

(3) When iron (III) hydroxide is heated above 200⁰ c,.....is Produced.

- (a) Iron (II)oxide. (b) Magnetic iron oxide.
(c) Iron (III)oxide. (d) Iron (II)hydroxide.

(4) When sodium nitrate is heated,gas evolved .

- (a) NO (b) NO₂ (c) N₂O (d) O₂

(B) What is the number of hydrogen moles necessary to reach with one mole of each of the following to obtain saturated compounds :

- (1) Aromatic benzene (2) 2-pentyne

(B) Fill the empty spaces in the following table , giving that the ionic product of water is 1x10⁻¹⁴ at 25⁰c

POH	PH	[OH ⁻]	[H ⁺]
.....	11	3
.....	1x10 ⁻⁹	5

Question : 3

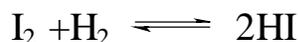
(A) Give reasons for the following :

- (1) ClO₃(OH) acid is stronger than PO(OH)₃ acid .
- (2) Copper is considered as transition element although its electronic structure of the outer shell is ₂₉Cu:(3d¹⁰ ,4s¹) .
- (3) The poly nitro organic compounds are very explosive substances.
- (4) Using a mixture of fluoride salts of aluminum , sodium and calcium instead of cryolite containing a little amount of fluorspar in the extraction of aluminum from bauxite .
- (5) The angle between two hybridized orbitals sp ,sp in C₂H₂ molecule equals 180⁰ .

(B) How can you differentiate between the following :

- (1) Copper sulphate and aluminum sulphate .
- (2) Ethanol and 2 methyl -2-butanol .

(C) Calculate the equilibrium constant for the reaction :



Provided that concentrations of iodine , hydrogen and hydrogen iodide at equilibrium are 0.1105 , 0.1105 and 0.7815 mole /liter respectively .

(D) Write the balanced chemical equation which illustrate the total reaction occurring in the alkaline nickel – cadmium cell.

Question : 4

(A): Choose from columns (B) and (C) which is suitable for column(A) :

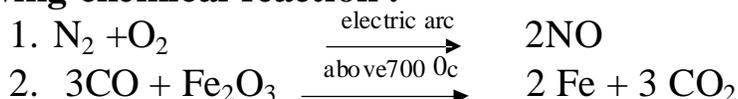
(A)	(B)	(C)
1. Poly vinyl chloride	a. Ketone	I. It is the main component of red spirit.
2. Ethylene glycol	b. Prepared from calcium carbide	II. It is formed by oxidation of isopropanol.
3. Acetone	c. Monohydric alcohol	III. It is used in manufacture of drainage tubes.
4. Ethanol	d. Produced from the Polymerization of chloro ethene	IV. It is used in the manufacture of carpets.
		V. It is used as antifreeze substance in car radiators.

(B) How many minutes necessary to precipitate 3.1752 grams of copper from copper(II) sulphate solution by passing an electric current of 10 amperes strength ? (Cu =63.5) .

(C) Compare between each of the following

- (1) Substitution alloys and inter- metallic alloys.
- (2) Chemical equilibrium and ionic equilibrium .

(D) Show the change of oxidation or reduction (if it exists) in the following chemical reaction :



Question : 5

(A) What is meant by each of the following :

- 1) Electrolytic cells
- 2) Hund's rule.
- 3) Pure covalent bond
- 4) Pig iron

(B) Calculate the density of oxygen gas (O₂) at (S.T.P) the atomic mass of oxygen is 16 .

(C) Write the structural formula of each of the following compounds :

- (1) Compound produced from halogenations of benzene in direct sun light.
- (2) Aromatic acid produced from hydrolysis of aspirin .
- (3) Acid used in the manufacture of Dacron fibers.
- (4) Dibasic carboxylic acid contains number of carbon atoms equals the number of carboxylic groups .

Question : 6

(A) One of the following compounds is used as initiator to obtain a mixture of ortho and Para chlorotoluene.

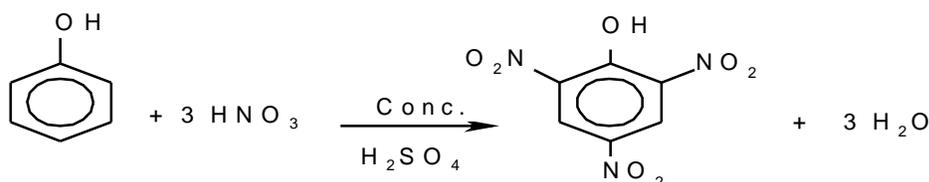
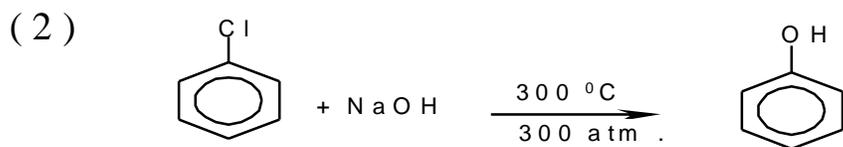
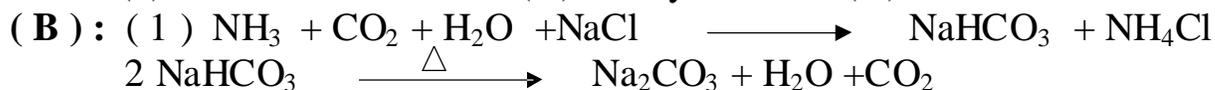
naphthalene – normal hexane – cyclic hexane – nitrobenzene

Write the balanced chemical equation which illustrate these reactions .

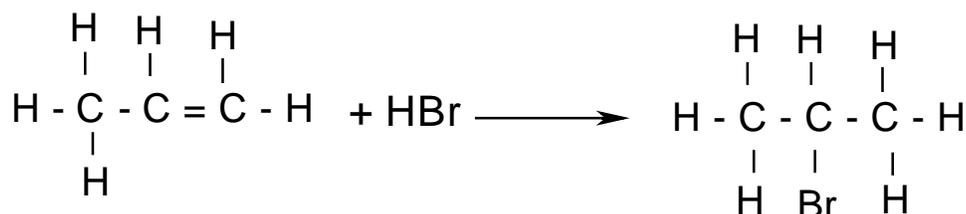
- (B) Four grams of impure sodium chloride were dissolved in water and an excess of silver nitrate solution was added to precipitate 9.256 grams of silver chloride. Calculate the percentage of sodium chloride in the sample
(Na = 23 , Cl = 35.5 , and Ag = 108)
- (C) Write the balanced chemical equation for preparation of nitric acid laboratory then draw the apparatus used in the preparation.
- (D) Draw the graphic which illustrates the difference between the orbit according to Boher's concept and the orbital according to wave theory concept.

Model Answer (2006) First Session

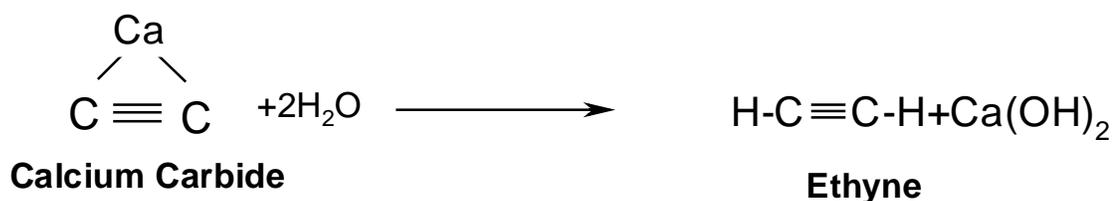
Q 1. (A) : (1) Magnetic quantum number . (2) Non metals . (3) Element .
(4) Metallic bond . (5) Catalyst . (6) One coulomb .



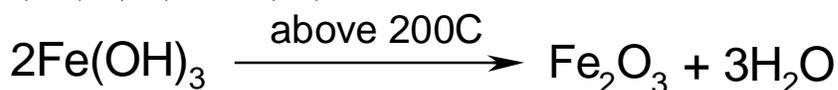
Q2.(A) : (1) 2- Bromo propane



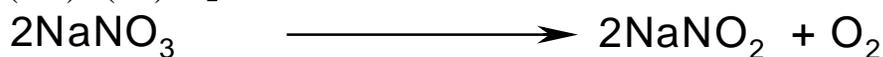
(A) .(2) Ethyne :



(A) .(3) Iron (III) oxide :



(A) .(4) O₂ :



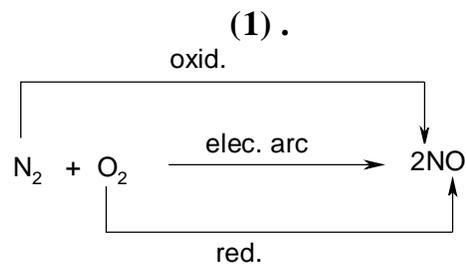
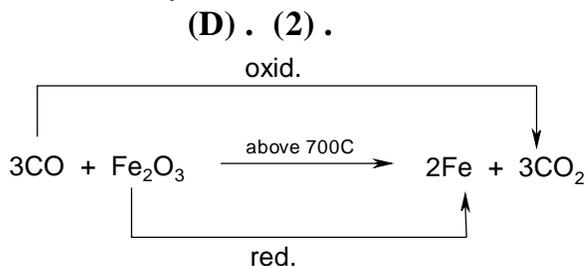
(B)(1) . 3mole H₂ . (2) . 2mole H₂ .

(c) . (1) .Interstitial , Substitution and Intermetallic Alloys :-

Interstitial alloy	Substitution alloy	Intermetallic alloy
On hammering the metal , a layer of atom can slip after the other layers . Introduction of other pure metal can form an alloy . If introduced atom is larger , so alloy is harder than pure metal .	Some of atoms of the lattice of pure metal are replaced by atoms of another metal of the same diameter , same chemical properties and same crystalline structure. e.g. : Copper-gold iron-nickel	Alloy elements lie in one group which does not combined chemically to form compounds with new properties differ from pure metal . Chemical formula disobey Laws of valency . e.g. : Cementite (Fe ₃ C)

(2) . Chemical Equilibrium : it is a dynamic system in which the rate of forward reaction equals the rate of backward reaction , and concentration of reactants and products remains constant at equilibrium in the reaction medium , keeping reaction conditions as temperature and pressure constant .

(3) . Ionic Equilibrium : this type of equilibrium is created in case of solutions of weak electrolytes , between it's molecules , and the formed ions .



Q5.(A). 1- Electrolytic Ce II :

Electrical energy from external source is changed to chemical energy .

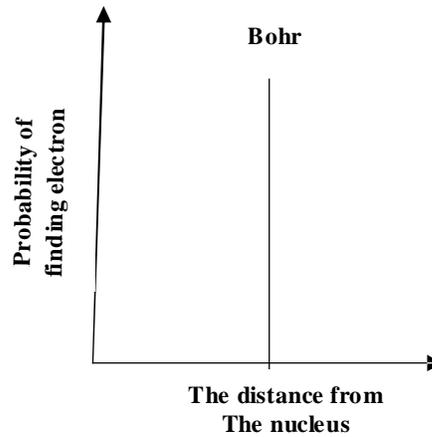
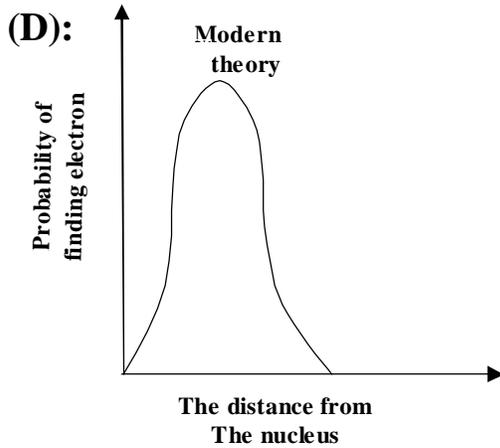
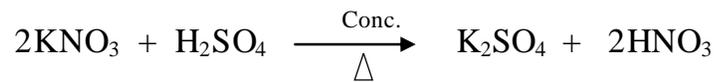
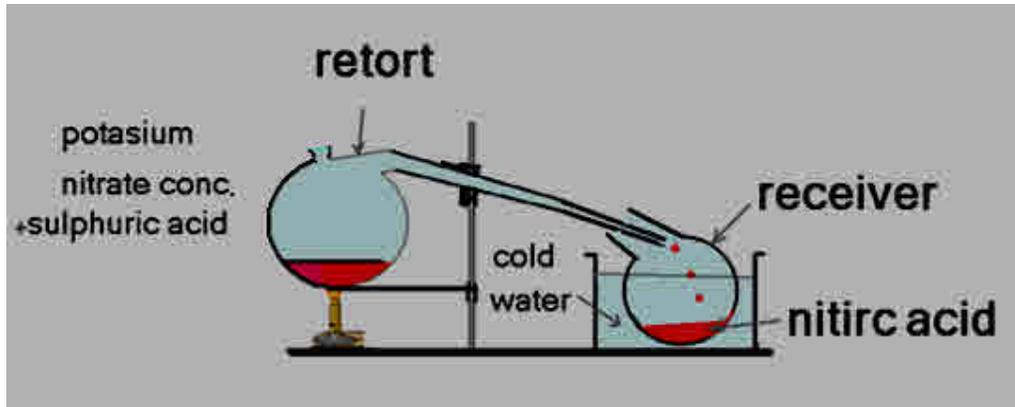
Anode is the positive electrode at which oxidation takes place .

Cathode is the negative electrode at which reduction takes place .

Oxidation and reduction reactions are non-spontaneous reactions .

(Irreversible cell).E.M.F =Potential difference between cell electrodes when circuit is open .

2- Hund`s rule :No electron pairing takes place in a given sublevel until each orbital contains one electron .



**General Secondary Certificate Examination
Second Session 2006**

Answer Five questions only of the following:

Question : 1

(A) Choose correct answer from the following to complete the phrase:

- (1) In 1926 the scientist Schrodinger succeeded to putting
(a) the uncertainty principle (b) the building up principle
(c) the wave equation. (d) the 1st theory of atomic structure .
- (2) The ionic bond is often formed between
(a) different metals (b) metals and non metals
(c) non metals and non metals (d) metalloids
- (3) When calcium Cyanamid is dissolved in water , the gas evolved is
(a) nitrogen (b) oxygen.
(c) ammonia (d) nitric oxide
- (4) When one faraday is passed through an electrolyte, this will lead to the dissolution or evolution or deposition of from the substance at any electrode.
(a) gram atomic mass. (b) gram equivalent mass
(c) Avogadro's number mass. (d) half gram equivalent mass
- (5) In the actinides series sublevelis filled successively by electrons.
(a) (3d) (b) (4d) (c) (4f) (d) (5f)
- (6) Dichloro diphenyl trichloro ethane is the chemical name of the compound .
a) Taflon b) Gamixane c) D.D.T d) Aspirin

(B) By using the balanced symbolic chemical equations, how can you obtain?

- 1) Nitrobenzene from sodium benzoate .
- 2) Iron (III)oxide from magnetic iron oxide .

Question : 2

(A) Write the scientific expression for each of the following sentences :

- (1) The amount of energy absorbed or emitted when an electron jumps from one energy level to another .
- (2) A number that refers to the electric charge(positive or negative) that the atom would have in the compound, is ionic or covalent.
- (3) With the exception of hydrogen , lithium and beryllium the atoms of all elements tend to reach the octet structure.
- (4) Molecules which have kinetic energy that equals or exceeds the activation energy.
- (5) The volumes of gases involved in a reaction and the gases produced exist in fixed ratios.
- (6) They are galvanic cells characterized by reversible chemical reactions and store the electrical energy as chemical energy.

(B)Write the structural formula for each of the following compounds?

- (1) 3 - methyl hexane. (2) 1,3- dibromo benzene
 (3) 2 - phenyl propane . (4) 3 - methyl - 1 - pentene

Question : 3

(A)Give reason for each of the following :

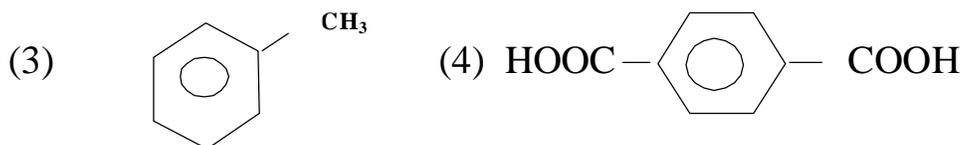
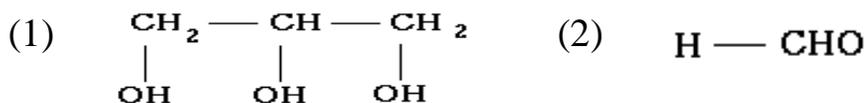
- 1) The stronger metal is placed down the left hand block of the periodic table.
- 2) It is difficult to oxidise manganese (II)ion to manganese (III) ion.
- 3) Alkali metals are considered as the most powerful reducing agents.
- 4) the ionic product of water $K_w = [10^{-7}][10^{-7}] = 10^{-14}$

(B)Hydrazine (N₂H₄)is used as a fuel for some rockets.

Calculate the mass of nitrogen gas produced from oxidation of 20 grams of hydrazine according to this equation 3 :



(C)write on use for each of the following :



Question : 4

(A) What is meant by?

- (1) Homologous series. (2) The dual nature of the electron
(3) Law of mass action (4) The first law of Faraday

(B) Calculate the equilibrium constant (K_p) of the reaction :



Provided that the atmospheric pressures are two, one and 0.2 for gases NO₂, O₂, N₂ respectively.

(C) What is the role of each of the following ?

- (1) Potassium hydroxide in the mercury cell.
(2) Quick lime in the preparation of ammonia gas in the laboratory.
(3) Pure lime in the preparation of ammonia gas in the laboratory.
(4) Concentrated sulphuric acid in the reaction of ester formation.

Question : 5

(A) Write two only of the most important defects of Bohr's theory

(B) If you provided with the following substance and tools:

Potassium nitrate–ammonium chloride–hydrochloric acid–conc. sulphuric acid–iron–distilled water–benzene flame.

Show by balanced chemical equations, how you can use all or some of them to obtain the following compounds.

- (1) Nitrogen dioxide (2) Iron(II) sulphate.

(C) How can you differentiate experimentally between each of the following :

- (1) Methane and ethane gases.
(2) Copper sulphate and aluminum sulphate.

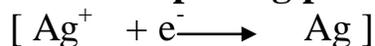
(D) Draw the apparatus used to detect carbon and hydrogen elements in the organic compounds. Write the balanced chemical equations which indicate the reactions occurred.

Question : 6

(A) Choose from columns (B) & (C) which is suitable for column (A) :

(A)	(B)	(C)
1. Sodium acetate anhydrous	a. C ₆ H ₅ OH	i) Obtained by catalytic hydration of ethyne
2. Vinyl alcohol	b. A type of plastic which is heat resistant	ii) Obtained by oxidation of acetaldehyde
3. Carbolic acid	c. CH ₃ COONa	iii) Used as primary material for the preparation of many product
	d. Unstable compound	iv) Used for the preparation of methane

(B) Calculate the number of Faradays necessary to precipitate 21.6 grams of silver on the surface of a spoon through the electroplating process [Ag= 108] the reaction at the cathode



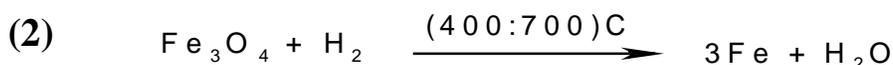
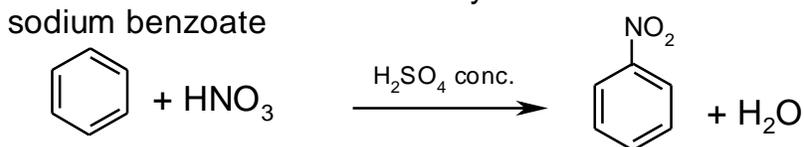
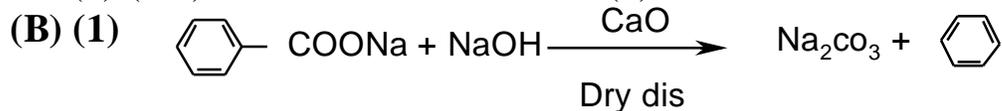
(C) Compare between each of the following:

- (1) Electronegativity and electron affinity .
- (2) Pi bond (π) and sigma bond (σ) .

(D) Calculate the volume of 0.1 mole of CO₂ gas at S.T.P.

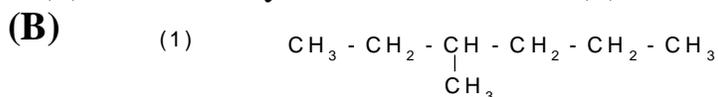
Q.1.(A)

- (1) The wave equation . (2) Metals and non metals .
 (3) Ammonia . (4) Gram equivalent mass .
 (5) (5f) . (6) D.D.T .

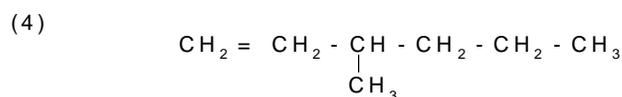
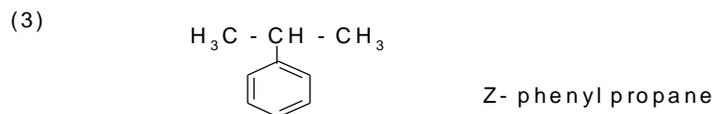


Q.2 (A) :

- (1) The quantum . (2) Oxidation number .
 (3) Octet rule (or Electronic theory of valency) .
 (4) Activated molecules .
 (5) Law of Gay – Lussac . (6) Secondary cells .



3- methyl hexane



3- methyl -1 - penten

Q.3 (A) :

(1) Because the metallic character increases as the atomic number increase in descending group .

(2) Manganese (II) ion is very stable (half filled) , due to the presence of 5 electrons in sublevel 3d .

(3) Since , these metals are characterized by easily losing their valence electrons .

(4) Since , $[H^+] = [OH^-] = 10^{-7}$, and water is neutral .



Molecular mass of hydrazine = $(14 \times 2) + (4 \times 1) = 32$

Molecular mass of nitrogen = $14 \times 2 = 28$ gm

Mass of nitrogen = $\frac{28 \times 32}{66} = 17.5$ gm

(C) : (1) **Glycerol** : It is used in manufacture of creams and cosmetics .

(2) **Formaldehyde** : It is used in manufacture of Bakelite .

(3) **Toluene** : It is used in manufacture of T.N.T .

(4) **Terphthalic acid** : It is used in manufacture of Dacron .

Q.4 .(A) (1) . Homologous series : It is a group of compounds which have the same molecular formula , chemical properties , and gradual physical properties .

(2) . **Dual nature of electron** : electron is not only a negative charged particle , but also it has a wave properties .

(3).**Law Of Mass Action** : The rate of a chemical reaction is directly proportional to the product of concentrations of the reactants given that temperature is kept constant .

(4). **Faraday's First Law** :The amount of chemical change produced by the passage of an electric current (quantity of substance) is directly proportional to the quantity of electricity passing through the solution .

(B) $K_p = \frac{D^F (N R_T)}{XZ^{\wedge} \cdot b \times h^j (p_r)} = \frac{(\quad)}{\cdot \times} = 20$

(C) (1) It is used as an electrolyte .

(2) Drying agent .

(3) Oxidation of the impurities and part of the pig iron .

(4) It prevents the reversible reaction .

Q.5 (A) : (1) $1 \longrightarrow C - IV$

(2) $2 \longrightarrow d - 1$

(3) $3 \longrightarrow a - III$

(B): Gram equivalent mass of silver = $\frac{108}{H} = 108 @@$.

One Faraday \longrightarrow 108 gm of silver .

X Faraday \longrightarrow 2.1 gm of silver

$$x = \frac{2.1}{108} = 0.2$$

(C).(1) Electron Affinity and Electro negativity :-

E. Affinity	E. Negativity
It is the amount of energy released when an extra electron is added to a neutral gaseous atom . $X + e^- \longrightarrow X^- + \text{energy}$	It is the tendency of an atom to attract the electrons of the chemical bond to itself .
It refers to an atom in its single state .	It refers to an atom combined in a molecule .
The atom accept complete negative charge .	The atom accept partially negative charge .
It is measured by KJ .	It is represented by numbers from 0 to 4 .

(2) Sigma and Pi-bond :-

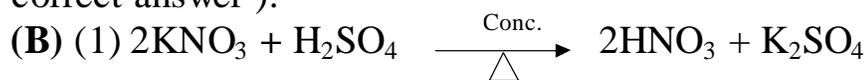
Sigma bond	Pi-bond
The overlapped orbitals are on one line (collinear) or head to head overlapping .	The overlapped orbitals are side by side between two parallel orbitals .
Strong bond, not easy to be destroyed .	Weak bond easily to be broken in addition reactions .
Atomic orbitals are either pure or hybrid .	Atomic orbitals are pure .
e.g. :- The overlap of sp^2 with sp^2 and that of s with sp^2 in ethylene molecule .	e.g. :- The overlap of p_z with p_z in ethylene molecule .

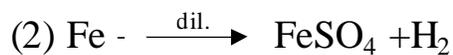
(D) Volume of CO_2 gas at S.T.P = $0.1 \times 22.4 = 2.24$ liter .

Q.6.(A) Inadequacy of Bohr's atomic model :

(1) Bohr's theory considered the electron as positive charged particle only and did not consider that it also has wave properties .

(2) It had succeeded in explaining the hydrogen spectral lines only , however it failed to explain the spectrum of any other element . (or any other correct answer) .



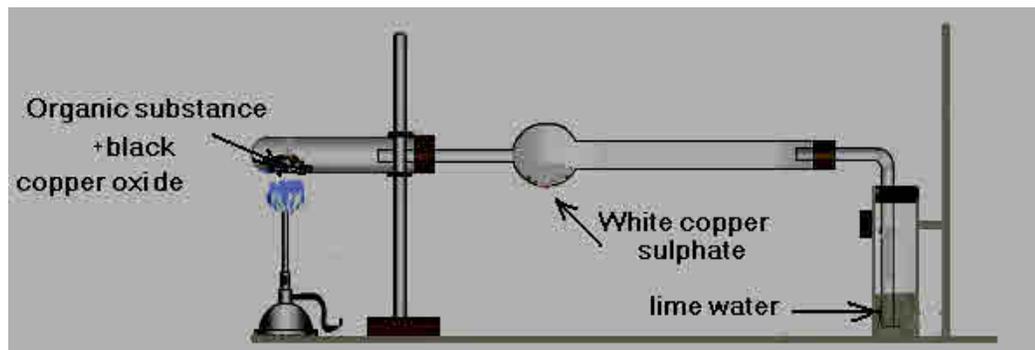


(C) (1)*By passing each of 2 gases through potassium permanganate solution in alkaline medium .

* If the violet color of KMnO_4 disappears, it is ethane gas .

* If not , it is methane gas .

(D)



**General Secondary Certificate Examination
First Session 2007**

Answer Five questions only of the following:

Question 1

(A) Choose the correct answer for each of the following :

- (1) The number of hydrogen atoms in the alkane molecule which consists of 4 carbon atoms is atoms.
(a) 5 (b) 10 (c) 7 (d) 8
- (2) Blue litmus paper turns red in the hydrolysis of salt .
(a) ammonium acetate. (b) ammonium chloride.
(c) sodium carbonate. (d) ammonium carbonate.
- (3) When iron reacts with dilute sulphuric acid.....are produced.
(a) iron (II)sulphate and water . (b) iron (III)sulphate and water.
(c) iron (II)sulphate and hydrogen.
(d) iron (III)sulphate and Hydrogen.
- (4) The most important modification(s) on the atomic model of "Boher" is (are)
(a) the dual nature of the electron .
(b) the uncertainty principle.
(c) finding the suitable equation which describes the wave motion of the electron.
(d) all the previous.
- (5) The oxidation number of oxygen in the hydrogen peroxide is....
(a) (-2) (b) (+2) (c) (+1) (d) (-1)
- (6) All the following are from the properties of the cathode rays except they
(a) have a thermal effect . (b) move in the straight lines .
(c) are positively charged.
(d) are effected by both electric and magnetic fields.

(B) Show by balanced chemical equations , how can obtain each of the following :

- (1) Benzene sulphonic acid from sodium benzoate.
- (2) Ethyl chloride from acetic acid.

Question 2

(A) Write the scientific term for the following statements :

- (1) The elements of the f-block, where the f-sublevels of these elements are successively filled by electrons .
- (2) A number , in which "Bohr" used it in explaining the spectrum of the hydrogen atom, it given the symbol (n)
- (3)The masses of the different materials formed or consumed by the same amount of electricity are proportional to their equivalent masses.
- (4) A bond produced from the electron cloud of valence electrons which decreases the repulsive forces between the positive metal ions in the crystal lattice.
- (5) The transition element which is not abundant in the earth's crust and has limited uses.

(B) solution contains solid barium sulphate (BaSO₄) in the equilibrium state with its ions, as in the following equation:



If the concentration of barium ions, in equilibrium, is 1.04×10^{-5} mol/liter, calculate the value of the solubility product of barium sulphate.

(C) Draw the apparatus used for the preparation of ammonia gas in the laboratory then answer the following :

- (1) Show by practical experiment how can you detect ammonia gas.
- (2) Write the balanced chemical equation which describes the reaction of ammonia with ethyl benzoate.

Question 3:

(A) Show by balanced chemical equations the effect of heat on each of the following :

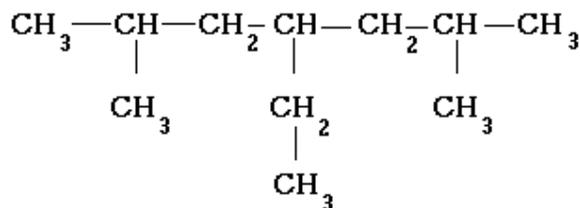
- (1) Iron (II) oxalate in absence of air.
- (2) Sodium bicarbonate
- (3) Normal hexane in presence of platinum.
- (4) Lime stone

(B) Calculate the volume of chlorine gas evolved at (S.T.P) during the electrolysis of sodium chloride (NaCl) solution by passing an electric current , its intensity is 10 amperes for 20 minutes (Cl=35.45) .

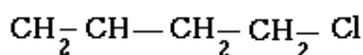
(C) What are inadequacies of the octet rule?

(Two points only with one example for each)

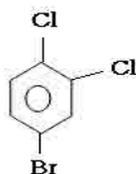
(1)



(2)



(3)



(B) Compare between metals and nonmetals (two points only)

(C) In the reaction : $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

What is the number of moles of the reactant gas? Which side of the equation (the products or the reactants) will increase with increasing the pressure?

(D) To obtain the iron in the blast furnace ,carbon monoxide reduces iron (III) oxide and if the haematite ore contain 45% of iron(III)oxide.

How many kilograms of haematite ore required to produce 1000 kilograms (one ton) of iron? [Fe=56 , O=16]

Question 6

(A) Read the following statement, then answer the question that follow it:

When glycerol reacts with substance(X) in the presence of concentrated sulphuric acid, sulphuric acid substance(Y) is produced. Substance (Y) is used to widen arteries in the treatment of heat crisis.

(1)Write the balanced chemical equation for preparing substance(X) in laboratory.

(2)Mention another use for substance(Y).

(3)Write the balanced chemical equation which describes the reaction of substance (X)with benzene in the presence of hot concentrated sulphuric acid(50°C).

(4) What is the type of chemical bonds formed between the atoms glycerol molecule?

(B) 0.2 gm of a mixture of solid substance containing sodium hydroxide and sodium chloride was titrated with 0.1 molar of hydrochloric acid.

The complete reaction takes place by the consumption of 10ml of the acid. [Na = 23, O =16 , H = 1]

(1) Calculate the percentage of sodium hydroxide in the mixture.

(2) How can you use sodium hydroxide solution in detecting copper(II) Cation in one of its solutions.

(3) State which of (Na^+) or (OH^-) ions is responsible for the detection of copper(II) Cation.

(C) What is meant by.....?

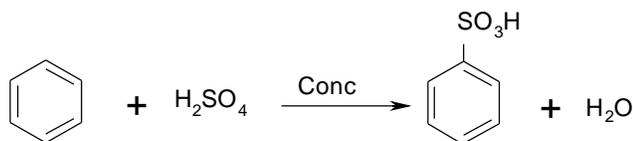
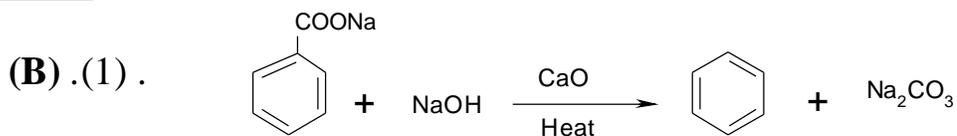
(1) Thomson's model of the atom.

(2) The hybridization.

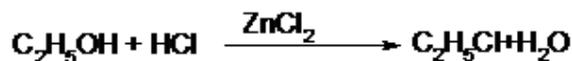
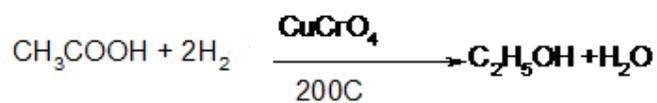
(3) The saturated water vapour pressure.

Model Answers (2007) First Session

Q1.(A): 1) B 2)B 3)C 4)D 5) D 6)C .



(2).



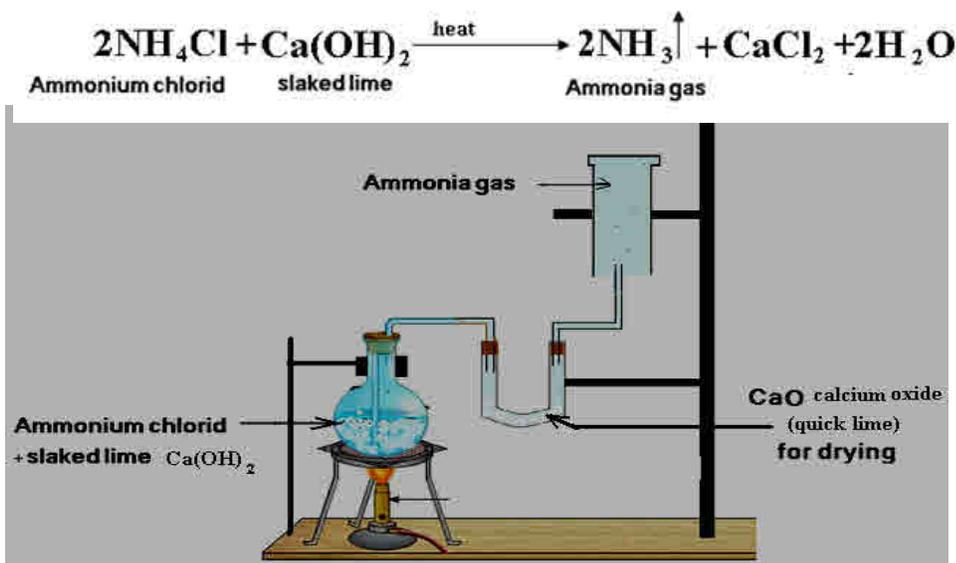
Q2.(A): (1) .Inner transition elements . (2). Principle quantum number .

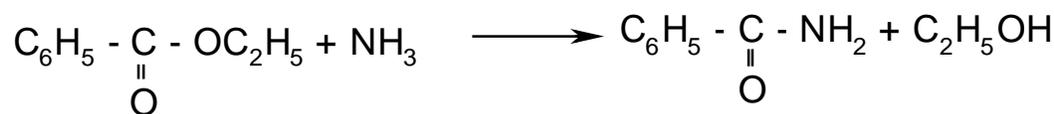
(3) . Faraday's second law . (4) . Metallic bond .

(5) .Scandium .

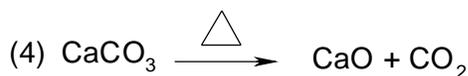
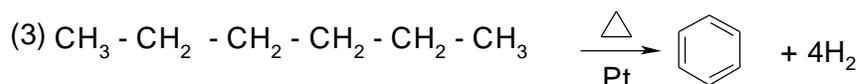
(B) : $k_{SP} = [S]_L^{NP} [Ba^{+2}]$
 $= [1.04 \text{ d f f }^{hj} \ln[1.04t \text{ v x x }^z |]$
 $= 1.08$

(C) (1).





Q3. (A) :



(B) . Equivalent mass of chlorine = $\frac{.00}{2} = 35.45$

mass of chlorine = $\frac{\text{HH} \times \text{NN} \times \text{TT} \times \text{ZZ} \cdot \wedge \wedge}{\text{bbbbbb}} = 4.4 \text{ pp}$

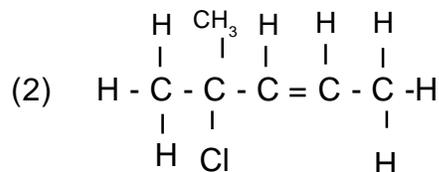
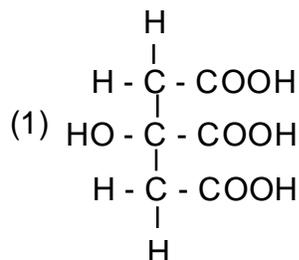
volume of chlorine at S.T.P = $0.062 \times 22.4 = 1.3888$

(C) (1) .Octet theorem in many molecules can't explain the nature of bonding as in case of phosphorus pentachloride , the phosphorus atom is surrounded by ten electrons and not eight as theory proposed .

(2) . Simple form of double bond as a pair of sharing electrons is not sufficient to explain the form of many molecules .

e.g.: angles between bonds in the molecules ,the shape of molecule in space .

(D)



Q4.(A). (1) Danial cell . (galvanic cell) . (2) . Spontaneous reaction .

(3) . (B)is of higher oxidation potential , so it is the anode at which oxidation takes place , and it is the negative pole .

(4) . It is primary cell (irreversible) .

(B) (1) . Owing to Hund's rule no electron pairing takes place in a given sublevel until each orbital contains one electron , and this is much

(2) .Since , hydrogen ion is attracted to the lone pair of electrons of oxygen atom of water molecules , to form coordination bond .

(3) . Benzene ring is strongly bonded to the hydroxyl group in phenol , and this bond is strong and short .

(4) . As the number of outer shells increase , this cause screening effect causes easily losing of outer most electron (low ionization energy) .

(5) .Since , alkynes contains 2: bonds can be easily destroyed to allow addition reactions .

(C) . Effect of concentration of reactants on the rate of chemical reaction :

As concentration of reactants increase , the number of reactant molecules increase , and the probability of collision increase , and the rate of chemical reaction increase .

Q5 .(A): (1) . 4- ethyl 2,6 – dimethyl heptane .

(2). 4- chloro 1- butane .

(3) . 1-bromo-3,4-dichloro benzene .

(B: Metals and non-metals :-

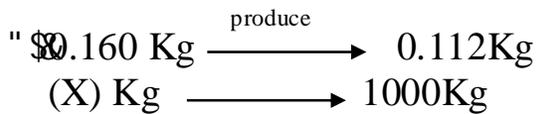
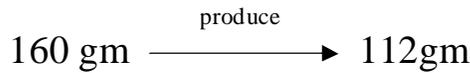
Metals	Non-metals
◆Elements which have less than half filling by electrons in it's valiancy level.	◆Elements which have more than half filling by electrons in it's valiancy level.
◆It's ionization gives positive ions by losing electrons . ◆Good conductors for electricity .	◆It's ionization gives negative ions by gaining electrons . ◆Bad conductors for electricity .
◆They have large atomic radii .	◆It has lower atomic radii .
◆It has lower ionization potential .	◆It has higher ionization potential .
◆They have lower electron affinity .	◆It has higher electron affinity .

(C) : – One mole of reactant gas .

- As pressure increase



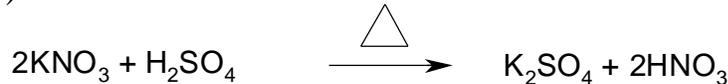
(56 p r t vvx) (56



2 The mass of iron (III) oxide = $\frac{160}{112} \times 1000$
 = 1428.571 kg

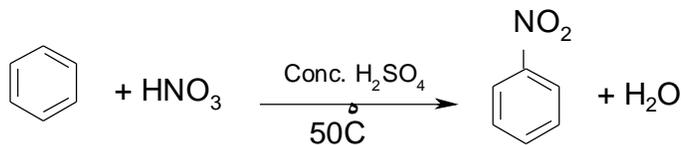
The required mass of haematite ore = $\frac{1428.571}{0.8}$
 = 3147.6 kg

Q6.(A): (1)



(2) It is used in the preparation of explosive substance .

(3)



(4) All chemical bonds between the atoms in the glycerol molecule are covalent bonds .

(B): (1) Number of moles of HCl = $\frac{0.001}{1}$

X Number of moles of NaOH = 0.001 mole

The mass of one mole NaOH = 23 + 16 + 1 = 40 gm

h The mass of NaOH in the mixture = 40 n 0.001 = 0.04gm

x The percentage of NaOH in the mixture = $\frac{0.04}{0.2} \times 100 = 20\%$

(2) By adding sodium hydroxide solution to the salt of copper (II) cation. Blue ppt. is formed which turns black on heating

(3) (OH⁻) ion is responsible for the detection of copper II cation .

(C): (1) Thomson's model of the atom :

He considered the atom as a sphere of uniform positive electricity in which a number of negativity charged electrons are embedded in, to make the atom electrical neutral.

(2) The hybridization :

The hybridization process is the overlap between two different orbitals or more of the same atom to produce a number of new orbitals called by hybridized orbitals.

(3) The saturated water vapour presser in air at a certain temperature.

**General Secondary Certificate Examination
Second Session 2007**

Answer Five questions only of the following :
(Write all the chemical equation balanced)

Question : 1

(A) Write the scientific term for each of the following statements :

- (1) The change in concentration of the reactants per unit time.
- (2) Numbers define the volume of space where there is maximum probability of finding electrons and they define the energy, shape and direction of orbitals.
- (3) Equal volumes of gases under the same conditions of pressure and temperature contain equal numbers of molecules .
- (4) The negative logarithm of hydrogen ion concentration.
- (5) Half the distance between the centers of two similar atoms in a diatomic molecule.
- (6) Electric cells in which the energy from an external source is used to make a non-spontaneous oxidation-reduction to occur.

(B) Show by balanced chemical equations the effect of heat on the following substances :

- (1) Iron (II) sulphate .
- (2) copper (II) hydroxide.
- (3) Phenol in presence of zinc.
- (4) Lithium carbonate .

Question : 2

(A) Choose the correct answer for each of the following :

- (1) When methane reacts with chlorine in direct sunlight and hydrogen chloride are produced .
 - (a) methyl chloride .
 - (b) dichloro methane.
 - (c) carbon .
 - (d) tetrachloro methane.
- (2) The bond in hydrogen chloride molecule is bond .
 - (a) pure covalent .
 - (b) polar covalent .
 - (c) coordinate .
 - (d) ionic.
- (3) Isopropyl alcohol (2-propanol) is alcohol.
 - (a) primary.
 - (b) secondary .
 - (c) dihydric .
 - (d) tertiary.

- (4) On adding concentrated nitric acid to iron , is-(are) produced.
- (a) iron (II) nitrate and hydrogen .
(b) iron(III) nitrate, water and nitric oxide .
(c) iron(III) nitrate and water . (d) non-porous oxide layer.
- (5) The number of orbitals in the sublevel (3d) equals
- (a) five. (b) four . (c)six . (d) seven
- (6)On heating magnetic iron oxide in air , it oxidized to
- (a) iron(II) oxide. (b) iron(II) hydroxide .
(c) iron(III) oxide. (d) iron(III) hydroxide .

(B) Write one use for each of the following :

- (1) Titanium. (2) Poly propylene.
(3) Hydrogen electrode . (4) Methyl orange.

(C) Write the molecular formula and the structural formula for each of the following :

- (1) Naphthalene . (2) Cyclopropane .

Question 3

(A) Give reason for each of the following:

- (1) The saturated monocarboxylic aliphatic acids are named fatty acids.
(2) Hydrolysis of sodium carbonate salt turns red litmus paper blue.
(3) Ferrochrome alloy is considered from substitution alloys.
(4) The boiling point of water is relatively high.

(B) Calculate the solubility product of silver chloride (AgCl), if the degree of solubility is 10^{-5} mole/liter.

(C) Compare between each of the following :

- (1) Blast furnace and Midrex furnace related to :
a. Reducing agent b. The type of product iron
(2) Dry cell and mercury cell related to the total spontaneous reaction of each one.

Question 4:

(A) Show by practical experiment how can you detect the presence of carbon and hydrogen elements in an organic substance.

(B) Show by balanced chemical equations what happens in each of the following cases :

- (1) Addition of iron(III) chloride solution to ammonium thiocyanate solution.
(2) Addition of yeast (zymase enzyme) to glucose solution.
(3) Addition of water to calcium cyan amide.

(4) The reaction of ethanol with concentrated sulphuric acid at 180°C.

(C) Mention four properties of cathode rays.

(D) What is the number of faradays required to precipitate gram/atom of copper according to the following reaction:



Question 5

(A): Choose from (B) and (C) columns which is suitable for column

(A):

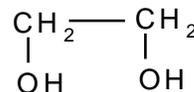
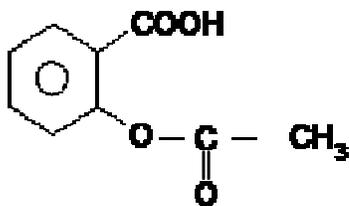
(A)	(B)	(C)
1. valance bond Theory. 2. Sigma bond. 3. Ionic bond.	a. it is a formed as a result of the overlap of two atomic orbitals side by side. b. it was based on the conclusions of quantum mechanics c. the atoms of all elements tend to reach the octet structure except hydrogen, lithium and beryllium d. it is formed as a result of the overlap of atomic orbitals along an axis. e. it is usually formed between metals and non metals.	I.it considered the molecule as one unit. II.the overlap orbitals are on one line III. it explains the formation of the covalent bond IV. it is formed between chlorine and sodium in sodium chloride V. it is formed from the electron cloud of the free valence electrons.

(B) Calculate the number of ions produced by dissolving 7.1 grams of sodium sulphate (Na_2SO_4) in water . [Na= 23 , S=32 , O=16] .

(C) Calculate the oxidation number of each of the following:

(1) Sulphur in S_2V_x^z (2) manganese in KMnO_4

(D) Write the chemical name of the following compounds:



Question 6:

(A) From the following substances or some of them (with Bunsen flame):

Calcium carbide – dilute hydrochloric acid – distilled water – sulphuric acid 40% - methyl acetate – mercury (II) sulphate – ammonium chloride – divided nickel – ethyl acetate .

Show by balanced chemical equation how can you obtain the following compound :

(1) Acetaldehyde .

(2) Acetamide

(B) What is meant by:

(1) Salt bridge in the galvanic cells.

(2) Electron affinity.

(3) The dual nature of the electron .

(4) Metalloids .

(C) Explain the role of each of the following :

(1) Analytical chemistry in agriculture.

(2) Catalysts in industry .

Model Answers (2007) Second Session

Q.1(A): 1. Rate of chemical reaction .

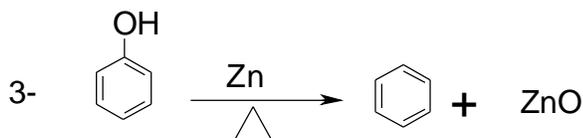
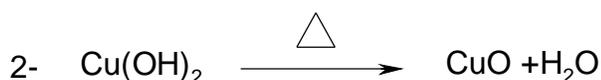
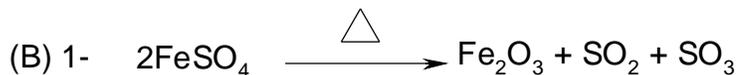
2. Quantum number .

3. Avogadro's law .

4. PH Value .

5. The atomic radius .

6. Electrolytic cells .



- Q.2(A) :**
- | | |
|------------------|-------------------------------|
| 1. (C) Carbon | 2. (b) Polar Covalent |
| 3. (b) Secondary | 4. (d) non porous oxide layer |
| 5. (a) five | 6. (c) iron (III) oxide |

(B) (One use only of each one) :

1. **Titanium** :in the manufacture of rockets and supersonic aircrafts .

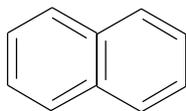
2. **Poly propylene** :in the manufacture of carpets ,cans or plastic cases.

3. **Hydrogen electrode** : in measuring the potentials of other elements Electrodes .

4. **Methyl orange** : As indicator in the titration processes .

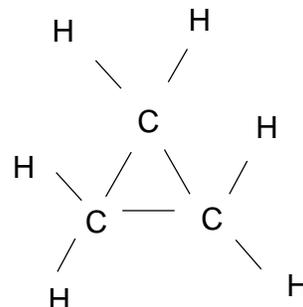
(C) (1) Naphthalene : Molecular formula $C_{10}H_8$

Structural formula



(2) Cyclo propane : Molecular formula C_3H_6

Structural formula



Q.3(A) : 1. Because many of them are present in fats in forms of ester with glycerol .

2. Because it is a salt of a weak acid (incomplete ionized) and a strong base $Na^+ OH^-$ (complete ionized) .

In the hydrolysis of sodium carbonate salt , carbonic acid H_2CO_3 , sodium ions and hydroxide ions are formed . The solution becomes alkaline and turns litmus paper blue .

3. Because all the atoms of the alloys have the same diameter, chemical properties and crystalline structure .

4. Due to the existence of the hydrogen bonds between water molecules .



$$K_{sp} = [Ag^+][Cl^-] \\ = 10^{-5} \times 10^{-5} = 10^{-10}$$

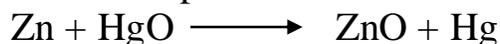
(C) :1. Blast and Midrex Furnaces :-

Point of comparison	Blast Furnace	Midrex Furnace
Charge	$Fe_2O_3 + CaCO_3 + C$	Fe_2O_3 (Hematite)
Reducing agent	CO	Mixture of CO + H_2 from natural gas .
Produced iron	pig iron	Spongy iron

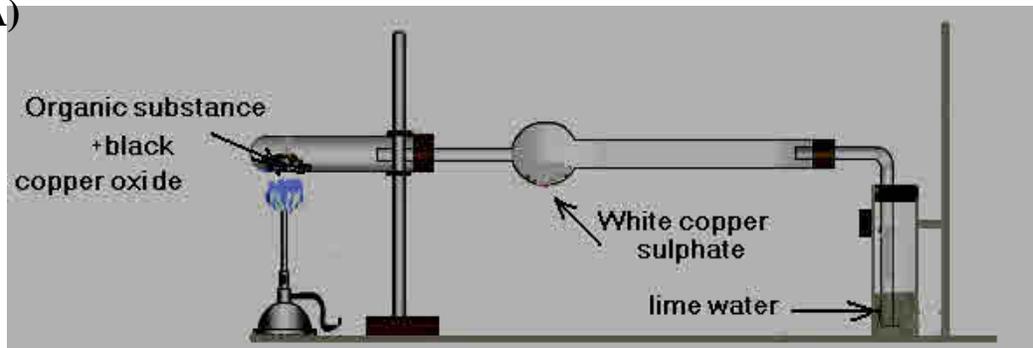
2. -The total spontaneous reaction in the dry cell :



. The total spontaneous reaction in the mercury cell :



Q.4 (A)



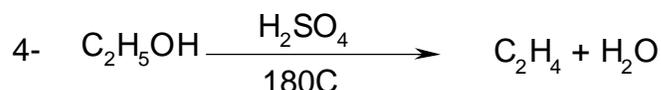
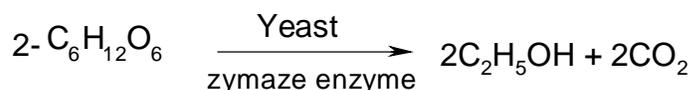
- Put a small amount of an organic Substance mixed with copper oxide in a glass tube and heat the test tube strongly then pass the resulting gases over anhydrous white copper sulphate , then through lime water

Observation :

1. The white color of anhydrous copper sulphate turns blue .
2. Lime water turns turbid .

Conclusion :

The organic compound contains carbon and hydrogen elements .



(C) : 1. They consists of very fine particles .

2. They move in straight lines .

3. They have a thermal effect .

4. They are affected by both electric and magnetic fields .

5. They are negatively charged .

6. They do not differ either in behavior or in nature , if the materials

of the cathode or the used gas are changed .

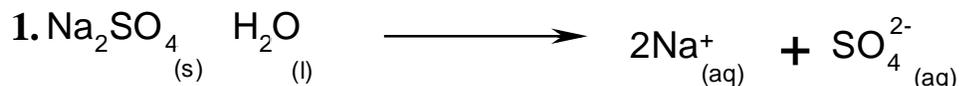
(D) : 2 Faradays .

Q.5 (A) 1. Valance bond theory \longrightarrow with (b) and (III) .

2. Sigma bond \longrightarrow with (d) and (II) .

3. Ionic bond \longrightarrow with (e) and (IV) .

(B)



2. Molecular mass of sodium sulphate =

(23 J LNPR TVXZ \ ^` b dfhhj l n p t vxxz ||| |

3. Number of moles of sodium sulphate = —

Each mole of sodium sulphate gives 3 moles of ions .

4. Total number of moles of the produced ions =

0 2 0.05 8 : <> @ BBBD

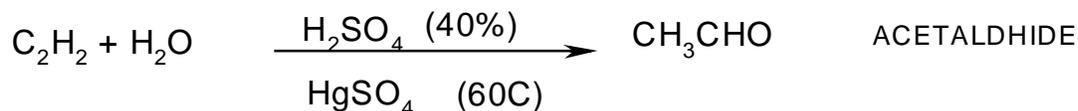
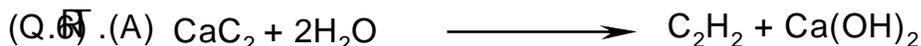
5. Total number of the produced ions R TVXZ \ ^` b bdf h j j ^ l n

rtvz "X, . QZ < @ JLNPR ^` bdfhhj l n p t vxxz ||| | " \$ons

* , . 1. Sulphur (+2) : < @ JLNPR ^` bdfhhj l n p t vxxz Manganese (+7)

"acetyl salicylic acid (or Aspirin) (*. QZ < @ JLNPR ^` bdfhhj l n p t vxxz Ethylene glycol

@ JLN



(B) 1. Salt bridge in galvanic cells :

It is a glass U- shaped tube filled with electrolyte solution , its ions do not react with the ions present in the two half cells , as well as with the electrode materials of the galvanic cell .

2. Electron affinity :

It is amount of energy released when an extra electron is added to a neutral gaseous atom .

3. The dual nature of the electron :

The electron is a material particle which also has wave properties .

4. Metalloids :

Elements that have metallic appearance and have most of the properties of non – metals . They are characterized by their valence shell is nearly half filled .their electro negativity is intermediate between metals and non-metals , their electrical conductivity is less than that of metals , but more than of non-metals . They have important industrial uses in electronic instruments such transistors and they are known as semiconductors .

(C)1. Analytical chemistry in agriculture :

It is possible to know the constituents of a soil and rocks to decide whether the soil is suitable or not for cultivation .

2. Catalysts in industry :

It is used in increasing of rate of some chemical reactions , and this leads to increasing the productivity .

**General Secondary Certificate Examination
First Session 2008**

Answer Five questions only of the following

Question 1:

(A) Choose the correct answer for each of the following :

- (1) The siderite ore is
- (a) Hydrated iron oxide (b) anhydrous iron oxide
(b) Iron (II) carbonate (d) black iron oxide
- (2) According to Maxwell's theory (during the movement of the electrons around the nucleus
- (a) gradual increase in its orbital radius.
(b) gradual decrease in its orbital radius.
(c) its orbital radius still constant.
(d) it keeps its energy constant.
- (3) The bonds in ammonium hydroxide molecule are.....
- (a) polar covalent . (b) coordinate.
(c) ionic . (d) all the previous.
- (4) One of the following salts solution turns litmus blue.....
- (a) potassium sulphate . (b) ammonium acetate.
(c) iron() nitrate . (d) sodium acetate.
- (5) On the electrolysis of molten sodium hydride.....will form at the anode.
- (a) sodium metal . (b) sodium oxide.
(c) hydrogen gas . (d) water.
- (6) An element its electronic configuration $Xe_{(54)} 6S^2 5d^3 4f^{14}$ it represents.....
- (a) the second transition series. (b) the third transition series.
(c) the lanthanide series. (d) the actinide series.

(B) Show by balanced chemical equations , how can you obtain each of the following:

1. Acetone from 2-Bromopropane.
2. Ethyl benzoate ester from toluene.

Question 2:

(A) Write the scientific term for each of the following statement :

(1) A dynamic system takes place when the rate of forward reaction equals the rate of backward reaction. The concentration of the reactants and products are not changed.

(2) Electric cells in which the energy from an external source is used to make a non spontaneous oxidation-reduction reaction to occur.

(3) Carbon atom has four single (un paired) electrons.

(B) A sample of 1.47 grams of hydrated calcium chloride salt ($\text{CaCl}_2 \cdot X \text{H}_2\text{O}$) was heated several times till a constant mass of 1.11 grams. Find out the number of water molecules of crystallization in the molecule of hydrated calcium chloride

(H = 1 , O = 16 , Ca = 40 , Cl = 35.5)

(C) compare between each of the following:

1. Subsidiary quantum number and magnetic quantum number.
2. Acidic oxides and basic oxides.

Question 3:

(A) Give reason for each of the following :

(1) Cobalt (II) chloride can be used in secret ink.

(2) Sodium metal has low melting point while the transition elements have high melting point .

(3) The catalyst do not affect the position of equilibrium in the reversible reactions.

(4) The bond length in iron (II) chloride is longer than that in iron (III) chloride.

(B) The molecular mass of a hydrocarbon is 58, its mole contains 48 grams carbon (H=1,C=12).

1. Write the formula for this compound.

2. This compound has two isomers (isomerism), write the structural formula for each isomer.

(C) Mention the name of the substance used in each of the following purposes :

1. Lining the layer of the hydrogen convertor.

2. Filtration of air in submarines from carbon dioxide.

(D) Calculate the oxidation number of carbon in ethylene glycol.

Question 4

(B) Write the structural formula for each of the following compounds:

1. Aromatic produced from the reaction of nitrobenzene with chlorine in the presence of a catalyst.
2. Carbohydrate compound its molecule contains more than one hydroxyl group in addition to ketonic group.
3. A compound from alkanes its molecule contains six carbon atoms and does not contain methane ($-\text{CH}_2$) group.

(B) Calculate the electric current intensity required for passing 3.7 faraday through an electrolyte for 40 minutes.

(A) What is meant by..... ?

1. Electronic theory of valency.
2. The quantum.
3. Representative elements.

(D) Draw the apparatus used for the preparation of nitric acid in the laboratory (write the labels on the drawing). How to differentiate practically between concentrated and diluted nitric acid.

Question 5

(A) When calcium reacts with carbon compound (A) is formed. On dropping water on compound (A) compound (B) is formed. On adding water to compound (B) in presence of catalyst and heating a liquid (C) is formed. On passing compound (B) through a red hot nickel tube a vapour of compound (D) is formed.

From the previous information:

1. Write the balanced chemical equations that illustrate the following:

- a. How to obtain dichloroethane from compound (B)?
- b. The effect of concentrated sulphuric acid on compound (D).
- c. How to obtain an agricultural fertilizer from compound (A)?

2. Mention one use for compound (C).

(B) Calculate the number of chloride ions produced by dissolving 117 grams of sodium chloride in water ($\text{Na}=23, \text{Cl}=35.5$)

(C) How to differentiate practically between Iron(II) sulphate and Iron(III) sulphate?

(D) Explain the role of each of the following :

1. Le chatelier in explaining the scientific bases.
2. Hund in development of science.
3. fluorspar on extraction of aluminum metal from its ore in industry.

Question 6

(A) What are the substances required for the preparation of each of the following compounds ? Then write the balanced chemical equations to prepare each compound.

1. Aspirin .

2. Picric acid .

(B) Calculate the degree of dissociation in 0.1 molar hydrocyanic acid (HCN) solution at 25⁰C . Providing that the equilibrium constant of the acid $K_a = 7.20 \times 10^{-10}$

(C) What happens in the following cases ? Illustrate with balanced chemical equations (whenever possible).

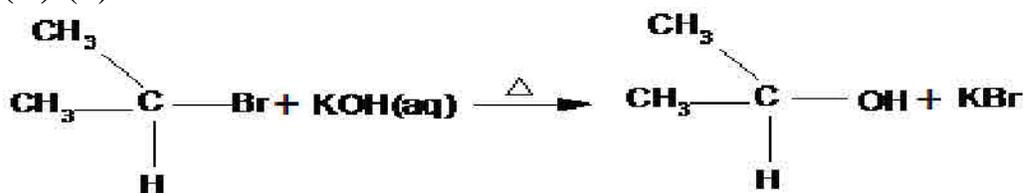
1. Adding concentrated sulphuric acid to the product of the reaction of red hot iron in air.
2. When an amount of electricity passes through different groups of electrolytic solutions connected in series.
3. Adding Iron(III)chloride solution to ammonium thiocyanate solution.
4. Passing ammonia and carbon dioxide gases in a saturated aqueous solution of sodium chloride.

Model Answer(First Session 2008)

(Q) (1) A:

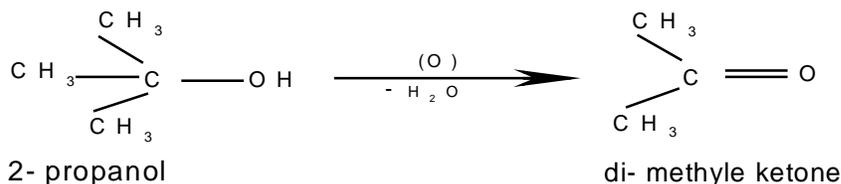
- (1) (c) Iron (II) carbonate
- (2) (b) gradual decrease in its orbital radius.
- (3) (d) all the previous
- (4) (d) sodium acetate
- (5) (c) hydrogen gas
- (6) (b) the third transition series.

(B) (1)



2-bromo propane

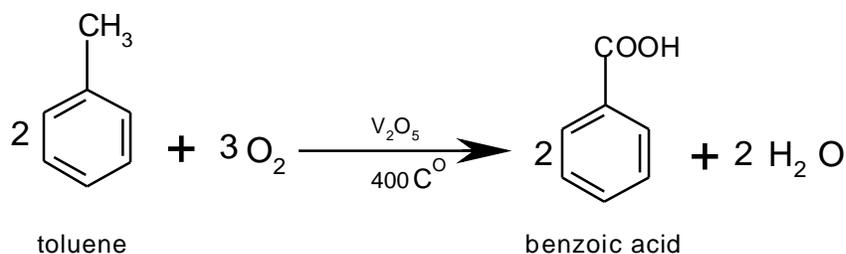
2- propanol



2- propanol

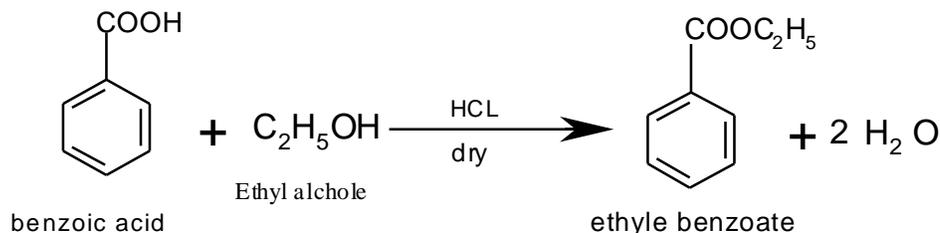
di- methyle ketone

(2)



toluene

benzoic acid



benzoic acid

Ethyl alchole

ethyle benzoate

(Q)(2)

- (A)** (1) Chemical equilibrium in reversible reactions
 (2) Electrolytic cells
 (3) excited carbon atom

(B) * The mass of water of crystallization in the sample
 = 1.47 – 1.11 = 0.36 gram

* Each 1.11 gram of anhydrous bind with 0.36 gram water of crystallization

*The molecular mass of (CaCl₂) = (36.6x2) + 40 = 111 gram

*1.11 gram CaCl₂ bind with 0.36 gram water of crystallization

*111 gram CaCl₂ bind with X gram water of crystallization

* X(mass of water of crystallization) = $\frac{1.11 \times 36.6}{0.36} = 36: :$

The molecular mass of (H₂O)=16+(2x1) =18 gm

The number of molecules of water of crystallization in the molecule of hydrated CaCl₂ = $\frac{36}{18} = 2$ molecules

(C):

	Subsidiary quantum number	magnetic quantum number.
(1)	It indicates the number of energy sublevels within each principle energy level.	It represents the number of orbitals within a certain energy sublevel.
(2)	each principle energy level consist of a number of energy sublevel to its principle equal quantum number	number of orbitals in each principle energy level equals square the number of the level (n ²)

	Acidic oxides	basic oxides
(1)	Non-metal oxides	metal oxides
(2)	Dissolve in water to give acids	Some of them dissolve in water to give alkalis and others do not dissolve in water
(3)	React with alkalis to give salts and water	React with acids to give salts and water

(Q)(3):

(A)(1) Cobalt (II)chloride has a pale pink color in dilute solutions and no color appears on using its aqueous solution in writing On heating it dehydrates and writing appears in a deep blue color.

(2) the strength of the metallic bond depends on the number of valence electrons in the metal atom, as the number of valence electrons increase, the atoms become more strongly bond and accordingly the metal becomes more hard and has higher melting point. Sodium atom has one single valence electron (weak metallic bond), while transition elements of electrons of (s, d)form strong metallic bond.

(3) Catalyst decreases the activation energy required to accelerate reversible and irreversible reaction at the same time.

(4) the length of ionic bond equals the sum of the two ionic radii of cation and anion, the ionic radius depends on the number of electrons gained or lost (ionic charge) .in case of metals, the radius of the positive ion decreases by the increase of the positive charge, as the ionic charge increase as from Fe^{+2} to Fe^{+3} the radius decreases.

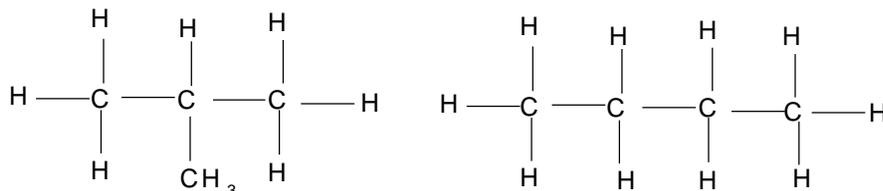
(B) : Mass of hydrogen = 58 - 48 = 10 grams

Number of carbon atoms = 48 /12 = 4 atoms

Number of hydrogen atoms = 10 atoms

The molecular formula of the hydrocarbon C_4H_{10}

The structural formula for the two isomers are



2- methyl propane

butane

(C): (1) Dolomite

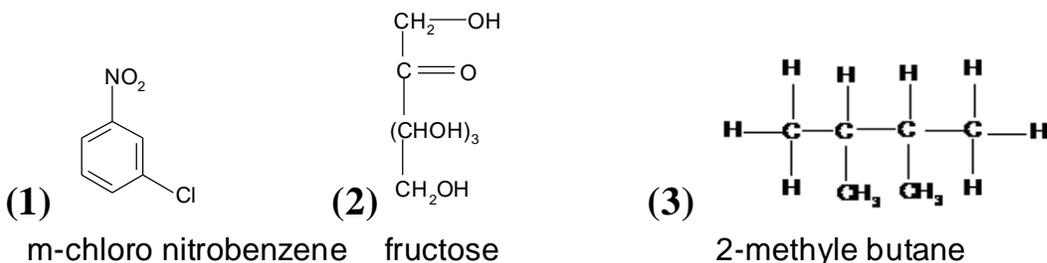
(2) potassium superoxide

(D) $C_2H_4(OH)_2$

$C_2 + (6 - 4) = \text{zero}$

$C_2 = -2$ So the oxidation number of (C)= -1

(Q)(4) : (A)



(B) **The quantity of electricity = current strength x time**

$$3.7 \times 96500 = I \times 40 \times 60$$

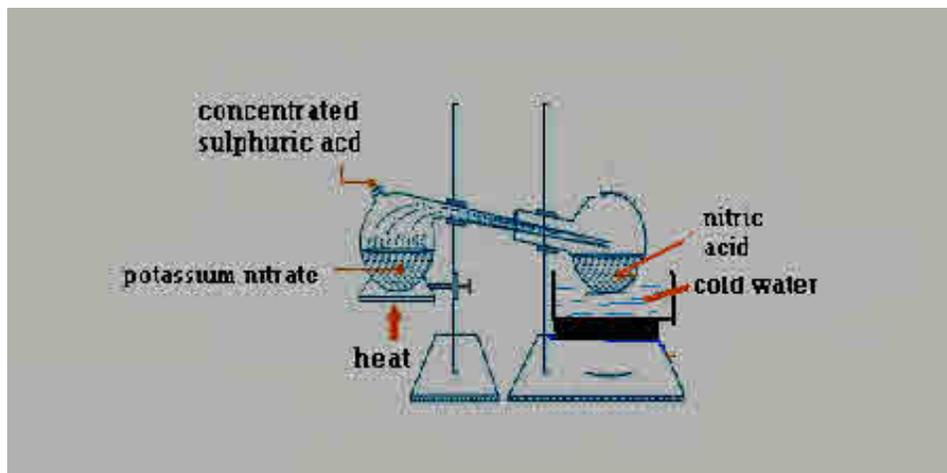
$$I = (3.7 \times 96500) / (40 \times 60) = 148.7 \text{ ampere}$$

(C)(1) **Electronic theory of valency** : With the exception of hydrogen, lithium and beryllium the atoms of all elements tend to reach the octet structure.

(2) **The quantum** : Is the amount of energy absorbed or emitted when an electron jumps from one energy level to another.

(3) **Representative elements** : They are elements of S and P block except that of group zero. These elements are characterized by the complete filling of all energy levels with electrons except for the highest level, it tends to reach the configuration (ns^2, np^6) .

(D)



To differ between concentrated and diluted nitric acid :

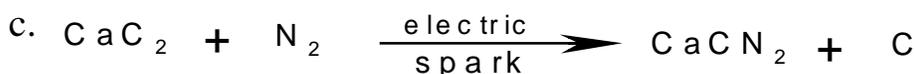
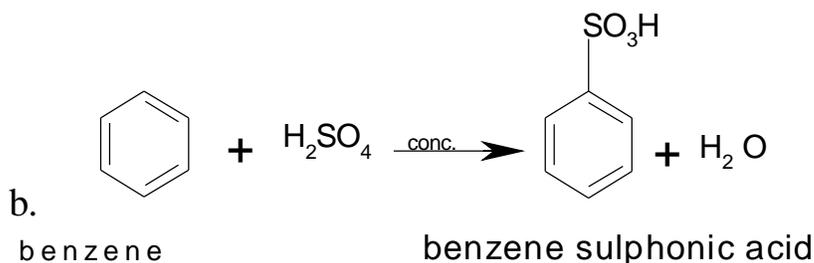
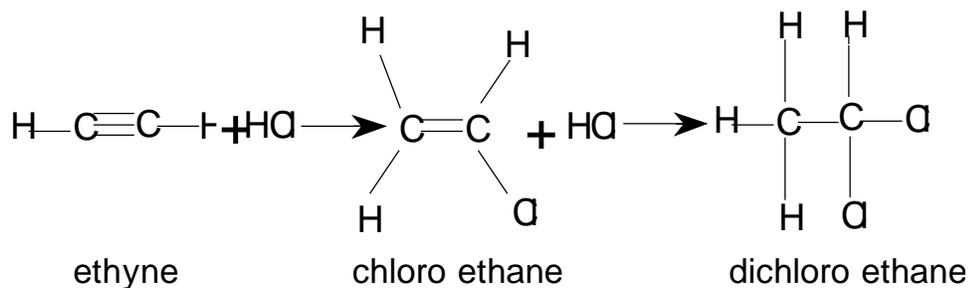
Add to both of them Cu then heat.

If a colorless gas changed into reddish brown at the mouth of the tube then it is dilute acid.

If reddish brown gas is formed without heating then it is concentrated acid.

(Q)(5):

(A) (1)a:



(2) preparation of ethanoic acid (acetic)

(B) : Mole of NaCl = 23 + 35.5 = 58.5 gram

Number of moles = 117 ÷ 58.5 = 2 moles

Each mole of NaCl gives 1 mole of Cl⁻

Number of moles of chloride ions produced from 117 grams =

$$2 \times 1 = 2 \text{ moles}$$

Number of moles of chloride ions produced from 117 grams NaCl = 2 x 6.02 x 10²³ = 12.04 x 10²³ ions

(C) : Add NaOH Solution to each salt solution

- if white precipitate turns to greenish white [iron(II) hydroxide] is formed it is iron(II) sulphate .

If reddish brown precipitate [iron(III) hydroxide] is formed it is iron(III) sulphate .

(D) : (1) The changes in any of the conditions of a chemical equilibrium such as concentration , pressure or temperature causes shift of the equilibrium in the direction which will oppose this change.

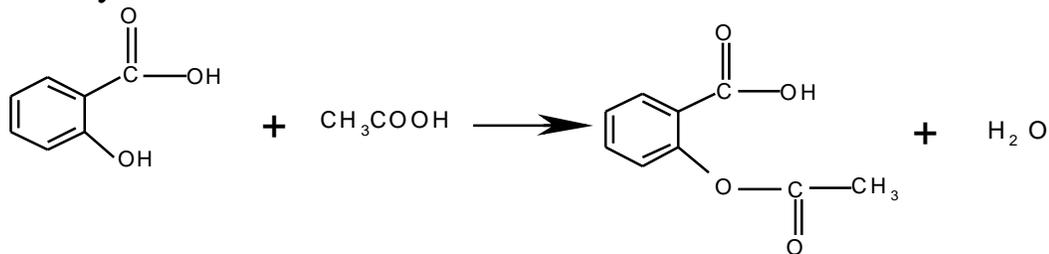
(2) **Hund's rule** : No electron pairing takes place in a given sublevel until each orbital contains one electron .

(3) Decrease the melting point of the mixture .

(Q)(6):

(A) (1) Required Substances for the preparation of Aspirin :

- 1 . Salycilic acid
2. Acetic acid

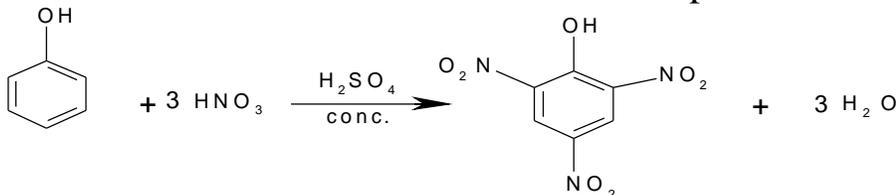


salcylic acid

Aspirin
(Acetylsalicylic acid)

(2) Required Substances for the preparation of picric acid

1. phenol
2. Mixture of concentrated nitric and sulphuric acids



Phenol

Picric acid



$$K_a = \alpha^2 \times C$$

$$7.2 \times 10^{-10} = \alpha^2 \times 0.1$$

$$\alpha^2 = 7.2 \times 10^{-10} \div 0.1 = 72 \times 10^{-10}$$

$$\alpha = \sqrt{72 \times 10^{-10}} = 8.5 \times 10^{-5}$$

(C): 1. Both iron(II) and iron(III) sulphate are produced

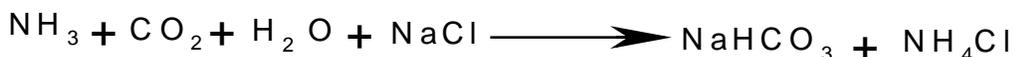


2. The masses of the different materials formed or consumed by the same amount of electricity are proportional to their equivalent masses.

3. A blood red color is formed



4. Sodium bicarbonate is formed :



**General Secondary Certificate Examination
second Session 2008**

Answer Five questions only of the following :

Question 1:

(A) Write the scientific term for each of the following statement :

- (1) The volumes of gases involved in a reaction and the gases produced are exist in fixed ratios .
- (2) The amount of energy released when an extra electron is gained by a neutral gaseous atom .
- (3) Bond in which the shared electron pair comes from one atom.
- (4) A substance that is repelled out of an external magnetic field because all of electrons of (d) sublevel are paired .
- (5) A standard electrode ,its potential equals zero.
- (6) A stream of invisible rays emitted in discharge tube with pressure 0.01 mm / Hg and potential difference of about 10.000 Volts.

(B) Show by balanced chemical equations , how can you obtain each of the following:

1. Diethyl ether from ethylene.
2. Methyl benzene from sodium benzoate.

Question 2

(A) Choose the correct answer for each of the following :

- (1) Atoms of all elements do not contain the energy sublevel
(a) 4d (b) 3s (c) 2d (d) 2p
- (2) The ionic product of water equalmol/litter
(a) 10^{-14} (b) 10^{-7} (c) 10^{-4} (d) 10^{-9}
- (3) The number of moles in 72 litres of ammonia gas (NH_3) at (stp) ismoles.
(a) 2.3 (b) 3.2 (c) 23 (d) 32
- (4) All the following decompose by heat except
(a) HNO_3 (b) NaNO_3 (c) Na_2CO_3 (d) NaHCO_3

(B) Calculate the oxidation number of each of the following:

1. chlorine in HClO_4
2. chromium in $(\text{Cr}_2\text{O}_7)^{-2}$

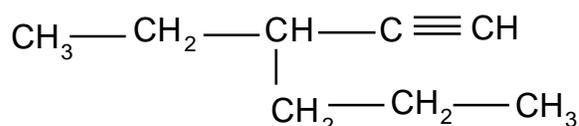
(C) compare between each of the following:

1. Reversible reactions and irreversible reactions.
2. Addition polymerization and condensation polymerization.

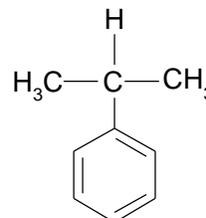
Question : 3

(A) Write the name of the following compounds according to IUPAC system :

1.



2.



(B) What is the quantity of electricity (coulomb) necessary to separate 5.6 grams of iron from solution of iron (III) chloride ?

Where the cathode reaction is :



(C) How can you differentiate practically between ?

1. Copper (II)sulphate and aluminum sulphate.
2. Sodium nitrite and sodium nitrate .

(D) What is meant by..... ?

1. Ionic equilibrium.
2. Hybridization sp^2 .
3. The Thomson's model of the atom.
4. Substitution alloys .

Question 4

(A) Give reason for each of the following :

1. The boiling point of carboxylic acids is higher than that of the corresponding alcohols.
2. The first ionization energy of noble gases is very high.
3. Titanium is preferred in the manufacture of rockets and supersonic aircrafts.

(B) Calculate the mass of potassium hydroxide (KOH) required for prepare

500ml of a 2 moles/liters solution [H= 1 , O=16 ,K=39].

(C) Write the structural formula of the compound 3- Methyl -1-butene. then explain:

1. What is the number of hydrogen moles required to react with one mole of this compound to obtain saturated compound ?
2. Show by chemical equation the reaction of the compound

with potassium permanganate in alkaline medium .

(D) What is the role of each of the following ?

1. Indicators in titration process .
2. Calcium oxide in preparation of ammonia gas in the laboratory.

Question 5

(A) Draw the apparatus used for the preparation of ethyne gas in the laboratory, write the labels on the drawing , then answer the following:

1. Show by the balanced chemical equations what happens when ethyne burns in excess amount of air .
2. What are the types of bonds between the two carbon atoms of this gas?

(B) In HClO molecule the bond length between chlorine and oxygen atoms

is 1.65 \AA and the bond length between chlorine and hydrogen atoms is 1.29 \AA The bond length in chlorine molecule is 1.98 \AA Calculate:

1. The bond length in oxygen molecule.
2. The atomic radius of hydrogen atom .

(C) Show by the balanced chemical equations what happens when :

1. Magnesium ribbon reacts with nitrogen at high temperature then water is added to the product .
2. Passing carbon monoxide gas at $230 - 300^{\circ}\text{C}$ on the product of the reaction of iron (II) oxide with hot air .

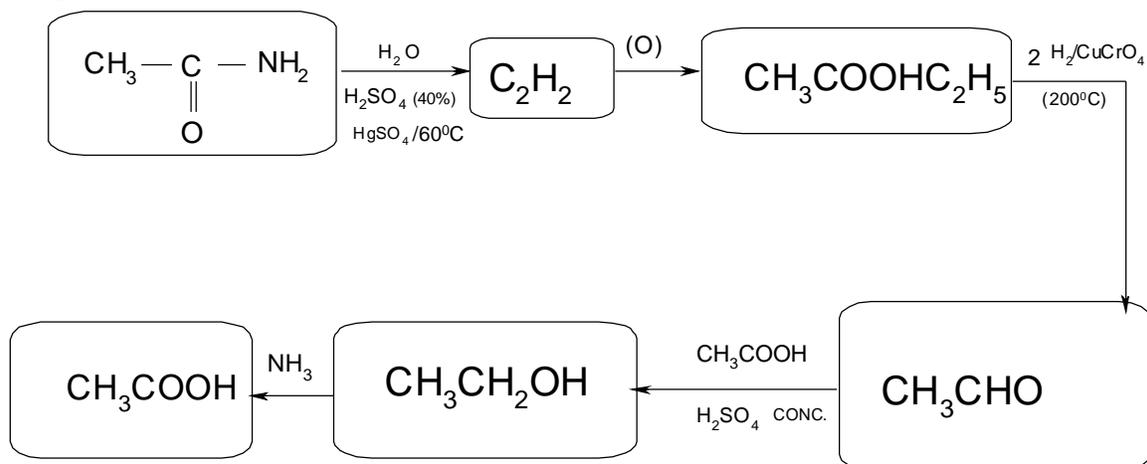
**(D) What are the factors affecting the rate of chemical reaction?
(Two factors enough).**

Question 6

(A) What is the name of scientist who did each of the following?

1. Found the relationship between the degree of dissociation (a) and the concentration (C) in mole /litter.
2. Prove that when 96500 coulomb is passed through an electrolyte , this will led to dissolution or evolution or deposition of gram equivalent mass from the substance at any electrode .
3. Concluded that the determination of both the velocity and the position of an electron at the same times is practically impossible
4. Discovered the hexagonal cyclic shape in which single and double bonds are exchanged .

(B) Rearrange correctly what are inside the boxes in the following diagram :



(C) If the equilibrium constant for the following reaction is 15.75



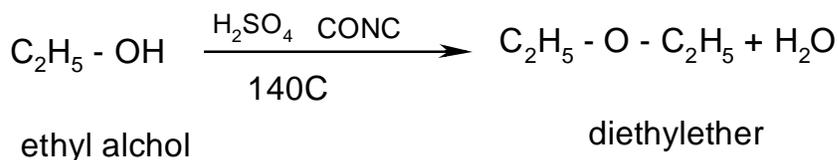
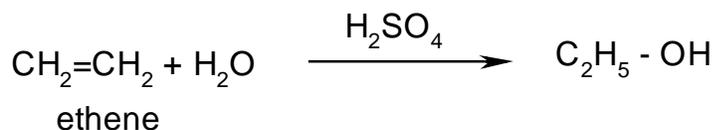
And the concentration of chlorine and phosphorus trichloride were 0.3 and 0.84 mole/ liter respectively .

Calculate the concentration of phosphorus pentachloride.

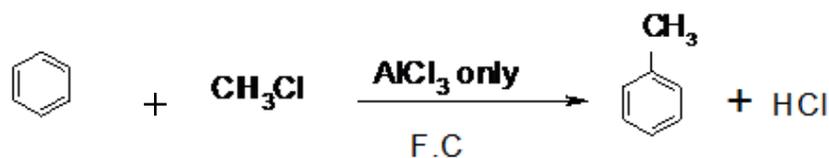
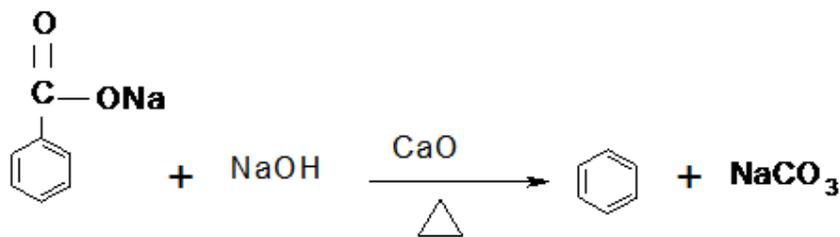
(D) Show by drawing only how the valence bond theory explain the bonding in hydrogen fluoride molecule .

- Q1.(A):** (1) . Law of mass action .
 (2) .Electron affinity .
 (3) . The coordinate bond .
 (4) .Diamagnetic .
 (5) . Standard hydrogen electrode .
 (6). Cathode rays .

(B): (1)



(2)



- Q2. (A):** (1) (c) 2d . (2) (a) 10^{-4} .
 (3) (b) 3.2 moles . (4) (c) Na_2CO_3

(B): HClO_4 , Cl = ?
 $(-2 \times 4) + \text{Cl} + 1 = \text{Zero}$
 $-8 + 1 + \text{Cl} = \text{Zero}$
 $-7 + \text{Cl} = \text{Zero}$
 Cl = +7
 $(\text{Cr}_2\text{O}_7)^{-2}$, Cr = ?

$$(-2 \times 7) + Cr_2 = -2$$

$$-14 + Cr_2 = -2$$

$$Cr_2 = -2 + 14 = +12$$

$$Cr = +6$$

(C): (1)

Complete reaction	Reversible reaction
Reaction takes place in forward direction only, gas or precipitate is formed. $Ca + 2HCl \longrightarrow CaCl_2 + H_2 \uparrow$ $NaCl + AgNO_3 \longrightarrow NaNO_3 + AgCl \downarrow$	Reaction takes place in both forward, and backward directions so that both reactants and products are present in reaction medium and neither gas evolved nor precipitate is formed . $CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$

(2)

Addition polymerization	Condensation polymerization
- It takes place by adding a huge number of unsaturated small molecules to each other to form a very large molecule .	- It take place between two different monomers and accompanied by losing a simple molecule such as water to form co – polymer which continues the polymerization.

Q3.(A) : (1) 3.Ethyl-hexyne .

(2) 2. Phenyl propane .

(B) : Equivalent mass of iron = $\frac{\text{Atomic mass}}{\text{valency}} = \frac{56}{3} = 18.67$

Quantity of electricity = $\frac{Q}{n \cdot F} = \frac{1000}{3 \cdot 96500} = 0.0034$

(C):(1) By adding sodium hydroxide solution to the solution of each salt.

- If a blue precipitate of copper (II) hydroxide turns black on heating

then it is copper (II) sulphate .

- If a white precipitate of aluminum hydroxide dissolves in excess of sodium hydroxide then it is aluminum sulphate .

(2) Using potassium permanganate acidified with conc.H₂SO₄

$\text{J J } \overset{\text{N}}{\text{L}}$ anions :

The violet color of potassium permanganate disappears .

\$\$. **anions:**

The violet color of potassium permanganate don't disappears

(D): (1) **Ionic Equilibrium** : this type of equilibrium is created in case of solutions of weak electrolytes , between it's molecules , and the formed ions .

(2) Hybridization SP^2 takes place between two orbitals (2P) and one orbital (2S) forming three hybridized orbitals each of which named (SP^2) hybrid orbital

(3) He considered the atom as a sphere of uniform positive electricity in which a number of negativity charged electrons are embedded in, to make the atom electrical neutral.

(4) Alloys in which some atoms of the pure metal are replaced by the atoms of the added metal where all atoms of the alloy have the same diameter, crystalline structure ,and chemical properties . (as in case of gold & copper) .

Q4.(A) : (1) The boiling point of carboxylic acid molecules by hydrogen bond , each acid molecule is linked to another molecule by two hydrogen bond

(2) This is due to the stability of their electronic configuration , because it is difficult to remove an electron from a completely filled shell.

(3) Because it is as strong as steel but less dense , resist corrosion and it has high strength at elevated temperature .

(B) : The mass of one of KOH = 39 + 16 + 1 = 56 gm

Number of moles of (KOH) =

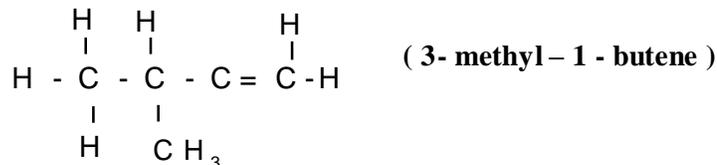
Concentration of solution (mole / liter) \times volume of the solution (liter)

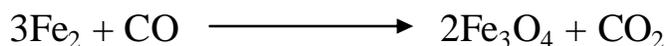
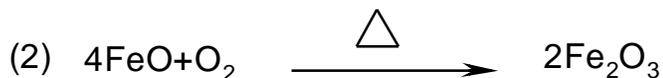
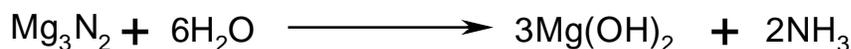
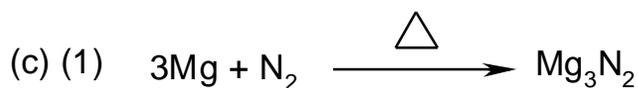
$$= \frac{\times 000}{2222} = 1 < < < <$$

The mass of potassium hydroxide in 1 mole

Number of moles \times mass of 1 mole = $1 \times 56 = 56$ gm

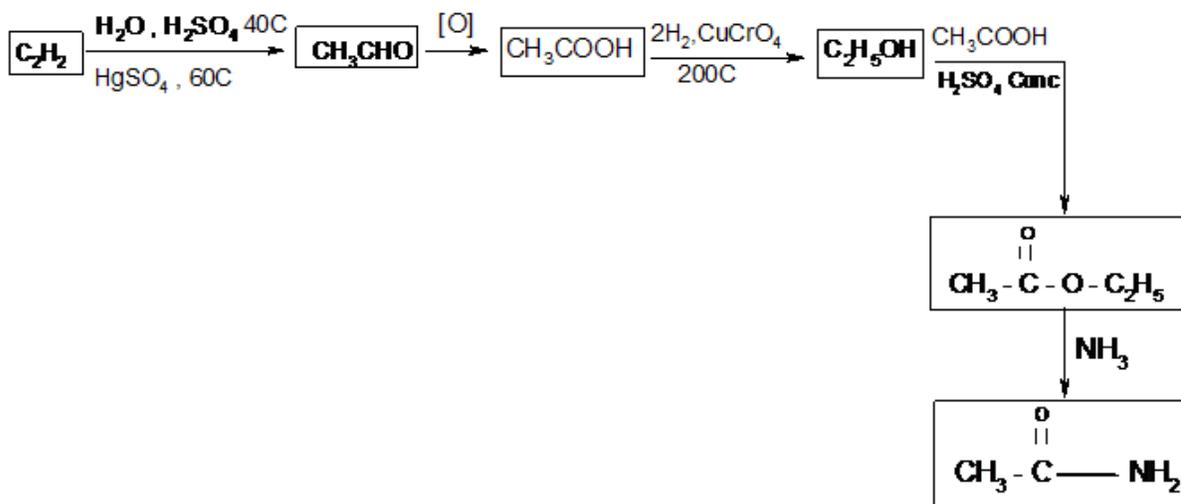
(C) : (1)





- (D): (1) Nature of the reactants . (2) Concentration of the reactants
 (3) Reaction temperature . (4) Pressure .
 (5) Catalyst . (6) Light .(Two factors enough).

Q.6(A):



(B): Equilibrium Constant K_c _____

$$15.75 = \frac{P_{RRT}^X}{\Delta^{\wedge} \text{bf } h_j l} = \frac{rt \ t \ v_x z}{|}$$

The concentration of $[PCl_5] = 15.75 \times 0.252$
 $= 3.969$ mole / liter

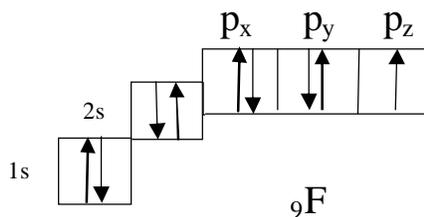
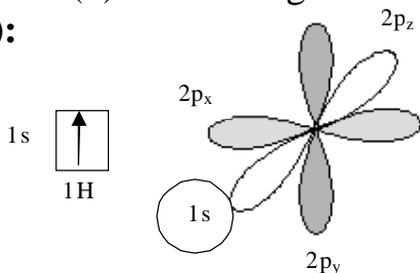
(C): (1) Ostwald

(2) Faraday

(3) Heisenberg

(4) Kekule

(D):



The bonding in hydrogen fluoride molecule according to the valence bond theory .

Answer Five questions only of the following :

Question 1

(A) Choose the correct answer for each of the following :

- (1) The number of orbitals in sublevel 5f is
(a) 3 (b) 5 (c) 7 (d) 4
- (2) The oxidation number of chlorine in KClO_4 compound is.....
(a) (-1) (b) (+7) (c) (-7) (d) (+1)
- (3) The chemical formula of limonite ore is
(a) $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ (b) $2\text{FeO} \cdot 3\text{H}_2\text{O}$
(c) $2\text{Fe}_3\text{O}_4 \cdot 3\text{H}_2\text{O}$ (d) $3\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
- (4) On adding sodium hydroxide to copper sulphate , then heating the product the colour of the precipitate formed is
(a) yellow (b) blue
(c) black (d) reddish brown
- (5) Ammonium chloride NH_4Cl compound contains bonds.
(a) ionic (b) covalent
(c) coordinate (d) all the previous
- (6) Hydrochloric acid is one of the strongest acids. The pH value of its solution of 1 molar concentration is
(a) Zero (b) 7
(c) 13 (d) 14

(B) Show by balanced chemical equations , how can obtain :

- (1) Secondary alcohol from propene .
- (2) Aromatic benzene from benzoic acid .

Question 2

(A) Write the scientific for the following statement :

- (1)The resultant of multiplying the concentration of hydrogen ion times that of hydroxyl ion from water ionization.
- (2)The bond formed as a result of overlap of two atomic orbitals side by side.
- (3) An ester produced from the reaction of salicylic acid with methyl alcohol.
- (4)The minimum amount of energy that must be gained by the molecule to react at collision.
- (5) A number that defines the number of orbitals in a given sublevel.

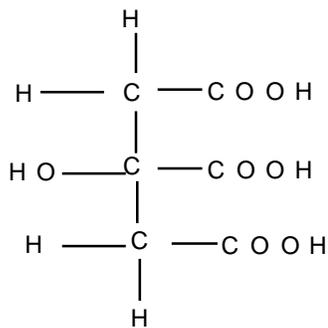
(B) Potassium superoxide KO_2 is a compound used to purify atmospheric air from carbon dioxide in a closed atmosphere .

If 14.2 gm of KO_2 is used calculate the volume of oxygen formed in liters (K=39, O = 16).

(C) Mention one application for each of the following:

1. $\text{CaCO}_3 \cdot \text{MgCO}_3$

2.



Question 3

(A) What is meant by ?

1. Aufbau principle.

2. Allotropy

(B) Two metals A and B their standard oxidation potentials are -0.3 and 0.7 volts respectively; each of them are divalent:

- Using a diagram how can represent the cell which can be formed from these two metals ?
- Calculate the electromotive force of this cell ?
- Does this cell produce an electric current ? Why?

(C) Show by balanced chemical equations , what would happen when:

- Magnesium nitride react with water .
- Iron reacts with chlorine .
- A mixture of ethyl alcohol and concentrated sulphuric acid heated at 140°C .

(D) Compare between :

- The electron affinity of both chlorine and fluorine atoms .
- The type of hybridization of carbon atom in methane molecule and ethane molecule .

Question 4

(A) Give reason for each of the following:

- (1) Nitrogen has several oxidation states .
- (2) Transition elements are characterized by variable oxidation numbers.
- (3) When nitro benzene reacts with chlorine , orthochloronitro benzene is not formed
- (4) Normal propane is less active then cyclopropane.

(B) Write the chemical formula for the following:

1. Cementite .
2. Terphthalic acid
3. Pyrogalol.

(C) Aluminum metal is produced from electrolysis of molten aluminum oxide. Calculate the number of aluminum moles produced when an electric current of intensity 9.65 amperes for 5 minutes .

The cathode reaction equation is :



Question 5

(A) State the role of sulphuric acid in the following reactions:

1. Ester formation .
2. Addition of water to ethene.

(B) How can you differentiate practically between ?

1. Dilute acetic acid and pure acetic acid.
2. Ethyl alcohol and phenol .
3. Iron(II) salts and Iron(III) salts .
4. Litmus solution and phenolphthalein solution .

(C) Calculate the concentration of hydronium ions (H_3O^+) in 0.2 molar solution of acetic acid at 25°C given that the equilibrium constant of the acid is (1.8×10^{-5}) .

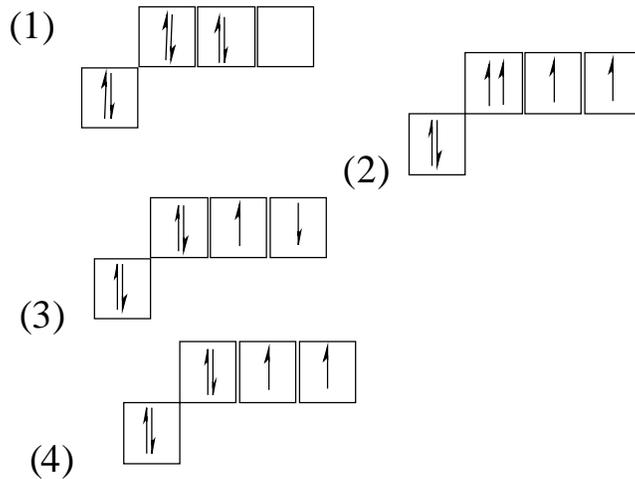
Question 6

(A) Draw the apparatus used for the preparation of acetylene gas in the lab and write the balanced chemical equation.

(B) Compare between :

1. Complete reaction and reversible reactions .
2. The value of first and second ionization energy of magnesium (Mg_{12}) (Explain the reason).

(C) Which of the following diagrams show the correct distribution of electrons in the last energy level of oxygen atom (O_8) ? Explain why?



(D) What are the main contribution of each of the following ?

1. Davy .
2. Lewis and Kosel .

(C): (1) dolomite ore is used as lining for the oxygen converter.

(2) Citric acid is added to frozen fruits to retain their color and taste, and prevents the growth of bacteria in food.

Q.3: (A) What is meant by:

(1) **Auf beau principle:** Electron occupy the sublevels in the order of increasing their energy, the lowest energy sublevels are filled.

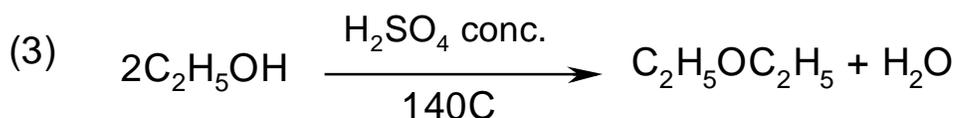
(2) **Allotropy:** the presence of the element in more than one form of different physical properties but of similar chemical one.

(B): (1) $B^0 \mid B^{+2} \parallel A^{+2} \mid A^0$

(2) e.m.f. = standard oxidation potential of anode – standard oxidation potential cathode = $0.7 - (-0.3) = 1$ volt.

(3) An electron current is produced because the e.m.f is positive value and the reaction inside the cell is spontaneous.

(C): show by balanced chemical reaction what would happen when?



(D) :Compare between:

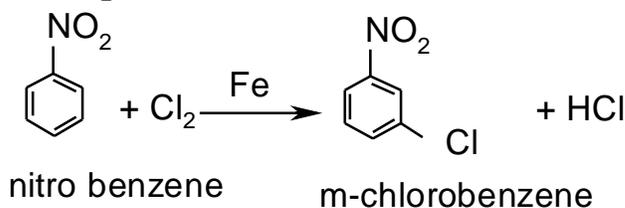
(1) electron affinity of fluorine is less than that for chlorine.

(2) the hybridization of carbon atom in methane molecule is SP^3 while in ethane is molecule SP^2 .

Q.4(A)Give reasons for: (1) Nitrogen may gain 3 electrons through covalent sharing or lose 5 electrons. the positive oxidation numbers are found in oxides because oxygen has higher electro negativity than Nitrogen .

(2) The two sublevels 4s and 3d of nearly equal energy and their electrons are lost in sequence.

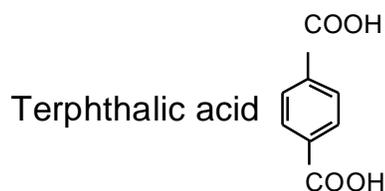
(3) Because the nitro group NO₂ on benzene ring directs the entering chlorine to Meta position.



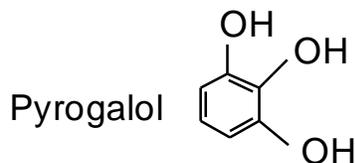
(4) In cyclopropane, the angle between the bonds equal 60° which is less than 109° that is found in normal alkenes, the overlap in cyclopropane is weak, thus the combination between carbon atom is weak therefore it is very active.

(B) : (1) cementite Fe₃C

(2)



(3)



(C): quantity of electricity = electric current intensity x time = 9065x5x60
= 2895 coulombs

equivalent mass of Al = atomic mass/ valiancy = $\frac{27}{3}$ g/equiv

96500 coulombs → 9 gm Al

2895 coulombs → X gm Al

$$X = 2895 \times \frac{9}{96500}$$

27 gm Al → 1 mole Al



$$X = 0.27 \times 1/27 = 0.01 \text{ mole Al}$$

$$\text{No. of moles} = \frac{\text{mass}}{\text{molar mass}}$$

Q.5:(A)(1) Conc. H₂SO₄ absorbs water and prevents the reversible reaction: CH₃COOH + C₂H₅OH → CH₃COOC₂H₅ + H₂O

(2) Water is a weak electrolyte, the concentration of H⁺ is very weak and is unable to break down the double bond, therefore sulphuric acid is added to ethane to increase the concentration of H⁺ required to break the bond.

(B): (1) by passing an electric current in each of.

Electric conductivity of dilute acid is more than pure acid, in case of dilute acetic the lamp gives illumination in case of pure acetic acid the lamp does not illuminate.

(2) by adding FeCl₃ solution: If violet color is formed it is phenol

If not violet color is formed it is ethanol.

(3) By adding NaOH solution: If white green p.p.t is formed it is iron(II) salt

If reddish brown p.p.t is formed it is iron(III) salt

(4) By adding acid solution to both solution:

If the color turns colorless the solution is phenolphthalein

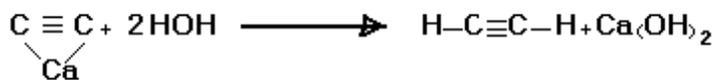
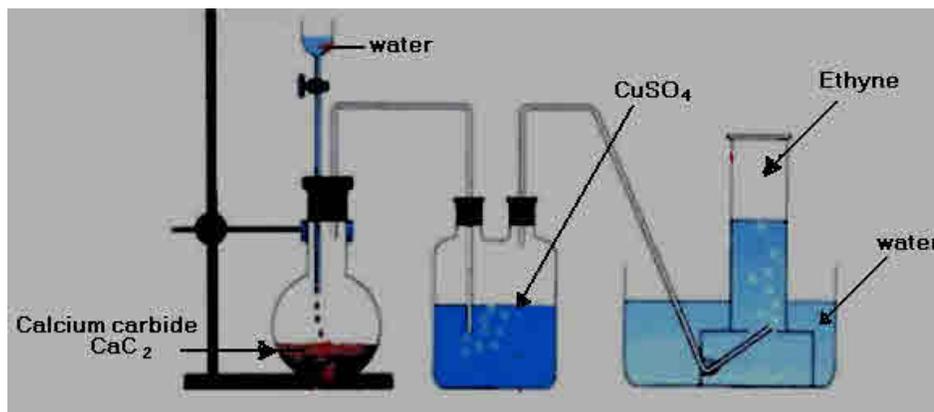
If the color turns red the solution is litmus.

$$(C): \quad K_a = \frac{[\text{CH}_3\text{COO}^-][\text{H}_3\text{O}^+]}{[\text{CH}_3\text{COOH}]} = K_a \times C = [\text{H}_3\text{O}^+]^2$$

$$\sqrt{K_a \times C} = [\text{H}_3\text{O}^+]$$

$$\sqrt{10^{-5} \times 1.8 \times 0.2} = 10^{-3} \times 1.897 \text{ molar}$$

Q.6:(A)



(B):(1)

Complete reaction	Reversible reaction
<p>Reaction takes place in forward direction only, gas or precipitate is formed.</p> $\text{Ca} + 2\text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2 \uparrow$ $\text{NaCl} + \text{AgNO}_3 \longrightarrow \text{NaNO}_3 + \text{AgCl} \downarrow$	<p>Reaction takes place in both forward, and backward directions so that both reactants and products are present in reaction medium and neither gas evolved nor precipitate is formed .</p> $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$

(2) the first ionization energy has a small value while the second ionization energy is greater .

This is due to the increase in positive charge of the nucleus and also the increase in its attraction forces.

(C):The correct answer is diagram (4) :

According to hund's rule, the orbitals of the same sublevel are filled with single electron first in the same direction then pairing takes place.

(D): (1) Davy:

Extracts Sodium and potassium metals from their molten halides by electrolysis .

(2) Lewis And Kosel:

Proposed electronic theory of valency (octet rule) to explain the formation of covalent bond .