G.C.E. A/L Examination March - 2017

Conducted by Field Work Centre, Thondaimanaru
In Collaboration with
Provincial Department of Education, Northern Province.

FWC

Grade :- 12 (2018)	CHEMISTRY	Time :- Three hours

Part- I

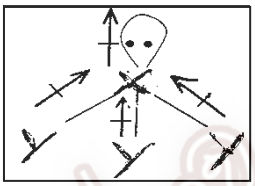
- **Answer the all questions.**

$N_A = 6.022 \times 10^{23}\ mol^{-1}$, $R = 8.314 J mol^{-1} K^{-1}$

1) How many electrons can have *l*=2 for n=3

(1) 5 *(2)* 2 *(3)* 12 *(4)* 10 *(5)* 14

2) XY_3 is the molecule produced by the elements X and Y. Which is false statement in the following on the basis of the structure given below.



(1) Electro negativity of X is greater than Y

(2) The resultant dispole moment is not zero.

(3) Electron geometry and shape are tetrahedral and trigonal pyramid respectively.

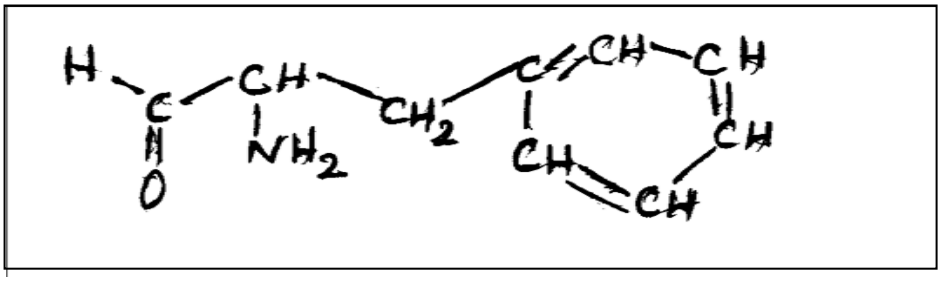
(4) X and Y are non metal

(5) Element X is in group VI.

3) $C^aH_2 = C^b = C^cH - C^dH_3$ Which is thee correct order of electrone gativity of *C* in the molecule.

(1) c >d > b>a 2) b > c > d >a 3) b > c > a >d 4) c > a > b > d 5) a > d > b >c

4) Which is not the oxidation number of *C* atoms in the following molecule.



(1) -1 *(2)* 0 *(3)* +1 *(4)* -2 *(5)* +2

5) Composition of Fe^{2+} in an aqueous solution is 14ppm. What is the concentration of Fe^{2+} in the solution in $mmoldm^{-3}$?

(1) 2.5 *(2)* 0.25 *(3)* 0.025 *(4)* 0.50 *(5)* 1.00

6) Standard enthalpy of combustion of $Al_{(s)}$, $S_{(s)}$ and $SO_{2(g)}$ are a,b and c kjmol^{-1} standard enthalpy of formation of $Al_2(SO_4)_3$ is d kJmol^{-1}

$Al_2O_{3(s)} + 3S0_{3(s)} \longrightarrow Al_2(SO_4)_{3(s)}$

Enthalpy change of the above reaction is

1. d – 2a – 3b – 3c
2. 2a + 3b + 3c – d
3. a – 2b + c + d
4. d – a – b – c
5. No suitable answer.,

7) Which of the following statement is false?

(1) The highest first ionization element is He

(2) Elements in period 4 and 6 consist of elements in three physical states.

(3) $CO_{2(s)}$ is non polar molecular lattice

(4) Non - polar covalent bond exist is in liquid of Argon.

(5) H_2O_2 function as oxidizing agents and disinfectant.

8) $KHC_2O_4 . H_2C_2O_4$ reacts with $KMnO_4$ in acidic medium and forms Mn^{2+}, K^+, CO_2, and H_2O as the products stocniometric radio between and $KMnO_4$ and $KHC_2O_4 . H_2C_2O_4$

(1) 4 : 5 *(2)* 8: 5 *(3)* 5: 4 *(4)* 4: 10 *(5)* 1: 5

9) Number of atoms of oxygen in a drop of water coming from burette.

1) $^1/_{18}$x 6.022x10^{23} *2)* $^1/_{18}$x 6.022x10^{22} 3) $^5/_{18}$x 6.022x10^{21}

4) $^5/_{18}$x 6.022x10^{23} *5)* $^1/_{18}$x 6.022x10^{21}

10) Which of the following equations is not redox reaction.

1) $3CuO + 2NH_3 \rightarrow 3Cu + N_2 + 3H_2O$

2) $Na_2S_2O_8 + 2NaI \rightarrow I_2 + 2Na_2SO_4$

3) $Mg + ZnSO_4 \rightarrow MgSO_4 + Zn$

4) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

5) $K_2CO_3 + 2HCl \rightarrow 2KCl + H_2O + CO_2$

11) $CH_3OH_{(2)} \rightleftharpoons CH_3OH_{(g)}$ $\Delta H = +35.3 kJmol^{-1}$

The equation represents the equilibrium between liquid methanol and methanol vapour of 338K given the $\Delta H = +35.3 kJmol^{-1}$ enthropy change when methanol is vaporized is,

1) $-104.4 JK^{-1}mo^{-1}$ *2)* $+104.4 JK^{-1}mo^{-1}$ 3) $^+208.8 JK^{-1}mo^{-1}$

4) $^+52.2 JK^{-1}mo^{-1}$ 5)$208.8 JK^{-1}mo^{-1}$

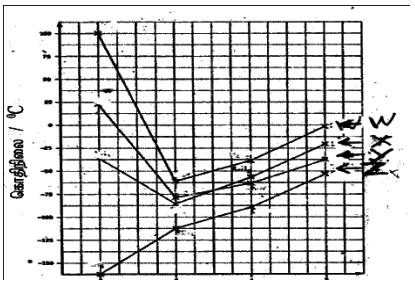
12) 0.025mol of a metal sulphate has a mass of 4.60 g . Identify the metal ion in the sample.

(1) Ca^{2+} *(2)* Be^{2+} *(3)* Sr^{2+} *(4)* Ba^{2+} *(5)* Mg^{2+}

13) Which of the following statements is false?

1. No exchange of energy, matter or work in an isolated systems.
2. Gases show ideal behaviour at high temperatures and low pressure.
3. Ionic compounds do not conduct electricity in solid state.
4. Heat capacity is an intensive property.
5. Standard enthalpy of $Ca_{(s)}$ is zero.

14) Boiling points of hydrides of P block elements in groups 14, 15,16 and 17 are indicated by the graphs W,X,Y and Z the correct order of the groups 14,15,16 and 17 respectively.



1) W , X , Y, Z
2) Z , X , W, Y
3) X , Y , W, Y
4) Z , Y , X , W
5) W , Z , X , Y

15) 5.20 g sample of Cu - Zn alloys reacts with HCl and to produce hydrogen gas If the hydrogen gas has a volume 0.50dm^3 at 27^{0}C and 1x 105 Nm^{-2}. What is the percentage of Zn in the alloy (C u does not react with HCl) (Zn = 65)

(1) 33.3% *(2)* 25% *(3)* 50% *(4)* 75% *(5)* 66.7%

❖ **For each the questions 16 to 20 follow this instructions**

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

16) Which of the following statements indicating the increasing order of the properties is or are true.

(a) C – O bond length CO < CO_2 < CO_3^{2-}

(b) Electro negativity of N atom NH_3 < NO_3^- < NO^-_2

(c) Bond angle S_1Cl_4 < ICl_4^- < NCl_3

(d) Melting points KCl< NaCl < LiCl

17) Which of the following statement regarding to NO_2^+ ion is or are true?

(a) ,It has two N = O bond.

(b) NO_2^+ and H_2S have the same shape

(c) N_2O_5 (s) contains NO_2^+ and NO^-_3 ions.

(d) N has no lone pair electrons.

18) Which of the following ions has three unpaired electrons.

(a) Cr^{3+} (b) Co^{2+} (c) Fe^{3+} (d) Ni^{2+}

19) Secondary forces that found in CH_3CH_2Cl

(a) Hydrogen bond

(b) London force

(c) Dipole - dipole interaction

(d) convalent bond

20) Which of the following reaction releases energy.

(a) $CaC_2O_{4(s)} \rightarrow CaCO_3 + CO_{(S)}$

(b) $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$

(c) $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$

(d) $Ba(OH)_2 + H_2SO_{4(m)} \rightarrow BaSO_{4(s)} + 2H_2O_{(l)}$

❖ **In question number 21 to 25 two statements are given in respect of each questions.**

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

	First statement	Second statements
21)	Na(s) forms $Na_3N(s)$ when heated with $N_2(g)$	N≡N bond energy is high.
22)	$I_2(s)$ is more soluble in KI(aq)	I_3^- is stable.
23)	Boiling point of Xe is higher than CH_4	Molarmass of Xe is greater than CH_4
24)	Reactions that have negative free energy change ($\Delta G < 0$) are spontaneous.	ΔG of a reaction that has negative values of ΔH and ΔS is always negative
25)	BeO reacts with strong acid and strong base	BeO is amphoteric

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Grade :- 12 (2018)	CHEMISTRY	Time :- 3 hours.

PART - II A

Answer all four questions on this paper.

01. (a) You are provided with the following list of some elements in the periodic table.

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

From the list

(i) Identify the element that has the highest ionization energy ----------

(ii) Identify the element that exhibits highest oridation state ----------

(iii) Identify the nonmetallic element that forms a homoatomic covalent Lattice of high hardness ----------

(iv) Identify the element which forms the largest anion ----------

(v) Identify the element that a P - black metal ----------

(vi) Identify the element that has the highest melting point ----------

(b) The following parts (i) to (vi) are based on the molecule HNCO (isocyanic acid)

It has the following skeleton.

$H - N - C - O$

(i) Draw the most acceptable Lewis structure for this ion

(ii) Draw resonance structures for this molecule and comment on their relative stabilities.

(iii) State the following given in the table below (around the atoms N and C)

		N atom	C atom
I	Electron pair geometry		
II	Shape		
III	hybriclization		

(iv) Is this molecule polar or nonpolar ?----------

(v) Identify the atomic / hybrid orbitals involved in the formation of the following bonds in the Lewis structure drawn in part (i) above.

I) H and N ----------

II) N and C ----------

III) C and O ----------

(vi) Sketch the shape of the Lewis structure drawn in part (i) above indicating approximate values of the bond angles.

---------- (100 marks)

02. (a) On treatment with cold water an element (A) reacted quietly, Liberating a colourless, odourless gas (B), a solution (C). Element (A) reacted with (B) yielding a solid product (D) which reacted with water to give basic solution (C). When carbondioxide was bubbled through solution (C) initially a white precipitate (E) is formed, but this redissolved forming solution (F) when more CO_2 was added. Precipitale (E) effervesced when moistened with concentrated hydrochloric acid and gave a brick red colouration to the burner flame. When (E) was heated at 1000°C a white compound (G) was formed. which when heated carbon at 2000°C gave a solid (H) of some commercial importance.

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

(A) ---------- (B) ---------- (C) ----------
(D) ---------- (E) ---------- (F) ----------
(G) ---------- (H) ----------

(ii) Give balanced chemical equations for the reaction described above.

(b) (i) Describe a test which would distingues sodium chloride from potassium chloride.

(ii) Write balanced equation for the following thermal decomposition reactions.

(I) $NaNO_3 \longrightarrow$
(II) $Mg(NO_3)_2 \longrightarrow$
(III) $BaCO_3 \longrightarrow$
(IV) $LiOH \longrightarrow$
(V) $NaHCO_3 \longrightarrow$

(iii) Write balanced equations for the following reactions.

(I) $Sr_{(s)} + O_{2(g)} \longrightarrow$
(II) $Mg_{(s)} + H_2O_{(g)} \longrightarrow$
(III) $Li_{(s)} + N_{2(g)} \longrightarrow$

03. (a) (i) State Dalton's Law of partialpressure.

(ii) At 300K and at $4.0\times 10^5\ Nm^{-2}$ He gas exists in a vessel with a volume $3.0m^3$. At 300K and at $8.0\times 10^5 Nm^{-2}$ Ne gas exsits in a vessel with a volume $7.0m^3$. The vessels are connected allowing the two gases to mix completely. Assuming the ideal gas behaviour calculate the following.

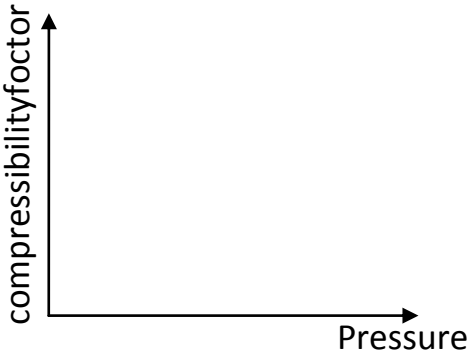
(I) The total pressure in the connected vessels.

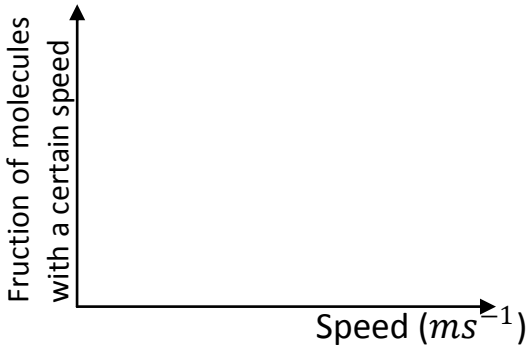
(II) The molefraction of the gas He in the mixture.

(III) The partial pressure of the gas in the connected vessels when the temperature of the gas mixture is increased to 400K maintaining the total volume of the two vessels the same.

(b) (i) Sketch below the variation of the compressibility factor with pressure for an ideal gas and for a real gas. State for the reasons for the difference in the sketches you drew for the two types of gases.

(ii) Sketch below Maxwell- Boltzmann curves for a gas at two different temperatures T_1K, T_2K ($T_1 < T_2$) state the reason for the difference in the sketch.





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04. Consider the chemical reaction.

$CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

and the thermochemical data given below (at 25°C)

Chemical species	$\Delta Hf^{\theta}(KTmol^{-1})$	$S^{\theta}JK^{-1}\,mol^{-1})$
$CaCO_{3(s)}$	- 1206	93
$CaO_{(s)}$	- 635	40
$CO_{2(g)}$	- 394	210

(i) Calculte ΔH^{θ} for the above reaction at 25°C

(ii) Calcute ΔS^{θ} for the above reaction at 25°C

(iii) Write an expression to relate ΔG of a chemical reaction to its ΔH and ΔS.

(iv) Calculate ΔG for the above reaction at 500°C and state whether the reaction is spontaneous or non- spontaneous.

(b) (i) What does the term entropy mean?

(ii) State whether the entropy change decrease or increase of the following changes.

I $H_2O_{(s)} \rightarrow H_2O_{(l)}$ ----------

II $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ ----------

III $Li_3N_{(s)} + 3H_2O_{(l)} \rightarrow 3LiOH_{(aq)} + NH_{3(g)}$ ----------

IV $NH_4Cl_{(s)} \rightarrow NH_{3(g)} + HCl_{(g)}$ ----------

V $CO_{2(g)} + C_{(s)} \rightarrow 2CO_{(g)}$ ----------

(c) Write down balanced chemid equation for the processes from (i) to (iv) statements .

(i) Standard enthalpy of second lonisation of calcium

(ii) standard enthalpy of formation of $MgBr_{2(s)}$

(iii) standard First electron gain enthalpy of orygen.

(iv) standard bond dissouiation enthalpy of bromine.

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Grade :- 12 (2018) **CHEMISTRY**

PART - II

B. Essay Questions.

❖ **Answer any two questions from this part.**

(01) (a) (i) What do you mean by disproportionation reaction?

(ii) The manganate (VI) ion in acid solution a disproportion reaction as follow.

$3MnO_4^{2-}{}_{(aq)} + 4H^+{}_{(aq)} \longrightarrow 2MnO_4^-{}_{(aq)} + MnO_{2(s)} + 2H_2O_{(l)}$

Write the half ion eqnation for oxidation and reduction of the above reaction

(iii) Give two disproportionation reactions with the balanced chemical equation.

(b)

(i) Write the balanced chemical equation of H_2S with the following reagents

(I) K_2CrO_4 (II) $FeCl_3$ (III) $KMnO_4$

From that calculate the number of the moles of each reagents that concert 1mol of H_2S to sulphur.

(ii) When a tablet weighing 0.940g was dissolved in dilute sulphuric acid and the resulting solution titrated with $0.016moldm^{-3}$ $K_2Cr_2O_7$ exactly $32.50cm^3$ of the $K_2Cr_2O_7$ solution were required to reach the end point. Calculate the percentage by mass of Fe^{2+} in the tablet. (Fe = 56)

(c) (i) Sodium carbonale crystals (27.80g) were dissolved in water made up to $1.0dm^3$ $25.0cm^3$ of the solution were neutralized by $48.80cm^3$ of hydrochlonic acid of concentration $0.10moldm^{-3}$ Find x in the formula $Na_2CO_3.xH_2O$.

(Na = 23, C=12, H=1, O=16) (150 Marks)

(02) (a)

(i) Write molecular Kinetic equation of gases and indicate all terms in the equation.

(ii) Derive $\sqrt{\overline{C^2}} = \sqrt{\frac{3RT}{M}}$ from equations for ideal gas.

(iii) Calculate root mean square speed of He gas at 27°C . (He=4)

(iv) Write four factors that influence diffusion rate of gases.

(b)

(i) State Hess's Law.

(ii) Find the standard enthalpy change for the reaction.

$\mathbf{CO_{(g)} + 2H_{2(g)} \longrightarrow CH_3OH_{(l)}}$

Use the datas

$\mathbf{CO_{(g)} + \frac{1}{2} O_{2(g)} \longrightarrow CO_{2(g)}}$ $\mathbf{\Delta H^{\emptyset} = -283KJmol^{-1}}$

$\mathbf{H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)}}$ $\mathbf{\Delta H^{\emptyset} = -286KJmol^{-1}}$

$\mathbf{CH_3OH_{(l)} + 3/2\ O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}}$ $\mathbf{\Delta H^{\emptyset} = -715KJmol^{-1}}$

(iii) Constuct a Born – Haber cycle for the formation of solid potassium chloride from its elements in their standard states use the data below and Calculate the standard enthalpy of formation of $KCl_{(s)}$

$K_{(s)} \longrightarrow K_{(g)}$ $\Delta H^{\emptyset} = 90KJmol^{-1}$

$K_{(g)} \longrightarrow K^+_{(g)} + e$ $\Delta H^{\emptyset} = 418KJmol^{-1}$

$\frac{1}{2} Cl_{2(g)} \longrightarrow Cl_{(g)}$ $\Delta H^{\emptyset} = 122KJmol^{-1}$

$Cl_{(g)} + e \longrightarrow Cl^-_{g)}$ $\Delta H^{\emptyset} = -348KJmol^{-1}$

$Cl^-_{g)} + K^+_{(g)} \longrightarrow KCl_{(s)}$ $\Delta H^{\emptyset} = -718KJmol^{-1}$ (150 Marks)

(03) (a) The first three ionization energy of an element M are 738, 1449, 7728 $kJmol^{-1}$ respectively. The halide of M give colourless flame Bunsen flame the solution of nitrate of M gives white precipitate with $NaOH_{(aq)}$. This precipitate will not dissolve in excess of $NaOH_{(aq)}$. M liberate NO_2 with Concentrated HNO_3

(i) Identify the element M.

(ii) Write the electronic configuration of M.

(iii) Write the balanced chemical equations of M when it is heated with air.

(iv) When we add water to the products obtained in a(iii) release a gas Identify the gas.

(v) Write the balanced chemical equation between M and HNO_3.

(vi) Write two uses of M.

(b) (i) Explain why both group 1 and 2 elements have melting points for metals and why group 1 melting points are Cower that those of group 2.

(ii) Which is the only group 2 metal not to from more ionic compounds.

(iii) State which of each pair of compounds is more soluble.

1. Maganesium hydroxide and barium hydroxide.
2. Calciumsulphate and strontium sulphate ($Sr\ SO_4$)

(iv) Give two reactions as to why rubidium nitrate is more thermally stable than maganesium nitrate.

(c) (i) Write the molecular formula of hydroxide of elements in period 3 indicate acid, base and amphoteric nature of their hydroxides.

(ii) Write the balanced chemical equation of amphoteric hydroxide obtained above with HCl and NaOH. (150 Marks)