G.C.E. A/L Examination March - 2019

Conducted by Field Work Centre, Thondaimanaru
In Collaboration with

Provincial Department of Education, Northern Province.

FWC

Grade :- 12 (2020)	Chemistry	Time : 2 Hours

Part - II
Structured Question - A

❖ **Answer all question.**

01. a) Consider the first 7 element in the 2nd period of the periodic table.

1) Identify and write the symbols of the elements described by the following properties.

(i) Highest Electron Affinity ……...

(ii) Element having 5 different oxidation states ……...

(iii) Elements having allotropes. ……

2) Write the chemical formula of compound formed by reaction of elements having the highest and lowest first ionization energy.

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3) Explain the reason for having highest second ionization energy in the cationic part of above mentioned compound in (ii).

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b) N_2O_4 is a Nitrogen compound having asymmetric and symmetric skeletons.

i) Draw the most Acceptable Lewis structure For Asymmetric and symmetric skeletons of N_2O_4

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ii) State the IUPAC Name for N_2O_4

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iii) Draw the stable Lewis structure for the oxide having nitrogen at its highest oxidation state.

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iv) Draw the resonance structures for the compound state in (iii).

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v) Draw the resonance hybrid with respect to the compound stated in (iii).

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vi) Draw the rough sketch of the molecule drawn in above (iii) indicating approximate bond angle.

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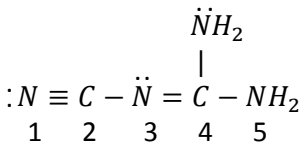
vii) Complete the following table regarding the Lewis structure given below.



	C_2	C_4
Hybridization		
Electron pair geometry.		
Shape around the atom.		
Oxidation number		

viii) Give atomic / hybrid orbitals with respect to the following $\sigma -$ bonds.

$C_2 - N_3 = C_2$ …… N_3 ……

$C_4 - N_5 = C_4$ …… N_5 ……

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

1) Energy released in the process $M_{(g)} + e \longrightarrow M_{(g)}^-$ where M is C, F, Mg, Cl.

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2) Covalent character in $MgBr_2$,$CaCl_2$, BaF_2, $BaCl_2$.

……. < ……. < ……. < ……..

3) Bond length (N – O) increasing order in NO, NO_2^- , N^+O_2, NO_3^-

……. < ……. < ……. < ……..

4) Atomic radius S, F, Si, Cl

……. < ……. < ……. < ……..

5) Electronegativity of S in SCl_2, H_2S, SF_6, SF_2.

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02. a) A and B are two elements having atomic number less than 30. They are successive elements in the same group. Covalent character of A is greater than that of B. Oxides of A and B has higher melting points among other oxides in their respective periods. A does not give answer to flame test.

1) Write the ground state electronic configuration of A and B.

A - ……..

B - …….

2) Write balanced chemical equations for the reactions of A with Air.

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3) Identify the final gaseous state product using relevant balanced equation, when the product obtained in (2) above treated with water.

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4) In the reaction of Aluminium and $NaNO_3$ in basic medium along with above (iii) gaseous product, $NaAlO_2$ obtained as final product. Give the relevant balanced chemical equation (Note : Use H_2O where necessary)

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5) Write the balanced chemical equation for the reaction of A with concentrated HNO_3.

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6) Demonstrate the simple experiment regarding flame test of element B.

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7) State one use for each elements A and B.

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b) A 30g sample of $Na_2C_2O_4$ was dissolved in diluted H_2SO_4. The resultant solution was treated with 1 $moldm^{-3}$ $KMnO_4$, Volume of $KMnO_4$ required for titration was $80cm^3$.

1) Write the relevant oxidation – reduction reactions for the above titration.

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2) Hence write the balanced chemical equation.

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3) Calculate the mass percentage of $Na_2C_2O_4$ in the above given sample.

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03. a) Write down balanced chemical equations for the processes appropriate to each of the following statements from (1) to (6)

1) The standard enthalpy of atomization, $\Delta H_A^{\emptyset}\ of\ Mg_{(s)}\ (148.0\ KJ\ mol^{-1})$

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2) The standard enthalpy of atomization, $\Delta H_A^{\emptyset}\ of\ Br_{2(l)}\ (192.0\ KJ\ mol^{-1})$.

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3) The standard of enthalpy of first ionization and standard enthalpy of second ionization of Mg, $\Delta H_{I_1}^{\emptyset} = 737.0\ KJ\ mol^{-1}\ and\ \Delta H_{I_2}^{\emptyset} = 1451\ KJ\ mol^{-1}$

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4) The standard electron gain enthalpy of $Br_{(g)}$, $\Delta H_{EA}^{\emptyset} = -328.0\ KJ\ mol^{-1}$.

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5) The standard formation enthaply of $MgBr_{2(s)}$ $\Delta H_f^{\emptyset} = (-552.0\ KJ\ mol^{-1})$.

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6) The standard lattice enthalpy ($\Delta H_L^{\emptyset}$) of $MgBr_{2(s)}$,

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b) Calculate the lattice enthaply of $MgBr_2$ using the above data given in part (a).

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c) An experiment have been arranged at 25^{o} C regarding the reaction between $1\ moldm^{-3}\ NaOH$ and $1\ moldm^{-3}\ HCl$. The experimental setup was arranged with the following.

- 500ml of NaOH and 500 ml of HCl.
- Calorimeter of mass 530g and specific heat capacity of $0.4\ Jg^{-1}\ K^{-1}$
- Test tube
- Volumetric Flask
- Neutralization enthalpy $\Delta\ H_N{}^{\emptyset} - 57.356\ kJ\ mol^{-1}$

The experiment is carried out and final maximum temperature was measured.

- Specific heat capacity of water is $4.2\ Jg^{-1}\ K^{-1}$.

1) Calculate the maximum temperature change expected at the end of experiment.

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2) But the maximum temperature attained was 30º C point out some reasons regarding the above observation.

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3) In another day an experiment was carried out using weak base and weak acid, the neutralization enthalpy obtained under standard condition with least degree of errors was $-50.4\ kJ\ mol^{-1}$. Briefly explain the deviation of standard neutralization enthalpy in above two situations.

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04. a) Predict the products of the following decomposition reactions.

1) $SrCO_{3(s)} \xrightarrow{\Delta}$

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2) $Rb_2CO_{3(s)} \xrightarrow{\Delta}$

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3) $LiNO_{3(s)} \xrightarrow{\Delta}$

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4) $Ba(NO_3)_{2(s)} \xrightarrow{\Delta}$

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5) $LiOH_{(s)} \xrightarrow{\Delta}$

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b) State whether following statements are true or false.

1) $C_{(graphite)} \longrightarrow C_{(diamond)}$ $\Delta H = +4\ KJmol^{-1}$, However Diamond cannot be obtained from graphite. (……)

2) Whenever the temperature of environment is raised the root mean square velocity of gas molecules raises in the isolated system. (……)

3) Pauli states that nor two electrons can be differentiated by same set of quantum numbers. (……)

4) Down the group II^A elements, melting point of elements increases and along the period 2 from left to right melting point of elements gradually increases. (……)

5) If one element of molecule or any species involved to oxidation and reduction, is called as disproportionation reaction. (……)

c) i. Define the critical temperature.

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ii. Arrange He, NH_3 and CO_2 according to ascending order of their critical temperatures.

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iii. Sketch approximately how the compressibility factor of an ideal gas, helium gas and ammonia gas varies with pressure, label your graphs.

d) Balance the following chemical equations using relevant half ionic equations.

1) $P_4 + HNO_3 \longrightarrow H_3PO_4 + NO_2 + H_2O$

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2) $C + HNO_3 \longrightarrow CO_2 + NO_4 + NO_2$

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3) $C + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2 + H_2O$

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e) Balance the following reactions using oxidation number method.

1) $Cr(OH)_3 + H_2O_2 + NaOH \longrightarrow Na_2CrO_4 + H_2O$

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2) $K_2Cr_2O_7 + HCOOH + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + CO_2 + H_2O.$

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Part – II
Essay Questions – B

05. a) 1) State the expression for ideal gas equation and identify its terms.
2) Derive Boyle's law from Ideal gas equation.
3) Derive the equation for Average kinetic energy of ideal gases using your knowledge in chemistry $\overline{E} = {}^{3}/_{2}\ KT\ (K = {}^{R}/_{L})$.
4) State five assumption in kinetic molecular theory of gases.
5) Root mean square velocity of an ideal gas given by $\sqrt{\overline{C^2}} = \sqrt{\frac{3RT}{M}}$. Assuming ideal behaviour of $O_{2(g)}$ and $N_{2(g)}$ at 27ºC. Find the ratio of $\left(\frac{\sqrt{\overline{C^2}\ O_{2(g)}}}{\sqrt{\overline{C^2}\ N_{2(g)}}}\right)$.

b) In a 5dm^3 vessel at 27ºC $A_2B_{4(g)}$ is present. The pressure was measured to be 2.995 x 10^5 Nm^{-2} Vessel was heated up to 100ºC, At 127ºC $A_2B_{4(g)}$ involves to following decomposition and attain equilibrium as follows.

$$A_2B_{4(g)} \rightleftharpoons A_{2(s)} + 2B_{2(g)}$$

Pressure at equilibrium 8 x 10^5Pa. Volume of $A_{2(s)}$ formed is 0.843 dm^3.

a) Number of mols of $A_2B_{4(g)}$ at 27ºC ?
b) Amount of gas mixture at 127ºC ?
c) Partial pressure of components at equilibrium?
d) Sketch a graph representing the number of moles of $A_2B_{4(g)}$ and $B_{2(g)}$ with time from initiation of reaction to equilibrium state. (27ºC ⟶ 127ºC)

06. a) Define the following phrases.
i. 1. Open system.
2. Closed system.
3. Isolated system.

ii. *1.* ${}^{1}/_{4}\ P_{4(s)} \longrightarrow P_{(g)}$

2. $HBr_{(g)} \longrightarrow H_{(g)} + Br_{(g)}$

3. ${Al_{(g)}}^{3+} \longrightarrow {Al_{(aq)}}^{3+}$

4. ${3Ba_{(aq)}}^{2+} + {2PO_{4(aq)}}^{3-} \longrightarrow Ba_3(PO_4)_{2(s)}$

5. $C_6H_{12(l)} + 9O_{2(g)} \longrightarrow 6\,CO_{2(g)} + 6H_2O_{(l)}$

b) Some bond dissociation energy data are given below.

Bond	Bond dissociation energy / ($kJmol^{-1}$)
$H-H$	+ 433
$C-H$	+ 413
$C-C$	+ 346
$C=C$	+ 612

Calculate the standard enthalpy change that is expected to occur in the hydrogenation of buta – 1, 3 – diene($H_2C=CH-CH=CH_2$) to butane $\left(CH_3\ CH_2\ CH_2\ CH_{3(g)}\right)$

$CH_2=CH-CH=CH_{2(g)} + 2H_{2(g)} \longrightarrow CH_3\ CH_2\ CH_2\ CH_{3(g)}$.

c) Consider the following reaction at 25°C and the thermochemical data associated with it

$$NH_4\ NO_{3(s)} \rightarrow N_2O_{(g)} + 2H_2O_{(l)}$$

Chemical	$NH_4\ NO_{3(s)}$	$N_2O_{(g)}$	$H_2O_{(l)}$
Standard enthalpy of Formation ($kJmol^{-1}$)	- 365	82	- 286
Standard entropy ($kJmol^{-1}K^{-1}$)	150	220	70

i. Find the standard enthalpy change of the above reaction.
ii. Find the standard entropy change of the above reaction.
iii. Hence find the standard free energy change of the above reaction?
iv. Thereby derive whether the above reaction is spontaneous / non spontaneous at 25ºC.

07. a) A is a metallic element having density lesser than water. A can be cut by razor blade. When small scraps of this metal put into gas jar containing chlorine gas explosive reaction took place and purple colour glowing is observed.

i. Identify the element A and state one use of it.
ii. Give the ground state electronic configuration of A.
iii. Give the balanced chemical equation for the reaction between chlorine and element A.
iv. When element A reacts with excess oxygen B, C, D are obtained as products, Write balanced chemical equations for the reactions of B, C, D with water?
v. Give balanced equation for the thermal decomposition of nitrate of element A.
vi. State whether the above thermal decomposition differs from the thermal decomposition of $Mg(NO_3)_2$ If it differs state the reason.
vii. Pure nitrate of element A of mass 2.02 g was heated strongly until a constant mass is obtained. Final residue weighs 1.70 g. Hence find the relative atomic mass of A? (N = 14, O = 16)

b) A solution having 2.68 x 10^{-3} mol B^{n+} ions was reacted with 1.61 x 10^{-3} mol $KMnO_4$ solution in acidic medium. B^{n+} ions were converted completely as BO_3^- ions hence find the value of 'n'.

c) The product resulted from burning 2.3g of Na in $O_{2(g)}$ was dissolved in excess dil.H_2SO_4 and diluted up to 250 cm^3 in a volumetric flask, A 25.00 cm^3 sample of this solution was taken into a titration flask and excess of $KI_{(aq)}$ was added it was titrated with 0.12 mol dm^{-3} $Na_2S_2O_3$ solution in the presence of starch. The burette reading obtained was 60 cm^3

1. State the balanced equations for the combustion reaction.
2. State the balanced equations for reactions in dissolution and the titration.
3. Calculate the mass of products obtained by the combustion.