



G.C.E. A/L Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In Collaboration with

Provincial Department of Education, Northern Province.

Grade :- 12 (2019)

Chemistry I

Time :- One hours

Part -I

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$h = 6.62 \times 10^{-34} \text{ Js}$$

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

❖ Answer all the questions

- The scientist who had experimentally obtained the value of $\frac{\text{Charge}}{\text{Mass}} (e/m)$ of electron.
1) Robert Millikan 2) Henry Mosely
4) Neil Bohr 3) Ernest Rutherford
5) J.J Thomson
- Which of the statements is false regarding the molecules given below.
 $BeCl_2, BCl_3, NH_3, CCl_4, ICl_3, SF_4, XeF_4, SF_6$
1) All the molecules have different shapes.
2) All the molecules have polar covalent bonds.
3) They have five types of electron pair geometry.
4) All the molecules satisfy octet rule .
5) Only four molecules have lone pairs of electrons at the central atoms.
- Oxidation state of sulphur is -1 in.
1) Na_2SO_3 2) $Na_2S_2O_8$ 3) Na_2S_8 4) $Na_2S_2O_3$ 5) $Na_2S_4O_6$
- Using the tetrahedral electron pair geometry around the central atom, the shapes of many molecules are obtained they are,
1) angular shape, triangular bipyramidal, see saw.
2) angular shape, triangular pyramidal, tetrahedron.
3) angular shape, triangular pyramidal, T - shape.
4) triangular bipyramidal, see - saw , T - shape.
5) angular shape, see - saw, T - shape.
- For the complete combustion of 1 mol. of an organic compound A 2mol of O_2 was required and the products were 2mol of CO_2 and 2mol of H_2O only. The molecular formula of A is,
1) $C_2H_4O_2$ 2) C_2H_4O 3) C_2H_4 4) C_2H_6 5) CH_4O
- The effective nuclear charge felt by the valence electron of sodium (Na) is (Na Z - 11 , relative atomic mass = 23)
1) less than + 11 2) equal to + 11 3) more than + 11
4) less than + 23 5) equal to + 23

7. At 25°C when $(\text{NH}_4)_2 \text{Cr}_2\text{O}_7$ is heated it decomposes. In this process which of the following for $\Delta H^\ominus, \Delta S^\ominus$ is correct.

ΔH^\ominus	ΔS^\ominus
1) Positive	Negative
2) Positive	Positive
3) Negative	Positive
4) Negative	Negative
5) Positive	Zero

8. A light produces 10J of energy per second in the red zone (650nm) of the visible region. How long will it take for the light to produce 1×10^{22} photons.

- 1) 3.05Sec 2) 10.5Sec 3) 305Sec 4) 61Sec 5) 71Sec

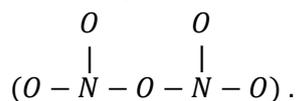
9. The following procedure was used to find the molar mass of an unknown gas. The mass of an empty rigid vessel of volume V was m_1 . Then when the vessel was filled with the unknown gas X the mass was m_2 . The gas is at temperature T and pressure P . Which of the following expressions gives the molar mass of the unknown gas.

- 1) $\frac{dRT}{P}$ 2) $\frac{(m_1 - m_2)RT}{PV}$ 3) $\frac{m_1 RT}{PV}$ 4) $\frac{(m_2 - m_1)RT}{PV}$ 5) $\frac{m_2 RT}{PV}$

10. Which of the following statements is false regarding the chemistry of Li and its compounds?

- 1) Li reacts with N_2 to produce Li_3N .
- 2) among the *gp I* elements, Li has the highest melting point.
- 3) among the hydroxides of *gp I* elements, $LiOH$ has the lowest basicity.
- 4) $LiNO_3$ decomposes to produce Li_2O, NO_2 and O_2 .
- 5) Li does not answer for flamentest.

11. How many stable resonance structures could be drawn to the molecule N_2O_5



- 1) 4 2) 5 3) 6 4) 8 5) 9

12. Which of the following statements regarding H_2S is false?

- 1) H_2S acts as oxidizing agent.
- 2) H_2S acts as reducing agent.
- 3) H_2S bleaches wet petal of a flower.
- 4) H_2S acts as an acid.
- 5) H_2S does not support acid rain.

13. When Li, Na, K, Mg are burnt in laboratory, which of the following products is not possible.

- 1) $Li_2O, Li_3N, Na_2O, Mg_3N_2$
- 2) $Li_2O, Na_2O_2, K_2O_2, Mg(O_2)_2$
- 3) $Li_3N, Na_2O, Na_2O_2, K_2O$
- 4) $Li_2O, Na_2O, Na_2O_2, KO_2$
- 5) $Na_2O, K_2O, KO_2, Mg_3N_2$

14. When 8 g of a mixture containing Na_2CO_3 and $NaHCO_3$ is heated, if the loss of mass is 1.845 g what is the mass percentage of Na_2CO_3 .

- 1) 31.24 2) 68.76 3) 62.5 4) 37.5 5) 50

15. Standard enthalpies of combustion of $C_2H_2(g)$, $C_6H_6(l)$ and $C(s)$ are -1300 , -3304 , and -394 kJmol^{-1} respectively. Find the enthalpy change for the reaction $3C_2H_2(g) \longrightarrow C_6H_6(l)$

- 1) 596 kJmol^{-1} 2) -596 kJmol^{-1} 3) 2004 kJmol^{-1}
 4) -2004 kJmol^{-1} 5) 200.4 kJmol^{-1}

❖ Instructions for questions 16 - 20

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 is correct

16. Which of the following statement / s regarding NH_3 and NF_3 is / are correct?

- a) Bond angle of NF_3 is approximately 102° .
 b) Bond angle of NH_3 is approximately 107° .
 c) The repulsion between bonded pairs in NF_3 is stronger than that in NH_3 .
 d) The dipole moment in NF_3 is larger than that in NH_3 .

17. When the gases CO_2 , SO_2 are passed through the solutions that could be differentiated by the changes in colour.

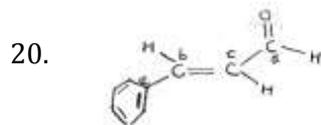
- a) $Mn^{2+}_{(aq)}$ b) $MnO_4^-_{(aq)}$ c) $Cr_2O_7^{2-}_{(aq)}$ d) $Cr^{3+}_{(aq)}$

18. Which of the following is / are not the assumptions of the molecular kinetic theory of gases?

- a) all gases are point masses.
 b) volume of gases are negligible, compared to the volume of the vessel.
 c) at a given temperature the kinetic energies of all the molecules are equal.
 d) at a given temperature, the velocities of all the molecules are equal.

19. Among group IA elements, the element that forms one type of oxide is Li. In an experiment, 21g of Li. is allowed to react with 33g of O_2 . Which of the following statements is / are true? ($Li - 7, O - 16$).

- a) Li completely reacts and small amount of O_2 is left behind.
 b) O_2 reacts completely and small amount of Li remains.
 c) Li and O_2 react completely.
 d) Theoretically 45g of product is formed.



The statement /s that is / are correct regarding the molecule given above.

- The atoms which are marked *a, b, c, d* are on a straight line.
- all the carbon atoms which are marked *a, b, c, d* are SP^2 hybridized.
- bond length between *b* and *c* is less than that of *c* and *d*.
- c* atoms *b, c, d* are on the same plane.

❖ Instructions for questions 21 - 25

First statement	Second statement
1) True	True and correctly explains
2) True	True but does not explain correctly
3) True	False
4) False	True
5) False	False

	First statement	Second statement
21.	The reaction between H_2S and SO_2 is an example for (comproportionation) reverse of disproportionation.	Reverse of disproportionation (comproportionation) is the process in which an element in two different oxidation states form a product with the intermediate oxidation state.
22.	When steam in an isolated vessel condenses, the entropy in the environment increases.	The heat expelled from an isolated vessel causes the molecules in the environment to increase heat motion.
23.	$C - O$ bonds in bicarbonate ion are not equal.	bicarbonate ion has two stable resonance structures.
24.	solubility of sulphates of group II reduces along group.	The hydration enthalpy of the cations of group II increases along group.
25.	When going downwards along the group, the reactivity of basic metals reduces.	When size of metallic atoms increases along group, the ability of losing electrons increases.



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Chemistry - II

Time :- 2 Hours

Part- II Structured essay - A

❖ Answer all questions on This paper itself.

01.

a)

(i) To calculate the charge (Q) of an atom in a Lewis structure, fill in the cages in the expression given below with the proper symbols N_A, N_{LP}, N_{BP} .

Here,

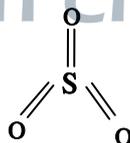
N_A = Number of valence electrons in the atom.

N_{LP} = Number of electrons in the lone pairs.

N_{BP} = Number of electrons in the bonded pairs around the atom.

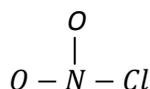
$$Q = \boxed{} - \boxed{} - \frac{1}{2} \boxed{}$$

(ii) By substituting values of N_A, N_{LP} and N_{BP} in the proper cages, calculate charge of S, $Q_{(sulphur)}$, in SO_3 the structure of which is given below.



$$Q = \boxed{} - \boxed{} - \frac{1}{2} \boxed{} = \boxed{}$$

(iii)

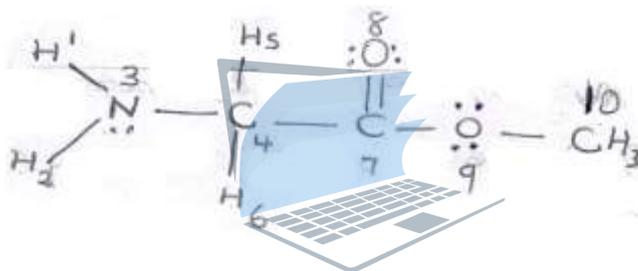


1. Draw the most acceptable Lewis structure for NO_2Cl molecule.

2. Draw three resonance structures for this for this molecule.

3. Indicate the unstable resonance structure and state reasons as to why this structure is unstable.

(iv) On the basis of the following Lewis structure, indicate the following for C, N, O atoms, in the table given below.



	N^3	C^4	C^7	O^9
1) Total number of electron pairs.				
2) Geometry of electron pair.				
3) Number of VSEPR pairs.				
4) Shape				
5) Hybridisation.				

(v) In the Lewis structure given in part (iv) above, identify the atom / hybrid orbitals related to the formation of 6 bonds.

I. $N^3 - C^4$	N^3 _____	C^4 _____
II. $C^4 - H^5$	C^4 _____	H^5 _____
III. $C^4 - C^7$	C^4 _____	C^7 _____
IV. $C^7 - O^9$	C^7 _____	O^9 _____

b) In I, II, III given below identify the type/s of intermolecular forces.

I. aqueous Cl^-

II. O_2 dissolved in water .

III. I_2 dissolved in KI solution.

02. (a) A and B are elements belonging to the S block of the periodic table. Under normal conditions, A does not react with water, but reacts with hot water to form the hydroxide. At the same time under normal conditions B reacts with water to form the hydroxide. Hydroxide of B is more basic than that of A . Hydroxide of B is used to identify the gas (C), which is responsible for global warming.

i. Identify A and B .

A -

B -

ii. Write the electronic configurations of A and B .

A -

B -

iii. Indicate the relative sizes for A and B for the following.

I. Size of atom > III. melting point >

II. density > IV. first ionization energy >

iv. Write the reactions that takes place when element B is burnt in atmosphere.

.....
.....

v. One of the products obtained in the above part when dissolved in water and the product obtained can be used to identify the gas C , which is responsible for global warming. write balanced equation for the formation of that product.

.....

vi. Identify gas C .

.....

vii. Write balanced equation for the reaction that takes place in the identification of C , using the product obtained in part (v)

- (b) i. Complete the reactions given below by selecting suitable solutions from the list given below.



Note :- One solution can be used more than once.

- I. $AgNO_{3(aq)} + \square \rightarrow A$ (White precipitate, which dissolves in dilute ammonia solution to produce clear solution)
- II. $BaCl_{2(aq)} + \square \rightarrow B$ (White precipitate, soluble in dilute ammonia solution producing clear solution)
- III. $KI_{(aq)} + \square \rightarrow C$ (Yellow precipitate, soluble in hot water)
- IV. $NaOH_{(aq)} + \square \rightarrow D$ (Ash colour precipitate soluble in excess ammonia solution)
- V. $Na_2S_2O_{3(aq)} + \square \rightarrow E$ (Yellow precipitate with yellowish turbidity, insoluble in HCl)
- VI. $Ba(NO_3)_{2(aq)} + \square \rightarrow F$ (White precipitate, soluble in dilute HCl)

- ii. Write the chemical formula of the precipitates from A to F.

A B C D E F

- iii. In part b (i) above, write balanced equation for the dissolution of the precipitates A, C and F.

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03. (a). Volumes of flasks A, B are $3m^3$. Flask A contains He gas at $300K$ and $2 \times 10^5 Pa$ pressure. Flask B contains N_2 gas at $300K$ and $5 \times 10^5 Pa$ pressure. Both flasks are connected and allowed to mix completely. The temperature and total volume remains the same. Calculate the following assuming that the gases behave ideally.

- i. Calculate the number of moles of He ?

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- ii. What is the mole fraction of N_2 ?

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iii. Without changing the temperature of flask A if temperature of flask B is raised to $400K$, what will be the common pressure?

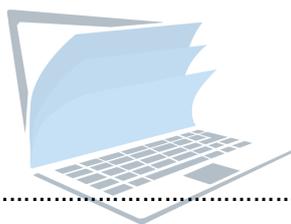
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(b) An alloy contains *Mg* and *Al*. When $5g$ of this alloy is dissolved in excess of H_2SO_4 , $5.59dm^3 H_2$ was obtained. Assuming that the reaction is conducted at standard temperature and pressure. Calculate the mass percentage of *Mg* in the alloy. (*Mg* - 24, *Al* - 27)

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04. (a). Briefly explain the following.

i. Closed system.



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.....

ii. Entropy

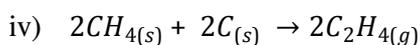
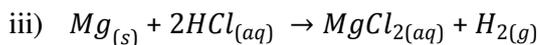
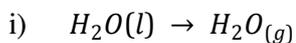
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iii. Gibbs energy

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(b). In the following changes, indicate whether the entropy increases / decreases.



- (c). Consider the thermo chemical data at 25°C which is given below and the chemical reaction $\text{CaCO}_{3(s)} \longrightarrow \text{CaO}_{(s)} + \text{CO}_{2(g)}$.

Chemical species	$\text{CaCO}_{3(s)}$	$\text{CaO}_{(s)}$	$\text{CO}_{2(g)}$
Standard enthalpies of formation kJmol^{-1}	-1207	-635	-393
Standard entropy. $(\text{J mol}^{-1}\text{K}^{-1})$	93	38	214

- i) Calculate ΔH^{θ} at 25°C for the above reaction.

.....

- ii) Calculate ΔS^{θ} at 25°C for the above reaction.

.....

- iii) I. Write the expression for a chemical reaction that relates ΔG , ΔH and ΔS .

.....

- II. Calculate ΔG^{θ} for the above reaction at 25°C .

.....

- III. With reason mention about the spontaneity of the reaction.

.....

- IV. Calculate the decomposition temperature of CaCO_3 ?

.....

- V. What is the assumption you used in Part (iv) above?

.....



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Chemistry - II

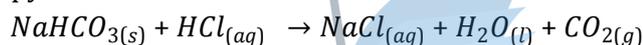
Part- II Essay Question - B

❖ Answer two questions only include question number five.

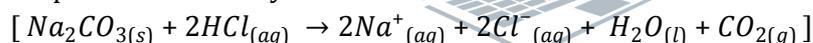
05. a.

- What do you understand by Ideal gas?
- Write the ideal gas equation and state what each of the terms represents.
- Obtain Boyles law from ideal gas equation.

b. The following experiment was done at room temperature in two (I, II) methods to calculate enthalpy of the reaction.



Ex I To $100cm^3$ of $1mol\ dm^{-3}$ HCl in a beaker $0.05mol$ of $Na_2CO_{3(s)}$ was added and the temperature raised by $2.5K$



Ex II It was found that during the complete decomposition of $0.5mol$ of $NaHCO_{3(s)}$, $20000J$ of heat was absorbed without loss of heat to the environment.

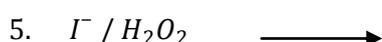
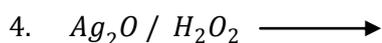
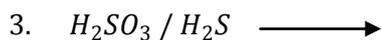
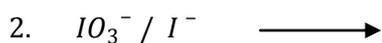


Specific heat capacity and density of HCl solution are $10Jg^{-1}K^{-1}$ and $1gcm^{-3}$ respectively.

- Calculate the enthalpy changes involved in procedures I and II above in $kJmol^{-1}$.
 - Using the values obtained in part (i) above and a thermocycle calculate ΔH^θ for the reaction. $NaHCO_{3(s)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$.
 - In the Calculation in part (ii) above, a particular enthalpy change that takes place when $NaHCO_{3(s)}$ dissolves in $HCl_{(aq)}$ is neglected. Mention that change.
- c. i. Draw the Born - Haber cycle for the formation of solid KCl .
- Using the data given below calculate lattice enthalpy, ΔH^θ_L of $KCl_{(s)}$
Standard enthalpy of formation of $KCl_{(s)}$ $\Delta H^\theta_f = -437kJmol^{-1}$
Standard enthalpy of sublimation of $K_{(s)}$ $\Delta H^\theta_s = +89kJmol^{-1}$
Standard enthalpy of dissociation of $Cl_{2(g)}$ $\Delta H^\theta_D = +244kJmol^{-1}$
Standard first ionization enthalpy of $K_{(g)}$ $\Delta H^\theta_{I_1} = +418kJmol^{-1}$
Standard enthalpy of electron affinity of $Cl_{(g)}$ $\Delta H^\theta_{EA} = -349kJmol^{-1}$

06. (a). 1.6g of a sample containing only $SrCO_3$ and $BaCO_3$ was dissolved in excess of $50cm^3$ $0.8mol\ dm^{-3}$ HCl . To neutralize the excess acid if $40cm^3$ of $0.5mol\ dm^{-3}$ $NaOH$ solution was required. Calculate the mass percentages of $SrCO_3$ and $BaCO_3$.
($Sr - 88, Ba - 137, C - 12, O - 16$)

(b). For the following write oxidation half reaction, reduction half reaction and balanced ionic equation.



(c). M^{n+} ion of a 3d block element can be oxidized to MO^{2+} ion by $Cr_2O_7^{2-}$ in the presence of dilute H_2SO_4 . In an experiment $20\ cm^3$ of $0.1mol\ dm^{-3}$ $K_2Cr_2O_7$ was required to oxidize $4 \times 10^{-3}mol$ of M^{n+} to MO^{2+} . Using these data calculate the value of n?

07. (a). When the nitrate B of S - block element A was heated it decomposed to produce solid C, brown gas D and a colorless gas E. A reacted with water to produce gas F and solution G. Solid C dissolved in water and produced the same solution G. In flame test solid C showed red colour. The properties of element A was slightly different from the other elements in the group.

i) Identify the substances from A to G?

ii) Write balanced equation for the reaction between element A and water.

iii) State a test to identify the gas F produced in the reaction in part (ii) above.

(b) Write balanced equations for that following reactions.

