ཤེས་རིག་ལྷན་ཁག།

སྒྲིག་ཐང་འཛིང་རིམ་སློབ་གྲྭ་ཚོང་མ།

MOTITHANG HIGHER SECONDARY SCHOOL, THIMPHU

"Every child is **inspired** to learn and **empowered** with **wisdom** to excel in life"

TRIAL EXAMINATION 2019

Chemistry **Time: 3 .15 Hours**

Class XII **Total Marks: 100**

2019

NAME:…… ROLL No…….SEC……

Invigilator's initial

For Teacher's Use Only												
Section A							Section B					
Qn Number	A	b	c	d	e	f	2	3	4	5	6	7
Marks	10	5	5	5	5	10	10	10	10	10	10	10
Marks Awarded												
Total Marks Awarded												
Teacher's Initial												

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Do not write during the first fifteen minutes. This time is to be spent on reading the questions. After having read the question, you will be given two hours to answer all questions.
2. In this paper, there are two sections: **A and B**. Section A is **compulsory**. You are expected to attempt any five questions from section B.
3. The intended marks for questions or parts of questions, are given in brackets [ ].
4. Read the directions to each question carefully and for Question 1 (a), MCQ, circle the correct answer in the question booklet itself.

Section A (40 Marks)

Compulsory: Attempt all questions

Question 1

(a) *For each question there are four alternatives: A, B, C and D. Choose the correct alternative and* ***circle it****. Do not circle more than ONE alternative. If there is more than one choice circled, NO score will be awarded.* [1x10=10]

i. Which of the following is the freezing point depression of 2 m(molal) glucose solution (K_f for water is 1.86Kkg Mol^{-1})?

a. 1.86K ***c.*** 3.72K

b. 2K ***d.*** 7.44K

ii. Which of the following solution cannot act as a buffer?

a. $CH_3COOH+CH_3COONa$ c. $H_3PO_4 +NaHPO_4$

b. $H_3PO_4 +NaH_2PO_4$ d. $HCl +NH_4Cl$

iii. The standard reduction electrode potential of three metals X,Y and Z are -2.38V, -1.05V and +0.34V respectively. The increasing order of their reducing power is

a. Z<Y<X c. X<Y<Z

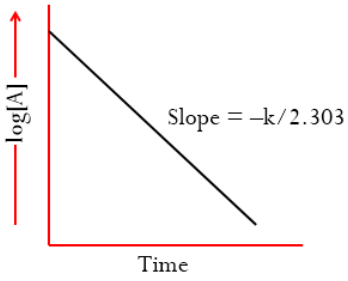
b. Y<Z<X d. Z<X<Y

iv. The conversion of A ⟶ B follows second order kinetics. Doubling the concentration of A will increase the rate of formation of B by a factor

a. 1/4 c. 1/2

b. 2 d. 4

v. A student monitors the rate of a reaction and plots the graph of $\log_{10}[A]$ of one reactant against time. The graph obtained is of the type shown below.



Which of the following best describes the above reaction?

a. The rate of reaction decreases with time.
b. The concentration of the reaction decreases with time.
c. The reaction is of first order .
d. The reaction is reversible.

vi. $_{90}Th^{232} \longrightarrow {}_{82}Pb^{208}$, the number of α and β particles emitted during the above reaction is:

a. 8α and 4β
b. 8α and 16β
c. 4α and 2β
d. 6α and 4β

vii. The positive value of ΔS indicates that

a. the system becomes less disordered.
b. the system becomes more disordered.
c. the system is in equilibrium position.
d. the system tends to reach at equilibrium position.

viii. The coordination number (CN) and oxidation number (ON) of the central metal in the complex $K_3[Fe(CN)_6]$ is

a. CN=9 and ON=3
b. CN= 6 and ON= 6
c. CN=6 and ON=3
d. CN=9 and ON= 6

ix. Which one of the following does not give silver mirror test?

a. C_6H_5CHO
b. HCOOH
c. CH_3CHO
d. CH_3COCH_3

x. The hydrolysis of methyl cyanide yields

a. Acetamide
b. Ethylamine
c. Acetaldehyde
d. Acetic anhydride

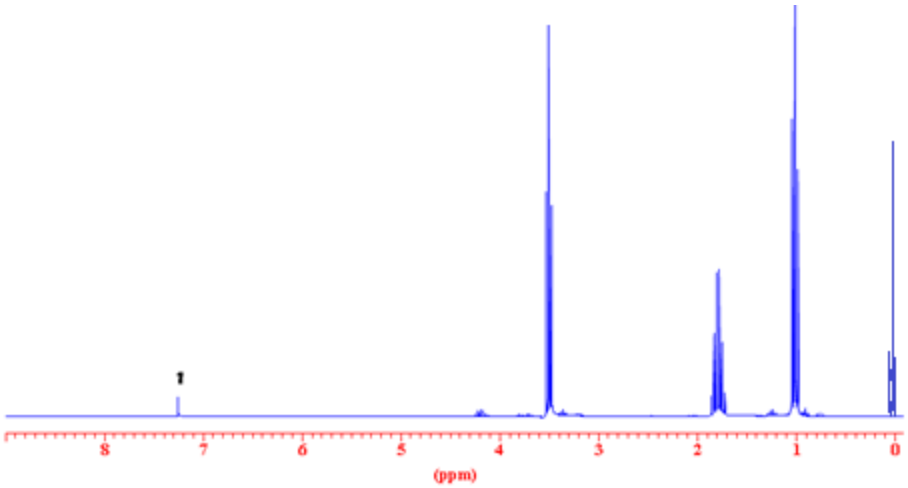
xi. Nylon is prepared from adipic acid and hexamethylenediamine. Which of the following statement is not true about nylon

a. Synthetic fibre
b. Co-polymer
c. Condensation polymer
d. Addition polymer

xii. A peptide bond is formed between two amino acids by

a. a condensation reaction forming an anhydride
b. a condensation reaction forming an ester
c. a condensation reaction forming an amide
d. a condensation reaction forming an amine

xiii. Study the proton NMR spectrum of an organic compound given below.



Which of the following compounds would give the above spectrum?

a.1-chlorobutane
b. 1-chloro ethane
c. 1-chloro pentane
d. 1- chloro propane

xiv. When a piece of copper is placed in a silver nitrate solution, silver gets precipitated because;

a. Both copper and silver have negative reduction potential.
b. Copper has lower reduction potential than silver.
c. Copper has higher reduction potential than silver.
d. Both copper and silver have positive reduction potential.

xv. Coordination compounds are widely used for the treatment of diseases. Which of the following coordination compound is used as antitumor agent in the treatment of cancer?

a. cis-platin
b. tetra ethyl lead
c. EDTA
d. vitamin B-complex

(b) Fill in the blanks with the most suitable words. ***[5x1=5]***

(i) The alkaline hydrolysis of esters is known as……..

(ii) Phenolphthalein indicator can be best used for the neutralization titration between strong……and weak …….

(iii) In a galvanic cell, oxidation takes place at the …….and reduction at the …….

(iv) The concentration of the reactant does not affect the half life of ……order reaction, and reaction rate of ……..order reaction

(v) The conversion of vegetable oil into biodiesel is done by a reaction which is called ……

(c) Match the items in Column A with the items in Column B. Rewrite the correct pairs in the space provided [10x1/5=5]

Column A	**Column B**
i. First law of thermodynamics	a. Raoult's law
ii. Werner's theory	b. Sec^{-1}
iii. Cannizaro reaction	c. P^{30}
iv. Hoffmanns degradation	d. Triesters of glycerols and fatty acids
v. Fats and oils	e. CH_3CONH_2
vi. Vapour pressure of an aqueous solution is lowered on addition of urea.	f. Reaction rate
vii. Functional group	g. IR spectrum
viii. Lead storage	h. C_6H_5CHO
ix. First order reaction	i. Coordination compounds
x. Chemical shift	j. mass spectrum
	k. NMR spectrum

Column A	Column B
i. First law of thermodynamics	
ii. Werner's theory	
iii. Cannizaro reaction	
iv. Hoffmanns degradation	
v. Fats and oils	
vi. Vapour pressure of an aqueous solution is lowered on addition of urea.	
vii. Functional group	
viii. Lead storage	
ix. First order reaction	
x. Chemical shift	

(d) Correct the following statements .[5X1=5]

i. Oxidation number of iron in $Fe(CO)_5$ is 3.

ii. **g**reater the standard oxidation potential(or lower is the value of standard reduction potential of a metal), more easily it can lose electrons and hence less active it is.

iii. The molality of the solution containing 90g of glucose per kg of water is5.0.

iv. When $\Delta G = 0$, the process is spontaneous.

v. Both nylon 6,6 and terylene are addition polymers.

***(e)Answer the following questions*[10 marks]**

i. Give the IUPAC name of the compound, $[CoCl(NH_3)_5]Cl_2$ [1]

ii. Write the chemical reaction for the following: [2]

(a) glacial acetic acid is heated with phosphorus pentoxide.

(b) sodium hydrogen carbonate is added to acetic acid.

iii. What happens to entropy during the following reactions? Justify your answer. [2]

a. $C(s) + H_2O(l) \rightarrow CO(g) + H_2(g)$

b. $H_2(g) + I_2(g) \rightarrow 2HI(g)$

iv. Mention two uses of mercury cell. What is anode, cathode and electrolyte made up of? [2.5]

v. Differentiate between molecularity and the order of a reaction[1]

vi. Differentiate between homo polymer and co-polymer. [1]

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vii. what do you mean by base peak in mass spectrum of a compound. [½]

SECTION B(60 MARKS)
ANSWER ANY SIX QUESTIONS

Question 2.

i. Draw a well labeled diagram of pH titration curve that is obtained while titrating; [3]
a.HCl vs. NH_4OH (Ammonia solution)
b.HCl vs. NaOH
c.CH_3COOH vs. NaOH

ii. Show the formation of zwitter ion. How it behaves in acidic medium?[2]

iii. Study **O=C=O** compound. It can undergo two different stretchings. Name these stretchings and define them.[2]

iv. Study the following cell carefully and answer the questions below. **[3]**

$Zn(s) \mid Zn^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s)$

a. Write oxidation and reduction half-cell reaction.[0.5]

b. Write the overall cell reaction.[0.5]

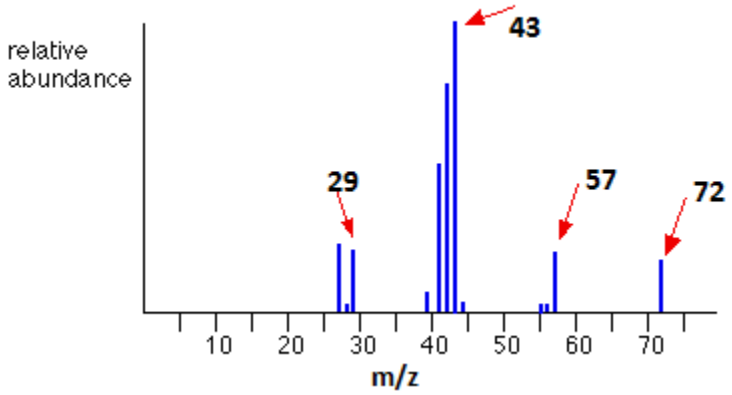
c. Identify anode and cathode half-cells.[0.5]

d. In which direction do electrons flow?[0.5]

e. Calculate standard emf of the cell if $E^0zn^{2+}/zn = -0.76v$ and $E^0Cu^{2+}/Cu = 0.34v$[1]

Question 3.

i. Study the given diagram and answer the following questions



a.Name the compound[1]

b.Write the fragmentation mode of the compound……..[1]

c.Identify the fragment which gives the base peak……[½]

ii. The vapour pressure of water at 27^oC is 18.15 mmHg and that of a solution containing 9.47 g of sucrose in 100g water at the same temperature is 18.0595 mmHg. Calculate the relative molecular mass of glucose. [2]

iii. What is pH? The hydronium ion concentration of coke juice is $4.6x10^{-4}$mol l^{-1}. Calculate pH of the juice. Is it acidic/basic/neutral and why?**[**2.5**]**

iv. Polyamides and polyesters are biodegradable. Justify. What kind of polymer is PGA?[1.5]

v. Aniline undergoes electrophilic substitution reactions at O- and P- position.Give reason.[1]

vi. meso-iomers are optically inactive[0.5]

Question 4.

i. Write the balanced chemical reaction when benzaldehyde is heated with conc. KOH solution. Name the reaction[2]

ii. Which of the following solutions will have a lower vapour pressure and why? [2]
   a. A 5% solution of cane sugar ($C_{12}H_{22}O_{11}$)
   b. A 5% solution of urea (NH_2CONH_2)

iii. A solution to be used in acid-base titration is prepared by dissolving 0.28 g of KOH in 1000 ml of water at 27^oC. What will be the pH of this solution? [k=39, O=16, H=1] [2]

iv. Mention one difference between alcoholysis and ammonolysisof acetyl chloride with an equation.[2]

v. Fill up the missing ones.[2]

Energy factor (ΔH)	Entropy factor (ΔS)	Free energy ΔG= ΔH- TΔS	Spontaneity of a reaction
-	+	…..-…….	Spontaneous at all temperatures
-	-	-when ΔH> TΔS	…spontaneous at all temperatures……..
		……+when ΔH< TΔS ……	Non-spontaneous at high temperatures
+	……-…..	……+……	Non-spontaneous at all temperatures

Question 5

i.Complete and balance the following reactions. **[4]**

a. $C_6H_5COOH + NaOH \rightarrow$

b.$(COOH)_2 + Na_2CO_3 \rightarrow$

c.$CH_3COCl + C_2H_5NH_2 \rightarrow$

d. $C_6H_5NO_2 + 3H_2 \rightarrow$

ii. For the reaction $2A + B \rightarrow C + D$ at 300K, the following data were obtained [3]

Expt. No	**[A] (mol/L)**	**[B] (mol lit^{-1})**	**Rate of reaction (mol L^{-1} min^{-1})**
1	0.1	0.1	6×10^{-3}
2	0.3	0.2	7.4×10^{-2}
3	0.3	0.4	2.88×10^{-1}
4	0.4	0.1	$2.4\text{x}10^{-2}$

a. What is the order of the above reaction and write the rate law
b. Calculate the value of rate constant (k)

iii. What are the conditions necessary for a molecules to show optical isomerism? Draw geometrical isomers of [Pt $(NH_3)_2Cl_2$]. **[2]**

(c) Give one chemical test to distinguish between the following pairs of compounds: **[1]**

(i) Aliphatic amines and aromatic amines.

Question 6

i. Calculate the heat of formation of methane from the following data.**[**3**]**

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H = -394$ kJ mol^{-1}…….(i)

$2H_2 + O_2(g) \longrightarrow 2H_2O(l)$ $\Delta H = -572$ kJ mol^{-1}…….(ii)

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$ $\Delta H = -890$ kJ mol^{-1}…….(iii)

ii. How many NMR signals do you expect from the following compounds? Indicate the splitting pattern of each of the signal.
[2]

a. CH_3COCH_3

b. CH_3CHO

iii. What does the primary and the secondary valencies recpectively represent in a coordination compound? Give one example each.[2]

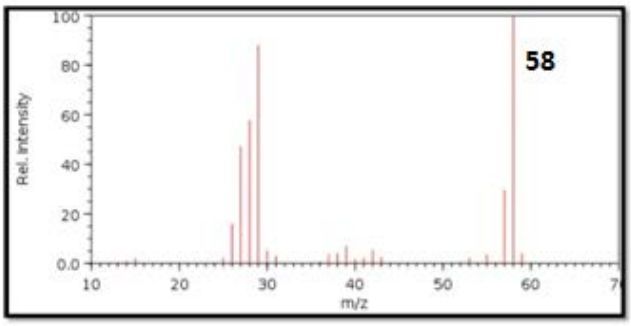
iv. Outline a mechanism for the reaction of aniline with methyl iodide. [2]

v. Why do some coordination compounds exhibit colour? [1]

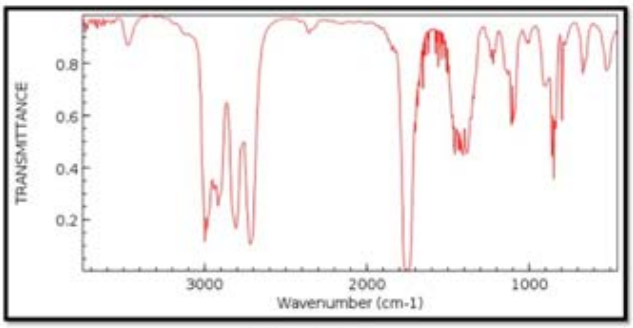
Question 7.

(a) Spectroscopic techniques are very useful in analyzing the components and identifying a given compound. A sample of an organic compound was analysed using spectroscopy techniques and gave the following result:

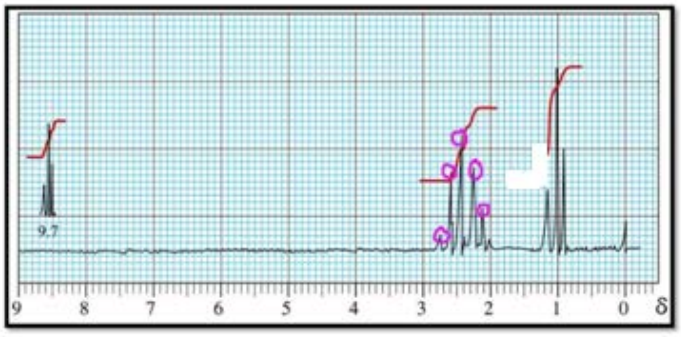
- ✓ Mass spectrum with parent peak at m/z value of 58,
- ✓ Infra-red spectrum with strong absorption band from 1720-1740 cm^{-1} and near $3000cm^{-1}$.
- ✓ NMR spectrum with three signals at different chemical shifts.



a) Mass spectrum



b) Infrared spectrum



c) NMR spectrum

Based on the spectra obtained, answer the following questions:

(i) What is the molecular mass of the compound? [0.5]

(ii) What do the strong absorption bands from 1720-1740 and near 3000 cm^{-1} respectively indicate?[1]

(iii) How many types of protons does the molecule have? [½]

(iv) Write the structure and identify the compound. [1]

(b).Give IUPAC names for the following organic compounds: **[1.5]**

i. $CH_3CH_2NHCH_3$

ii. $[Co(NH_3)_6]Cl_3$

iii. $K_2[Ni\ (CN)_4]$

(c) Write the formula from the IUPAC names of the following.[1.5]

i. Ethanoic anhydride-

ii. Pentaamminenitrocobalt(III)chloride-

iii. hexaaquamanganese(II) ion-

(d) Write the chemical reaction for the following: **[2]**

i. glacial acetic acid is heated with phosphorus pentoxide.

ii. sodium hydrogen carbonate is added to acetic acid.

(e) A buffer solution is prepared by mixing 500 mL each of 0.2 M ammonium hydroxide solution and 0.1M ammonium chloride solution. Calculate the pH of buffer solution. ($K_b = 1.8\times10^{-5}$) [2]

Question 8

i. 5moles of gas expand against a constant pressure of 2 atmospheres from volume of 8 litres to 12 litres. In doing so it it absorbs 200J heat from the surroundings. Determine the change in internal energy of the process. [2]

ii. Give one chemical test to distinguish between aniline and ethylamine[1]

iii. aminoacids behave as zwitter ions in neutral solutions. Towards which electrode will aminoacids migrate in an acidic solution?why?[1]

iv. Predict the products A and B for the following reaction and write a balanced chemical equation for the formation of B. [2]

$$CH_3CONH_2 \xrightarrow{P_2O_5} A \xrightarrow{H_2/Ni} B$$

v. A two bottles containing acetaldehyde and acetone lost their labels. What chemical test would you perform to identify them?[1]

vi. (a**).** How is the first law of thermodynamics guided by the law of conservation of energy?[1]

(b) Give its mathematical form[1]

(c). What will be the internal change (ΔE) in isothermal process and adiabatic process.[1]