Grade 12 3rd
2018 July
Visakha (9)

Advanced Level Science Section Visakha Vidyalaya Colombo

General Certificate of Education (Adv. Level) Examination, July - 2018

Chemistry I | **02 E I** | **Time : Two Hours**

* Thispaper consists of 8 pages. (Periodic table is provided.)
* Answer all the questions.
* Use of calculators is **not allowed**.
* Write your **index number** in the space provided in the answer sheet.
* Follow the instructions given on the back of the answer sheet carefully.
* In each questions **1 to 50**, pick one of the answer sheet with a cross (x) in accordance with the instructions given on the back of the answer sheet.

Grade 12
3rd Term Test

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

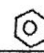
(1) The set of quantum numbers associated with the last two elections of an atom in an element are $(3, 1, +1, +\frac{1}{2})$ and $(3, 1, +1, \frac{-1}{2})$. The element is,
(1) Al (2) Ca (3) Cl (4) Ar (5) S

(2) Which of the following ion has the highest polarization power?
(1) Al^{3+} (2) Ca^{2+} (3) Ba^{2+} (4) Mg^{2+} (5) Na^{+}

(3) Number of compounds with molecular formula $C_4H_{10}O$, which are optically inactive is,
(1) 3 (2) 4 (3) 5 (4) 6 (5) 7

(4) The increasing order of acidity of Cl_2O_7, Na_2O, P_2O_5 and MgO is,
(1) $Na_2O < MgO < P_2O_5 < Cl_2O_7$
(2) $Na_2O < MgO < Cl_2O_7 < P_2O_5$
(3) $MgO < Na_2O < Cl_2O_7 < P_2O_5$
(4) $MgO < Na_2O < P_2O_5 < Cl_2O_7$
(5) $P_2O_5 < Na_2O < Cl_2O_7 < MgO$

(5) The answer that does not show the correctly matching name with structure of the organic compound is,

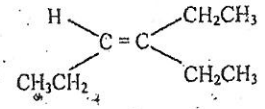
Compound	IUPAC name
1) $CH_3CH_2C(Br) = CH\ CH(CH_3)\ CH_3$	3-bromo-5-methylhex-3-ene
2)  $CH_2\ CH_2\ CH= CH\ CH_2\ OH$	5-phenylpent -2-en-1-ol
3) $CH_3CH_2CH = CH-C(=O)CH_3$	hex-3-en-2-one
4) $CH_3C\equiv C\ C(=O) - C(OH)\ CH_3$	2-hydroxyhex -4-yn-3-one
5) $CH_3C\equiv C\ C(=O)CH_2CHO$	3-oxohex-4-ynal

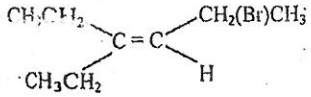
(6) When inorganic compound A was thermally decomposed, diatomic colourless gas was evolved. When it was reacted with metallic element with atomic number 12, and water was added to obtained product. Then a tetra atomic colourless gas was evolved. Elements that can be present in A are,
(1) C, H, O (2) N, O, H (3) C, H, Cl (4) N, Cl, O (5) N, H, C

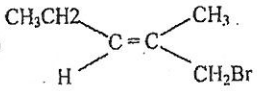
(7) Mass of Helium atom is twice as that of Hydrogen molecule. At 298K mean kinetic energy of Helium is,

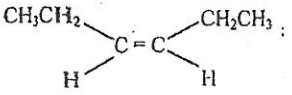
(1) twice as that of Hydrogen.
(2) Same as that of Hydrogen.
(3) Four times as that of Hydrogen.
(4) Half as that of Hydrogen.
(5) Above all statements are fauls.

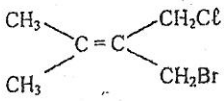
(8) Which of the following compound shows enantiomerism?

(1) 

(2) 

(3) 

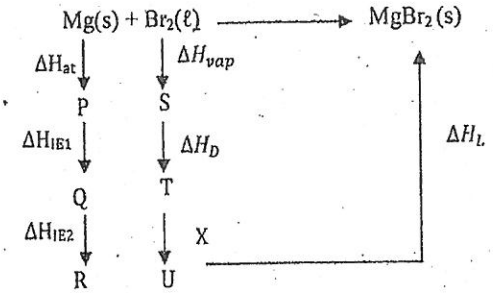
(4) 

(5) 

(9) Which of the following statement is **incorrect** regarding $Na_2S_2O_3$.

(1) At last with reaction of $Pb(NO_3)_2$, a black colour precipitate is formed.
(2) Used in iodometric titration to determine I_2.
(3) When reacted with dill HNO_3, collodial S is formed.
(4) Give a white colour precipitate with aqueous solution of $BaCl_2$.
(5) Gives Br_2 when reacted with KBr

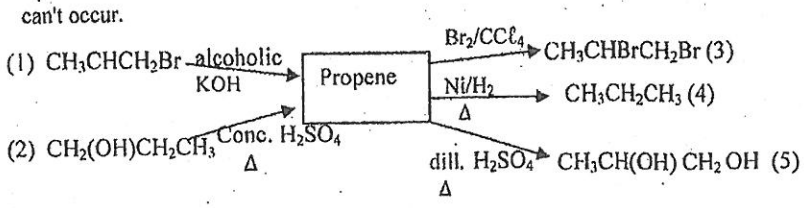
(10) Given below-is the Born - Haber cycle of formation of $MgBr_2$ lattice.



The answer that gives value of X is,

(1) $\Delta H_f - \Delta H_{at} - \Delta H_{IE1} - \Delta H_{IE2} - \Delta H_{vap} - \Delta H_D - \Delta H_L$
(2) $\frac{1}{2}\left[\Delta H_f - \Delta H_{at} - (\Delta H_{IE1} - \Delta H_{IE2}) - \Delta H_{vap} - \Delta H_D - \Delta H_L\right]$
(3) $\frac{1}{2}(\Delta H_f - \Delta H_{at} - \Delta H_{IE1} - \Delta H_{IE2} - \Delta H_{vap} - \Delta H_D - \Delta H_L)$
(4) $2(\Delta H_f - \Delta H_{at} - (\Delta H_{EE1} - \Delta H_{IE2}) - \Delta H_{vap} - \Delta H_D - \Delta H_L)$
(5) $2(\Delta H_f - \Delta H_{at} - \Delta H_{IE1} - \Delta H_{IE2} - \Delta H_{vap} - \Delta H_D - \Delta H_L)$

(11) Following diagram shows formation reactions of propene and its reactions. Which of the following reaction can't occur.



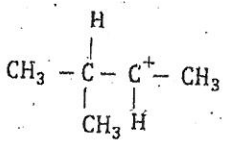
(12) Ideal gas A present in a container at 27^0C temperature and $2x10^5$ Pa pressure with volume 5 m^3. What is the density of that gas? (M_A=28 $gmol^{-1}$)

(1) 32.54 kgm^{-3} (2) 2.245 kgm^{-3} (3) 0.2245 kgm^{-3}
(4) 32.54 kgm^{-3} (5) 3.345 kgm^{-3}

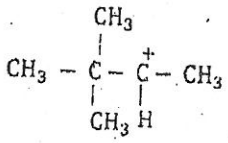
(13) At constant pressure, temperature of mass of gas is increased from 19^0C to 20^0C. The volume (V) increasement of that gas is,

(1) Up to V (20/ 19).
(2) $^1/_{273.15}$ amount by volume at 0^0C.
(3) $^1/_{273.15}$ amount by volume at at 0 K.
(4) $^1/_{273.15}$ by its volume.
(5) No change in volume.

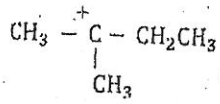
(14) Consider following carbocations.



(A)



(B)



(C)

The correct increasing order of stability of above carbocations is,

(1) A < B <C (2) B< C < A (3) C < B < A (4) C < A < B (5) A < C < B

(15) When aqueous ammonia solution was added to solution of certain metal ion, a white precipitate was formed. When NaOH solution was added in excess, precipitate get dissolved. This metal ion can be,

(1) Ca^{2+}(aq) (2) Ba^{2+}(aq) (3) Mg^{2+}(aq) (4) Al^{3+}(aq) (5) All above

(16) Which of the following statement is **incorrect**, regarding titration of $K_2Cr_2O_7$ and $C_2O_4^{2-}$ in acidic medium.

(1) Cr^{3+} formed in reaction acts as self indicator for the reaction.
(2) Phosphoric acid is used to remove formed CO_2 from medium.
(3) $C_2O_4^{2-}$ acts as standard solution.
(4) The $C_2O_4^{2-}$ solution should be heated up to certain extent at the beginning.
(5) A separate indicator is not used for the titration.

(17) Solution X is prepared by dissolving 0.288 g of FeC_2O_4 in dill. H_2SO_4. This solution was heated to 65^0C. Under this condition, volume of 0.025 $moldm^{-3}$ requires to react completely with FeC_2O_4 is (in cm^3)
(C=12, O=16 , Fe =56)

Notable : In solution X, FeC_2O_4 exists as Fe^{2+} and $C_2O_4^{2-}$

(1) 50 (2) 40 (3) 48 (4) 32 (5) 36

(18) Which of the following compound has the highest boiling point,

(1) $(CH_3)_3 CCH_2CH_3$
(2) $(CH_3)_2 CHCH (CH_3)_2$
(3) $(CH_3)_2 CHCH_2CH_2 CH_3$
(4) $CH_3CH_2CH (CH_3) CH_2CH_3$
(5) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2$

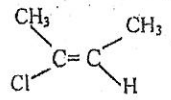
(19) How much is the SO_4^{2-} composition (in ppm) in a solution formed by mixing 125 cm^3 of 0.2 $moldm^{-3}$ NaOH and 125 cm^3 of 0.1 $moldm^{-3}$ H_2SO_4 (S=32 O=16 Na=23 H=1)

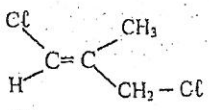
(1) 960 (2) 480 (3) 4800 (4) 9600 (5) 1420

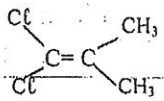
(20) In commertial H_2SO_4 acid solution with density 1.84 gcm^{-3} consists 98 % H_2SO_4 acid by mass. The amount of water moles in 500 cm^3 of this acid solution is, (H=1 , S=32 , O=16)

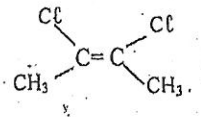
(1) 2.0 (2) 2.5 (3) 1.0 (4) 3.6 (5) 1.8

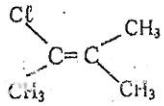
(21) Which of the following molecule has the lowest polarity,

(1) 

(2) 

(3) 

(4) 

(5) 

(22) Physical properties of three species R, S and T are given below.

Species	Melting point/ ^0C	Boiling point/ ^0C	Electrical conductivity	
			Solid	Molten
R	801	1413	poor	excellent
S	2852	3600	poor	excellent
T	3550	4827	excellent	not known

Which of the following can be R, S and T species,

	R	S	T
(1)	NaF	KCℓ	Cu
(2)	NaBr	BaO	SiO_2
(3)	NaCℓ	MgO	C(graphite)
(4)	NaBr	MgO	C(diamond)
(5)	LiI	$BeCℓ_2$	Ag

(23) In dichromate of metal M, there are 2 Cr atom for 1 atoms of M. In the oxide of M, mass percentage of M is 60% . Relative molar mass of M is, (Cr=52 , O = 16)

(1) 28 (2) 30 (3) 26 (4) 24 (5) 32

(24) Consider following thermo chemical data.

Compound	Standard formation enthalpy/$kJmoℓ^{-1}$
$OF_2(g)$	+23.0
$H_2O(g)$	-242.0
HF(g)	-267.0

The standard enthalpy change of the reaction,

$OF_2(g) + H_2O(g) \longrightarrow O_2(g) + 2HF(g)$ is, (in $kJmoℓ^{-1}$)

(1) −57 (2) −315 (3) −753 (4) +573 (5) +315

(25) The **incorrect** statement regarding factors that affect rate of a chemical reaction is,

(1) When temperature increases, reaction rate increases.

(2) When concentration of reactant increases in any chemical reaction, rate increases.

(3) In a solid reactant, by increasing contact surface area rate increases.

(4) When there are gaseous reactants, partial pressure change of those at unit time, can be considered as the rate.

(5) Rate of a reaction is the change in concentration per unit time.

(26) When iodine is heated, easily it sublimizes. Which of the following is correct regarding solid iodine and iodine vapour,

	Solid	**vapour**
(1)	Ionic	Atomic
(2)	Ionic	Molecular
(3)	Molecular	Atomic
(4)	Molecular	Molecular
(5)	Atomic	Molecular

(27) You are provided with bottles consist solutions of $AgNO_3$ and $Pb(NO_3)_2$ solutions. Which of the following reagent can be used to distinguish those.

(1) $Na_2S_2O_3(aq)$ (2) $K_2Cr_2O_7(aq)$ (3) $Na_2S(aq)$
(4) $KNO_3(aq)$ (5) $H_2O(l)$

(28) 3d transition metallic element A was reacted with dill. HCl. Obtained product was boiled with conc. HNO_3 and resultant solution gave a brown colour precipitate with dill. NaOH as well as NH_4Cl and NH_4OH mixture. Also precipitate was insoluble in excess of above reagents. The most suitable oxidation states for A can be,

(1) +1 and +4 (2) +2 and +3 (3) +3 and +5 (4) +3 and +6 (5) +3 and +7

(29) Pair of compounds that under goes disproportionation in aqueous solution is,

(1) $PC\ell_3$ and $NC\ell_3$ (2) NO_2 and SO_2 (3) SO_2 and SO_3
(4) NO_2 and $C\ell_2$ (5) $C\ell_2$ and $NC\ell_3$

(30) Metal M was reacted with conc.HNO_3 to convert it into $M(NO_3)_2$. When H_2S gas was passed through resultant solution, sulphide of metal was formed as a precipitate. Here 1.27 g of metal M gave a mass of dry sulphide with 1.910 g. Metal M can be,

(S = 32, Aℓ = 27 , Cr = 52, Fe=56. CO= 59 , Cu = 63.5)

(1) Aℓ (2) Cr (3) Fe (4) CO (5) Cu

Instructions for questionno. 31 to 40.

For each of the questions 31 to 40, four responses (a), (b), (c) and (d) are given. One or more of these is/are correct. Select the correct response / responses. In according to 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 (a) and (d) are correct
(5) If any other number or combination of response is correct

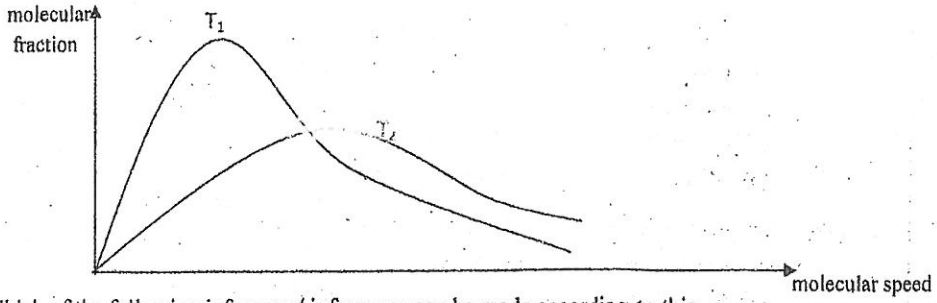
Summary of above Instruction.

(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 pairs of lines has / have same difference which is equal to the difference between 2nd and 3rd lines of Balmer series of atomic spectrum of Hydrogen?

(a) 4th and 5th lines of Lyman series
(b) 2nd and 3rd lines of Paschen series
(c) 3rd and 4th lines of Lyman series
(d) 1st and 2nd lines of Paschen series

(32) Molecular speed distribution of gas at two temperatures T_1 and T_2, is given in below graph.



Which of the following inference / inferences can be made according to this,

(a) Among T_1 and T_2temperatures, higher temperature is T_2.

(b) Its confirmed that this gas is an ideal gas.

(c) at temperature T_1, value of the most probable velocity is larger than that at temperature T_2.

(d) Molecular speed distribution is high at temperature T_2 than at temperature T_1.

(33) Which of the following statement /s is /are **incorrect** regarding any two compounds with same empical formula

(a) Molecular formula should be same.

(b) Percentage composition of element should be same.

(c) Molecular mass can be different .

(d) Number of atoms in each compound should be same.

(34) Which of the following statement/s is / are true regarding nitrite (NO_2^-)

(a) It does not consist π bonds.

(b) Its geometry is trigonal planer.

(c) Its shape is bent.

(d) Valance shell of Nitrogen has less than 8 electrons.

(35) Wave energy in microwave oven is absorbed by polar molecule. Which of the following can absorb micro wave.

(a) C_2H_5OH (b) SiO_2 (c) CH_3COOH (d) $CC\ell_4$

(36) $H-C\equiv C-CH_2-\underset{\underset{H}{|}}{C}=CH_2$

True statement/s regarding above compound is / are,

(a) Gives a silver mirror with reaction of ammonical $AgNO_3$.

(b) Evolves H_2 with reaction of sodium.

(c) Decolourizes Br_2 water.

(d) Gives a reddish brown precipitate with ammonical $CuC\ell_2$.

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

(a) If the density of water is $1gcm^{-3}$, when $0.1mo\ell$ of NaOH is dissolved in 1kg of water , molarity of NaOH solution is $0.1\ moldm^{-3}$

(b) Since volume of solution depends on temperature, concentration of solution depends as temperature.

(c) Molality of Na_2CO_3 aqueous solution at 25^0C is same as that at 30^0C of same solution.

(d) Concentration is an extensive property.

(38) Which of the following statement/s is /are true regarding thermodynamic sytems.

(a) In a closed system , through the boundary work does not exchange.

(b) In an open system, through the boundary both matter and energy exchange.

(c) In an siolated system, any process with positive entropy change is spontuneous.

(d) In an isolated system, even though matter does not exchange , energy exchanges.

(39) $CH_3 - \underset{\underset{Br}{|}}{CH}CH = Br$

Which of the following statement /s is /are correct regarding above compound.

(a) It can exist in four stereoisomeric forms.

(b) Product formed by catalytic hydrogenation shows two stereoisomeric forms

(c) product formed by treating with alcoholic KOH shows optical isomerism.

(d) Product formed by treating with alkaline $KMnO_4$ has four steoisomeric forms

(40) Consider the following reaction,

$3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$

Which of the following relation/s is/are correct regarding rate of this reaction.

(a) $-\frac{1}{3}\frac{\Delta[H_2(g)]}{\Delta t} = \frac{-\Delta[N_2(g)]}{\Delta t}$

(b) $-\frac{1}{3}\frac{\Delta[H_2(g)]}{\Delta t} = \frac{\Delta[N_2(g)]}{\Delta t}$

(c) $\frac{\Delta[N_2(g)]}{\Delta t} = \frac{2\Delta[NH_3(g)]}{\Delta t}$

(d) $\frac{-\Delta[H_2(g)]}{\Delta t} = \frac{1}{2}\frac{\Delta[N_2(g)]}{\Delta t}$

Instructions for question no. 41 to 50.

In question no. 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 appropriatly on your answer sheet.

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

	First statement	Second Statement
41.	Van der waal equation can be used for gases that begaves ideally.	Van der waal equation consits ammendment for deviation of real gases.
42.	Molar volume of an ideal gas is 22.4 dm^3.	Molecules of ideal gas are free of molecular volume and do not show inter molecular interactions.
43.	Concentration is an intensive property.	Intensive property is a property which depends on amount of substance in the system.
44.	All three carbon atoms of propynal lie on same plane.	All the carbon atoms of propynal show same hybridization.
45.	By subjecting CH_3CH_3 for chlorination, $CH_3CH_3C\ell$ can be obtained.	In the presence of diffused sun light, alkanes are subjected to chlorination.
46.	IF_4^- ion is not tetrahedral.	In IF_4^- ion, geometry around I atom is not tetrahedral.
47.	In the presence of NaOH, MnO_2 and KI react to form I_2 and $Mn(OH)_2$.	KI can act as a reducing agent.
48.	When conc.$HC\ell$ is added to a test tube which consits a solid mixture of Na_2CrO_4 and $PbC\ell_2$ gives a yellow colour precipitate.	$PbC\ell_2$ is a yellow colour precipitate.
49.	Boiling point at H_2O_2 is greater than that of water.	Inter molecular attraction of H_2O_2 is stronger than that of H_2O.
50.	Conc. Sulphuric acid can be used to dry NH_3 gas.	Conc. Sulphuric acid is dehydrating agent.

VisakhaVidyalaya – Colombo

Third Term Test July 2018

Grade – Year 12

Chemistry II

Time : 3 hours

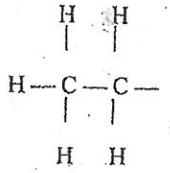
Name :- .....

Part A – Structured Essay (Pages 02 – 08)

*Use of calculators is not allowed.

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

In answering questions 4 and 7, you may represent alkyl groups in a condensed manner.

eg  may be shown as $CH_3\,CH_2-$

Part B and Part C – Essay (Pages 11 - 16)

* Answer four questions selecting not more than two questions from each part.
* At the end of the time allocated for this paper, the answers to 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 Part B and C of the question paper from the Examination Hall.

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

For Examiner's Use only

Part	Q. NO.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	

Final Marks

In numbers	
In Letters	

Structure Essay – Part A

- **Answer all the questions.(each question carries 10 marks.)**

1. (a) (i) Complete the expression given below to determine the oxidation state (O) of an atom in a Lewis structure by inserting the terms N_A, N_{LP} and N_{BP} in the appropriate boxes

N_A=Number of valence electrons in the atom

N_{LP}= Number of electrons in lone pairs

N_{BP}= Number of electrons in bonding pairs around atoms (Here bond electron pair belongs to more electro negative element)

$O =$ ☐ − (☐ + ☐)

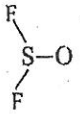
(ii) Fill in the values for N_A, N_{LP} and N_{BP} in the appropriate boxes and calculate the oxidation state on N, $O_{(N)}$, in the structure NCO^- given below.

$[:\ddot{N}-C\equiv O:]^-$

$O_{(N)} =$ ☐ − (☐ + ☐)

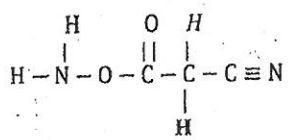
(iii) Draw the most acceptable Lewis structure for $S_2C\ell_2$.

(iv) Draw two resonance structures for SF_2O.

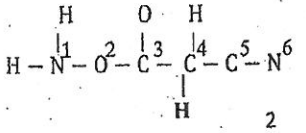


(v) Based on the Lewis structure given below, state the following regarding C, N and O atoms given in the below table.

I. VSEPR pairs around the atom.
II. Electron pair geometry around the atom .
III. Shape around the atom.
IV. hybridization of the atom.



Atoms are numbered as follows.



	N^1	O^2	C^3	N^6
VSEPR pair				
electron pair geometry				
Shape				
hybridization				

(vi) Identify atomic / hybrid orbitals involved in the formation of the following σ bonds in Lewis structure given in part (v) above. (Numbering of atoms is as in part (v))

I. N^1-O^2 N_1 ..... O_2 .....

II. O^2-C^3 O^2 ..... C^3 .....

III. C^3-C^4 C^3 ..... C^4 .....

IV. C^5-N^6 C^5 ..... N^6 .....

(6.5 marks)

(b) (i). In Cr, write relevant quantum number set for electron /s in sub energy level with the highest energy.

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(ii) Identify the type/s of intermolecular forces present in I, II and III given below.

I) Xe gas .....

II) CO_2 gas .....

III) Glucose solution .....

(iii) "The boiling point of 2,2-dimethylpropane is lower than the boiling point of pentane" Giving reasons state whether this statement is true or false.

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(iv) Arrange the following in the increasing order of properly indicated i parentheses (Reasons are not required)

I. CH_3CN, CH_3CONH_2, $CH_3CH_2NH_2$, CH_3CHNH (C-N bond length)

..... < ..... <..... <.....

II. LiOH, NaOH, KOH (Water solubility)

..... < ..... <.....

III. CH_4, CH_3^-, CH_3Cl, HCN (electro negativity of C atom)

..... < ..... <..... <..... *(3.5 marks)*

2. (a) A , B, C are three gaseous consecutive elements in same period in periodic table which are non transition. The first ionization variation of these elements is B<A<C order.

(i) Identify elements A, B and C.

A ..... B ..... C .....

(ii) State all positive oxidation states of A and give chemical formula of example for each oxidation state.

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(iii) Write formula of compound D formed by combining B and C.

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(iv) Write formula of oxyanion formed by combining A and B.

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(v) Write a chemical test that can be used to distinguish two anions given in (iv).

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(4.0 marks)

(b) Colourless aqueous solution R consists two anions and a cation. Following tests were carried out to identify these ions. For each test a new portion of solution R was used.

Test	Observation
1. (i) Dill. HCℓ was added.	colourless gas was evolved.
(ii) Evolved gas was tested with filter paper dipped in lead acetate.	No colour change.
(iii) Evolved gas was tested with filter dipped in acidified potassium dichromate.	Orange colour changed to green.
2. (i) Small amount of aqueous $AgNO_3$ was added.	A pale Yellow precpitate (X) was formed.
(ii) Precipitate was separated by filtering and excess dill. HNO_3 acid was added.	yellow precipitate (Y) was formed. Gas was evolved.
(iii) Evolved gas was subjected to test 1(iii)	Colour changed from orange to green.
(iv) Yellow precipitate Y was separated by filtering and washed and then conc. NH_4OH was added.	Precipitate did not dissolve.
3. (i) NaOH was added and heated.	A gas evolved.
(ii) Evolved gas was tested tested with filter paper dipped in Nessler's reagent.	Filter paper turned brown.

(i) What is /are the gas / gases responsible for observation in test I (i).

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(ii) What are the compounds in pale yellow precipitate (X) in test 2(i).

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(iii) What are the two anions in R.

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(iv) What is the cation in R.

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(v) Write the chemical formula of species responsible for observations in following situations.

I. Dark yellow precipitate (Y) in 2(ii).

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II. Gas in 3(ii).

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(vi) Write a balanced ionic equation for reaction in 1(iii).

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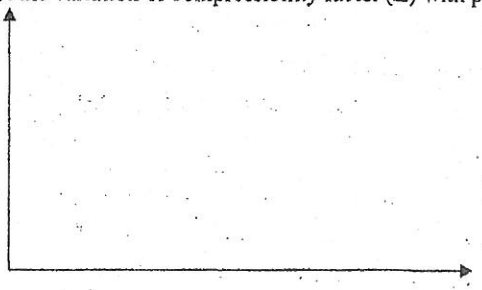
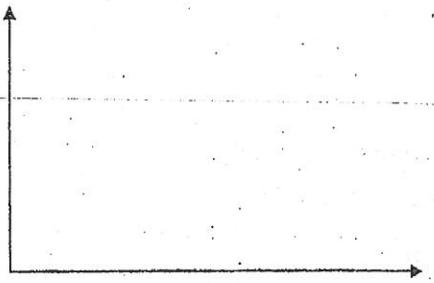
(6.0 marks)

3. (a) (i) For an ideal gas plot the variation of compressibility factor (Z) with pressure (P) at 237 K temperature.



(ii) At same temperature is above graph, draw the variation expected for H_2, CH_4 and C_2H_4 gases.

(iii) Draw the variation of Z with P for 1mol of Hydrogen gas at -70^0C and 20^0C temperature in a new graph.



(iv) Give reasons for the difference of variation of compressibility factor for real gases with respect to ideal gases.

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(v) 2.30 g of $MgCO_3$ was heated strongly to get a constant mass of residue 1.10g. When evolved CO_2 was collected at 27 ^{0}C and $1x10^5$ Pa , volume was 250 cm^3. Find out molar volume CO_2 of at STP. (Mg = 24 , C = 12 , O = 16)

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(4.6 marks)

(b) (i) Consider following thermochemical data.

Standard Formation enthalpy $CH_3COOH(g)$ = −487.6 kJmol^{-1}

Standard sublimation enthalpy C =715 kJmol^{-1}

Standard bond dissociation enthalpyH−H =432 kJmol^{-1}

Standard bond dissociation enthalpyC−H =413 kJmol^{-1}

Standard bond dissociation enthalpy C−*C* =346 kJmol^{-1}

Standard bond dissociation enthalpy C−*O* =352 kJmol^{-1}

Standard bond dissociation enthalpy O−*H* =484 kJmol^{-1}

Standard bond dissociation enthalpy O=O =496 kJmol^{-1}

(i) Calculate standard bond dissociation enthalpy of C=O bond using a thermochemical cycle.

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(ii) Following thermochemical data are provided at 25^{0}C for reaction,

$H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$

Chemical species	$H_{2(g)}$	$Cl_{2(g)}$	$HCl_{(g)}$
Standard formation enthalpy /kJmol^{-1}	0.00	0.00	-90.00
Standard entropy / kJmol^{-1}K^{-1}	0.80	0. 12	0.60

(I) Calculate ΔH^{θ} for reaction at 25^{0}C.

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(II) Calculate ΔS^{θ} for reaction at 25^0C.

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(III) Deduce whether reactions is spontaneous or not at 25^0C by a calculation.

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(5.5 marks)

4. (a) In hydrocarbon A, mass percentage of carbon is 88.89%. Its relative molecular mass is about 55. (C=12 , H=1)

(i) Find out empirical formula and molecular formula of A.

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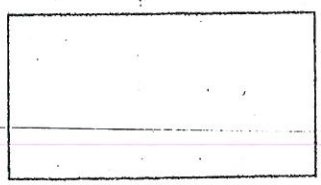
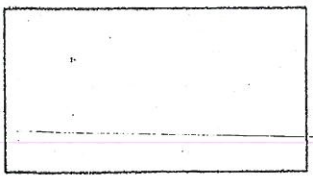
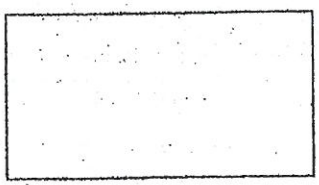
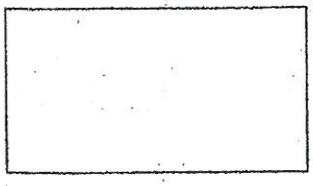
(ii) If A is not a cyclic compound, draw 04 structures that can have for A.

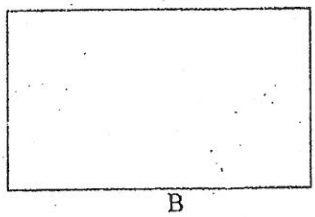




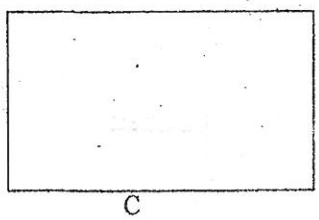




(iii) One mol of B, which is an isomer of A, reacts with 1 mol of H_2 in the presence of Lindlar catalyst to form gaseous hydrocarbon C. C shows diastenomerism. Identify B and C.



B



C

(4.4 marks)

(b) Write a mechanism for following reaction.

$$CHCl_3 + Cl_2 \xrightarrow[\text{sun light}]{\text{diffused}} CCl_4 + HCl$$

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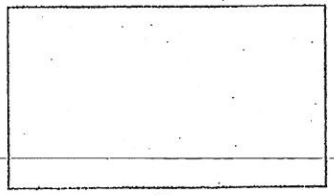
(1.6 marks)

(c) Acyclic unsaturated hydrocarbon X with molecular formula C_nH_m shows enantiomerism has the lowest relative molecular mass.

(i) Write the smallest possible values for n and m.

n..... m.....

(ii) When above hydrocarbon X was subjected to catalytic hydrogenation, saturated hydrocarbon Y was formed. Draw the structure of Y.



Y

(iii) Identify carbon atoms that hybridization changed during formation of Y from X and label these carbon atoms by drawing a cycle, in above structure of Y drawn by you.

(iv) How to distinguish X andY by a chemical test.

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(4.0 marks)

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General Certificate of Education (Adv. Level) Examination, 2018 July

රසායන විද්‍යාව II Chemistry II	13 – ශ්‍රේණිය, 12 –Grade– 12 3– වන වාරය, , 3rd Term Test	02 E II

* Universal gas constant R = 8.314 J mol^{-1}K^{-1}
* Avogadro's constant N_A= 6.022 x 10^{23} mol^{-1}

Part B - Essay

Answer two questions. (Each carries 15 marks)

5. (a) (i) Write ideal gas equation and introduce each term.

(ii) Two rigid contains with volume Vdm^3 in each, consist oxygen gas are connected by a capillary tube with value which has a negligible volume. Then value was opened and both bulbs were maintained at 27^{0}C temperature. The pressure of the system was 1.2×10^5 Pa Temperature of one container was maintained at 27 ^{0}C ,while tempe¾ture of other container was raised to 127^{0}C. What is the new pressure of the system.

(5.0 marks)

(b) (i) Write balanced chemical equations for following enthalpy changes for compound $CaC\ell_2$ (s) which is highly water soluble ionic compound.

I. Standard dissolution enthalpy of $CaC\ell_{2(s)}$ = -x kJ mol^{-1}
II. Standard hydration enthalpy of $CaC\ell_{2(s)}$ = -y kJ mol^{-1}
III. Standard lattice enthalpy of $CaC\ell_{2(s)}$ = -z kJ mol^{-1}

(ii) Using enthalpy level diagram, derive a relationship for standard dissolution enthalpy of $CaC\ell_{2(s)}$ using X,Y and Z.

(iii) Determine either ionic compound $NaC\ell_{(s)}$ or $LiC\ell_{(s)}$ has the highest water solubility, using energy level diagram and a calculation, if following data are provided

	ΔH^{θ}_{hyd}/ kJ mol^{-1}
$Li^+(g)$	-499
$Na^+(g)$	-390
$C\ell^-(s)$	-381

	ΔH^{θ}_{f}/ kJ mol^{-1}
$LiC\ell(s)$	-848
$NaC\ell(s)$	-776

(8.5 marks)

(c). Consider the following gaseous equilibrium system at standard state.
$N_2O_4(g) \longrightarrow 2NO_2(g)$; ΔH^{θ}_R = 57 kJmol^{-1}
At the considering temperature , ΔS^{θ} of $N_2O_4(g)$ and $NO_2(g)$ are 304 J mol^{-1} K^{-1} and 240 J mol^{-1} K^{-1} respectively. Find out temperature T , that system is at equilibrium.

(1.5 marks)

6. (a) (i) "In an ideal gas, molar mean kinetic energy of molecules is proportional to thermodynamic temperature (T)". Explain this statement considering ideal gas equation and molecule kinetic equation.

(ii) 50.0 g of mixture consists thermally stable inert material, and equimolar composition of KNO_3 and $KMnO_4$ was heated to decompose completely. Evolved gas was collected by downward displacement of water at 27^{0}C room temperature. When 20% of formed gas gets dissolved in water, resultant gas has a volume of 400 cm^3 and pressure of 1.5x10^5 Pa.

At 27°C saturated vapour pressure of water is 26.50 mmHg. Atmospheric pressure is 760 mmHg

(i) Find out the mass percentage of inert substance in the sample.
(K=39, N = 14 , O = 16, Mn = 55)

(ii) How much is the mean square speed of gas.

(6.0 marks)

(b) (i) Following table shows the results of 04 experiments used to find out rate of below reaction at 300 K.

$2NO_{(g)} + Cl_{2(g)} \longrightarrow 2NOCl_{(g)}$

Experiment number	Initial concentration/ mol dm^{-3}		Initial rate / mol dm^{-3} s^{-1}
	[NO]	[Cl_2]	
1)	0.010	0.010	1.2×10^{-4}
2)	0.010	0.020	2.4×10^{-4}
3)	0.020	0.015	R_3
4)	0.020	0.020	4.6×10^{-4}

(i) Introduce an expression for rate of the above reaction.

(ii) What is the total order of the reaction?

(iii) Find out value of rate constant K.

(iv) In 3rd experiment, what is the value of reaction R_3.

(6.0 marks)

7. (a) Aqueous solution of salt A gave a white crystalline precipitate B with dill. HCl. Precipitate was removed by filtering and H_2S gas with passed through the resultant filterate to get a black colour precipitate C. Compound B is soluble in hot water and KI was added, and cooled to get golden yellow precipitate D. Compound A does not evolve any gas with dill. HCl. But when compound A was heated a reddish brown gas E was evolved.

(i) Identify compound A to E.

(ii) Write balanced chemical equation for thermal decompotion of compound A.

(iii) Write another chemical test (other than given in above) to identify the anion in compound A.

(4.0 marks)

(b) A, B and C are 03 coordinate complex compounds consist ion, of metal Nickel. In all 03 shape is octahedral. In all 03 compounds Nickel is at same oxidation state. Only CN^- and H_2O are coordinated as ligands. Only K^+ is present as non coordinate ion. A, B and C compounds give altogether 2, 3 and 4 ions respectively.

(i) What is the oxidation state of Ni in coordinate complexes.

(ii) Write electronic configuration of that ion corresponds to above oxidation state.

(iii) Write the Formula of coordinate compound A, B and C(No need to give reasons)

(iv) When compound B is heated with NaOBr above Nickel ion in (i) get oxidized to another oxidation state. In this new coordinate complex molecular formula is $NiK_3C_3N_3H_3O_3$. It has CN^- and OH^- as ligands. It also has octahedral geometry.

(I) In this complex what is the new oxidation state of Ni.

(II) What is the formula of new compound

(5.5 marks)

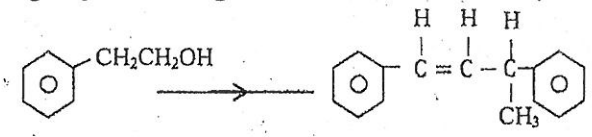
(C) Following table gives, data of experiment carried out to determine kinetics of reaction of bromination of acetone (CH_3COCH_3) in acidic medium.

Experiment number	[CH_3COCH_3] / mol dm^{-3}	[Br_2] / mol dm^{-3}	[H^+] / mol dm^{-3}	rate of consumption of Br_2/ mol dm^{-3} s^{-1}
1	0.30	0.05	0.05	5.7×10^{-5}
2	0.30	0.10	0.05	5.7×10^{-5}
3	0.30	0.05	0. 10	1.14×10^{-4}
4	0.40	0.05	0.05	7.6×10^{-5}

(i) Rate of the reaction depends in concentration of CH_3COCH_3 , H^+ and Br_2 . Considering K as rate constant , write an expression for rate of the reaction r.
(ii) Find out order with respect to each reactant using above data.
(iii) What is the total order of the reaction.
(iv) Calculate rate constant of the reaction.

(5.5 marks)

8. (a) Using only chemicals given in the list, show how do you carry out following conversion.



Chemical list:- H_2, $Pd/BaSO_4$ / quinoline, HBr, conc. H_2SO_4, Br_2, CCl_4, alcholic KOH , Na

(5.0 marks)

(b) Using A as the only initial organic compound, show how do you synthesize compound B.

$CH_3CH_2CH_2Br$ $\qquad$ $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

(A) $\qquad$ (B) *(3.5 marks)*

(c) Write the mechanism for reaction of 2-Methylpropene and HBr .

(d) Hydrocarbon A gives a white precipitate with $AgNO_3/NH_3$. A has two C atoms with sp^2hybridization and two C atoms with sp hybridization. Also it has 3 sp^3 hybridized carbon atoms. A shows geometric and optical isomerism.

(i) What is the molecular formula of A.
(ii) Draw the structure of A.
(iii) What is the IUPAC name of A. *(4.0 marks)*

9. (a) When two aqueous solutions of compound A and B were mixed, water insoluble and insoluble in dill. HNO_3 compound C and water soluble compound D were formed. When compound A was heated brown colour gas E was formed. When $(NH_4)_2CO_3$ was added to aqueous solution of A, White precipitate F was formed and that precipitate releases a colourless gas on heating. A gave a apple green flame in flame test.

When NH_4OH was added to aqueous solutions of compound B, dirty green precipitate H, formed, which is insoluble in excess reagent.

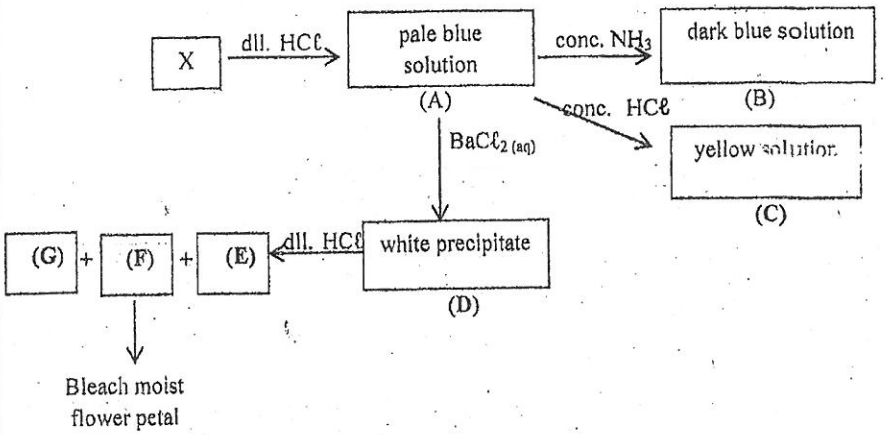
(i) Identify compounds A to H.
(ii) Write balanced chemical equations for reactions of formation of compound C to H.

(7.5 marks)

(b) 1.0 g of $KClO_3$ and KCl mixture was dissolved in 250.0 cm^3 of water. From this solution 25.0 cm^3 was reacted with excess SO_2 and reaming SO_2 was expelled by heating. When acidified $AgNO_3$ was added, a precipitate with mass 1.435 g was formed.
From the initial solution another 25.00 cm^3 was taken and 30.00 cm^3 of 0.5 $moldm^{-3}$ $FeSO_4$ was added. Unreacted $FeSO_4$ in this, was reacted with 0.1 $moldm^{-3}$ $K_2Cr_2O_7$ solution which required 12.50 cm^3 volume. Find out molar ratio of $KClO_3$ and KCl in initial mixture.
(Ag = 108 , Cl = 35.5)

(7.5 marks)

10. (a) Certain reactions relevant to salt X are given in below.



(i) Write chemical formula for complexes of A, B and C.
(ii) Name those compounds according to IUPAC method.
(iii) Name shapes of A, B and C.
(iv) Identify D, E, F and G.
(v) Write the chemical formula of salt X.

(7.0 marks)

(b) 8.0 g of mixture consists $(NH_4)_2Cr_2O_7$, $(NH_4)_2SO_4$ and NH_4NO_3 was provided.

(A) When this mixture was heated to get a constant mass, mass of resultant solid residue was 0.76 g.

(B) Then above initial mixture was dissolved to get 1.0 dm^3 of aqueous solution. 100.0 cm^3 of this solution was heated with 2 mol dm^{-3} excess NaOH to give solution X and a gas was evolved. Evolved gas was absorbed on 100.0 cm^3 of 0.1 mol dm^{-3} HCℓ solution. Remaining HCℓ was back titrated with 0.1mol dm^{-3} NaOH solution which required 40.0 cm^3 to reach end point.

(C) Above solution X was heated by adding Aℓ power and evolved gas was absorbed on 75.00 cm^3 of 0.1 mol dm^{-3} HCℓ solution. When it was observed that bubbling ceased remaining HCℓ was back titrated with 0.1 mol dm^{-3} NaOH solution, which required 30.0 cm^3 to reach end point.

(i) Write balanced equations for all reaction that take place in process A, B and C.
(ii) Find out amount (molℓ) of $(NH_4)_2Cr_2O_7$, $(NH_4)_2SO_4$ and NH_4NO_3 separately.
(iii) Find out mass percentage of NH_4NO_3 in initial mixture.
(Cr = 52, N = 14, H = 1, O = 16, P = 31)

(8.0 marks)

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