acidic nature of hydroxides changes to strong basic nature.
3. Compounds of Xe has the oxidation numbers +2, +4, +6 and +8.
4. ClO^- is stable than $HOCl$ under acidic conditions.
5. ClO^- is stable at low temperatures while ClO^- disproportionate at high temperatures.

27. Which of the following factor / (s) is / are effect the rate constant of a reaction.
(a) Temperature (b) Concentration (c) Catalyst
1. (a) and (b) only 2. (a) and (c) only 3. (b) and (c) only
4. (a) only 5. All (a), (b) and (c)

28. Percentage productivity of the reaction which converts methyl benzene $(C_6H_5CH_3)$ to $4-nitromethylbenzene$ is 80%.What is the mass of $4-nitromethylbenzene$ obtained from 10.0 g of methyl benzene. ?
$(C=12\ ,\ H=1\ ,\ N=14)$ $(C=12\ ,N=14\ ,\ O=16\ ,\ H=1)$

$$productivity\ percentege = \frac{Mass\ of\ product\ obtained}{Expected\ mass\ of\ the\ product} \times 100\%$$

1. $2.92g$ 2. $11.91g$ 3. $8.75g$ 4. $6.91g$ 5. $14.89g$

29. The reaction $2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O\,(g)$ take place according to the following elementary steps at $T\ K$ temperature.
$2NO(g) \rightleftharpoons N_2O_2(g)$ fasts reaction in equilibrium.
$N_2O_2\,(g) + H_2\,(g) \rightarrow N_2O(g) + H_2O\,(g)$ slow reaction.
$N_2O\,(g) + H_2\,(g) \rightarrow N_2(g) + H_2O\,(g)$ fast reaction.
Rate constant at T K is k. According to the mechanism of above reaction the rate expression would be?
1. $Rate = k[N_2O_2(g)]\,[H_2(g)]$ 2. $Rate = k\,[H_2(g)]^2\,[NO_3]^2$ 3. $Rate = k[NO(g)]^2\,[H_2(g)]$
4. $Rate = k\,[H_2(g)]^2\,[NO\,(g)]$ 5. $Rate = k\,[H_2(g)]\,[N_2O(g)]$

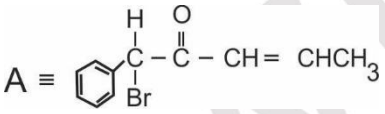
30. Which of the following statement is true regarding the dissolution of $NH_4Cl\,(s)$ in water.
1. Temperature of the system increases during this process.
2. Enthalpy of products is higher than the enthalpy of reactants in this process.
3. Entropy of the system decreases during this process.
4. System releases heat to the environment during this process.
5. This process is spontaneous at all temperature.

- **For each of the questions 31 to 40 , one or more responses out of the four responses (a) , (b) , (c) and (d) given is /are correct. Select the correct response/responses in accordance with the instructions given on your answer sheet , mark**
  (1) If only (a) and (b) are correct. **(2) If only (b) and (c) are correct.**
  (3) If only (c) and (d) are correct. **(4) If only (d) and (a) are correct.**
  (5) If any other number or combination of responses is correct.
  Summary of above Instructions,

1	2	3	4	5
Only (a) and (b) are correct	**Only (b) and (c) are correct**	**Only (c) and (d) are correct**	**Only (a) and (d) are correct**	**Any other number or combination of responses is correct**

31. Which of the following statement / statements /s / are true regarding oxoacids of Nitrogen?
(a) Nitric acid is a unstable, strong acid under normal atmospheric conditions.
(b) Nitrous acid can disproportionate to colorless nitrogen monoxide and HNO_3.
(c) Nitric acid is oily liquid while it is strong oxidizing agent.
(d) Nitric acid does not decompose in the presence of light.

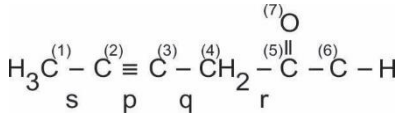
32. Which of the following statement / (s) is / are true regarding the following molecule A ?



(a) A, shows enantiomerism as well as diasteriomerism.
(b) The product obtained when A react with Br_2 does not show enantiomerism while it shows diasteriomerism.
(c) A does not show nucleophilic substitution reaction while it shows nucleophilic addition reaction.
(d) The product obtained when A reacts with HBr does not show diasteriomerism.

33. Which of the following statements / (s) is / are true regarding catalysts.
(a) Catalyst is subjected completely to a chemical change.
(b) Activation energy of a reaction is reduced by catalyst.
(c) Rate of a reaction is increases by catalyst.
(d) Catalyst provide other path with lower activation energy to the reaction.

34. Which of the following statements / (s) is / are true regarding the following molecule ?



(a) C atoms marked as (3) , (4) , (5) exist in a same plane.
(b) When considering the bond length it is increases as $p < q < r$.
(c) Electronegativity increases as $c^{(4)} < c^{(5)} < c^{(3)}$
(d) Atoms marked as (4) , (5) , (7) , (6) exist in a same plane.

35. Which of the following response / (s) is / are not represent the correct enthalpy change.

(a) Standard sublimation enthalpy of $Ca(s)$ $\quad Ca(s) \rightarrow Ca(g)$
(b) Standard bond dissociation enthalpy of Bromine. $\quad Br_2(l) \rightarrow 2Br(g)$
(c) Standard dissolution enthalpy of $NaCl(s)$ $\quad NaCl(aq) \rightarrow Na^+(aq) + Cl^-(aq)$
(d) Standard atomization enthalpy of Iodine. $\quad \frac{1}{2} I_2(s) \rightarrow I(g)$

36. True regarding a multistep reaction.

(a) The overall reaction is the sum of elementary reaction steps.
(b) A species that is formed in one step and used up in a latter step is an intermediate.
(c) The species which is not participate in any step is act as a catalyst.
(d) Neither intermediates nor catalyst are seen in the overall reaction rate law.

37. Which of the following statement / (s) is / are true?

(a) The most stable allotropic form of sulfur is crystalline sulfur.
(b) Water is amphioprotic because water can either donate or accept a proton.
(c) H_2O_2 is a viscous liquid due to the extensive hydrogen bonding.
(d) Hot conc. H_2SO_4 acid can act as a reducing agent.

38. Which of the following statement /(s) is / are not true regarding the electronegativity of an element in a compound. ?

(a) Electronegativity increases when the s character increases.
(b) Electronegativity is maximum when there is no charge on atoms (zero) when s character is constant.
(c) Electronegativity is maximum when the positive nature of oxidation number increases despite increases of $s-$ character.
(d) When the $s-$ character, charge, oxidation number are same, it is need to consider the nature of atoms which are attached to the relevant atom.

39. Which of the following statement /(s) is / are true.

(a) Pressure of an ideal gas is proportional to mean square velocity of molecules at given temperature.
(b) Pressure of a real gas is higher than the pressure of ideal gas.
(c) Vander Waals equation is applicable for real gaseous at high temperatures and low pressures only.
(d) Ideal gases can liquify by cooling and compressing.

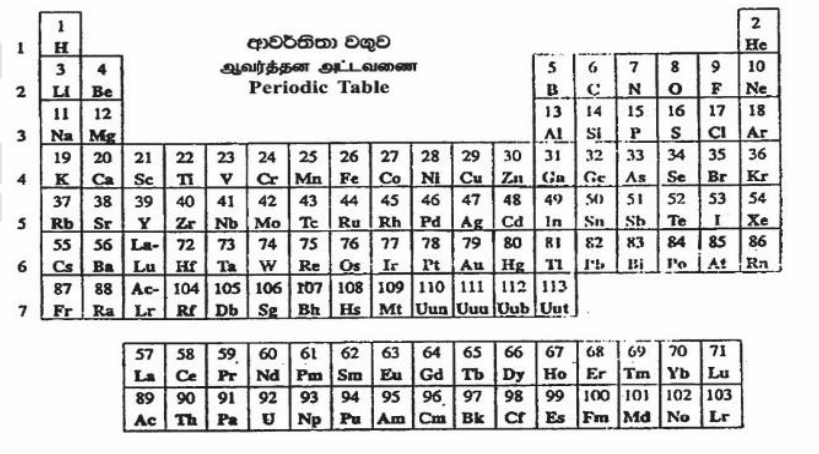
40. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta H^\theta < 0$, According to the above reaction NH_3 can be produced by reacting $N_2(g)$ and $H_2(g)$. Which of the following statement/(s) is / are true?

(a) High temperatures are suitable for the production of NH_3.
(b) Entropy change of the above reaction is negative.
(c) NH_3 production is spontaneous at low temperatures.
(d) Since the entropy change of this reaction is positive, NH_3 production is spontaneous at all temperatures.

- **In question numbers 41 to 50, two statements are given in respect of each question. From the table given below, select the response out of the responses (1), (2), (3), (4) and (5) that best fits the two statements and mark appropriately on your answer sheet.**

1st Statement	2nd Statement	Response
True	True and 1st statement is explained correctly	1
True	True and 1st statement is not explained correctly	2
True	False	3
False	True	4
False	False	5

	Statement 01	Statement 02
41.	All $Cl-O$ bond lengths in ClO_4^- is identical.	ClO_4^- is a hybrid of four stable resonance structures.
42.	Basicity of $C_6H_5NH_2$ is lower than that of CH_3CONH_2	Lone pair on N in $C_6H_5NH_2$ delocalized with the benzene ring.
43.	Molar volume of any gas is same at given temperature and pressure.	Volume of one mole of real gas at $0^0\ C$ and at $1\ atm$ is not equal to $22.4\ dm^3\ mol^{-1}$
44.	Nitrobenzene can be subjected to alkylation easily.	Nitro groups deactivate the benzene ring.
45.	Molecularity cannot be zero, negative, fractional, infinite and imaginary.	Molecularity of an elementary reaction is the minimum number of molecules or ions in reactant / (s) required for the reaction to occur.
46.	Boiling points of NO and O_2 are approximately equal.	Strength of intermolecular attractions among NO is higher than that of O_2.
47.	Colour of $[Mn(H_2O)_6]^{2+}$ is light pink while the colour of $[Ni(H_2O)_6]^{2+}$ is green.	If the ligand and the oxidation number of the central atom is same, Colour of the complex change when the metal ion change is,
48.	$CO(g)$ as well as $CO_2(g)$ are acidic gaseous.	$CO_2(g)$ condensed at high temperatures and high pressures due to London forces.
49.	Critical temperature of a substance is the maximum temperature at which the vapour of that substance liquify by applying high pressure.	The critical pressure of a substance is the pressure required to liquefy a vapour at critical temperature.
50.	All 4 carbon atoms of $but-2-enal$ exist in same straight line.	All C atoms of $but-2-enal$ are sp hybridized.



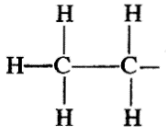
First Term Test - Grade 13 - 2020

Index No : .....

Chemistry II

Three Hours

* *A Periodic Table is provided on page* 16.
* ***Use of calculators is not allowed.***
* *Universal gas constant,* $R = 8.314\ J\ K^{-1}\ mol^{-1}$
* *Avogadro constant,* $N_A = 6.022 \times 10^{23}\ mol^{-1}$
* **In answering this paper, you may represent alkyl groups in a condensed manner.**

Example:  group may be shown as CH_3CH_2-

❑ PART A — Structured Essay (pages 2 - 8)

* *Answer* ***all*** *the questions on the question paper itself.*
* *Write your answer in the space provided for each question. Please note that the space provided is sufficient for the answer and that extensive answers are not expected.*

❑ PART B and PART C — Essay (pages 9 - 15)

* *Answer* ***four*** *questions selecting* ***two*** *questions from each part. Use the papers supplied for this purpose.*
* *At the end of the time allotted for this paper, tie the answers to the three Parts* **A, B** *and* **C** *together so that Part* **A** *is on top and hand them over to the Supervisor.*
* *You are permitted to remove* **only** *Parts* **B** *and* **C** *of the question paper from the Examination Hall.*

For Examiner's Use Only

Part	Question No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	
Total		

Final Mark

In Numbers	
In Letters	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by :	
Supervised by :	

Part A - Structured Essay

(01) (a) Consider the following element and answer the following question given below.

Al , Si , Cl , Sc , Cr , S , N , Zn

(i) 1. The element which formed a coloured amphoteric oxide with +3 oxidation state.

.....

2. What is the colour of that oxide. .....

3. Write the chemical formula of that oxide. .....

(ii) The stable cation of an element form a white gelatinous precipitate with aq. $NaOH$.

1. Identify the element.

.....

2. Write the chemical formulae of the product obtained when that precipitate react with excess $NaOH$.

.....

(iii) 1. Identify the element which form an oxide with high melting point. .....

2. Write the balanced chemical equation hydrolysis of the chloride of that element with less water.

.....

(iv) 1. Identify the element which show disproportionate reaction with cold $NaOH(aq)$.

.....

2. Write the balanced chemical equation for above (1).

.....

(v) 1. What is the element, where its Chloride react with water to produce two acids giving milky coloured solution.

.....

2. Identify the balanced chemical equation for the above (I).

.....

(vi) 1. Identify the element which is not a transition element.

.....

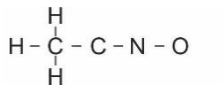
2. Write the balanced chemical equation for reaction with that stable ion of above element with limited $NaOH$.

.....

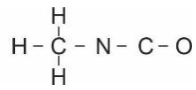
(b) Consider the molecule C_3H_3NO. (methyl isocyanate)

(i) 1. Draw the most acceptable Lewis structure of C_3H_3NO considering its skelton as.

(a)



(b)

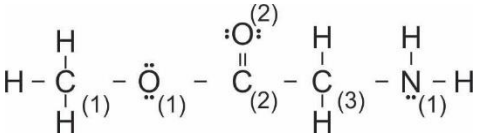


(ii) Draw other three (3) possible resonance structures for(a). Mention the most unstable structure.

(iii) Draw other two (2) possible resonance structure for (b).

(iv) Based on the Lewis structure given below, state the following regarding atoms given in the table below.

i. VSEPR pairs around the atom (repulsive units)
ii. Electron pair geometry around the atom
iii. Shape around the atom
iv. Hybridization of the atom
v. Valency of the atom



	C_2	C_3	O_1	N
i. VSEPR pairs				
ii. Electron pair geometry				
iii. Shape				
iv. Hybridization				
v. Valency				

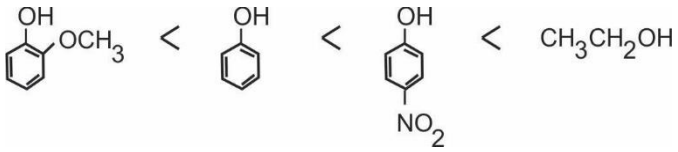
(v) Identify the atomic / hybrid orbitals involved in the formation of the following σ/π bonds in the Lewis structure given in (iv) above.

i. $C_2 - O_1$ (σ bond) C_2 ..... O_1 .....
ii. $C_2 - C_3$ (σ bond) C_2 ..... C_3 .....
iii. $C_2 - O_2$ (π bond) C_2 ..... O_2 .....
iv. $C_3 - N$ (σ bond) C_3 ..... N .....

(C) Mention following statements are true / false.

(i) Boiling point of H_2O_2 is higher than that of NH_3 .....

(ii) Following is the correct increasing order of acidity of given compounds.



.....

(iii) $N - O$ bond length in NO is shorter than that in NO_3^- .....

(iv) Covalent nature of $CsCl$ is lower than that of CsI .....

(02) (a) X and Y are two P block elements belong to the some group of consecutive periods of periodic table.
Oxo acid A, formed with the highest oxidation state of X is unstable to light. Hydrolysis of Chlorides B, C derived from Y form acidic solutions.
Oxidation number of Y in B > Oxidation number of Y in C

(i) Identify X , Y , A , B and C.
X : ..... Y : .....
A : ..... B : .....
C : .....

(ii) Draw the Lewis structure of oxo acid formed by X .

(iii) a) Write the balanced chemical equation for the decomposition of A in the presence of light.

b) Mention suitable method to store A in the laboratory.

(iv) Write balanced chemical equation to,
Hydrolysis of B

.....

Hydrolysis of C

.....

.....

(v) Hydride formed by X is D. Write balanced chemical equation each to show following properties of D ?

a) D as an acid.

b) D as an oxidizing agent.

c) D as an reducing agent.

(vi) Chloride of X is used as water disinfecting agent.

a) What is the main component used in above process.

.....

b) Write the balanced chemical equation for the above hydrolysis reaction

.....

(vii) Excess amount of aqueous solution of D was allowed to react with aqueous solution E, which contains a cation of d block.
Observation – deep blue solution.

a) What is the d block cation in E.

.....

b) Write the IUPAC name of that cation.

.....

c) Write balanced chemical equations for the above cation.

I. With limited D(aq)

.....

II. With Excess D(aq)

.....

(viii) I. Write the observation when you add $NaOH\ (aq)$ to an aqueous solution of E.

.....

II. What is the main product.

.....

(b) Element X is a d block element and one oxo anion formed by that element pocess the highest possible oxidation state among other d block compounds.

I. Identify X.

.....

II. Write the condensed electron configures of that element.

.....

III. Following sequence of experiments were done to a solution containing above oxo anion. Complete the following table.

	Experiment	**Observation**	**Species responsible for the observation**
(1)	Dilute solution containing above oxo anion was taken to a boiling tube.		
(2)	About 2 cm^3 sample of above solution was taken and acidified slightly and add $conc.KOH$ dropwise.		
(3)	Add few drops of H_2O_2 in to the solution in (2)		
(4)	Add few drops of $conc.HCl$ to the above solution.		

IV. Write balance half ionic equal for the reaction in (3).

.....

(03) (a) (i) Write two essential characteristics of a primary standard.

.....

.....

(ii) Write one compound which is used as a primary standard.

.....

(iii) $25.0\,cm^3$ of $0.04\,mol\,dm^{-3}$ KIO_3 solution was taken in to a titration flask and add $20.0\,cm^3$ H_2SO_4 acid followed by $10.0\,cm^3$ of KI solution . $22.50cm^3$ of $Na_2S_2O_3$ solution was required when observing the colour change at the end point.

I. Write balanced ionic equations for the reactions takes place in above titration.

.....

.....

II. Calculate the amount of I_2 produce when KI react with KIO_3.

.....

.....

.....

.....

III. What is the amount of moles of $S_2O_3^{-2}$ reacted.

.....

.....

.....

.....

IV. Determine the concentration of $S_2O_3^{2-}$ solution used.

.....

.....

.....

.....

.....

V. i. What is the indicator use in this titration?

.....

ii. What is the colour change takes place at the end point.

.....

iii. When do you add the indicator in this experiment.

.....

.....

iv. What is the reason for (iii) above.

.....

.....

v. Why can't you use the hydrated KIO_3 in this reaction .

.....

(b) Consider the following date given at the $25^0\ C$.

Substance	s^θ / J K^{-1} mol $^{-1}$
$Cl\ NO_{2(g)}$	272.00
$NO(g)$	211.00
NO_2	240.00
$ClNO(g)$	262.00

Substance	ΔH_f^θ / J K^{-1} mol $^{-1}$
$Cl\ NO_2$	12.5
$NO(g)$	90.00
NO_2	33.00
$ClNO(g)$	52.00

(i) Calculate (ΔH^θ) for the above reaction?

(ii) Calculate (ΔS^θ) for the above reaction?

(iii) Determine whether the above reactions is spontaneous or not at $25^0\ C$ using suitable calculation.

(04) Compounds A, B, C, D, E and F are structural isomers of each other having the molecular formula $C_5H_{10}O$.

- All compounds react with 2 , 4 – DNP to give yellow – orange precipitate.
- Only A, B and C give silver mirror with $NH_3 \,/\, AgNO_3$ while C shows optical isomerism.
- Same compound G, is produced when D and E was allowed to react with $LiAlH_4$ / ether followed by hydrolyses and dehydrate with conc. H_2SO_4/Δ .
- E is a symmetrical molecule.
- When A and B was allowed to react with $LiAlH_4$ / ether followed by hydrolyses and dehydrate with conc. H_2SO_4/Δ , only B gives a optically active compound.

(i) Identify A, B, C, D, E, F and G.

A

B

C

D

E

F

G

(ii) What is the isomerism shown by G.

Draw its isomeric structures in following boxes and name them.

(iii) Write the main product of following reactions.

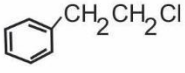
D. $\xrightarrow{Zn(Hg)/Conc.\,Hcl}$ H

F. $\xrightarrow[\text{II. } H^+ / H_2O]{\text{I. } CH_3MgBr \,/\, \text{Dry ether}}$ I

H I

(iv) Write how you can distinguish I with the product obtained whey A react with CH_3MgBr, H^+ / H_2O

(b) The reactant and reagent in each of the reactions 1 – 5 are given in the table balow. For each reaction write the reaction type. (Nucleophilic addition (A_N) , Electrophilic addition (A_E) , Nucleophilic substitutes (S_N) , Electrophilic Substation (S_S) , Elimination (E) , Oxidation (O)) and the major product in the relevant boxes.

	Reacted	Reagent	Reaction Type	Major Product
01	$CH_3CH_2-\overset{O}{\overset{\|\|}{C}}-H$	HCN		
02		Conc. H_2SO_4 / Conc. HNO_3		
03	$CH_3CH=CH_2$	Conc. H_2SO_4		
04		NaOH (aq)		
05	$CH_3-\overset{H}{\underset{OH}{\overset{\|}{\underset{\|}{C}}}}-CH_3$	PCC		

First Term Test – 2020
Chemisty 13 – II - PART B

- **Answer two question only (Each question carries 15 mark)**

(05) (a) R.A.M. of Mg is determined experimentally using the molar mass of $H_2(g)$. For that known mass of Mg was allowed to react with $dil.HCl$ acid and H_2 gas obtained is collected by the downword displacemt of water. Following are the collection of readings obtained.

Mass of the Mg strip	=	$0.05\ g$
Volume of H_2 collected	=	$54cm^3$
Room temperature	=	$27^0\ C$
Pressure	=	$750\ mm\ Hg$
Saturated vapour pressured of H_2O at 27^0C	=	$26.7\ mm\ Hg$

I (i) What are the gases which do not react with water?
(ii) Among the metals K, Ag, Zn, Cu, Al ,
1. Mention two other metals which can use for the above experiment?
2. Mention two metals which could not be used for the above experiment. Write the reason briefly.

(iii) Write the name of the apparatus used to do the above experiment?
Write suitable apparatus which could be used instead of above from the laboratory

II (i) Write the balanced chemical equation between Mg and dil. HCl.
(ii) What is the pressure of the dry H_2 gas collected.
(iii) Write the name of the law which is used for the above calculation.
(iv) What is the reason for the pressure of dry H_2 gas collected is not equal to the atmospheric pressure of that moment.
(v) Calculate the r.a.m. of Mg using above readings.
(760 mmHg $= 1$ x 10^5 Pa)

(b) (i) Write the Avogadro's law.
(ii) If the density of gas is (d) and molor mass of that is (M) Use above law to show $M = k\ d$.
$K -$ is a constant.

III Neon gas mainly consist with two natural isotopes $^{20}_{10}Ne$ and $^{22}_{10}Ne$. Natural abundance of them as molar percentages are 90% and 10% respectively. 100mol of Natural Neon gas was placed inside a rigid vessel at $27^0\ C$. Pressure of the vessel is 8.314 x 10^5 Pa .
(i) Calculate the partial pressures exerted by each gas inside the vessel.
(ii) Calculate r.a.m. of Ne.
(iii) Calculate the density of the gaseous mixture.
(iv) Calculate the density of the gaseous mixture when the pressure of the vessel increases to 8.314 x 10^6 Pa without changing the temperature.

(06) (a) (i) Write three factors which effect the rate of a reaction.

(ii) Select one of the above factor and explain briefly how it effects the rate of a reaction using the collision theory.

(iii) Chlorination of Methane takes place in the presence of diffused sunlight while the reaction between $F_2\ (g)$ and Methane takes place rapidly at dark. Explain the above incident briefly.

(b) (I) Consider the reaction $2P + Q \rightarrow 3R$

Readings obtained at the reaction was done as follows at $300K$.

Experiment Number	$[P]/mol\ dm^{-3}$	$[Q]/mol\ dm^{-3}$	Rate $/[P]/mol\ dm^{-3}$
I	0.1	0.1	2.4×10^{-2}
II	0.1	0.5	2.4×10^{-2}
III	0.2	0.1	4.8×10^{-2}

(i) Express the rate law for the reaction.

(ii) Calculate the order with respect to each reactant.

(iii) What is the overall order.

(iv) Calculate the rate constant at $300K$.

(II) It all above experiments were done after keep all the conditions same and increase the temperature to $600K$. Compare values of (I) above regarding following and state whether they change or not,

(i) Rate of the reaction. (ii) Overall order. (iii) Rate constant

(III) Propose a suitable mechanism for the above reaction.

(IV) Half-life of this reaction is 12 minutes. What is the concentration of P remains in the third test tube after 30 minutes.

(c) (i) Consider the equilibrium system A $\rightleftharpoons$ B , Initially only A exist in the system After t time system reach to the equilibrium. Draw the graph of time vs the rate

(ii) Write the expression for the equilibrium constant k_P for the following equilibrium system. $2A(g) + B(g) \rightleftharpoons C(s) + 2D(g)$

(iii) Derive an expression for the above equilibrium system for k_C using k_P.

(07) (a) Use the following data for the given calculations.

Bond	$\Delta H_D^{\theta}\ / kJmol^{-1}$
$C = O$	743
$O - H$	463
$H - H$	436
$C - H$	412

(i) Calculate the standard reaction enthalpy of the reaction.

$CO(g) + H_2O\ (g) \rightarrow CO_2\ (g) + H_2(g)$.

(ii) Calculate the atomization enthalpy of $C_{(s,\ graphit)}$, if the standard formation enthalpy of $CH_4\ (g)$ is $-75\ kJ\ mol^{-1}$.

(b) (i) Calculate the standard dissolution enthalpy of $NaCl\ (s)$ using given data.

Ion	Standard hydration enthalpy $(kJ\ mol^{-1})$
Na^+	-399
Cl^-	-381

Standard lattice dissociation enthalpy of $NaCl\ \ (s)$ is $769\ kJ\ mol^{-1}$.

(ii) Explain briefly $NaCl$ dissolves easily in water whether the dissolution of $NaCl$ is a endothermic reaction.

(c) Impure sample of H_2O_2 solution of $0.01\ g\ cm^{-3}$ density, was allowed to react with $20\ cm^3$ of $0.316\ g$ of $KMnO_4(s)$ in acidic medium.
Solution obtained at the end of reaction was titrated with $0.25\ mol\ dm^{-3}\ Na_2C_2O_4$ solution and the amount consumed was in $12\ cm^3$ acidic medium.

(i) Write balanced chemical equations for all the reaction.

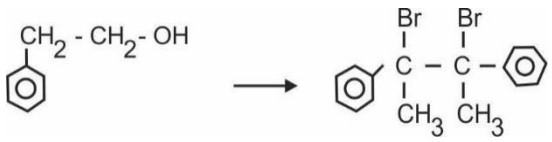
(ii) 1. Find the moles of H_2O_2 in the initial solution.

2. Calculate the percentage of H_2O_2 in the initial solution.

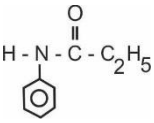
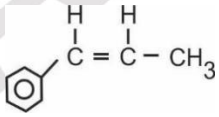
Part - C ESSAY

- **Answer two question only (Each question carries 15 marks)**

(08) (a) Show how you would carry out the following conversion in not more than eight (8) steps by using only the suitable reagents in the list given below.



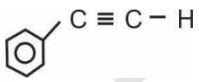
Reagents - dil. H_2SO_4 , HBr , cons. H_2SO_4 , Br_2 , Mg , dry ether, H_2O , acidic $KMnO_4$

(b) Use  as the only organic reagent and synthesis 

Using minimum number of steps.

(c) (i) Explain how you can distinguish following pairs of compounds.

1. $CH_3CH = CHCH_3$ and $CH_3CH_2CH = CH_2$

2. $HC \equiv CH$ and 

(ii) 1. Write the mechanism for the reaction between CH_3CH_2OH and HBr .

2. What is the type of this reaction.

3. What is the leaving group of this reaction.

(09) (a) Following tests were carried out for salt A and observations obtained were given in the table below.

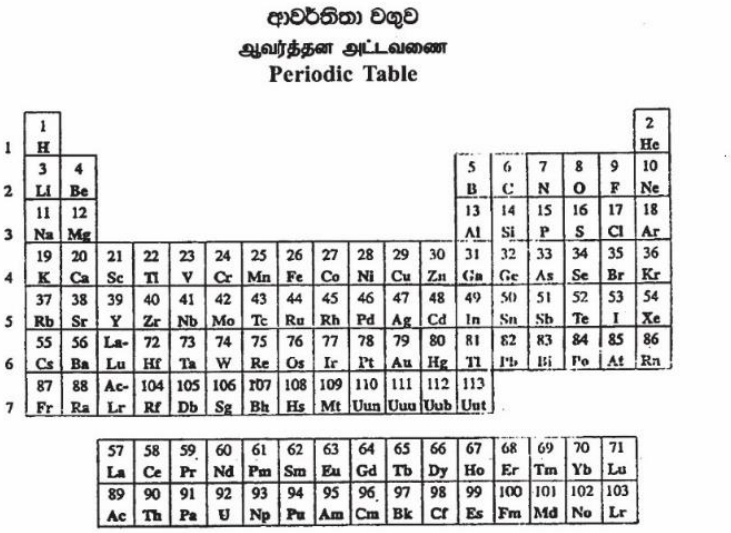
Experiment	Observation
1. Add dil. HCl in to the salt A and heat.	Obtained a colourless solution and no evolution of a gas.
2. Bubbling $H_2S\ (g)$ in to the solution obtained in (1) above.	Obtained a orange coloured precipitate (P)
3. Add aqueous $NaOH$ in to the salt A and heat.	No evolution of gas.
4. Add Al powder with $aqueous\ NaOH$ in to the salt A and heat.	The gas evolved (Q) turns the filter paper dipped with Nestler reagent to brown.
5. Add $HCl + H_2O$ to the salt.	Obtained a white precipitate (R)

(i) Identify P. Q and R explaining the observations obtained in the above experiments.
(ii) Write the formula of the salt A.
(iii) Write other experiment which can be used to identify the anion in salt A.

(b) Solution X contain Fe^{2+} ions and $C_2O_4^{2-}$ ions. $40\,cm^3$ of $0.1\,moldm^{-3}K_2Cr_2O_7$ was required to react completely with $25\,cm^3$ of above solution under acidic conditions. Mass of precipitate obtained when aqueous Na_2CO_3 is added to $25\,cm^3$ sample taken from X is $0.116g$.
(i) Write the balanced ionic equations for the reactions of Fe^{2+} and $C_2O_4^{2-}$ with $K_2Cr_2O_7$ in acidic medium.
(ii) Calculate the concentrations of Fe^{2+} and $C_2O_4^{2-}$ in solution X.
(iii) Write one experiment each to identify the existence of Fe^{2+} and $C_2O_4^{2-}$ ions in the solution X. (fe - 56, C- 12, O-16, Na – 23)

(10) (a) A, B and C are salt solutions of $3d$ elements in the periodic table. Observations obtained, when $NaOH$ solution added separately in to each salt solution are given below.
A Obtained a white precipitate which is soluble with excess $NaOH$ and with excess aqueous NH_3 .
B Obtained a light blue precipitate, Insoluble in excess $NaOH$ solution and soluble in excess aqueous NH_3 solution.
C Obtained a green colour solution, Insoluble is excess $NaOH$ solution as well as excess NH_3 solution.
(i) Identify cations in A, B and C.
(ii) Write formulae of coloured species obtained in A, B and C.
(iii) Write the $IUPAC$ names of species formed in A, B and C. Mention the shapes of them.
(iv) What do you observe when each solution is acidified with dil. HCl and bubble $H_2S\,(g)$. Explain the reason for that.

(b) Compound X contain 29% of Hydrogen, 56% of Flourine, 10.6% Boron and 30.5 % of phosphorous. (r.a.m. $F = 19, P = 31, B = 11, H = 1$)
(i) Find the empirical formulae of X.
(ii) Find the molecular formula of X If there are three H atoms in one molecule of X.
(iii) If molecule X derived from a Lewis acid and a Lewis base, mention the structure of that.



Grade 13 - First Term Test 2020
Chemistry
Marking Scheme

Part I

(1) – 2	(11) – 1	(21) – 5	(31) – 2	(41) – 1
(2) – 5	(12) – 4	(22) – 4	(32) – 4	(42) – 4
(3) – 2	(13) – 3	(23) – 3	(33) – 3	(43) – 4
(4) – 5	(14) – 5	(24) – 4	(34) – 5	(44) – 4
(5) – 3	(15) – 1	(25) – 3	(35) – 2	(45) – 1
(6) – 2	(16) – 3	(26) – 2	(36) – 5	(46) – 4
(7) – 4	(17) – 3	(27) 4	(37) – 2	(47) – 1
(8) – 4	(18) – 2	(28) – 2	(38) – 2	(48) – 5
(9) – 4	(19) – 3	(29) – 3	(39) – 5	(49) – 2
(10) – 3	(20) – 2	(30) – 2	(40) – 2	(50) – 3

Structured Essay

Part A.

(a) (i) I Cr
II Green
III Cr_2O_3

(ii) I Al
II $Na[Al(OH)_4]$ / $NaAlO_2$

(iii) I Si
II $SiCl_4 + H_2O \longrightarrow 4HCl + SiO_2$

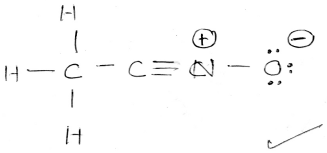
(iv) I Cl
II $Cl_{2(g)} + NaOH_{(aq)} \xrightarrow{\text{Cold dil}} NaCl_{(aq)} + NaOCl_{(aq)} + H_2O_{(l)}$

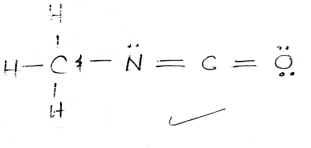
(v) I S
II $SeCl_2 + H_2O \longrightarrow H_2SO_3 + S + HCl$

(vi) I Zn
II $[Zn(H_2O)_6]^{2+} + 2OH^- \longrightarrow Zn(OH)_2 + 6H_2O$

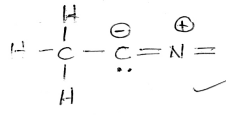
2 × 13 = 26

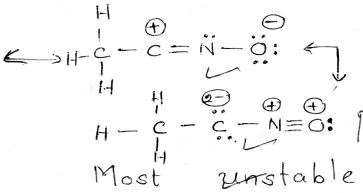
(b) I a) CH_3CNO CH_3NCO





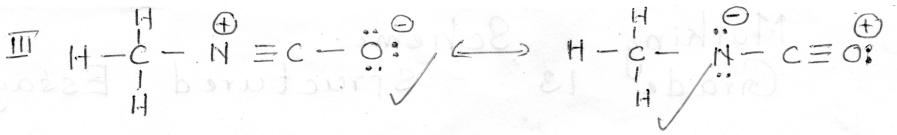
00

II 



Most unstable. (1)

10

III 

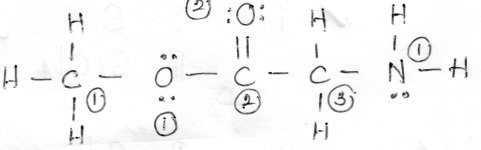
08

IV

	C_2	C_3	O_1	N
I	3	4	4	4
II	Trigonal Planer	Tetrahedral	Tetrahedral	Tetrahedral
III	Trigonal Planer	Tetrahedral	Angular	Pyramidal.
IV	sp^2	sp^3	sp^3	sp^3
V	4	4	2	3

20

(C) I False
II True
III True
IV False.



$3 \times 4 = 12$

V (I)

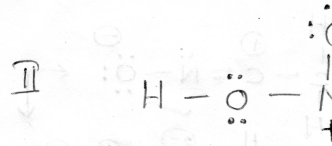
C_2 (σ)	sp^2 h.o	O_1	sp^3 h.o.
C_2 (σ)	sp^2 h.o	C_3	sp^3 h.o.
C_2 (π)	2p n.h.o	O_2	2p. u.h.o.
C_3 (σ)	sp^3 hy.o	N.	sp^3 h.o.

08

02 I

X – N
Y – P
A – HNO_3.
B – PCl_5 or (PCl_5)
C – PCl_3 or (PCl_3).

2x5
10

II 

03

III a) $4\,HNO_{3(aq)} \xrightarrow{h\nu} 4NO_{2(g)} + O_{2(g)} + 2H_2O_{(l)}$

04

b) Store in dark bottles.

02

(2)

IV $PCl_3(l) + 3H_2O(l) \longrightarrow H_3PO_3(aq) + 3HCl$ 02
(Excess water).

$PCl_5(s) + H_2O(l) \longrightarrow POCl_3(aq) + 2HCl(aq)$
less water

$PCl_5(s) + 4H_2O(l) \longrightarrow H_3PO_4(aq) + 5HCl(aq)$
excess water.

09

(V) (a) $2Na(s) + 2NH_3(l) \longrightarrow 2NaNH_2(l) + H_2(g)$
OR
$3Mg(s) + 2NH_3(l) \longrightarrow Mg_3N_2(l) + 3H_2(g)$.

(b) Any reaction from (a) above.

(c) Excess
$2NH_3(g) + 3Cl_2(g) \longrightarrow N_2(g) + 6HCl(g)$
OR
Excess
$Cl_2(g) + NH_3(g) \longrightarrow 3HCl(g) + NCl_3(l)$
OR
$3CuO(s) + 2NH_3(g) \longrightarrow N_2(g) + 3Cu(s) + 3H_2O(g)$
OR
$2NH_3(g) + 3Cl_2(g) \longrightarrow N_2(g) + 6HCl(g)$.

5x3 = 15

VI (a) HOCl

(b) $NCl_3(l) + 3H_2O(l) \longrightarrow NH_3(g) + 3HOCl(aq)$

02+04 = 06

VII (a) $[Cu(H_2O)_6]^{2+}$

(b) hexaaquacopper(II) ion.

02x2 = 04

(A)

(3)

(c)

I $[Cu(H_2O)_6]^{2+}(aq) + 2NH_3(aq) \longrightarrow Cu(OH)_2(s) + 2NH_4^+(aq) + 4H_2O(l)$

II $[Cu(H_2O)_6]^{2+} + 4NH_3(aq) \longrightarrow [Cu(NH_3)_4]^{2+}(aq) + 6H_2O(l)$

$6 \times 2 = 12$

VIII I blue precipitate.

II $Cu(OH)_2$.

$02 \times 2 = 04$

(b) I Mn

II $[Ar]\,4s^2 3d^5$

$02 \times 2 = 04$

III

	Observation.	Substance Responsible for the observation.
I	purple coloured solution.	$KMnO_4$ / $MnO_4^-(aq)$
II	Dark green colour.	$[MnO_4]^{2-}(aq)$
III	Brown precipitate	$MnO_2(s)$
IV	Colourless / pale pink solution	$Mn^{2+}(aq)$

$3 \times 03 = 09$

IV [illegible]

03

(03) (a) (i) High purity.
Low hygroscopicity (to minimize weight change due to humidity.
Stable
Have high molecular weight

02x02 = 04

(ii) $K_2C_2O_4$.

03

(iii) I $IO_3^-(aq) + 5I^-(aq) + 6H^+(aq) \longrightarrow 3I_2(aq) + 3H_2O(l)$

$2S_2O_3^{2-}(aq) + I_2(aq) \longrightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$

02x03 = 06.

II $n_{IO_3^-} = 0.04\ mol\,dm^{-3} \times 25\times10^{-3}\ dm^3$

$= 1\times10^{-3}\ mol\ (0.001\ mol)$.

04x3 = 12

III $\frac{n_{IO_3^-}}{n_{I_2}} = \frac{1}{3}$

$n_{I_2} = 0.003\ mol\ (3\times10^{-3}\ mol)$.

04x03 = 12

III $\frac{n_{I_2}}{n_{S_2O_3^{2-}}} = \frac{1}{2}$

$n_{S_2O_3^{2-}} = 0.006\ mol$.

04x3 = 12

IV $C_{S_2O_3^{2-}} = \frac{0.006\ mol}{22.5\times10^{-3}\ dm^3}$

$= 2.67\times10^{-4}\ mol\,dm^{-3}$

04x3 = 12

(v) I Starch

II deep blue to colourless

III When contents in the titration flask is pale yellow. (Near the end point).

IV To give sharp end point (Avoiding the formation of excess starch-I_3^- / Iodine complex)

V It loses water of crystals and it is not stable.

02 x 05 = 10

(b) $ClNO_{2(g)} + NO_{(g)} \longrightarrow NO_{2(g)} + ClNO_{(g)}$

i) $\Delta H^\ominus = \sum H^\ominus$ products $- \sum H^\ominus$ reactants.

$= \{1 \times \Delta H_f^\ominus NO_{2(g)} + 1 \times \Delta H_f^\ominus (ClNO_{(g)})\} - \{1 \times \Delta H_f^\ominus (ClNO_{2(g)}) + 1 \times \Delta H_f^\ominus (NO_{(g)})\}$

$= (+2\ kJ\ mol^{-1} + 33\ kJ\ mol^{-1}) - (12.5\ kJ\ mol^{-1} + 90.25\ kJ\ mol^{-1})$

$= (85\ kJ\ mol^{-1} - 102.75\ kJ\ mol^{-1})$

$= \underline{-17.75\ kJ\ mol^{-1}}$

2 x 5 = 10

(ii) $\Delta S^\ominus = \sum S^\ominus$ products $- \sum S^\ominus$ reactants.

$= (262\ JK^{-1}mol^{-1} + 240\ JK^{-1}mol^{-1}) - (272\ JK^{-1}mol^{-1} + 211\ JK^{-1}mol^{-1})$

$= 502\ JK^{-1}mol^{-1} - 483\ JK^{-1}mol^{-1}$

$= \underline{19\ JK^{-1}mol^{-1}}$

2 x 4 = 08

(iii) $\Delta G^\ominus = \Delta H^\ominus - T\Delta S^\ominus$

$= -17.75\ kJ\ mol^{-1} - (298\ K \times 19 \times 10^{-3}\ kJ\ K^{-1}mol^{-1})$

$= -17.75 - 5.662\ kJ\ mol^{-1}$

$= -23.412\ kJ\ mol^{-1}$

2 x 4 = 08

$\Delta G^\ominus < 0$ Reaction is spontaneous //

03

(5)

(04) (a) I $C_5H_{10}O$ 04

A $CH_3CH_2CH_2CH_2-\overset{O}{\overset{\|}{C}}-H$

B $CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-\overset{O}{\overset{\|}{C}}-H$

C $CH_3CH_2-\underset{CH_3}{\overset{H}{\overset{|}{C}}}-\overset{O}{\overset{\|}{C}}-H$

D $CH_3CH_2CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

E $CH_3CH_2-\overset{O}{\overset{\|}{C}}-CH_2CH_3$

5X7 = 35

F $CH_3-\underset{CH_3}{\overset{H}{\overset{|}{C}}}-\overset{O}{\overset{\|}{C}}-CH_3$.

G. $CH_3CH_2CH=CHCH_3$

(ii) a) Geometric isomerism. 02

b) CH_3CH_2, H, H, CH_3 $\quad$ CH_3CH_2, H, H, CH_3.

cis 2-pentene $\quad$ trans 2-pentene. 16

iii) D $\longrightarrow$ $CH_3CH_2CH_2CH_2CH_3$. 04

F $\xrightarrow[(ii)\ H^+/H_2O]{(i)\ CH_3MgBo}$ I $\quad$ $CH_3-\underset{CH_3}{\overset{H}{\overset{|}{C}}}-\underset{CH_3}{\overset{OH}{\overset{|}{C}}}-CH_3$.

04

(iv) ~~How you distinguish I with A/B.~~

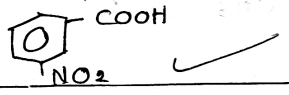
I. $\quad$ A $\xrightarrow[H^+/H_2O]{CH_3MgBr}$

↓ Lucas reagent

Instant turbidity ✓ Turbidity after few minutes. ✓

3×3 09

(b)

(1)	AN	$CH_3CH_2-\underset{CN}{\overset{OH}{C}}-H$ ✓
(2)	S_E	 ✓
(3)	AE	$CH_3\underset{OH}{CH}-CH_3$ ✓
(4)	S_N	 CH_3CH_2OH ✓
(5)	O	$CH_3-\overset{O}{\overset{\|\|}{C}}-CH_3$ ✓

3×10 30

01

Chemistry - Grade 13

Part B - Essay

Answer Script.

(5) (a) I i) $H_2/O_2/N_2/He/Ne/Ar$ CO_2

ii) 1- Al/Zn

2. Na/Ag/Ca.

Na - Reation rate is high may occur with explosion.

Ag/Ca - Do not react with dil HCl.

(iii) Eudiometer.

burette placed downward.

II (i) $Mg + 2\,HCl \longrightarrow MgCl_{2(aq)} + H_{2(g)}$.

(ii) $P_{H_2} = (750 - 26.7)\ mmHg$.

$= 733.3\ mmHg$.

(iii) Dalton's law of partial pressures.

(iv) H_2 collect from the downward displacement of water Due to the presence of water, pressure we measured is

$P = P_{H_2(g)} + P_{(H_2O(g))}$.

(v) $PV = nRT$

$0.96 \times 10^5\ Pa \times 54 \times 10^{-6}\ m^3 = n \times 8.314\ J\ mol^{-1}K^{-1} \times 300K$

$n = 0.0021\ mol.$

$P = \frac{723.3}{760} \times 1 \times 10^5$

$= 0.96 \times 10^5\ Pa.$ (01)

∴ Number of moles evolved = 0.0021 mol. 02

According to stoichiometry

moles of Mg = 0.0021 mol.

∴ Molar mass of Mg = $\frac{0.05g}{0.0021\ mol.}$

$= 23.8\ g\ mol^{-1}.$

∴ r.a.m of Mg = 23.8

(b) I i) Avagadro's Law:

ii) $PV = nRT$

$PV = \frac{m}{M} RT \qquad n = \frac{m}{M}$

$PM = \frac{m}{V} RT \qquad \frac{m}{V} = d.$

$PM = dRT$

$M = \frac{dRT}{P}$

Since it is considered gases Under same temperature pressure conditions

$M = dK$

$M = kd.$

(i) $P_{^{20}Ne} = X_{^{20}Ne} \times P$

$= \frac{9}{10} \times 8.314 \times 10^5 \text{ Pa}$

$= 7.48 \times 10^5 \text{ Pa}$.

$P_{^{22}Ne} = X_{^{22}Ne} \times P$

$= \frac{1}{10} \times 8.314 \times 10^5 \text{ Pa}$

$= 8.314 \times 10^4 \text{ Pa}$.

(ii) R.a.m of He $= \frac{20 \times 90 + 22 \times 10}{100}$

$= \frac{2020}{100} = \underline{\underline{20.2}}$

(iii) Volume of the vessel V

$PV = nRT$

$8.314 \times 10^5 \text{ Pa} \times V = 100 \text{ mol} \times 8.314 \text{ JK}^{-1}\text{mol}^{-1} \times 344 \text{ K}$

$V = \frac{3}{10} = \underline{\underline{0.3 \text{ m}^3}}$

(iv) $d = \frac{m}{V} = \frac{2020 \text{ kg}}{0.3 \text{ m}^3}$

$= \underline{\underline{6.73 \text{ kg m}^{-3}}}$

(v) $PM = dRT$

⑥ (a) (i) 03

(ii) Temperature / concentration (pressure) / physical nature.

(iii) Explanation.

(iii) for the chlorination of methane first / initial step;

$Cl_2 \longrightarrow 2Cl\cdot$

Activation energy is relatively larger value. To produce that energy reaction takes place under diffused sunlight.

But the activation energy for the reaction F_2 and Cl_2 is zero. There for it is not need to supply energy to initiate that reaction ant it takes place in dark conditions too.

(b) (i) Rate $= k[P]^x[Q]^y$

(ii) $2.4 \times 10^{-2}\ mol\,dm^{-3}s^{-1} = k(0.1\ mol\,dm^{-3})^x(0.1\ mol\,dm^{-3})^y$ - (1)

$2.4 \times 10^{-2}\ mol\,dm^{-3}s^{-1} = k(0.1\ mol\,dm^{-3})^x(0.5\ mol\,dm^{-3})^y$ - (2)

$4.8 \times 10^{-2}\ mol\,dm^{-3}s^{-1} = k(0.2\ mol\,dm^{-3})^x(0.1\ mol\,dm^{-3})^y$ - (3)

$\frac{(2)}{(1)}$ $\quad 1 = \left(\frac{0.5}{0.1}\right)^y$ $\qquad$ $\frac{(3)}{(1)}$ $\quad 2 = \left(\frac{0.2}{0.1}\right)^x$

$y = 0$ $\qquad$ $x = 1$.

(iii) Overall order $= 1 + 0 = 1$

(iv) (I) Substituting to (1)

$2.4 \times 10^{-2}\ mol\,dm^{-3}s^{-1} = K \times 0.1\ mol\,dm^{-3}$

$K = 2.4 \times 10^{-1}\ s^{-1}$

(4)

II i) Increasing
ii) No change
iii) Increase.

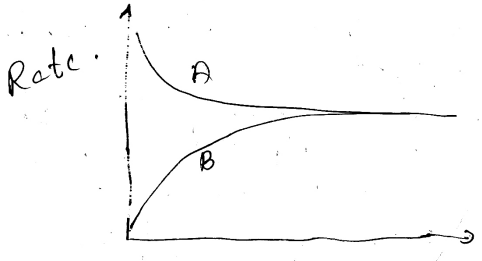
III $2P \longrightarrow A$ R.T.S.

$A + Q \longrightarrow 3R$

$2P + Q \longrightarrow 3R$ Overall reaction.

IV $0.0625\ mol\,dm^{-3}$
Half life is 12s.

(c) (i) $A \rightleftharpoons B$.



(ii) $2A_{(g)} + B_{(g)} \longrightarrow C_{(g)} + 2D_{(g)}$.

$K_p = \frac{(P_D)^2}{(P_A)^2 \times P_A}$.

(iii) $K_p = \dfrac{(P_D)^2}{(P_A)^2 (P_B)}$ —— (1)

$K_c = \dfrac{[D_{(g)}]^2}{[A_{(g)}]^2 [B_{(g)}]}$ —— (2)

$PV = nRT$

$P = CRT$

$C = \dfrac{P}{RT}$

$[D] = \dfrac{P_D}{RT}$ $\quad [A] = \dfrac{P_A}{RT}$

$[B] = \dfrac{P_B}{RT}$

Substituting to (2)

$$K_c = \frac{\left(\frac{P_D}{RT}\right)^2}{\left(\frac{P_A}{RT}\right)^2 \left(\frac{P_B}{RT}\right)}$$

$$= \frac{(P_D)^2}{(P_A)^2 (P_B)} \quad RT$$

$K_c = K_p \times RT$

07 (a)

(i) $CO(g) + H_2O(g) \xrightarrow{\Delta H} CO_2(g) + H_2(g)$.

$\Delta H_R^\ominus = \Sigma \Delta H_{D(\text{bonds broken})}^\ominus - \Sigma \Delta H_{D(\text{bonds forms})}^\ominus$.

$\Delta H_R^\ominus = \{\Delta H_{D(C\equiv O)}^\ominus + 2\Delta H_{D(O-H)}^\ominus\} - \{2\Delta H_{D(C=O)}^\ominus + \Delta H_{D(H-H)}^\ominus\}$

$= [1077 + 2\times463] - [2\times743 + 436]$ kJ mol^{-1}

$= (2003 - 1922)$ kJ mol^{-1}

$= 81$ kJ mol^{-1}.

(ii).

$C(s, \text{graphite}) + 2H_2(g) \xrightarrow{-75 \text{ kJ mol}^{-1}} CH_4(g)$

$\Delta H_{atm(C)}^\ominus + 2\Delta H_{D(H-H)}^\ominus$; $4\Delta H_{D(C-H)}^\ominus$

$C(g) + 4H(g)$

from Hess law

$\Delta H_{atm(C)}^\ominus + 2\Delta H_{D(H-H)}^\ominus = \Delta H_f^\ominus(CH_4(g)) + 4\Delta H_{D(C-H)}^\ominus$

$\Delta H_{atm(C)}^\ominus = (-75 + 4\times412 - 2\times436)$ kJ mol^{-1}

$= (-947 + 1648)$

$= 701$ kJ mol^{-1}.

(b) $\Delta H_L^\ominus(NaCl) = 787.3$ kJ mol^{-1}

$NaCl(s) + aq \xrightarrow{\Delta H^\ominus} Na^+(aq) + Cl^-(aq)$.

787.3 kJ mol^{-1} ; $\Delta H_{hyd}^\ominus = (-399 - 381)$ kJ mol^{-1}.

$Na^+(g) + Cl^-(g) + aq$

$\Delta H^\ominus = [(-339 - 381) + 787.3]$ kJ mol^{-1}

$= +3.3$ kJ mol^{-1}.

(7)

(ii) $NaCl_{(s)}$ dissolves in water 05

$NaCl_{(s)} + aq \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$.

$\Delta S > 0$

$\Delta G = \Delta H - T\Delta S$

To the reaction to be spontaneous

$\Delta G < 0$

$\Delta G = (+) - T(+)$.

ΔG is a small (+) value.

∴ At low temperatures also $\Delta G < 0$.

∴ NaCl dissolves easily.

(c) $2MnO_4^- + 5H_2O_2 + 16H^+ \longrightarrow 5O_2 + 2Mn^{2+} + 8H_2O$

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

Moles of $C_2O_4^{2-}$ consumed $= \frac{0.25}{1000} \times 12$

$= 3 \times 10^{-3}$ mol

∴ Number of MnO_4^- moles remains without reacting $= 3 \times 10^{-3} \times \frac{2}{3}$

$= 1.2 \times 10^{-3}$ mol

Total amount of KMnO4 used $= \frac{0.316\,g}{158\,g\,mol^{-1}}$

$= 0.002$ mol.

Reacted moles of $MnO_4^- = (2 \times 10^{-3} - 1.2 \times 10^{-3})$ mol

$= 8 \times 10^{-3}$ mol

∴ H_2O_2 moles in the solution $= 0.8 \times 10^{-3} \times \frac{3}{2}$ mol

$= 2 \times 10^{-3}$ mol.

Mass of $20\,cm^3$ of $H_2O_2 = 0.01\,g\,cm^{-3} \times 20\,cm^3$

$= 0.2\,g$.

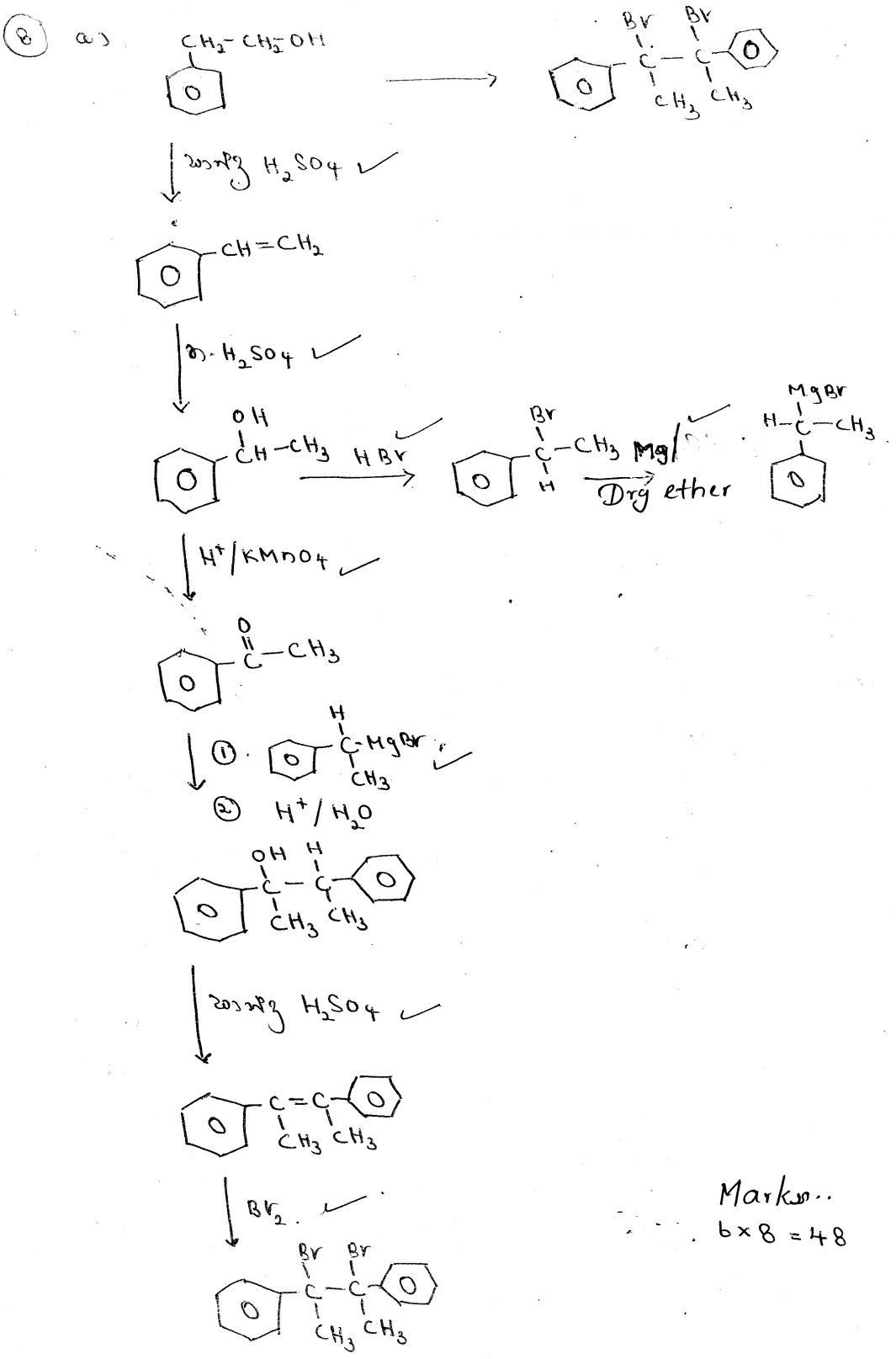
∴ percentage of $H_2O_2 = \frac{0.002}{0.2} \times 100$

$= 1\%$

Mn - 55
K - 39
O - 16.

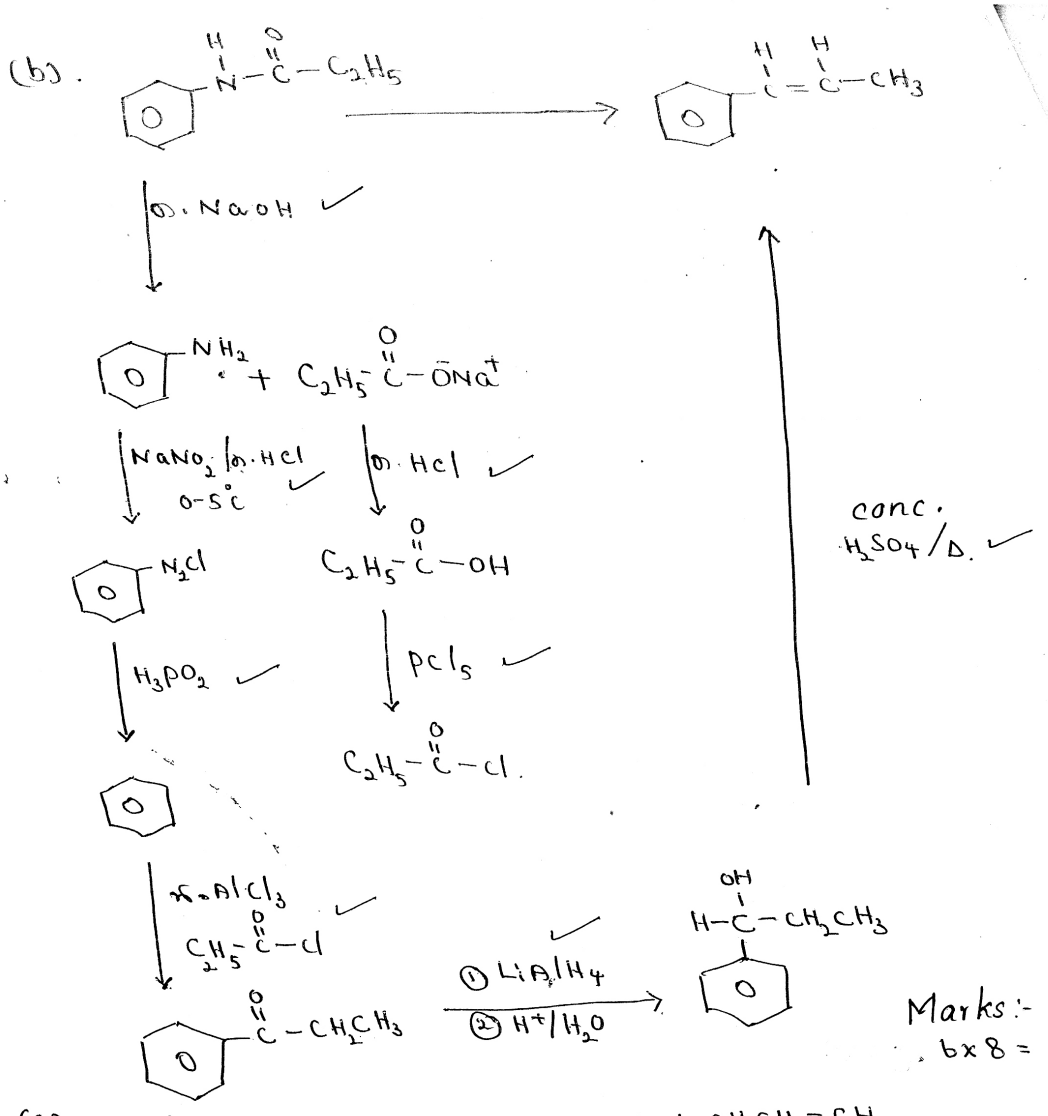
Chemistry - Grade 13
Answers.

(8) a)



Marks..
6 × 8 = 48

(b).



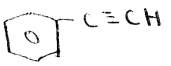
Marks :-
6 x 8 = 48

(c). I). $CH_3CH=CHCH_3$ or $CH_3CH_2CH=CH_2$

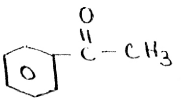
$CH_3CH=CHCH_3$ → (Br_2) → $CH_3CH(Br)-CH(Br)CH_3$ → (Δ. KOH) → $CH_3C\equiv C-CH_3$ → ($NH_3/AgNO_3$) → No observation.

$CH_3CH_2CH=CH_2$ → (Br_2) → $CH_3CH_2CH(Br)-CH_2(Br)$ → (Δ. KOH) → $CH_3CH_2C\equiv CH$ → ($NH_3/AgNO_3$) → White precipitate.

12 marks.

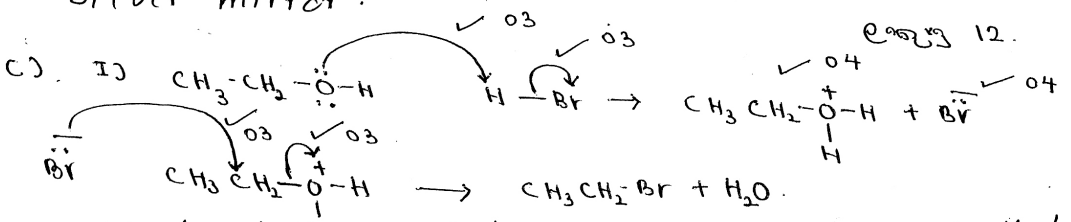
II). $HC\equiv CH$ ... 

$\downarrow Hg^{2+}/$ dil. H_2SO_4 ... $\downarrow Hg^{2+}/$ dil. H_2SO_4

$CH_3-C(=O)-H$ ... 

$\downarrow NH_3/AgNO_3$ ... $\downarrow NH_3/AgNO_3$

Silver mirror. ... No observation.

C) I) 

II) Nucleophilic substion. ... 20 Marks

III) H_2O. ... 05 Marks

05 Marks

Total 150 Marks

Experiment.

(9) (a) (i)

① - CO_3^{2-} / HCO_3^- / S^{2-} / HS^- / SO_3^{2-} / $S_2O_3^{2-}$ / NO_2^- ...

② - Orange colour ppt. - Sb_2S_3

Sb^{3+} contains (P).

③ - No NH_4^+ ions

④ - NO_3^- contains.

(Q) NH_3.

⑤ - SbOCl White Precipitate (R).

$5 \times 11 = 55$ Marks.

(ii). $Sb(NO_3)_3$. ... 10 marks

(iii)

First freshly prepared $FeSO_4$ (aq) is added to the ion containing solution and later pour conc. H_2SO_4 along the wall of the test tube. Can observe the brown ring at the surface. ... 10 marks

(b) (i) $6Fe^{2+} + 14H^+ + Cr_2O_7^{2-} \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$ ✓

$Fe^{2+} \rightarrow Fe^{3+} + e$

$6e + 14H^+ + Cr_2O_7^{2-} \rightarrow 2Cr^{3+} + 7H_2O$

$3C_2O_4^{2-} + 14H^+ + Cr_2O_7^{2-} \rightarrow 6CO_2 + 2Cr^{3+} + 7H_2O$ ✓

$Cr_2O_7^{2-} + 14H^+ + 6e \rightarrow 2Cr^{3+} + 7H_2O$

$C_2O_4^{2-} \rightarrow 2CO_2 + 2e$

(ii) $Fe^{2+} + CO_3^{2-} \rightarrow FeCO_3$ ✓

$FeCO_3$ moles $= \frac{0.116g}{116 g mol^{-1}}$ ✓

$\therefore Fe^{2+}$ moles $= 0.001$ mol

Fe^{2+} concentration $= \frac{0.001 mol}{0.001 mol}$ ✓

$= \frac{0.001 mol}{25} \times 1000 \ dm^{-3}$ ✓

$= 0.04 mol \ dm^{-3}$ ✓

Total moles of $K_2Cr_2O_7$ consumed $= \frac{0.1}{1000} \times 40$ ✓

$= 4 \times 10^{-3}$ mol ✓

Moles of $K_2Cr_2O_7$ consumed for $Fe^{2+} = \frac{1 \times 10^{-3}}{6}$ mol ✓

Moles of $K_2Cr_2O_7$ consumed for $C_2O_4^{2-} = 4 \times 10^{-3} - \frac{1}{6} \times 10^{-3}$ mol

$= \frac{23 \times 10^{-3}}{6}$ mol ✓

Moles of $C_2O_4^{2-} = \frac{23 \times 10^{-3}}{6} \times 3$ mol

$= 11.5 \times 10^{-3}$ mol ✓

Concentration of $C_2O_4^{2-} = \frac{11.5 \times 10^{-3} mol}{25} \times 1000 \ dm^{-3}$ ✓

$= 0.46 mol \ dm^{-3}$ ✓

$5 \times 13 = 65$ Marks

(iii) After acidifying the part of solution X by adding conc. HNO_3 add SCN^- ions. (03)
If dark red colour occurs can conclude the existance of Fe^{3+} ions (02).
Add acidified $KMnO_4$ into the part of solution of X and gas evolved should pass through lime water (03)
If lime water turns milky colour and with excess gas it turns colourless, the gas evolved is CO_2. and can conclude the existance of $C_2O_4^{2-}$ in the solution X (02).

Total 150 marks.

(10) (a) (i) A - Zn^{2+} ✓
B - Cu^{2+} ✓
C - Fe^{2+} ✓

Marks $10 \times 3 = 30$.

(ii) $Zn(OH)_2$ White = A ✓
$Cu(OH)_2$ Light blue B ✓
$Fe(OH)_2$ - green - C ✓

(iii) $[Cu(NH_3)_4]^{2+}$ - tetraaminecopper (II) ion. ✓
$[Zn(NH_3)_4]^{2+}$ - tetraaminezinc (II) ion. ✓

$[Zn(NH_3)_4]^{2+}$ Tetrahedral ✓
$[Cu(NH_3)_4]^{2+}$ - square planer ✓

Marks $5 \times 7 = 35$

(iv) Black precipitate obtained in B only ✓ 3.
CuS ✓

Reason :- Only the cations in group II cation analysis group precipitate as S^{2-} in acidic medium.

marks $5 \times 3 = 15$.

(b) (i)

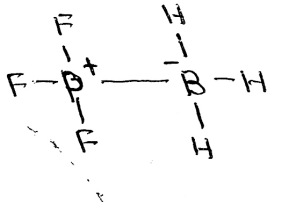
	H	:	F	:	B	:	P
Mass Ratio	2.9	:	56	:	10.6	:	30.5
Mole Ratio	$\frac{2.9}{1}$	:	$\frac{56}{19}$	:	$\frac{10.6}{11}$	:	$\frac{30.5}{31}$
	2.9	:	2.94	:	0.96	:	0.98
Simples mole ratio	3	:	3	:	1	:	1

Marks 5×4 = 20

Empirical formula of X H_3F_3BP — 10 Mark.

(ii) Molecular formula H_3F_3BP — 10 Marks

(iii) $BH_3 \cdot PF_3$



20 marks

Total 150

Protect Yourself From Coronavirus

YOU STAY AT HOME

WE DELIVER!

ORDER NOW

075 699 9990

WWW.LOL.LK

TOP CATEGORIES

- GCE O/L Exam NEW
- Grade 09, 10 & 11
- Grade 06, 07 & 08
- Grade 04 & 05
- Grade 01, 02 & 03
- About Us
- Shop HOT
- Cart

HUGE SALE – SHOP NOW

ISLANDWIDE DELIVERY
Free delivery on all orders over Rs. 3500

More than 1000+ Papers
For all major Subjects and mediums

ONLINE SUPPORT 24/7
Shopping Hotline 071 777 4440

FEATURED PRODUCTS

SORT BY

- ☐ GCE O/L Exam

GCE O/L EXAM, SCIENCE
O/L Science Past Paper Book
රු 350.00
1 ADD TO CART

GCE O/L EXAM, MUSIC
O/L Music Past Paper Book
රු 350.00
1 ADD TO CART

GCE O/L EXAM, MATHEMATICS
O/L Mathematics Past Paper Book
රු 350.00
1 ADD TO CART

GCE O/L EXAM, INFORMATION & COMMUNICATION TECHNOL...
O/L Information & Communication Tec...
රු 350.00

GCE O/L EXAM, HISTORY
O/L History Past Paper Book
රු 350.00

GCE O/L EXAM, HEALTH & PHYSICAL EDUCATION
O/L Health & Physical Education Past P...
රු 350.00