GROUPE SCOLAIRE MARIE REINE RWAZA

TEL. 0788548407
P.O BOX 45 RUHENGERI
E-mail: mariereinerwaza@yahoo.fr
Website :www.mariereinerwaza.rw

SENIOR4 MCB CHEMISTRY QUESTION BANK

PREPARED BY MAZIMPAKA SAMUEL

1. ATOMIC STRUCTURE AND ELECTRONIC STRUCTURE

1.a.Define the term ionization energy

b. the ionization energy of the 3rd group elements generally increase across the period but phosphorous z=15 has high ionization energy than sulphur z=16.explain this in terms of their electronic structures./1mark
c.explain why the second ionization energy of magnesium is greater than its first ionization energy
d. would you expect alkaline metals or noble gas to have high ionization energy? explain./2marks

2. It has been found by mass spectrometric analysis that the relative abundance of the various isotopic atoms of silicon in nature are: 92, 21% of Si-28; 4.70% of Si-29 and 3.09% of Si-30

(a)define the term isotope/1mark
(b**)** calculate the average atomic mass of silicon/2marks
(c**)** calculate the number of neutrons and electrons in the isotopes of $^{28}Si_{14}$/1mark
(d) explain why all isotope of silicon have similar chemical properties/1mark

3. a)write down the electronic configuration of calcium and calcium ion in terms of s ,p…,atomic number =20
b)why is the atomic radius of calcium significantly greater than that of calcium ion?/
c)write down the formula of a chloride of calcium/2marks

4.The last electron of an atom is characterized by the following quantum numbers:
n=4,l=0;s=+1/2
a. give the electronic configuration (using s,p,d notation)of that atom
b .how many p orbitals are completely filled?
c .how many orbitals are unsaturated?
d.which of the following orbital could not exist:

6f; 5s;1p;3p;2d;3d

5. a. Define the term
i. Atomic number
ii .Mass number
b. Explain why
i. The net charge of an atom is neutre
ii .All mass of atom is described to be located into the nucleus

6. a.Define the term electronegativity

b.Describe a general trends in electronegativity across the period and down the group of the peridictable

7.a.define the following terms
i. Wave
ii. wavelength
iii. Frequency
iv. spectrum
b. By using examples state the main difference between continuous spectrum and discontinuous spectrum

8.It has been found that copper consist of two Cu^{63} and Cu^{65}
(a**)** calculate the abundances for each isotopes of copper if its relative atomic mass is 63.55amu

b) calculate the number of neutron in the most abundandant isotope of copperc)Bromine occurs naturally in terms of two isotopes Br^{79} and Br^{81}.when Br_2+ is passed through the mass spectrometer ,three peaks ,three peaks of different abundances have been recorded on the screen of detector .give the ion responsible of each peak

9.explain the following statement:

(a) the size of Ca is greater than that of Ca^{2+}

(b) the size of Br^- is greater than that of Br

(C) the first electronaffinity of oxygen is negative while its second electroaffinty is positive

(d) the electric conductivity of potassium is greater than that of sodium

10. i. An element z has the following electronic structure

$1s^2\ 2s^2\ 2p^6\ 3s^2 3p^5$

(a) State the atomic number of z
(b) State the group and period of z
(c) State the block of z in the periodic table with explanation
(d) Write the formula the compound formed between z and magnesium

ii .compare the reactivity of calcium with water with that of magnesium with water

11.This question is about the properties of halogens

describe how each of the following parameter changes down the group
i. Oxidizing power
ii .Reactivity
iii .Melting and boiling point
iv .Polarity of their hydrides(HF, HCl ,HBr and HI)
v .Electronegativity
vi.Acidity of their hydrides

12.a.From an element M write the equation to show the first ,the second and the third ionization energy

b .state 3 factors affecting the magnitude of ionization energy

c. the element of second period are in sequence :Li, Be ,B,C, N ,O ,F ,Ne ,

classify these element in increasing order of their ionization energy then explain your arrangement

d. draw a graph to explain how the ionization can change as function of number of removed electrons

13.a. define the term oxidizing power

b. the oxidizing power of halogens decrease from fluorine to iodine explain this trend

c. predict the product of the following reaction, if they are not possible explain

i. $CaCl_{2(l)} + Br_2 \rightarrow$

ii. $NaC(aq) + F_{2(g)} \rightarrow$

iii. $NaI(aq) + Cl_2(g) \longrightarrow$

iv. $KF + I_2(s) \longrightarrow$

d. briefly explain why halogens are not found in nature in free state

e. use phosphorus z=15 to write the formula of its

i. chloride at highest oxidation state

ii .oxide at lowest oxidation state

14.a. describe the origin of emission spectrum of hydrogen

b. draw the spectral series found in hydrogen spectrum showing clearly the name of each serie

c. among the series drown choose which gives rise to:

i. ultraviolet region

ii. visible region

c .calculate the wavelength, frequency, energy emitted by an electrons that transit from the third orbit to Lyman series

d .differiante absorption spectrum from emission spectrum

15.manganese and iron are both d block elements

a. i. use atomic number 25 for manganese,26 for iron to define a d block elements

ii. draw the electronic configuration of Fe2+ and Mn2+ then explain why Fe^{2+} is oxidezed to Fe3+ while

Mn^{2+} can not be oxidized to Mn^{3+}

b. draw the electronic configuration of manganese in MnO_4^-

c. In establishment of the electronic configuration copper z=29 and chromium z=24 exbit unusual electronic structure

i. draw the electronic structure of copper and chromium and explain they are

unusual

ii. draw the electronic configuration of

a. Copper in CuI

b .Chromium in $Cr_2O_7^{2-}$

16.. Explain the following statement in terms of bonding

i. Ammonia form a bond with boron Trichloride
ii .Calcium chloride is a solid with high melting point while Sulphur dioxide is a gas at room temperature
iii. H ydrogen fluoride boils at high temperature than hydrogen chloride .
iv .The boiling point of propane is lower than that of ethanol
v. Silicon dioxide is a solid with high melting point

17. In Lyman series what could be the value of energy level on which an electron of 2.464555×10^{15} S^{-1} is from?

b)There exists 3 isotopes of oxygen that occur naturally with atomic mass 16, 17 and 18 with abundance 99.1% ; 0.89% and 0.01% respectively. Given that oxygen occurs naturally as diatomic molecular,

a. predict and explain the number of peaks that will be observed on the screen when 0_2^+ is passed through the mass spectrometer.

b. Calculate the relative atomic mass of oxygen

18. Iron is a transition metal with the atomic number 26

a. Write the electronic configuration of iron in this complex [$(Fe(CN)_6]^{3-}$
b .Explain why iron forms a complex with cyanide ion
c. By using equation explain why an aqueous solution of $FeCl_3$ is acidic
d. Explain why Fe^{2+} is less stable than Fe^{3+}

19. Describe all steps involved in the functioning of the mass spectrometer **/**

b.A mass spectrometer provided the information on the right for a sample of naturally occurring germanium.

Isotope	Detector current in arbitrary units
70	6.83
72	9.13
73	2.60
74	12.17
76	2.60

Calculate the relative atomic mass for germanium.

b. The figure below shows how the second ionization energies of the elements Helium to sodium changes.

a) Explain the shape of the graph.

b) Why is it always the case that the second ionization energy is larger than the 1st, and the 3rd ionization energy larger than the 2nd ionization energy?

BONDING and Structure

1.Draw and name the shape of the following molecules:
CO_2

, NH_3, SO_2 , CH_4 and $AlCl_3$ and show the bond angle for each molecule
b .Explain how the angle bond changes when water (NH_3) forms Ammonium(NH_4^+)
c.Give a brief explanation why water is bent shaped while methane is tetrahedral shaped .

d. Explain why SO_2 is polar whereas CO_2 is non polar

2. a) What is the significance of the term lattice enthalpy ?
b) State and explain two factors factors affecting lattice enthalpy
c) Explain which between KBr and NaBr exhibits greater lattice enthalpy

3. a) Define the following terms:

(i)Chemical bonding (ii) Electronegativity **1mark**

b) Differentiate using at least three elements i) covalent bond from an ionic bond ii) covalent compound

4. The table below shows the boiling and melting points for Hydrides of group VIa.

Formula of Cpd	Molar mass (g/mol)	Melting point(°C)	Boiling point(°C)
H_2O	18	0	100
H_2S	34	-85.5	-60.3
H_2Se	81	-65.7	-42
H_2Te	130	-49	-2

a) Water is with the smallest molar mass but with the highest melting and boiling point. Explain.
b) Explain the trends in other hydrides from H2S to H_2Te
c) The boiling point of Ethane, Water, and Sodium hydride increases in the order: $C_2H_6 < H_2O < NaH$.

5. Hydrogen chloride is a gas at room temperature while sodium fluoride is a solid of high melting point.

a) State the type of bonding present in each compound.
b) Briefly explain in terms of bonding why their melting points are different
c) Why HF boils at high temperature than other group seven hydrides?

6. (a)Explain the following observations in terms of bonding:

(i)$SiCl_4$ is a volatile liquid whereas SiO_2 is a solid with high melting point.

(ii)The boiling point of Ethane, Water, and Sodium hydride increases in the order: $C_2H_6 < H_2O < NaH$.
(iii)The density of ice is lower than that of liquid water.

b) Why a molecule of BCl_3 is able to form a bond with a molecule of NH_3? Name the type of bond formed . (Boron atomic number =5)

7. X, Y and Z represent element of atomic numbers 9, 19 and 34.

(a) Write the electronic structures for X, Y, and Z
(b) Predict the type of bonding that you would expect to occur between
(i) X and Y (ii) X and Z (iii) Y and Z
(c) Draw "dot/cross" diagrams for the compounds formed, showing only the electrons in the outermost shell for each atom
(d) Predict, giving reasons, the relative
(i) Electrical conductivity
(ii) Solubility in waterof the compound formed between X and Z compared with that formed between X and Y

8..The following table shows the ionization energies(in kJ mol-1) of five elements lettered A, B, C, D and E

Element	**1st I.E**	**2nd I.E**	**3rd I.E**	**4th I.E**
A	500	4600	6900	9500
B	740	1500	7700	10500
C	630	1600	3000	4800
D	900	1800	14800	210000
E	580	1800	2700	11600

(a) Which of these elements is most likely to form an ion with a charge of +1? Give reasons for your answer.

(b) Which two of the elements are in the same group of the periodic table? Which group do they belong to?

(c)In which group of the periodic table is element E likely to occur? Give reasons for your answer

(d) Which element would require the least energy to convert one mole of gaseous atoms into ions carrying two positive charges?

9. Use the data in the table below to answer the questions that follow.

substance	Mp(OC)	Bp(OC)	Solubilty in water	Conductance		Density at room temperature g/cm^3
				Solid form	Molten form	
A	714	1418	Very good	none	good	2.3
B	-95	56	Very good	none	none	0.8
C	1083	2580	insoluble	good	good	8.9
D	-101	-34	verygood	none	none	2.55
E	-23	77	Insoluble	none	none	1.6
F	-219	-11	Sligltly soluble	none	none	1.33

(a) (i) Name two substance that are liquid at room temperature.

.....

.....

(ii) Which of the two is more volatile?

.....

(b) Which substances) would dissolve in water and could be separated from the solution by

(i) fractional distillation?

.....

(ii) by evaporation of the water ?

.....

(c) Which of the substances A to F,

(i) has a structure consisting of ions ?

.....

(ii) is a metal ?

.....

(i) is a liquid which would form separate layer with water?

(ii)

.....

would the water be above or below ?

.....
.....

(d) Which substance is a gas which

(i) would not be collected efficiently over water.

.....

(ii) would be collected efficiently over water.

10. The net charge of an atom is

A. Positive B. Negative C. zero D. No true answer

11.a) what is the ground state electronic configuration of Boron and Nitrogen? Atomic number: N=7, B=5)

b) Explain why the spatial arrangement (shape) of BF_3 is different from that of NH_3 **(**

C) Draw and name the shape of CO_2, SO_2, BCl_3, $SiCl_4$, PF_5 .show the angle bond for each case.

d) Explain why ammonia is polar while boron trichloride is non polar

12. a) Define the term ionization energy

b) State and Explain the general trend in first ionization energy across the third period then explain

c) Why the first ionization energy of phosphorus Z= 15 , is much high than that of Sulphur ? S Z=16.

d) Explain why the electrical conductivity of magnesium is lower than that of Aluminium

e)) Why does Magnesium has high melting point than Na.

13.a) State and explain the trend in oxidizing power of group seven elements down the group of the period table.

b) Use equation to explain how an aqueous solution of chlorine can be used to distinguish NaBr and NaI solution.

c) Use the reaction of chlorine with chlorine to explain a disproportionation reaction(

d) account for the trend in volatility of group seven elements from fluorine to iodine

14. a) What is the name given to different atoms of an element

b) In mass spectrometer two isotopes Cl-35, Cl-37 the peak intensity occurred the ratio 3:1 use this information to calculate the relative atomic mass of chlorine

ii) Calculate the number of neutrons, electrons in the least abundant isotope of chlorine

c) Explain why elements are ionized in mass spectrometer and state how this is achieved.

15. Explain the following statement:

a) Silicon dioxide is a solid with high melting point while carbon dioxide is a gas at rtp.
b) Hydrochloric acid in water, conducts electricity but in methylbenzene it does not conduct electricity.
c) Sodium chloride in crystalline state does not conduct electricity while in molten state it conducts electricity.
d) Ammonia boils at high temperature than phosphine (PH_3
e) Diamond is hard and bad conductor of electricity while graphite is soft and good conductor of electricity
f) The bond angle of water increase when water forms hydronium ion
g) The melting point of magnesium oxide is greater than that of shurphur trioxide

h) Ice floats on water.

16. a) State and explain two differences between covalent compounds and ionic compounds

b) By using a simple diagram explain metallic bonding**.**

c) State and explain at least 2 properties of metals

d)During an investigation a metal X reacts with a sulphate of a metal Y and Z,

Y removed an oxygen from an oxide of the metal Z. put these metals(X,Y,Z) in increasing order of their reactivity

Periodic table

1. a) Hydrogen is placed in group I of the Periodic Table and has a double behavior:

(i)Give one reason that makes Hydrogen to behave as alkali metals (Group I elements).

(ii)State two reasons that make Hydrogen to behave as halogens (Group VII elements).

b) (i) Write and balance the chemical equation illustrating the reaction between chlorine (Cl_2) and Sodium hydroxide(NaOH).

(ii)Referring to the equation b (i), state the commonly known use of aqueous solution of halogens.

2.a) State and explain how the reactivity of halogens changes down the group (from the top to bottom)

b) Write a molecular equation and an ionic equation of the reaction observed when chlorine gas (Cl_2) is passed in solution of potassium iodide then state the color change during this reaction.

c) State the type of reactions in(b)

3. a.State the physical state and the colour of halogens

b. Use chemical equations to explain how chlorine can be used to distinguish between sodium bromide and sodium iodide.show the expected observations in each case.

4. State and explain how the following parameters changes down the group four elements of the periodic table

a. volatility of their hydrides

b. melting and boiling point of their tetrachlorides

c. hydrolysability of their tetrachlorides

d. Thermal stability of their hydrides

e. acidity of their dioxides

5 .a) Describe how the stability of +2 and + 4 oxidation state change down the group
(b) Use the oxides of C and P b to support your answer in (a)**.**
(c) Explain why $SiCl_4$ is hydrolyzed while CCl_4 is inert with water
d) Write the balanced equation for the reaction taking place when $SiCl_4$ hydrolysed
e) Explain why Lead(II) Chloride is ionic while Lead (IV) Chloride is covalent
f) Write equations to explain the amphoteric nature of aluminium oxide.

6. a) Sulphur is the starting material used in contact process for manufacturing sulphuric acid in large scale in industry

i) Use chemical equations for the reactions to describe all steps involved in contact process for sulphuric acid production

ii) Explain how the process in (i) affects the environment .
iii)State two large scale uses of suphuric acid
iv) Write the equation for the reaction between sulphuric acid with i.Copper Cu). ii. sulphur iii.sucrose
v. Explain why concentrated sulphuric acid is not suitable to prepare HBr when is reacted with sodium bromide

7. a) Name the main ore from which iron metal is extracted
b) Iron is extracted from its ore in the blast furnace by mixing the ore with limestone and coke
i. State the role of each compound in this process
ii. Explain using equations all steps taking place in the blast furnace during iron extraction
iii, Explain how the process of iron extraction affect the environment
iv. State 2 uses of iron
v. Write a balanced equation between iron and Chlorine

8. This question concerns the chemistry of group VII elements of the periodic table.

a) Explain the trend in the volatility of halogens down the group from Chlorine to Iodine.

b) By using appropriate chemical equations, describe what is observed when aqueous silver nitrate is added to:

(i) Cl^- (aq)
(i) I^-(aq)

c) How does the oxidizing power of halogens change down group VII?

d) Predict which of the reaction below is likely to occur and give its product:

(i) $Br_2 + KCl \rightarrow$.....
(ii) $Cl_2 + KBr \rightarrow$.....
(iii) $I_2 + NaF \rightarrow$.....

9. .(a) Describe the general trends in solubility of group II Sulphate from $BaS0_4$ to $SrSO_4$

(b) How thermal stability of group (II) nitrate change down the group
(c) Which between calcium nitrate and magnesium nitrate has high thermal stability
(d) Write a balanced equation of thermal decomposition of magnesium nitrate and sodium nitrate and account for the difference in terms of the products formed.
(f) Use Be and Al to explain the term diagonal relationship

10. (a) When red trilead tetraoxide (Pb_3O_4) was reacted with nitric acid solution a solid was formed. Write a balanced equation for the reaction.
b) The mixture from (a) was filtered and the residue warmed with concentrated hydrochloric acid
i) What was observed? Explain your answer
ii) Write equation for the reaction
c) The filtrate from (a) was divided into two parts
i) To the first part was added KI what was observed and write an equation for the reaction

ii) The second part was evaporated to dryness and heated strongly. Explain what was observed and write the equation for the reaction

11. a) State and explain how the reactivity of i.group one element changes down the group ii. halogen changes down the group

b) Write a reaction between sodium and cold water and state the effect of the resultant solution on phenolphthalein indicator

c) Account for the solubility of group two sulphates down the group of periodic table

12.a) Define the term electronegativity

b) Explain how the electronegativity changes down and across the period of the period table

c) State and explain the trend i.in polarity of group seven hydrides(from HF to HI) ii. In acidity of group seven hydrides from HF to HI**.**

13.a) Explain how thermal stability of group II nitrates change down the group of the periodic table

b) Write the equation for thermal decomposition of calcium nitrate then show how it is different from that of sodium nitrate.

C) Explain why nitrates are used as fertilizers

14. Beryllium as the first element in group 2 display some abnormality in properties called diagonal relationship when is compared to the other element of the same group

a) What do you understand by the term diagonal relationship? Explain its causes?
b) Show the similarity between beryllium and Aluminium to explain their diagonal relationship
c) State other two pairs of elements in the periodic table that exhibit a diagonal relationship.

15 a. Chlorine is an strong oxidizing agent prepared in the laboratory by action of manganese dioxide and hydrochloric acid

Using redox balancing method Write a balanced equation for the reaction between manganese (IV) oxide and hydrochloric acid

b. Describe a chemical test of chlorine gas

c) Write an ionic equation when chlorine react with iron(II) Chloride and show that it is a redox process

16.a) Aluminium hydroxide is described as amphoteric , prove this statement using balanced equation

b) AluminiumTriChloride is considered as a Lewis acid, explain this by using an example.

c) Alums are substances used in water treatment

i. the formula of compound used as alum

ii. State the importance of alum in water treatment

a) Use a balanced equation to show how the use of alum can increase the acidity in water
b) State another chemical which is added in water to reduce the acidity caused by alum in water.
c) Explain the properties of aluminium that make it valuable to make airships and kitchen utensils

17a) Describe all steps involved in sulphuric acid manufacture from sulphur by means of equations and follow chart .

b) Explain how the use of coals containing sulphur is an environmental problems
c) Explain why sulphuric acid can react with sodium chloride to produce hydrogen chloride but it can't react with sodium bromide to produce hydrogen bromide
d) Write a balanced reaction for the reaction between concentrated sulphuric acid and copper metal

18. a) Explain how the stability of +2 and + 4 oxidation state in group elements changes down the group of the periodic table

b) Use the oxide of lead and carbon to sustain your answer in (a)

c) Using examples of CO_2 and SnO_2 ,briefly explain the trend in acid-base character of oxides of group four in oxidation state +4.

c) Briefly explain why i) $PbCl_4$ is covalent while $PbCl_2$ is ionic ii) Silicon tetrachloride is hydrolysed while carbon tetrachloride is not hydrolysable.

d) Write a chemical equation for the reaction between i) Silicon tetrachloride and water ii) silicon dioxide and limestone.

19. The table below shows the first , the second and the third ionization energies in(kj/mol) of 6 successive elements on the periodic table.

Element	First ionization energies	Second ionization energies	Third ionization energies

A	1060	1900	2920
B	1000	2260	3390
C	1260	2300	3850
D	1520	2660	3950
E	418	3070	4600
F	590	1150	4940

NB: The elements are not only in one period

a) For a given element M, write the equations which represent the first, second and the third ionization energegy.
b) According to the table above , identify the letter corresponding to
   i. An alkaline –earth metal(group(II)). Explain your answer
   ii. a noble gas

C) Suggest the formula of a compound formed by element F and C .explain your answer

d) Suggest the elements which are metals

e) Draw the shape of a graph of ionization energy as the function of the number of removed electrons and explain the shape of the graph

20.Define the following terms:

a) Isotopes
b) Relative atomic mass
c) Electron affinity
d) First ionization energy
e) Shielding effect

21.a) What is a mass spectrometer?

b) With support of a draw, describe the mass spectrometer functional and explain what happens in each step.

22.a)A given element of the periodic table has 2 isotopes.The first one has seventeen protons and eighteen neutrons with

the abundance of 75.45%.The second has two neutrons more than the first. Calculate the relative atomic mass

of the element.

b) Complete the following table:

Atom or ion	Electrons	Protons	Neutrons	Mass number
Cs	55		78	
Se^{2-}		34		79
La^{3+}		57		139

23.. For the elements of period 3(Na to Ar) of the periodic table,state and explain:

a) The general trend in the first ionization energy.

b) Why the first ionization energy of sulphur is lower than theat of phosphorus?
(Atomic number :P = 15, S = 16).

24. The ions F^-,Na^+ and Mg $^{2+}$ all have the same number of electrons.

a) Using the s,p,d.....notation write the electronic configuration of F^-.
b) Arrange the above ions in order of increasing size (ionic radius).Explain why they are in that order of size.
c) Briefly explain why F^-has a larger size than F.(Atomic numbers :F= 9, Na = 11, Mg = 12).

25.An element X has the following electronic configuration:
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$.

a) What is the atomic number of X?
b) To which GROUP of the periodic table doesX belong?

c) To which PERIOD of the periodic table doesX belong?

d) To which BLOCK of the periodic table does X belong?

e) Write the formula of compound formed between Mg and X.

26.a) Explain the origin of Hydrogen spectrum.

b) Calculate the energy and wavelength to the transition of an electron from n =2 to n= 4.
c) Does the transition correspond to Emission or absorption? Why?

(Rydberg constant R_H =2.18 x 10^{-18}J ,Light velocity,C =3 x10^8m/s, Planck c^{nt} ,h = 6.63 x 10-34J.S)

27..a) Without explaining ,state the factors that affect the electron affinity.

b)Given the table below showing the electron affinity across the Period III:

Element	Na	Mg	Al	Si	P	S	Cl
Electron affinity $KJmol^{-1}$	-20	+67	-30	-135	-60	-200	-364

(i)Explain why the electron affinity of Mg is positive.

(ii)Explain why the electron affinity of Phosphorus tends to be less negative than that of Silicon.

28..a) What is the most electronegative element in the Periodic Table?

b) What is the most electropositive element in the Periodic Table?

Acid and Bases

1.a). Define the terms acid and base by using Bronsted –Lowry definition of acid and base

(b) Write the equation of dissociation of ammonia in water and show acid-base conjugate pairs .

(C) Explain why water is said to be an amphiprotic species

2. Explain why all Lewis bases are Bronsted lowry bases but all lewis acd are not Bronsted lowry acid (motivate your answer by using examples)

3. Ammonia reacts with water as shown by the equation below:

$NH_3(aq) + H_2O(aq) \longleftrightarrow NH_4^+(aq) + OH^-(aq)$a)Identify the acid base conjugate pairs.

4. .Various theories of acidity have been proposed by different scientists.

a)By using suitable examples ,differentiate a Bronsted-Lowry acid and Lewis acid.

b) Write the equation of dissociation of ethanoic acid in water , and show the conjugate acid –base pairs

c) Explain why hydrogen fluoride is the weakest acid among group seven hydrides

Chemical equilibrium.

1.a) State two characteristics of the system at dynamic equilibrium

b) State Lechatelier principle

c) The following reaction shows the equilibrium of conversion of chromate ion into dichromate ions in acid medium :

$2CrO_4^{2-}$ (yellow) $+2H^+(aq) \longleftrightarrow Cr_2O_7^{2-}{}^{(aq)}$(orange) $+ H_2O_{(l)}$ ΔH=-KJ/mol

1. State whether this reaction is redox or not

2. Describe the effect of adding i .An acid on equilibrium position and on colour change ii. Abase on equilibrium position and on colourchange

d) State two industrial processes in which Lechatelier principle is applied and describe how its application is economical for getting best yield of the product

3.a)Methane gas reacts with steam according to the equation given below:

$CH_4(g) + H_2O(g) \rightarrow 3H_2(g) + CO_2(g)$: ΔH=+210KJ/mol.

(i)How does an increase of pressure affect the yield of hydrogen ?Explain.

(ii)Write an expression for the equilibrium constant,Kc,and state its units.

4. The part of contact process for the manufacture of sulphuric acid is represented by the following equilibrium : $2\ SO_2\ (g) + O_2\ (g) \leftrightarrow 2\ SO_3\ (g) + Q$ kJ.

a.State Lechatelier principle

b. For the above equilibrium ,state and explain the effect on equilibrium position of

i. decrease in pressure

ii.An increase in temperature

iii.An increase in the concentration of O_2

c. Write an expression of KC for the above reaction.

(d) State the name of catalyst used in this reaction and explain its effect on equilibrium position and on the time taken to reach equilibrium

5. a) State and explain briefly two characteristics of a system in a dynamic equilibrium.

b)Consider a system in equilibrium:

$$2NO\ (g) + O_2\ (g) \leftrightarrow 2NO_2\ (g) \quad DH < -X\ KJ/mol$$

Explain the effect on the equilibrium position of

i. Rising pressure

ii. Decreasing temperaure

iii. Addition of a catalyst

c) Draw well labelled energy diagram for this reaction

Chemical energetic

1.Photosynthesis is a process which takes place in green plants

a) Explain why green plants act as open system
b) Is photosynthesis an endothermic process or exothermic ? explain your answer
c) Write a balanced equation for photosynthesis process and draw energy diagram for this reaction
d) Define standard enthalpy of formation and combustion

2. Define the following terms

a) Enthalpy b) exothermic reaction c) endothermic reaction
e) Standard enthalpy of combustion iv) Standard enthalpy of neutralization v) lattice enthalpy v) atomization energy vi) electroaffinity

3. The reaction between nitrogen and hydrogen represents an exothermic process. a)Draw the energy profile for this reaction

b). By means of examples distinguish the terms

i. closed system , open system and isolated system

4. State the first law of thermodynamic

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GROUPE SCOLAIRE MARIE REINE RWAZA

TEL. 0788548407
P.O BOX 45 RUHENGERI
E-mail: mariereinerwaza@yahoo.fr
Website :www.mariereinerwaza.rw

SENIOR4 MCB CHEMISTRY QUESTION BANK

PREPARED BY MAZIMPAKA SAMUEL

1.a.Define the term ionization energy

b. the ionization energy of the 3rd group elements generally increase across the period but phosphorous z=15 has high ionization energy than sulphur z=16.explain this in terms of their electronic structures./1mark
c.explain why the second ionization energy of magnesium is greater than its first ionization energy
d. would you expect alkaline metals or noble gas to have high ionization energy? explain./2marks

2. It has been found by mass spectrometric analysis that the relative abundance of the various isotopic atoms of silicon in nature are: 92, 21% of Si-28; 4.70% of Si-29 and 3.09% of Si-30

(a)define the term isotope/1mark
(b**)** calculate the average atomic mass of silicon/2marks
(c**)** calculate the number of neutrons and electrons in the isotopes of $^{28}Si_{14}$/1mark
(d) explain why all isotope of silicon have similar chemical properties/1mark

3. a)write down the electronic configuration of calcium and calcium ion in terms of s ,p…,atomic number =20
b)why is the atomic radius of calcium significantly greater than that of calcium ion?/
c)write down the formula of a chloride of calcium/2marks

4.the last electron of an atom is characterized by the following quantum numbers:

n=4,l=0;s=+1/2
a. give the electronic configuration (using s,p,d notation)of that atom
b .how many p orbitals are completely filled?
c .how many orbitals are unsaturated?
d.which of the following orbital could not exist:

6f; 5s;1p;3p;2d;3d

5. a. define the term
i. atomic number
ii .mass number
b. explain why
i. the net charge of an atom is neutre
ii .all mass of atom is described to be located into the nucleus

6. a.Define the term electronegativity

b.Describe a general trends in electronegativity across the period and down the group of the peridictable

7.a.define the following terms
i. Wave
ii. wavelength
iii. Frequency
iv. spectrum
b. By using examples state the main difference between continuous spectrum and discontinuous spectrum

8.It has been found that copper consist of two Cu^{63} and Cu^{65}
(a**)** calculate the abundances for each isotopes of copper if its relative atomic mass is 63.55amu

b) calculate the number of neutron in the most abundandant isotope of copperc)Bromine occurs naturally in terms of two isotopes Br^{79} and Br^{81}.when Br_2+ is passed through the mass spectrometer ,three peaks ,three peaks of different abundances have been recorded on the screen of detector .give the ion responsible of each peak

9.explain the following statement:

(a) the size of Ca is greater than that of Ca^{2+}

(b) the size of Br^- is greater than that of Br

(C) the first electronaffinity of oxygen is negative while its second electroaffinty is positive

(d) the electric conductivity of potassium is greater than that of sodium

10. i. An element z has the following electronic structure

$1s^2\ 2s^2\ 2p^6\ 3s^2 3p^5$

(e) State the atomic number of z
(f) State the group and period of z
(g) State the block of z in the periodic table with explanation
(h) Write the formula the compound formed between z and magnesium

ii .compare the reactivity of calcium with water with that of magnesium with water

11.this question is about the properties of halogens

describe how each of the following parameter changes down the group
i. oxidizing power
ii .reactivity
iii .melting and boiling point
iv .polarity of their hydrides(HF, HCl ,HBr and HI)
v .Electronegativity
vi.Acidity of their hydrides

12.a.From an element M write the equation to show the first ,the second and the third ionization energy

b .state 3 factors affecting the magnitude of ionization energy

c. the element of second period are in sequence :Li, Be ,B,C, N ,O ,F ,Ne ,

classify these element in increasing order of their ionization energy then explain your arrangement

d. draw a graph to explain how the ionization can change as function of number of removed electrons

13.a. define the term oxidizing power

b. the oxidizing power of halogens decrease from fluorine to iodine explain this trend

c. predict the product of the following reaction, if they are not possible explain

i. $Ca\ Cl_{2(} \xrightarrow{+Br_2}$

ii. $NaC(aq)l + F_{2(g)} \rightarrow$

iii. $NaI(aq) + Cl_2(g) \longrightarrow$

iv. $KF + I_2(s) \longrightarrow$

d. briefly explain why halogens are not found in nature in free state

e. use phosphorus z=15 to write the formula of its

i. chloride at highest oxidation state

ii .oxide at lowest oxidation state

14.a. describe the origin of emission spectrum of hydrogen

b. draw the spectral series found in hydrogen spectrum showing clearly the name of each serie

c. among the series drown choose which gives rise to:

i. ultraviolet region

ii. visible region

c .calculate the wavelength, frequency, energy emitted by an electrons that transit from the third orbit to Lyman series

d .differiante absorption spectrum from emission spectrum

15.manganese and iron are both d block elements

a. i. use atomic number 25 for manganese,26 for iron to define a d block elements

ii. draw the electronic configuration of Fe2+ and Mn2+ then explain why Fe^{2+} is oxidezed to Fe3+ while

Mn^{2+} can not be oxidized to Mn^{3+}

b. draw the electronic configuration of manganese in MnO_4^-

c. In establishment of the electronic configuration copper z=29 and chromium z=24 exbit unusual electronic structure

i. draw the electronic structure of copper and chromium and explain they are

unusual

ii. draw the electronic configuration of

a. Copper in CuI

b .Chromium in $Cr_2O_7^{2-}$

16.. Explain the following statement in terms of bonding

i. Ammonia form a bond with boron Trichloride

ii .Calcium chloride is a solid with high melting point while Sulphur dioxide is a gas at room temperature
iii. H ydrogen fluoride boils at high temperature than hydrogen chloride .
iv .The boiling point of propane is lower than that of ethanol
v. Silicon dioxide is a solid with high melting point

17. This question concerns the chemistry of group VII elements of the periodic table.

a) Explain the trend in the volatility of halogens down the group from Chlorine to Iodine.

b) By using appropriate chemical equations, describe what is observed when aqueous silver nitrate is added to:

(i) Cl^- (aq)
(i) I^-(aq)

c) How does the oxidizing power of halogens change down group VII?
(1mark)

d) Predict which of the reaction below is likely to occur and give its product:

(i) Br_2 + KCl →.....
(ii) Cl_2 + KBr →.....
(iii) I_2 + NaF →.....

18. a) Differentiate by giving one example to each case : a strong electrolyte and weak electrolyte

b. Molten sodium chloride was electrolyzed for the purpose of extraction of sodium metal in down cell, calcium chloride was added

i. Why is it necessary to have molten sodium chloride before electrolysis?

ii. What is the purpose of adding calcium chloride

iii. Write equations for the reaction taking place at the cathode and at the anode

iv. Explain why an aqueous solution of sodium chloride is not suitable for sodium extraction

19. a) Hydrogen is placed in group I of the Periodic Table and has a double behavior:

(i)Give one reason that makes Hydrogen to behave as alkali metals (Group I elements).

(ii)State two reasons that make Hydrogen to behave as halogens (Group VII elements).

b) (i) Write and balance the chemical equation illustrating the reaction between chlorine (Cl_2) and Sodium hydroxide(NaOH).

(ii)Referring to the equation b (i), state the commonly known use of aqueous solution of halogens.

20.a) State and explain how the reactivity of halogens changes down the group (from the top to bottom)

b) Write a molecular equation and an ionic equation of the reaction observed when chlorine gas (Cl_2) is passed in solution of potassium iodide then state the color change during this reaction.

c) State the type of reactions in(b)

21. a.State the physical state and the colour of halogens

b. Use chemical equations to explain how chlorine can be used to distinguish between sodium bromide and sodium iodide.show the expected observations in each case.

22. State and explain how the following parameters changes down the group four elements of the periodic table

a. volatility of their hydrides

b. melting and boiling point of their tetrachlorides

c. hydrolysability of their tetrachlorides

d. Thermal stability of their hydrides

e. acidity of their dioxides

23. a) Define the following terms:

(i)Chemical bonding ***(1mark)*** (ii) Electronegativity **1mark**

b) Differentiate using at least three elements i) covalent bond from an ionic bond ii) covalent compo

24 .a) Describe how the stability of +2 and + 4 oxidation state change down the group

(b) Use the oxides of C and P b to support your answer in (a)**.**

(c) Explain why $SiCl_4$ is hydrolyzed while CCl_4 is inert with water

d) Write the balanced equation for the reaction taking place when $SiCl_4$ hydrolysed

e) Explain why Lead(II) Chloride is ionic while Lead (IV) Chloride is covalent

f) Write equations to explain the amphoteric nature of aluminium oxide.

25. a) What is the significance of the term lattice enthalpy ?
b) State and explain two factors factors affecting lattice enthalpy
c) Explain which between KBr and NaBr exhibits greater lattice enthalpy **./**
26. a) Sulphur is the starting material used in contact process for manufacturing sulphuric acid in large scale in industry

i) Use chemical equations for the reactions to describe all steps involved in contact process for sulphuric acid production

ii) Explain how the process in (i) affects the environment .
iii)State two large scale uses of suphuric acid
iv) Write the equation for the reaction between sulphuric acid with i.Copper (Cu). ii. sulphur iii.sucrose
v. Explain why concentrated sulphuric acid is not suitable to prepare HBr when is reacted with sodium bromide

27. a) Name the main ore from which iron metal is extracted
b) Iron is extracted from its ore in the blast furnace by mixing the ore with limestone and coke
i. State the role of each compound in this process
ii. Explain using equations all steps taking place in the blast furnace during iron extraction
iii, Explain how the process of iron extraction affect the environment
iv. State 2 uses of iron
v. Write a balanced equation between iron and Chlorine und and ionic compound

28. In Lyman series what could be the value of energy level on which an electron of 2.464555×10^{15} S^{-1} is from?
b)There exists 3 isotopes of oxygen that occur naturally with atomic mass 16, 17 and 18 with abundance 99.1% ; 0.89% and 0.01% respectively. Given that oxygen occurs naturally as diatomic molecular,
a. predict and explain the number of peaks that will be observed on the screen when 0_2^+ is passed through the mass spectrometer.

b. Calculate the relative atomic mass of oxygen
29. Iron is a transition metal with the atomic number 26
a. Write the electronic configuration of iron in this complex [($Fe(CN)_6]^{3-}$
b .Explain why iron forms a complex with cyanide ion
c. By using equation explain why an aqueous solution of $FeCl_3$ is acidic
d**.** Explain why Fe^{2+} is less stable than Fe^{3+}
30. Draw and name the shape of the following molecules:
CO_2, NH_3, SO_2 , CH_4 and $AlCl_3$ and show the bond angle for each molecule

b .Explain how the angle bond changes when water (NH_3) forms Ammonium(NH_4^+)
c.Give a brief explanation why water is bent shaped while methane is tetrahedral shaped .

d. Explain why SO_2 is polar whereas CO_2 is non polar

31. .(a) Describe the general trends in solubility of group II Sulphate from $BaS0_4$ to $SrSO_4$

(b) How thermal stability of group (II) nitrate change down the group
(c) Which between calcium nitrate and magnesium nitrate has high thermal stability
(d) Write a balanced equation of thermal decomposition of magnesium nitrate and sodium nitrate and account for the difference in terms of the products formed.
(f) Use Be and Al to explain the term diagonal relationship

32. Describe all steps involved in the functioning of the mass spectrometer **/**
b.A mass spectrometer provided the information on the right for a sample of naturally occurring germanium.

Isotope	Detector current in arbitrary units
70	6.83
72	9.13
73	2.60
74	12.17
76	2.60

Calculate the relative atomic mass for germanium.
b. The figure below shows how the second ionization energies of the elements Helium to sodium changes.

a) Explain the shape of the graph.

b) Why is it always the case that the second ionization energy is larger than the 1st, and the 3rd ionization energy larger than the 2nd ionization energy?

28
(Pl
solution a solid was formed. Write a balanced equation for the reaction**.**
b) The mixture from (a) was filtered and the residue warmed with concentrated hydrochloric acid
i) What was observed? Explain your answer
ii) Write equation for the reaction
c) The filtrate from (a) was divided into two parts

i) To the first part was added KI what was observed and write an equation for the reaction
ii) The second part was evaporated to dryness and heated strongly. Explain what was observed and write the equation for the reaction

33. The table below shows the boiling and melting points for Hydrides of group VIa.

Formula of Cpd	Molar mass (g/mol)	Melting point(°C)	Boiling point(°C)
H_2O	18	0	100
H_2S	34	-85.5	-60.3
H_2Se	81	-65.7	-42
H_2Te	130	-49	-2

d) Water is with the smallest molar mass but with the highest melting and boiling point. Explain.
e) Explain the trends in other hydrides from H2S to H_2Te
f) The boiling point of Ethane, Water, and Sodium hydride increases in the order: $C_2H_6 < H_2O < NaH$.
g) Write the balanced equation for the reaction between chlorine and
i. water ii. Hot concentrated sodium hyrdroxide

34. Hydrogen chloride is a gas at room temperature while sodium fluoride is a solid of high melting point.

d) State the type of bonding present in each compound.
e) Briefly explain in terms of bonding why their melting points are different
f) Why HF boils at high temperature than other group seven hydrides?

35. (a)Explain the following observations in terms of bonding:

(i)$SiCl_4$ is a volatile liquid whereas SiO_2 is a solid with high melting point.

(ii)The boiling point of Ethane, Water, and Sodium hydride increases in the order: $C_2H_6 < H_2O < NaH$.
(iii)The density of ice is lower than that of liquid water.

b) Why a molecule of BCl_3 is able to form a bond with a molecule of NH_3? Name the type of bond formed . (Boron atomic number =5)

36. X, Y and Z represent element of atomic numbers 9, 19 and 34.

(e) Write the electronic structures for X, Y, and Z**(Application level)**
(f) Predict the type of bonding that you would expect to occur between (i) X and Y (ii) X and Z (iii) Y and Z**(Synthesis level)**

(g) Draw "dot/cross" diagrams for the compounds formed, showing only the electrons in the outermost shell for each atom**(Application level)**

(h) Predict, giving reasons, the relative

(iii) Electrical conductivity**(Evaluation level)**

(iv) Solubility in waterof the compound formed between X and Z compared with that formed between X and Y.**(Evaluation level)**

38..The following table shows the ionization energies(in kJ mol-1) of five elements lettered A, B, C, D and E

Element	**1st I.E**	**2nd I.E**	**3rd I.E**	**4th I.E**
A	500	4600	6900	9500
B	740	1500	7700	10500
C	630	1600	3000	4800
D	900	1800	14800	210000
E	580	1800	2700	11600

(a) Which of these elements is most likely to form an ion with a charge of +1? Give reasons for your answer. **(Evaluation level)**

(b) Which two of the elements are in the same group of the periodic table? Which group do they belong to? **(Analysis level)**

(c)In which group of the periodic table is element E likely to occur? Give reasons for your answer**(Evaluation level)**

(d) Which element would require the least energy to convert one mole of gaseous atoms into ions carrying two positive charges? **(Analysis level)**

39. Use the data in the table below to answer the questions that follow.

substance	Mp(OC)	Bp(OC)	Solubilty in water	Conductance		Density at room temperature g/cm^3
				Solid form	Molten form	
A	714	1418	Very good	none	good	2.3
B	-95	56	Very good	none	none	0.8
C	1083	2580	insoluble	good	good	8.9
D	-101	-34	verygood	none	none	2.55
E	-23	77	Insoluble	none	none	1.6

F	-219	-11	Sligltly soluble	none	none	1.33

(a) (i) Name two substance that are liquid at room temperature.

.....

.....

(ii) Which of the two is more volatile?

.....

(b) Which substances) would dissolve in water and could be separated from the solution by

(i) fractional distillation?

.....

(ii) by evaporation of the water ?

.....

(c) Which of the substances A to F,

(i) has a structure consisting of ions ?

.....

(ii) is a metal ?

.....

(i) is a liquid which would form separate layer with water?

(ii)

.....

would the water be above or below ?

.....
.....

(d) Which substance is a gas which

(i) would not be collected efficiently over water.

……

(ii) would be collected efficiently over water.

40. The net charge of an atom is

B. Positive B. Negative C. zero D. No true answer

41.a) what is the ground state electronic configuration of Boron and Nitrogen? Atomic number: N=7, B=5)

b) Explain why the spatial arrangement (shape) of BF_3 is different from that of NH_3 **(**

C) Draw and name the shape of CO_2, SO_2, BCl_3, $SiCl_4$, PF_5 .show the angle bond for each case.

d) Explain why ammonia is polar while boron trichloride is non polar

42. a) Define the term ionization energy

b) State and Explain the general trend in first ionization energy across the third period then explain

c) Why the first ionization energy of phosphorus Z= 15 , is much high than that of Sulphur ? S Z=16**.**

d) Explain why the electrical conductivity of magnesium is lower than that of Aluminium

e)) Why does Magnesium has high melting point than Na.

43.a) State and explain the trend in oxidizing power of group seven elements down the group of the period table**.**

b) Use equation to explain how an aqueous solution of chlorine can be used to distinguish NaBr and NaI solution**.**

c) Use the reaction of chlorine with chlorine to explain a disproportionation reaction(

d) account for the trend in volatility of group seven elements from fluorine to iodine

44. a) What is the name given to different atoms of an element

b) In mass spectrometer two isotopes Cl-35, Cl-37 the peak intensity occurred the ratio 3:1 use this information to calculate the relative atomic mass of chlorine

ii) Calculate the number of neutrons, electrons in the least abundant isotope of chlorine

c) Explain why elements are ionized in mass spectrometer and state how this is achieved.

45. a) State and explain how the reactivity of i.group one element changes down the group ii. halogen changes down the group

b) Write a reaction between sodium and cold water and state the effect of the resultant solution on phenolphthalein indicator

c) Account for the solubility of group two sulphates down the group of periodic table

46.a) Define the term electronegativity

b) Explain how the electronegativity changes down and across the period of the period table

c) State and explain the trend i.in polarity of group seven hydrides(from HF to HI) ii. In acidity of group seven hydrides from HF to HI**.**

47.a) Explain how thermal stability of group II nitrates change down the group of the periodic table

b) Write the equation for thermal decomposition of calcium nitrate then show how it is different from that of sodium nitrate.

C) Explain why nitrates are used as fertilizers

48. Beryllium as the first element in group 2 display some abnormality in properties called diagonal relationship when is compared to the other element of the same group

d) What do you understand by the term diagonal relationship? Explain its causes?
e) Show the similarity between beryllium and Aluminium to explain their diagonal relationship
f) State other two pairs of elements in the periodic table that exhibit a diagonal relationship.

49. a) State and explain two differences between covalent compounds and ionic compounds

b) By using a simple diagram explain metallic bonding**.**

c) State and explain at least 2 properties of metals

d)During an investigation a metal X reacts with a sulphate of a metal Y and Z,

Y removed an oxygen from an oxide of the metal Z. put these metals(X,Y,Z) in increasing order of their reactivity

50. a) What do you understand when one talk about spectrum

b) Explain the origin of hydrogen spectrum

C) Calculate the frequency and energy of electron in the second line of Balmer series $R_H = 1.08\times10^7$ m s . $C = 3\times10^8$m/s $h=6.6\times10^{-34}$js

51. An element x has an atomic number 33,

a) Write down the electronic confirmation of X
b) State the group, period and block of X in the periodic table
c) Write a chloride of X at highest oxidation state then name its molecular shape
d) Write an oxide of X at lowest oxidation state and use an equation to explain if it is acidic , basic or amphoteric

52. a. Chlorine is an strong oxidizing agent prepared in the laboratory by action of manganese dioxide and hydrochloric acid

Using redox balancing method Write a balanced equation for the reaction between manganese (IV) oxide and hydrochloric acid

b. Describe a chemical test of chlorine gas

c) Write an ionic equation when chlorine react with iron(II) Chloride and show that it is a redox process

53.a). Define the terms acid and base by using Bronsted –Lowry definition of acid and base

(b) Write the equation of dissociation of ammonia in water and show acid-base conjugate pairs .

(C) Explain why water is said to be an amphiprotic species

54. Photosynthesis is a process which takes place in green plants

f) Explain why green plants act as open system
g) Is photosynthesis an endothermic process or exothermic ? explain your answer
h) Write a balanced equation for photosynthesis process and draw energy diagram for this reaction
i) Define standard enthalpy of formation and combustion

55. a) State two characteristics of the system at dynamic equilibrium
b) State Lechatelier principle
c) The following reaction shows the equilibrium of conversion of chromate ion into dichromate ions in acid medium :

$$2CrO_4^{2-}\text{(yellow)} + 2H^+(aq) \longleftrightarrow Cr_2O_7^{2-}(aq)\text{(orange)} + H_2O_{(l)} \quad \Delta H=-KJ/mol$$

1. State whether this reaction is redox or not
2. Describe the effect of adding i .An acid on equilibrium position and on colour change ii. Abase on equilibrium position and on colourchange

d) State two industrial processes in which Lechatelier principle is applied and describe how its application is economical for getting best yield of the product

56. Explain the following statement:

i) Silicon dioxide is a solid with high melting point while carbon dioxide is a gas at rtp.
j) Hydrochloric acid in water, conducts electricity but in methylbenzene it does not conduct electricity.
k) Sodium chloride in crystalline state does not conduct electricity while in molten state it conducts electricity.
l) Ammonia boils at high temperature than phosphine (PH_3
m) Diamond is hard and bad conductor of electricity while graphite is soft and good conductor of electricity
n) The bond angle of water increase when water forms hydronium ion
o) The melting point of magnesium oxide is greater than that of shurphur trioxide
p) Ice floats on water.

57.a) Aluminium hydroxide is described as amphoteric , prove this statement using balanced equation

b) AluminiumTriChloride is considered as a Lewis acid, explain this by using an example.

c) Alums are substances used in water treatment

i. the formula of compound used as alum

ii. State the importance of alum in water treatment

d) Use a balanced equation to show how the use of alum can increase the acidity in water
e) State another chemical which is added in water to reduce the acidity caused by alum in water**.**
f) Explain the properties of aluminium that make it valuable to make airships and kitchen utensils

58.a) Describe all steps involved in sulphuric acid manufacture from sulphur by means of equations and follow chart .

e) Explain how the use of coals containing sulphur is an environmental problems
f) Explain why sulphuric acid can react with sodium chloride to produce hydrogen chloride but it can't react with sodium bromide to produce hydrogen bromide
g) Write a balanced reaction for the reaction between concentrated sulphuric acid and copper metal

59. a) Explain how the stability of +2 and + 4 oxidation state in group elements changes down the group of the periodic table

b) Use the oxide of lead and carbon to sustain your answer in (a)

c) Using examples of CO_2 and SnO_2 ,briefly explain the trend in acid-base character of oxides of group four in oxidation state +4.

c) Briefly explain why i) $PbCl_4$ is covalent while $PbCl_2$ is ionic ii) Silicon tetrachloride is hydrolysed while carbon tetrachloride is not hydrolysable.

d) Write a chemical equation for the reaction between i) Silicon tetrachloride and water ii) silicon dioxide and limestone.

60. The table below shows the first , the second and the third ionization energies in(kj/mol) of 6 successive elements on the periodic table.

Element	First ionization energies	Second ionization energies	Third ionization energies
A	1060	1900	2920
B	1000	2260	3390
C	1260	2300	3850
D	1520	2660	3950
E	418	3070	4600
F	590	1150	4940

NB: The elements are not only in one period

c) For a given element M, write the equations which represent the first, second and the third ionization energegy.
d) According to the table above , identify the letter corresponding to
   iii. An alkaline –earth metal(group(II)). Explain your answer
   iv. a noble gas

C) Suggest the formula of a compound formed by element F and C .explain your answer

d) Suggest the elements which are metals

e) Draw the shape of a graph of ionization energy as the function of the number of removed electrons and explain the shape of the graph

61.Define the following terms:

f) Isotopes
g) Relative atomic mass
h) Electron affinity
i) First ionization energy
j) Shielding effect

62.a) What is a mass spectrometer?

b) With support of a draw, describe the mass spectrometer functional and explain what happens in each step.

63.a)A given element of the periodic table has 2 isotopes.The first one has seventeen protons and eighteen neutrons with

the abundance of 75.45%.The second has two neutrons more than the first. Calculate the relative atomic mass

of the element.

b) Complete the following table:

Atom or ion	Electrons	Protons	Neutrons	Mass number
Cs	55		78	
Se^{2-}		34		79
La^{3+}		57		139

64.. For the elements of period 3(Na to Ar) of the periodic table,state and explain:

c) The general trend in the first ionization energy.

d) Why the first ionization energy of sulphur is lower than theat of phosphorus? (Atomic number :P = 15, S = 16).

65. The ions F^-,Na^+ and Mg^{2+} all have the same number of electrons.

d) Using the s,p,d.....notation write the electronic configuration ofF^-.
e) Arrange the above ions in order of increasing size (ionic radius).Explain why they are in that order of size.
f) Briefly explain why F^-has a larger size than F.(Atomic numbers :F= 9, Na = 11, Mg = 12).

66.An element X has the following electronic configuration:
$1s^22s^22p^63s^23p^64s^23d^{10}4p^3$.

f) What is the atomic number of X?
g) To which GROUP of the periodic table doesX belong?

h) To which PERIOD of the periodic table doesX belong?

i) To which BLOCK of the periodic table does X belong?

j) Write the formula of compound formed between Mg and X.

68.a) Explain the origin of Hydrogen spectrum.

b) Calculate the energy and wavelength to the transition of an electron from n =2 to n= 4.
c) Does the transition correspond to Emission or absorption? Why?

(Rydberg constant R_H =2.18 x 10^{-18}J ,Light velocity,C =3 x10^8m/s, Planck c^{nt} ,h = 6.63 x 10-34J.S)

69..a) Without explaining ,state the factors that affect the electron affinity.

b)Given the table below showing the electron affinity across the Period III:

Element	Na	Mg	Al	Si	P	S	Cl
Electron affinity $KJmol^{-1}$	-20	+67	-30	-135	-60	-200	-364

(i)Explain why the electron affinity of Mg is positive.

(ii)Explain why the electron affinity of Phosphorus tends to be less negative than that of Silicon.

70..a) What is the most electronegative element in the Periodic Table?

b) What is the most electropositive element in the Periodic Table?

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