"O" LEVEL CHEMISTRY SEMINAR

SEETA HIGH SCHOOL

22nd July 2017

1. a) i) Distinguish between the terms electrode and Electrolyte.
   ii) Name the particles by which electric current is conducted in an electrode and in an electrolyte respectively.

   b) Draw a labelled diagram to show how a solution of copper (II) sulphate can be electrolyzed using graphite electrodes. Explain how the products at the electrodes are formed.

   c) Electrolysis of copper (II) Sulphate solution in (b) was repeated using copper electrodes.
      i) Identify the substance that was formed at the anode, and explain briefly why the substance you have identified forms.
      ii) State two industrial applications of electrolysis of Copper (II) sulphate Solution using copper as the anode.

   d) When copper (II) Chloride solution was electrolyzed between graphite electrodes Chlorine was evolved at the anode.
   State the condition under which the electrolysis was carried out.

   e) Sodium Hydroxide is manufactured by Electrolysis.
   Name the substance used as the;
      i) Electrolyte.
      ii) Anode and give a reason.
      iii) Cathode.

   f) Explain the reactions which lead to the formation of solid Sodium hydroxide; and State any two uses of Sodium Hydroxide.

2. a) Define the term
      i) An acid.
      ii) A base.
      iii) An alkali.
      iv) An Indicator.

   b) Explain why aqueous solution of hydrogen chloride produces carbon dioxide when added to sodium hydrogen carbonate whereas a solution of hydrogen chloride in methyl benzene does not.

   c) i) Describe how a pure dry sample of Iron (II) sulphate crystals can be prepared in the laboratory and write equations to illustrate your answer.
   ii) Warm concentrated Nitric acid was added to aqueous solution of Iron (II) sulphate and later 3 drops of dilute sodium hydroxide was added. State what was observed and explain your observation.

   d) State what is meant by the term "solubility of a solute".

e) **The table below shows the solubility of Iron (11) sulphate in water at various temperatures.**

Temperature(°C)	0	10	20	30	40	50	60
Solubility of $FeSO_4$(*g/100g of water*)	12	20	32	46	62	85	110

i) Plot a graph of solubility of Iron (II) sulphate against temperature.
ii) Using your graph, determine the mass of Iron (II) sulphate that would crystallize if the temperatures were cooled from 55°C to 15°C.

3. a) Describe the effect of heat on nitrates of lead, copper, potassium and mercury. Your answer should include; Observation and equations.

b) Potassium Nitrate can be used in the laboratory preparation of Nitric acid.

i) State the conditions and write equation for the reaction that leads to the formation of Nitric acid.

ii) Draw a labeled diagram for the set-up of apparatus used in the preparation of nitric acid

iii) Write equation for the reaction of Nitric acid with sulphur.

iv) State any one use of nitric acid.

c) Ammonium sulphate and Ammonium Nitrate are commonly referred to as N-fertilizer.

i)State what is meant by an N-fertilizer.

ii)Explain briefly which one is a better N-fertilizer.

[N=14, S=32, H=1,O=16].

d) i)Describe how a dry sample of ammonia can be prepared in the laboratory [No diagram required, but your answer should include the reactants, condition, drying agent, equation and method of collection and reason for the choice of collection method.

ii) Using equation to illustrate your answer, give reasons why ammonia can not be dried using concentrated sulphuric acid or fused calcium chloride.

(e)Write down equation for the;

(i)Combustion of ammonia in air.

(ii)Reaction to show that ammonia is a reducing agent.

(iii)Reaction between ammonia and oxygen in presence of hot platinum foil.

(f) Ammonia is prepared on large scale by the Haber process in presence of a catalyst.

(i) Identify the catalyst.

(ii)Write an equation leading to formation of Ammonia in the Haber process.

4. Chemical reaction are accompanied by evolution or absorption of heat energy.
   (a) Name the type of reaction in which;
   (i)Heat is evolved.
   (ii)Heat is a absorbed.
   Give two examples in each case in a(i) and (ii).
   (b) The molar heat of combustion of ethanol is -965.8 KJmol
   (i)Define the term "molar heat of combustion".
   (ii)Draw a labeled diagram of the set up of apparatus that can be used to determine the molar heat of combustion of ethanol in the laboratory.
   (iii)State why the molar heat of combustion of ethanol obtained experimentally using the kind of apparatus that you have drawn is normally found to be less than the literature value and state two ways by which the experimental valve can be improved.
   (iv) State any two practical applications of enthalpies of combustion.
   (v)Calculate the mass of ethanol that must be burnt completely in oxygen to evolve heat energy that raises the temperature of $500cm^3$of impure water from 25.4°c to 37.8°c.
   [*Specific heat capacity of water= 4.2Jg^{-1} °C^{-1} density of water is 1.05gcm^{-3},C=12,O=16,H=1*]
   (c) When 4.0g of ammonium Nitrate was dissolved in $96.0cm^3$ of water, the temperature of water dropped from 27.0°C to 24.1°C.
   (i)Give a reason why there was a drop in the temperature of the water.
   (ii)Calculate the enthalpy of solution of ammonium Nitrate.
   [H=1,N=14,O=16, Density of water is 1gcm^{-3},and heat capacity of ammonium Nitrate solution is 4.2Jg^{-1} °C^{-1}]
   (d) (i)Define the term Enthalpy of neutralization.
   (ii)When $70.0cm^3$ 0f a 1M calcium hydroxide solution, the temperature of the solution rose from 27.0°c to 35.8°c .Calculate the enthalpy of neutralization the units for your answer. [Specific heat capacity of the solution and its density are 4.2Jg^{-1}°C^{-1} and 1.0gcm^{-3} respectively]
   (e) The enthalpies of combustion of some carbon compounds and the number of moles of carbon atoms per mole of each compound are shown in the below;

Enthalpy of combustion /KJmol^{-1}	730	1400	2020	2700	3340
Moles of carbon atoms.	1	2	3	4	5

(i)Plot a graph of Enthalpy of combustion against number of moles of carbon atoms

(ii)Comment on the shape of the graph.

(iii)Determine the enthalpy of combustion of the carbon compound containing six moles of carbon atoms.

(iv)Use your graph to determine the change in enthalpy of combustion per carbon atom.

5. Sulphur as an element consists of two major allotropes.
   (a) Define allotropes and Name the two major allotropes of sulphur.
   (b) Describe briefly how sulphur is extracted by the Frasch process.
   (c) Sulphur dioxide gas is prepared in the laboratory from sodium sulphate crystals and an acid.
   (i)Name the acid used, state the condition s for the reaction and write down an ionic equation leading to the formation of sulphur dioxide.
   (ii)With the aid of a labeled, Explain how a pure dry sample of sulphur dioxide can be prepared using your answers in (i) above.
   d) Briefly Explain with the aid of Equation (s) (Where Possible) why sulphur dioxide gas.
      i) Turns acidified potassium dichromate solution from Orange to green.
      ii) Cannot be dried by Calcium Oxide.
      iii) Turns damp blue litmus red and finally white.
   e) Sulphur dioxide gas is used as a raw material in the manufacture of sulphuric acid by the contact process.
      i) Name the source of SO_2 in the contact process. (*and write an equation to illustrate your answer*)
      ii) Name the catalyst used and give a reason why it preferred to platinum.
      iii) Outline with the aid of equations, the reactions which take place during the contact process starting from Sulphur dioxide.
      iv) State one industrial use of sulphuric acid.
   f) Write an equation to show that sulphuric acid is;
      i) An acid.
      ii) A dehydrating agent.
      iii) An oxidizing agent.
6. Ethene $H_2C{=}CH_2$ Can be prepared from Ethanol and it can form a Polymer.
   a) State the conditions under which Ethanol can react to produce Ethene.
   b) Write equation for the reaction to show how;
      i) Ethene can be produced from Ethanol.
      ii) Ethene can form a polymer.
   c) Ethene was bubbled through a Solution of Bromine in Tetra Chloromethane. State what was observed and write equation for the reaction that takes place.
   d) Give a reason why ethane cannot affect the reaction in (c) as ethene.
   e) The polymer of ethene is a Synthetic polymer and it's a thermo softening Plastic.
      i) Distinguish between a synthetic polymer and a natural polymer. Give two examples in each case.
      ii) Distinguish between a thermo softening plastic and a thermosetting plastic. Give two examples in each case.

7. The atomic number of elements Q, R and T are 2,6, and 17 respectively.

a)

i) State what atomic number means.

ii) Write down the electronic configuration of each of th elements Q,R, and T.

b) State the;

i) Group in the periodic table to which Q belongs.

ii) Period in the periodic table to which T belongs.

iii) Reason why Q is generally unreactive.

c) When R combines with T, the compound formed is a liquid at room temperature and is insoluble in water.

i) Write the formula of the compound.

ii) State one reason why the compound is not soluble in water.

d) Atoms M and X are represented as $^{27}_{13}M$ and $^{16}_{8}X$

i) Determine the number of neutrons in the atom of M and X.

ii) State the valency of M and X and write the formula of their ions.

iii) M and X combine to form a compound Z. using outermost shell electrons only, illustrate how compound Z is formed.

8.

a) .

i) Name the two Crystalline forms of Carbon, and any one amorphous form of carbon.

ii) State one physical difference between the two crystalline forms of carbon you have named in a(i) above.

iii) Give one use of each Crystalline form of carbon, and the amorphous form of carbon you have named in a(i) above.

b) Carbon -12 and Carbon -14 are the two common atoms of carbon, and carbon -14 is used extensively in determining ages of old objects State;

i) One word which means the relationship between atoms like carbon -12 and carbon -14.

ii) The property of carbon -14 that is applied when its used in determining the age of an old object.

c) Carbon dioxide can be prepared in the laboratory using calcium Carbonate and a substance T.

i) Identify T and write equation for the reaction leading to the formation of carbondioxide.

ii) Draw a labelled diagram for the set up of apparatus that can be used to prepare a dry sample of carbon dioxide starting from calcium carbonate.

iii) With the aid of the diagram that you have drawn in c(ii), Explain the preparation of carbondioxide.

d) When bubbled though calcium hydroxide solution, Carbon dioxide reacted to form a white precipitate of calcium carbonate according to the following equation.

$Ca(OH)_{2\,(aq)} + CO_{2(g)} \rightarrow CaCO_{3(s)} + H_2O_{(l)}$

Calculate the Mass of dry calcium carbonate would be obtained if 600.0cm^3 of carbon dioxide measured at room temperature was bubbled through calcium Hydroxide Solution. (Ca=40, C=12, O=16, 1 Mole of gas occupied 24.0dm^3 at Room temperature)

e) More carbon dioxide was bubbled through the mixture containing calcium carbonate in (d).
   i) State what was observed.
   ii) Explain the reaction that took place.

f) Burning Magnesium was lowered into a jar of carbondioxide.
   i) State what was observed.
   ii) Write equation for the reaction that took place.
   iii) Identify the substance that was Oxidized and the one that was reduced in the above reaction.

9. Sodium and Iron are extracted from their ores by electrolysis and reduction respectively.

a) .
   i) Define the term an ore.
   ii) State why Sodium is extracted by Electrolysis whereas Iron is Extracted by Reduction.

b) .
   i) Name one common ore of Sodium.
   ii) Write the chemical name and formula of one oxide and one Carbonate, which are some of the Major ores of Iron.

c) Briefly describe how sodium can be extracted from its ore and write equation(s) to illustrate your answer.

d) Describe with aid of equations, how sodium reacts with;
   i) Oxygen.
   ii) Water.
   iii) Chlorine.

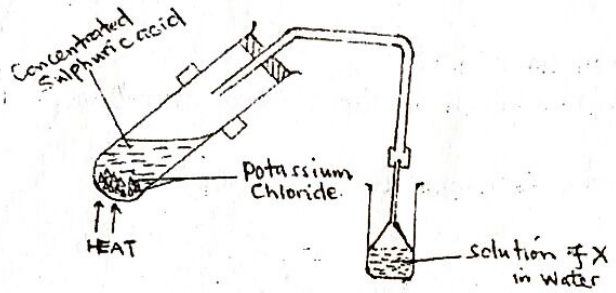
e) During the Extraction of Iron, the ores are first roasted in air before being transferred into the blast furnace;
   i) State the purpose of roasting the Iron ores in air.
   ii) Name the Major impurity in the Iron ore.
   iii) Name two substances that are also fed into the furnace together with the roasted Iron ore.
   iv) Name any one substance that is all fed into the furnace, and describe where from the substance is let into the furnace.

f) Using equations, Outline reactions which take place in the blast furnace up to;
   i) Reduction of the Ore.
   ii) Removal of the Major Impurity in the ore.

g) State the importance of Slag during extraction of Iron in the furnace.

h) When excess Iron fillings was added to $250cm^3$ of a solution containing 0.5 moles of Copper (II) Sulphate per dm^3, and the experiment allowed to stand until there was no further change, a brown solid formed on the iron fillngs. Determine the maximum mass of the brown solid that was formed. (O=16, S=32, Fe=56, and Cu=64).

10. A mixture of concentrated Sulphuric Acid and solid potassium Chloride was heated to evolve a colorless gas X, which dissolves in water as shown below;



a) Name the;
i) Colourless gas X.
ii) Solution of X in water.

b) .
i) Write an equation leading to the formation of gas X.
ii) Give a reason why the funnel was inverted.

c) The solution of X in water was separately added to Sodium Carbonate, Magnesium Powder and Silver nitrate Solution.
State what was observed in each case and write an ionic equation for the reaction that took place.

d) Gas X was passed over heated Iron fillings in a hard combustion tube and a white sublimate was formed.
i) Name the white sublimate.
ii) Write the equation between gas X and Iron.

e) The white sublimate was shaken with distilled water and the resultant solution divided into three portions. State what is observed in each case and Explain each of your observations with the aid of Equations.
   i) To the First portion was added Lead (II) Nitrate Solution and then Boiled.
   ii) To the second portion was added dilute sodium hydroxide and allowed to stand for about 5 minutes.
   iii) Chlorine gas was bubbled through the third portion.

11..

a) What is meant by rate of a chemical reaction.

b) Explain how the following factors affect the rate of a chemical reaction.

i) Temperature.

ii) Surface area of reactant.

iii) Concentration of reactant.

c) The table below shows the time taken for reaction of a certain substance Z to complete when solution containing Various concentrations of Z were used.

Concentration of Z (Moldm $^{-3}$)	0.1	0.3	0.4	0.6	0.8
Time, t for Completion of Reaction (s)	120	40	30	20	15
Reciprocal of time $^{1}/_{t}$, (s^{-1})					

i) Calculate the value of 1/t for each time.

ii) Plot a graph of 1/t against concentration of Z.

iii) Deduce from your graph how the rate of the reaction varies with concentration of Z.

d) .

i) Draw a sketch graph to show how volume of carbon dioxide would vary with time if excess dilute Hydrochloric acid was added to a certain Mass Wg of Marble Chips and Label it **X**.

ii) Draw on the same Axes in d(i) , the sketch graph you would expect if equimolar volume of the dilute hydrochloric acid was added to Wg of powdered Marble chips, and label it **Y**.

iii) Draw on the same Axes in d(i), the sketch graph you would expect if equivalent volume of concentrated Hydrochloric acid was added to Wg of powdered Marble Chips and Label it **P.**

12. Electro Chemical Cells are usually used to compare reactively of some metals.

a) Define the term "Electrochemical Cell".

b) The cell Notation of an electrochemical cell between Zinc and Copper is given below.

$Zn(s)/Zn^{2+}(aq)//Cu^{2+}(aq)/Cu(s)$

i) Identify the metal that acted as the anode and cathode.

ii) Identify what the "Double lines" represent and state its purpose.

iii) Write the overall equation of reaction and use it to compare the reactivities of Zinc and Copper.

iv) State what would be observed when Zinc Metal is dropped into a solution of Copper (II) Sulphate.

c) With the aid of a well-labelled diagram, describe how an electro chemical cell can be set up between Silver and Magnesium Electrodes. Include;

i) Equation of Reaction at the anode and cathode.

ii) Overall cell reaction equation.

iii) Cell notation.

d) If silver was replaced with lead metal in (C) above.

i) Name the electrolyte of the Lead electrode. Give a reason for your answer.

ii) Write down equation for the reaction that occurs at the electrode in d(i) above.

13. Under suitable conditions, Oils and fats can be used to make soap.

a)

i) Distinguish between Oils and Fats.

ii) Name one Source of oil and Fat in your Local area.

b)

i) Define the term Soap.

ii) State one word, which means formation of Soap.

c) Describe briefly how a sample of solid soap can be obtained in the laboratory using the source of oil or fat you have named in a (ii).

d) Soap solution was shaken separately with a sample of;

i. Rain water.

ii. Water in which Magnesium sulphate is dissolved.

In each case, state what would be observed and write equation if any for the reaction that took place.

e) A sample of water containing substance X was boiled and white precipitate was formed.

When soap solution was added to the boiled water sample, lather formed in a short period of time.

Suggest one substance that X could be.

f) Water which contains substance similar to X are not convenient for washing.

i. Suggest a substance that can be used more conveniently for washing in such water instead of soap.

ii. Give a reason why, when the use of the of the substance named in f (i) is prolonged, it causes water pollution.

g) The substance named in f (i) above can be prepared from petroleum products.

i. Briefly outline how the substance can be prepared.(**Equation Not Required**)

ii. State advantages and disadvantages of using the substance prepared in (g) above over soap.

14.a) (i) Chlorine gas can be prepared in the laboratory using potassium manganate (VII) and a substance R.

Identify Substance R and State the conditions for the reaction between R and Potassium Manganite (VII) to Produce Chlorine.

(ii)Write equation for the reaction leading to the formation of chlorine.

(iii) Explain how a pure dry sample of chlorine can be obtained during its preparation as stated in a (i).(No diagram required)

(b)State and explain how chlorine is prepared on large scale. (No diagram required).

(c)Write equation and state the condition (s) for the reaction that can take place between chlorine and

(i)Iron

(ii)Turpentine, $C_{10}H_{16}$

(iii)Water

(d)State with the aid of ionic equation, what would be observed if chlorine was added to;

(i)Sodium Iodide Solution.

(ii)Aqueous Iron (II) Chloride solution.

(iii)Cold dilute potassium hydroxide solution.

(iv) Potassium Bromide Solution.

(e)Dilute Hydrogen Chloride solution was added drop wise to lead (ii) oxide until in a small excess and the Mixture allowed to stand.

(i)State what was observed and write equation for the reaction that took place.

(ii)From the reaction in e (i), deduce any conclusion that can be made concerning the composition of hydrogen chloride.

15. The figure below shows part of the periodic table. The letters are not the actual symbols of the elements.

	I	II	III	IV	V	VI	VII	VIII
2							W	
3	X					Z		
4		Y						
5	R							

(a)Write the electronic configuration of:

(i)Atoms of X.

(ii)Most common ion of Y.

(ii)Atoms of W.

(b)Show how the atoms of elements use their outer electrons to form compound between;

(i)R and Z.

(i)Z and W.

(c)The compound formed between R and Z conducts electricity in molten and aqueous state, however, it does not conduct in the solid state.

(i)Explain the observation.

(ii)State any two other properties of the compound formed between R and Z.

(d)(i)What name is given to the elements in the group to which W belongs?

(ii)State two physical properties and two chemical properties of elements in the group to which W belong.

(e)X is a solid at room Temperature and Monoatomic.

i. State what would be observed when X is dropped into cold water.
ii. Write equation for the reaction that occur in e (i) above.
iii. A few drops of copper (ii) sulphate solution were added to the solution formed in e (ii).state what was observed and write an ionic equation to illustrate your observation

16. 25.0cm^3 of a 0.1M Hydrogen peroxide were decomposed to produce oxygen gas at room temperature in presence of a black solid T.

a)(i)Name the black solid T.

(ii)State the purpose of the black solid T.

(iii)Write equation leading to formation of oxygen gas.

(iv) Calculate the volume of oxygen gas that was collected.(1mole of gas occupies 24000cm^3 at room temperature).

b) State what is observed and write equation for the reaction that takes place between oxygen and;

i. Burning sodium when the gas is in excess.
ii. Burning sulphur.
iii. Ret hot Iron wool.

(c)The product formed in b(i) above was added to water in a beaker.

i. State what was observed.
ii. Write equation for the reaction that took place.
iii. A piece of red litmus paper was dropped into the resultant solution. State what was observed and deduce the nature of the product in b(i).

(d)Apiece of copper foil was lowered into a solution of silver nitrate in water.

i. State what was observed.
ii. Write down an Ionic equation for the reaction that took place.

(e)Ammonia solution was added drop wise to the resultant solution in (d) at the end of reaction, until ammonia solution was in excess.

i. State what was observed.
ii. Using equation to illustrate your answer, Name the Cation that was present after the addition of excess ammonia solution.

17. (a) Ethene can undergo polymerization.

i. What is meant by the term polymerization?
ii. Name the product of polymerization of ethene and write equation for the reaction leading to the formation of the product you have named.
iii. State one use of the product you have named in a(ii).

(b)On polymerization, Ethene formed a compound T of Molecular mass 16,660.

i. Determine the number of Moles of Ethene molecules that combined to form T.[C=12, H=1]
ii. State the term which is used to describe a single unit of the Ethene Molecule in T.

(c)Natural rubber is extensively used in the manufacture of gloves, but it's of less use in its Natural form Not Until it's made hard.

i. State how natural rubber is made hard.
ii. Give the process through which rubber is made hard.
iii. State any two reasons why rubber is made hard before use.
iv. Other than Manufacture of gloves, Give any two uses of hardened rubber.

(d) (i)What is sewage?

(ii)Explain the role of bacteria in sewage treatment.

(iii)State the name give to the solid component and liquid component of sewage.

(iv)State any two uses of the solid component of sewage.

18. Barium is an element in group II of the periodic table and its properties closely resemble those of calcium.

(a)Write down the chemical formula of;

i. Barium carbonate.
ii. Barium dihydrogen phosphate.

(b)Briefly describe and write equation to show;

i. How Barium Carbonate can react with Hydrochloric acid.
ii. The effect of heat on Barium Nitrate crystals.
iii. How Barium Hydroxide solution can react with excess carbon dioxide if the reaction took place for a long period of time.

(c)Name the method, and briefly describe how a pure sample of Barium sulphate can be prepared in the laboratory stating from Barium Nitrate, and write an Ionic equation to illustrate your answer.

(d) 8.0g of a solid Mixture of an hydrous sodium carbonate and Lead(II) carbonate

iii) Draw a labelled diagram(s) for set up of an experiment which can be used to show that the conditions(s) you have stated in g(ii) is/are necessary for Iron to Rust.

iv) State and Explain observation that would be made if the experiment Set up in b(iii) was allowed to stand for some days.

c) i) State two methods by which rusting can be prevented.

ii) Give reasons why rusting Must be prevented.

END

Wishing you all the Best