



FWC

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

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

Grade :- 12 (2020)

Chemistry I

Time :- One hour

## Part - I

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1} \quad h = 6.626 \times 10^{-34} \text{ Js} \quad c = 3 \times 10^8 \text{ ms}^{-1} \quad R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

❖ Answer all questions by selecting the most possible answer out of the given.

- 1) Number of elements with melting point less than  $25^\circ \text{C}$  at 1 atm.  
1. 5                      2. 2                      3. 11                      4. 13                      5. 15
- 2) The energy of the first energy level of H atom is  $-2.18 \times 10^{-18} \text{ J}$ . The lowest wavelength line of Lyman series in H – emission spectrum.  
1. 91 nm                      2. 109 nm                      3. 145 nm                      4. 434 nm                      5. 987 nm
- 3) Which of the following statement is true regarding Lithium?  
1. Though Li react with steam, it does not react with hot water.  
2. Li react with excess air at high temperature and produce  $\text{Li}_3\text{N}$ ,  $\text{Li}_2\text{O}_2$  and  $\text{LiO}_2$ .  
3.  $\text{Li}_2\text{CO}_3$  is thermally stable.  
4.  $\text{LiHCO}_3$  cannot be obtained at solid state.  
5. Thermal decomposition of  $\text{LiNO}_3$  produces  $\text{LiNO}_2$  and  $\text{O}_2$
- 4) Which one of the following is the most possible example for disproportionation reaction?  
1.  $\text{K}_2\text{Cr}_2\text{O}_7 + 3\text{H}_2\text{SO}_4 + 4\text{HCl} \longrightarrow 3\text{K}_2\text{SO}_4 + 3\text{H}_2\text{O} + 2\text{CrO}_2\text{Cl}_2$   
2.  $\text{Fe}_3\text{O}_4 + 8\text{HCl} \longrightarrow \text{FeCl}_2 + 2\text{FeCl}_3 + 4\text{H}_2\text{O}$   
3.  $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}$   
4.  $2\text{HCl} + \text{Na}_2\text{S}_2\text{O}_3 \longrightarrow 2\text{NaCl} + \text{S} + \text{SO}_2 + \text{H}_2\text{O}$   
5.  $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$
- 5) The first five successive ionization energies of element X (in  $\text{kJ mol}^{-1}$ ) are 801, 2427, 3660, 25025, 32866 which of the following could be the formula of oxide of X?  
1. XO                      2.  $\text{X}_2\text{O}$                       3.  $\text{XO}_2$                       4.  $\text{X}_2\text{O}_3$                       5.  $\text{X}_2\text{O}_5$
- 6) Correct increasing order of C – C bond length of the following.  
1.  $\text{C}_2\text{H}_2 < \text{C}_2\text{H}_4 < \text{CH}_3\text{CN} < \text{Diamond}$                       2.  $\text{Diamond} < \text{CH}_3\text{CN} < \text{C}_2\text{H}_2 < \text{C}_2\text{H}_4$   
3.  $\text{Diamond} < \text{C}_2\text{H}_2 < \text{CH}_3\text{CN} < \text{C}_2\text{H}_4$                       4.  $\text{C}_2\text{H}_2 < \text{CH}_3\text{CN} < \text{C}_2\text{H}_4 < \text{Diamond}$   
5.  $\text{CH}_3\text{CN} < \text{C}_2\text{H}_4 < \text{Diamond} < \text{C}_2\text{H}_2$
- 7) When  $\text{CO}_{(g)}$  is passed through  $\text{Fe}_2\text{O}_3$  under hot conditions, part of  $\text{Fe}_2\text{O}_3$  was converted to  $\text{Fe}_3\text{O}_4$ . Then this  $\text{Fe}_3\text{O}_4$  was completely converted to  $\text{FeO}$ . If the mass of  $\text{Fe}_2\text{O}_3$  taken was 16g and final mass was 15.6 g. What is the mass percentage of decomposed  $\text{Fe}_2\text{O}_3$ ?  
( $\text{Fe}_2\text{O}_3 - 160 \text{ g mol}^{-1}$ ,  $\text{FeO} - 72 \text{ g mol}^{-1}$ )  
1. 10                      2. 25                      3. 40                      4. 50                      5. 60

8) One mol of  $N_2H_4$  forms the compound Y by removing 10 moles of Electrons. If all the N atoms in the initial compound are present in compound Y. What is the oxidation number of N atom in Y?  
1. -3                      2. -2                      3. +1                      4. +3                      5. +5

9) Consider the following

- A. The pressure of an ideal gas is always greater than the pressure of a real gas having equal volume, equal amount at same temperature.  
B. Compressibility factor of a real gas is always lesser than that of an Ideal gas.  
C. The unit of constant 'a' of Vander Waal's equation is  $Nm^4mol^{-2}$ .  
D. Vander Waal's equation can't be used to an ideal gas.  
E. Vander Waal's equation is given by  $(P + \frac{n^2a^2}{v^2})(v - nb) = nRT$ .

Which of the above is / are true,

1. a, b and c              2. c, e                      3. c only                      4. e only                      5. a, b

10) How many stable resonance structures are possible For  $N_2O_5$ ?

1. 5                      2. 3                      3. 2                      4. 4                      5. 6

11) Consider the following tests & observation regarding a sodium piece kept exposed to atmosphere.

**Tests**

**Observation**

- A. Added to cold water                      • Gas evolution with hissing sound.  
B.  $BaCl_2$  added to resultant solution from A.                      • White solid, soluble in dilute acids is obtained.  
C.  $Mg(NO_3)_2$  added to resultant solution from B.                      • White solid residue obtained.

Relevant species corresponds to above test A, B & C.

1.  $NaHCO_3$ , Na,  $Na_2CO_3$                       2.  $Na_3N$ ,  $NaHCO_3$ ,  $Na_2CO_3$                       3. Na,  $Na_2CO_3$ ,  $Na_3N$   
4. Na,  $Na_2CO_3$ , NaOH.                      5. NaOH, Na,  $Na_2CO_3$

12) 2.32 mg of  $Fe_3O_4$  was dissolved well in  $H_2SO_4$  and shaken well with KI for complete reaction. It was made up to  $1dm^3$  by adding distilled water. The concentration of  $Fe^{2+}$  in ppm? (Fe-56, O - 16)

1. 1.12                      2. 16.8                      3. 1.68                      4. 0.168                      5. 11.2

13) The standard enthalpies of combustion of  $C_{(s)}$ ,  $H_{2(g)}$  and  $C_2H_{6(g)}$  are  $-394 kJmol^{-1}$ ,  $-284 kJmol^{-1}$ ,  $-1540 kJmol^{-1}$  respectively. The standard enthalpy of formation of  $C_2H_{6(g)}$

1.  $-86 kJmol^{-1}$                       2.  $-100 kJmol^{-1}$                       3.  $+ 100 kJmol^{-1}$   
4.  $+ 86 kJmol^{-1}$                       5.  $- 90 kJmol^{-1}$

14) In which of the following groups the Atomic number and 2<sup>nd</sup> ionization energy are in increasing tendencies?

1. He, Li, Be              2. Be, B, Li              3. Be, B, C                      4. Li, Be, B                      5. C, N, O

15) When 10g of a solid mixture of  $CrO_3$  and  $Cr_2O_3$  is heated until a constant mass is obtained. Only  $Cr_2O_3$  was obtained as the solid product. The loss in mass when heating is 1.92g. What is the mass percentage of  $Cr_2O_3$  in solid mixture?

1. 10                      2. 20                      3. 40                      4. 60                      5. 80

❖ Summary of instructions for question from 16 – 20.

1	2	3	4	5
only a,b correct	only b,c correct	only c,d correct	only a,d correct	Any other answer

16) Root mean square velocity of ideal gases can be given by  $\sqrt{C^2} = \sqrt{\frac{3P}{d}}$  (d – density). Which of the following statement /s are true?

- With increase of pressure velocity of ideal gas increases.
- For different ideal gases under same temperature and pressure, speed varies.
- Velocity of  $H_{2(g)}$  at  $50^\circ C$  is higher than that of  $O_{2(g)}$  at  $100^\circ C$ .
- With increase of density of given gas, velocity of gas decreases

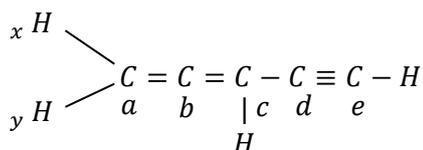
17) Which statements (s) is / are incorrect regarding  $K^+$  and  $Cu^+$ ?

- Both have unpaired electrons.
- Both have same nuclear charge.
- Ionic radius of  $K^+$  is greater than  $Cu^+$ .
- Electron affinity of  $Cu^+$  is less than  $K^+$ .

18) In which of the Following the given enthalpy change is correctly described?

Enthalpy change	Relevant reaction
a) Standard enthalpy of sublimation of iodine	$I_{2(s)} \longrightarrow 2I_{(g)}$
b) Standard enthalpy of combustion of $CH_3OH_{(l)}$	$2CH_3OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 6H_2O_{(l)}$
c) Standard lattice enthalpy of $MgBr_{2(s)}$	$Mg^{2+}_{(g)} + 2Br^{-}_{(g)} \longrightarrow MgBr_{2(s)}$
d) Enthalpy of atomization of $O_{2(g)}$	$O_{2(g)} \longrightarrow 2O_{(g)}$

19)



Consider the above compound, which of the following statement/s is / are correct.

- There are 2 sp hybridized Carbon atoms, and 1 sp<sup>2</sup> hybridized Carbon atom.
- Carbon atoms c, d, e are in straight line.
- $H_x - C_a - H_y$  bond angle is approximately  $120^\circ$ .
- Hydrogen atoms attached to Carbon atoms a and c are in same plane.

20) Which of the following is/are intensive property?

- Heat capacity.
- Activation energy.
- Electric potential.
- Mass

❖ Following the introduction given for question 21 – 25.

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

	First Statement	Second Statement
21.	By heating of Lithium Carbonate, $\text{Li}_2\text{O}$ and $\text{CO}_2$ are obtained as products.	On heating of Group IA metal carbonates, their respective metal oxides can be obtained.
22.	Compressibility of an ideal gas can be given as $Z = \frac{PV}{nRT}$ .	$\text{NH}_{3(g)}$ does not behave as an ideal gas at high pressure and low temperature.
23.	$\text{AlF}_3$ is an ionic compound, but $\text{AlCl}_3$ is a covalent compound.	Radius of $\text{F}^-$ is less than radius of $\text{Cl}^-$ and the polarizing power of $\text{F}^-$ is greater than $\text{Cl}^-$
24.	$\text{C}_2\text{F}_4$ Molecule has polar bonds.	Planar molecules are nonpolar.
25.	Spontaneous reactions occurring in an isolated system always take place with an increasing entropy.	The overall effect of $\Delta H$ and $\Delta S$ is given by the Gibb's free energy change $\Delta G$ as $\Delta G = \Delta H - T\Delta S$ .



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

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Grade :- 12 (2020)

Chemistry

Time : 2 Hours

## Part - II Structured Question - A

❖ Answer all question.

01. a) Consider the first 7 element in the 2<sup>nd</sup> 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<sub>2</sub>O<sub>4</sub> is a Nitrogen compound having asymmetric and symmetric skeletons.

i) Draw the most Acceptable Lewis structure For Asymmetric and symmetric skeletons of N<sub>2</sub>O<sub>4</sub>

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ii) State the IUPAC Name for N<sub>2</sub>O<sub>4</sub>

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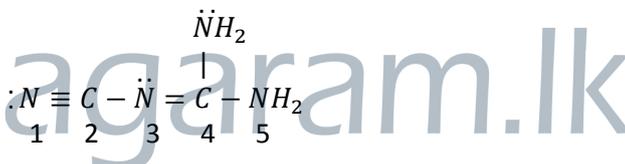
v) Draw the resonance hybrid with respect to the compound stated in (iii).

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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 <sub>2</sub>	C <sub>4</sub>
Hybridization		
Electron pair geometry.		
Shape around the atom.		
Oxidation number		

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

C<sub>2</sub> - N<sub>3</sub> = C<sub>2</sub> ..... N<sub>3</sub> .....

C<sub>4</sub> - N<sub>5</sub> = C<sub>4</sub> ..... N<sub>5</sub> .....

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  $\text{MgBr}_2$ ,  $\text{CaCl}_2$ ,  $\text{BaF}_2$ ,  $\text{BaCl}_2$  .  
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- 3) Bond length (N – O ) increasing order in  $\text{NO}$ ,  $\text{NO}_2^-$ ,  $\text{N}^+\text{O}_2$ ,  $\text{NO}_3^-$   
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- 4) Atomic radius S, F, Si, Cl  
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- 5) Electronegativity of S in  $\text{SCl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{SF}_6$ ,  $\text{SF}_2$ .  
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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  $\text{NaNO}_3$  in basic medium along with above (iii) gaseous product,  $\text{NaAlO}_2$  obtained as final product. Give the relevant balanced chemical equation (Note : Use  $\text{H}_2\text{O}$  where necessary)

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5) Write the balanced chemical equation for the reaction of A with concentrated  $\text{HNO}_3$ .

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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  $\text{Na}_2\text{C}_2\text{O}_4$  was dissolved in diluted  $\text{H}_2\text{SO}_4$ . The resultant solution was treated with  $1 \text{ moldm}^{-3}$   $\text{KMnO}_4$ , Volume of  $\text{KMnO}_4$  required for titration was  $80\text{cm}^3$ .

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

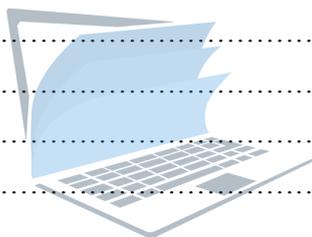
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2) Hence write the balanced chemical equation.

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3) Calculate the mass percentage of  $\text{Na}_2\text{C}_2\text{O}_4$  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,  $\Delta H_A^\ominus$  of  $\text{Mg}_{(s)}$  ( $148.0 \text{ KJ mol}^{-1}$ )

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2) The standard enthalpy of atomization,  $\Delta H_A^\ominus$  of  $\text{Br}_{2(l)}$  ( $192.0 \text{ KJ mol}^{-1}$ ).

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

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

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5) The standard formation enthalpy of  $\text{MgBr}_{2(s)}$   $\Delta H_f^\ominus = (-552.0 \text{ KJ mol}^{-1})$ .

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6) The standard lattice enthalpy ( $\Delta H_L^\ominus$ ) of  $\text{MgBr}_{2(s)}$ ,

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

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c) An experiment have been arranged at  $25^\circ C$  regarding the reaction between  $1\text{ moldm}^{-3} NaOH$  and  $1\text{ moldm}^{-3} HCl$ . 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  $0.4\text{ Jg}^{-1} K^{-1}$
- Test tube
- Volumetric Flask
- Neutralization enthalpy  $\Delta H_N^\ominus = -57.356\text{ kJ mol}^{-1}$

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

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

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

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2) But the maximum temperature attained was  $30^\circ C$  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  $-50.4\text{ kJ mol}^{-1}$ . Briefly explain the deviation of standard neutralization enthalpy in above two situations.

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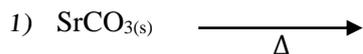
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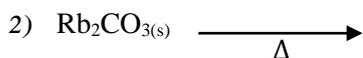
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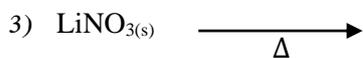
04. a) Predict the products of the following decomposition reactions.



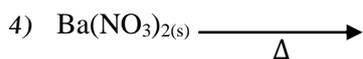
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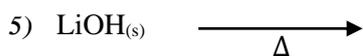
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b) State whether following statements are true or false.

1)  $\text{C}_{(\text{graphite})} \longrightarrow \text{C}_{(\text{diamond})} \quad \Delta H = +4 \text{ KJmol}^{-1}$ , 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<sup>A</sup> 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<sub>3</sub> and CO<sub>2</sub> 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.



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e) Balance the following reactions using oxidation number method.



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Grade :- 12 (2020)

Chemistry

## 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  $\bar{E} = \frac{3}{2} KT$  ( $K = R/L$ ).  
4) State five assumption in kinetic molecular theory of gases.  
5) Root mean square velocity of an ideal gas given by  $\sqrt{C^2} = \sqrt{\frac{3RT}{M}}$ . Assuming ideal behaviour

of  $O_{2(g)}$  and  $N_{2(g)}$  at  $27^\circ C$ . Find the ratio of  $\left( \frac{\sqrt{C^2 O_{2(g)}}}{\sqrt{C^2 N_{2(g)}}} \right)$ .

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



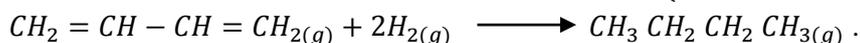
Pressure at equilibrium  $8 \times 10^5 Pa$ . Volume of  $A_{2(s)}$  formed is  $0.843 dm^3$ .

- a) Number of mols of  $A_2B_{4(g)}$  at  $27^\circ C$  ?  
b) Amount of gas mixture at  $127^\circ C$  ?  
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. ( $27^\circ C \rightarrow 127^\circ C$ )
06. a) Define the following phrases.
1. Open system.  
2. Closed system.  
3. Isolated system.
  - ii. 1.  $\frac{1}{4} P_{4(s)} \longrightarrow P_{(g)}$   
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.  $C_6H_{12(l)} + 9O_{2(g)} \longrightarrow 6CO_{2(g)} + 6H_2O_{(l)}$

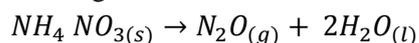
b) Some bond dissociation energy data are given below.

Bond	Bond dissociation energy / (kJmol <sup>-1</sup> )
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 ( $CH_3 CH_2 CH_2 CH_3(g)$ )



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



Chemical	$NH_4 NO_3(s)$	$N_2O(g)$	$H_2O(l)$
Standard enthalpy of Formation (kJmol <sup>-1</sup> )	- 365	82	- 286
Standard entropy (kJmol <sup>-1</sup> K <sup>-1</sup> )	150	220	70

- Find the standard enthalpy change of the above reaction.
- Find the standard entropy change of the above reaction.
- Hence find the standard free energy change of the above reaction?
- Thereby derive whether the above reaction is spontaneous / non spontaneous at 25°C.

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.

- Identify the element A and state one use of it.
- Give the ground state electronic configuration of A.
- Give the balanced chemical equation for the reaction between chlorine and element A.
- 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?
- Give balanced equation for the thermal decomposition of nitrate of element A.
- State whether the above thermal decomposition differs from the thermal decomposition of  $Mg(NO_3)_2$  If it differs state the reason.
- 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  $2.68 \times 10^{-3}$  mol  $B^{n+}$  ions was reacted with  $1.61 \times 10^{-3}$  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<sup>3</sup> in a volumetric flask, A 25.00 cm<sup>3</sup> sample of this solution was taken into a titration flask and excess of  $KI_{(aq)}$  was added it was titrated with  $0.12 \text{ mol dm}^{-3}$   $Na_2S_2O_3$  solution in the presence of starch. The burette reading obtained was 60 cm<sup>3</sup>

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