GOLDLITE EXAMINATIONS

FORM 4 JUNE 2022 PRE-MOCKS

233/2- CHEMISTRY

PAPER 2

FORM FOUR

2 HOURS

Name..... Adm No.....

Signature.....
Date.....

Instructions to candidates.

a) *Write your name and adm number in the spaces provided above.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **All** the questions in the spaces provided.*
d) *KNEC mathematical tables and silent non-programmable electronic calculators may be used.*
e) *All working **MUST** be clearly shown where necessary.*
f) *All answers should be written in the spaces provided.*
g) This paper consists of 12 printed pages.
h) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
i) Candidates should answer all the questions in English.

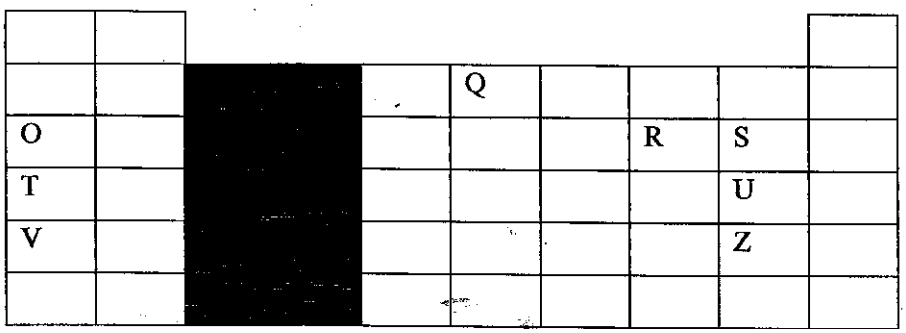
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Question	Maximum Score	Candidate's Score
1	13	
2	12	
3	15	
4	12	

5	**8**	
6	**10**	
7	**10**	
Total	**80**	

1. (a) The grid below represents part of the periodic table. Study it and answer the questions that follow.

The letters do not represent the actual symbols of the elements.



i. Which element will require the least amount of energy to remove one of the outermost electrons?
(1mk)

_____

ii. Select the most reactive non-metal.
(1mk)

_____

iii. Which of the elements has the greatest tendency of forming covalent compounds? Explain
(2mks)

_____

_____

_____

iv. What name is given to the family of elements to which elements **O**, **T** and B belong?(1mk)

_____

v. An element **W** has atomic number 15.m indicate the position of **W** on the grid. (1mk)

_____

vi. Explain why the atomic radius of **S** is smaller than that of **R**.

(2mks)

_____

_____

vii. Explain why the atomic radius of **Z** is smaller than its ionic radius.

(1mk)

_____

(b) Study the information given in the table below and answer question that follow.

Formula of compound	Na Cl	$MgCl_2$	$AlCl_2$	$SiCl_4$	PCl_5	SCl_2
Boiling point ^0C	1470	1420	Sublimes at 180^0C	60	75	60
Melting point ^0C	800	710		-70	-90	-80

i. Give **two** chlorides that are liquids at room temperature. Give a reason for your answer. (2mks)

_____

_____

_____

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ii. Give a possible reason why $AlCl_2$ has much lower boiling point $MgCl_2$ although both Aluminium and Magnesium are metals.

(2mks)

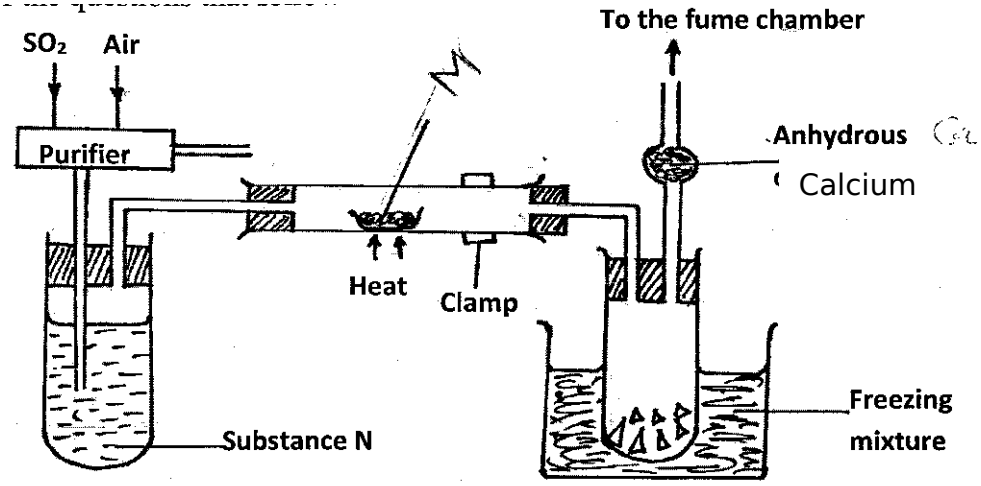
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2. The figure below represents a set up that can be used to prepare sulphur (VI) oxide. Study it and answer the questions that follow.



a. Name substance **M** and **N**
(1mk)

M_____

N_____

b. State the function of substance **N**.
(1mk)

_____

c. Given that the equation for the reaction that occurs is
$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \Delta H=-197kJ$
What information about the reaction is provided by $\Delta H=-197kJ$?
(1mk)

d. Give the name of the method of gas collection shown above.
(1mk)

_____

e. What is the advantage of using calcium oxide instead of anhydrous calcium chloride in the experiment above?
(1mk)

_____

II. Concentrated sulphuric (VI) acid is manufactured in large scale through contact process

i. Identify **two** substances that are recycled during contact process.

(1mk)

_____

_____

ii. Why is recycling necessary? Give **two** reasons

(1mk)

_____

_____

(b)(i) Sulphur (IV) oxide gas is removed by scrubbing in the contact process. What is meant by scrubbing?
(1mk)

_____

(ii) Write an equation showing how sulphur (IV) oxide is scrubbed.
(1mk)

(c) Explain why sulphur (VI) oxide is dissolved in concentrated sulphuric (VI) acid and not in water during contact process.
(1mk)

_____

_____

III. Given that a concentrated solution of suhuric (VI) acid is 18.2M, determine the volume of the concentrated sulphuric (VI) acid that can be mixed with distilled water to make one litre of 2M sulphuric (VI) acid solution.
(2mks)

3. Use the standard electrode potential for the elements A, B, C and D given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

		E^{θ} (volts)
$A^{+2}_{(aq)} + 2e^- \longrightarrow$	$A_{(s)}$	-0.76
$B^{+2}_{(aq)} + 2e^- \longrightarrow$	$B_{(s)}$	-0.44
$C_{2(g)} + 2e^- \longrightarrow$	$2C^-_{(aq)}$	+0.54
$D^{+4}_{(aq)} + e^- \longrightarrow$	$D^{+3}_{(aq)}$	+1.61

a. Which element is the:

i. Strongest oxidizing agent.

(1mk)

_____

_

ii. Strongest reducing agent

(1mk)

_____

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b. (i) Draw a labeled diagram of the electro chemical cell that would be obtained when half cell of element A and B are combined.

(ii) Calculate the E^{θ}value of the electrochemical cell constructed in 3b (i) above (1mk)

(iii) Which **two** elements if used together in a cell would produce the largest e.m.f. (1mk)

_____

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_____

_

c. Calculate the number of faradays required to completely reduce 0.1 mole of Fe^{+3} to Fe (2mks)

d. One of the major application of electrolysis is electroplating. In chromium plating the steel article is usually plated first with nickel or copper then chromium in a plating both which contain chromium compounds in sulphuric (VI) acid water. Chromium deposits on the article.

i. Give a reason why steel parts are chromium plated. (1mk)

_____

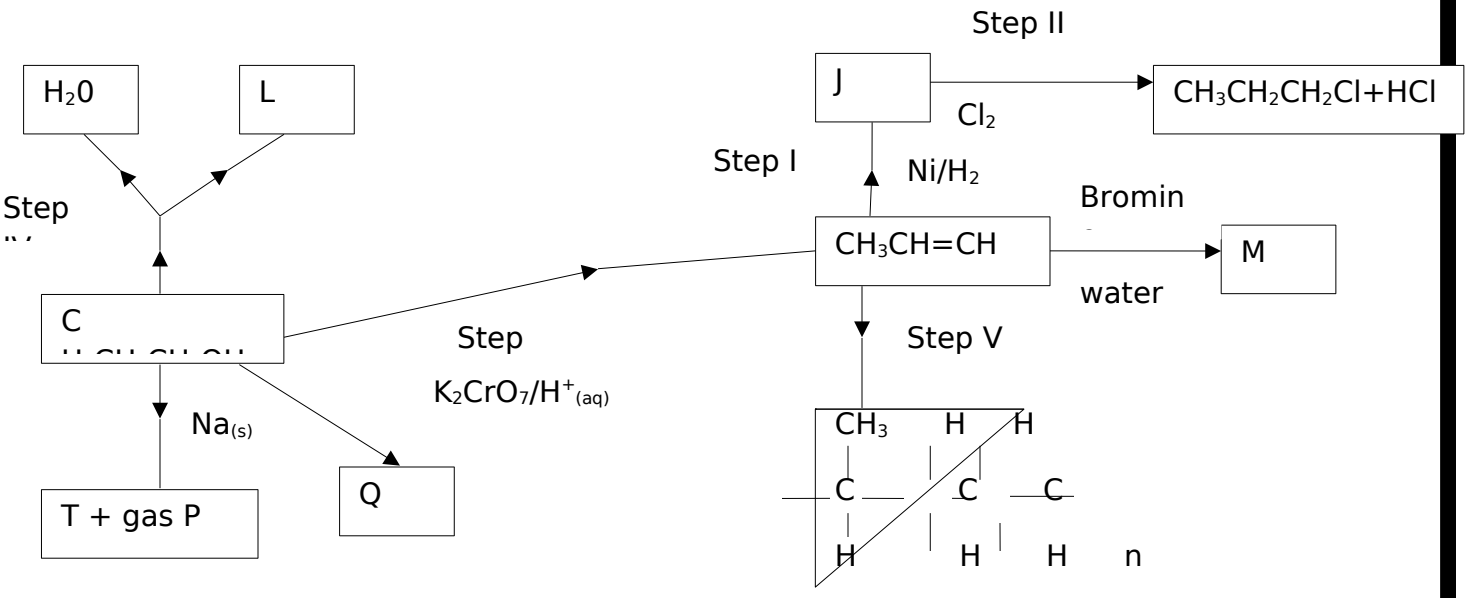
ii. Why is it necessary for the steel to be mated first with nickel or copper before chromium is applied.
(1mk)

_____

iii. Give an ionic equation for the process responsible for chromium plating.
(1mk)

iv. If an electrical current of 4.5 amperes is passed through the chromium plating for 20 hours, what would be the mass of steel article? (Cr=52.0, 1 faraday = 96,500 coulombs) (3mks)
(Oxidation state of chromium = +2)

4. Study the flow chart below and answer questions that follow.



a. Name substance J and draw its structural formula.
(2mks)

Name

_____

Structural

formula_____

b. What reagent and conditions are necessary for:
(2mks)

(I) Step

III_____

Reagent_____

__

Condition_____

__

(II) Step

II_____

Condition_____

__

c. Name the following

i. L _____(1mk)

ii. Gas P _____(1mk)

iii. Q _____(1mk)

iv. M _____(1mk)

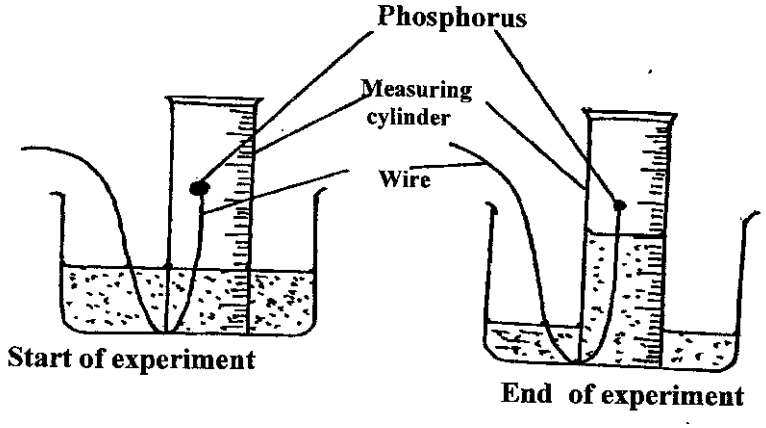
d. Write the equation of the reaction that occur in step P
(1mk)

e. Give the name of process in step V
(1mk)

_____

f. If the relative molecular mass of R is 21,000. Determine the value of n (C=12.0, H =1.0)
(2mks)

5. A student set up the apparatus shown below in order to determine the percentage by volume of oxygen in the air. Study it and answer the questions that follow.



a. (i)State one observation made in the measuring cylinder at the start of the experiment. Explain
(2mks)

_____

_____

__

(ii) The pH of the contents of the beaker at the end of the experiment was found to be 4. Explain the observation
(2mks)

_____

_____

(iii) The volume of air in the measuring cylinder at the end of the experiment was measured study the data given below and answer the questions that follow.

Volume of air at start of the experiment =36.65cm^3
Volume of air at the end of the experiment =24.28cm^3
Determine the percentage volume of oxygen in the air
(1mk)

b. State and explain the observation made when a mixture of magnesium powder and copper (II) oxide is heated in a crucible.
(2mks)

_____

_____

__

c. State **two** air pollutants produced by motor vehicles.
(1mk)

_____

_____

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6. (a) The results below were obtained in an experiment conducted by form 3 students from Ratansi secondary school using magnesium.
Mass of the crucible + Lid =19.52g
Mass of the crucible + Lid + Magnesium ribbon =20.36g
Mass of the crucible + Lid + magnesium oxide = 20.92g

(i) Use the results to find the percentage mass of magnesium and oxygen in magnesium oxide.
(2mks)

(ii) Determine the empirical formula of magnesium oxide. (Mg=24, O= 16.0)

(b) Sodium hydroxide pellet were accidentally mixed with sodium chloride, 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm^3 of the solution was neutralized by 20.0cm^3 and 0.25M sulphuric (VI) acid

i. Write an equation for the reaction that took place.
(1mk)

ii. Calculate the:
I. Number of moles of the substance that reacted with sulphuric (VI) acid.
(2mks)

II. Number of moles of the substance that would react with sulphuric (VI) acid in the one litre solution.
(1mk)

iii. The percentage of sodium chloride in the mixture.
(2mks)

7. (a) Use the bond energies given in the table below to calculate the enthalpy change for the reaction.
(2mks)

$C2H_{6(g)} + Br_{2(g)} \longrightarrow C_2H_5Br_{(g)} + HBr_{(g)}$

Bond	C – H	C - Br	Br – Br	H- Br
Bond energy KJ/mol	413	280	193	635

(b) On the space provided below, sketch the cooling curve that would be obtained when a boiling tube
Containing water at 80^0C is immersed in a freezing mixture maintained at 10^0C. (2mks)

(c) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

ΔH_C^θ (Carbon) = -393kJ/mol

ΔH_C^θ (Hydrogen) = -286kJ/mol

ΔH_C^θ (Butane) =-2877kJ/mol

(i) Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements. (2mks)

(ii) Calculate the heat of formation of butane ΔH_f^θ (C_4H_{10})
(2mks)

(d) Given that the lattice enthalpy of potassium chloride is +690kJ/mol and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride.
(2mks)