5.1. Chemistry Theory Paper 1

INSTRUCTIONS TO CANDIDATES

i) This paper consists of two Section, A and B. Section A consists of 10 structured questions. Section B has six questions of essay type or semi structured.

ii) Answer **all** questions in Section A in the spaces provided

iii) Answer **Any Four** questions in Section B

Chemistry
Paper 1
Sample paper 2021

2 hours

Uganda Certificate of Education

Chemistry

Paper 1

2 hours 30 minutes

CANDIDATE NAME: _____

CANDIDATE NUMBER: _____

CENTRE NUMBER: _____

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Do not write in the boxes on this page. The examiner will use them to keep a record of your marks.

SECTION A

Qn	1	2	3	4	5	6	7	8	9	10	Total
Max marks	4	4	4	4	4	4	4	4	4	4	40
Actual marks											

SECTION B

Qn	11	12	13	14	15	16					Total
Max marks	15	15	15	15	15	15					60
Actual marks											

SECTION A

Answer all questions in this section. Write your answers to the questions in the spaces provided.

1. Students were asked to identify examples of the changes that can take place in the atmosphere but use the same components of air. One student mentioned the burning of magnesium in air and the rusting of iron.

   (a) What component(s) of air are used during burning of magnesium and rusting of iron. (1 mark)

   _____

   _____

   (b) What is the similarity between the two chemical changes (1 mark)?

   _____

   _____

   (c) c) What makes rusting of iron different from burning of magnesium in air in term conditions for the reaction (1 mark)

   _____

   _____

   (d) d)Write the formulae of the products of each of the changes (1mark)

   _____

   _____

2. A student dropped a few pieces of marble in dilute hydrochloric acid contained in a test tube. The gas produced was passed through calcium hydroxide solution (lime water) for a long time.

   (a) What changes would be observed in lime water? (2 marks)

   _____

   _____

   (b) Write balanced chemical equations for the changes observed.

   _____

   _____

   (2 marks)

3. Food cooked without common salt is tasteless. Only those suffering from hypertension (high blood pressure) and associated illnesses are advised to eat food without salt. This is because the ions of the chemical elements in salt can worsen their health conditions.

   (a) Identify the chemical elements present in common salt and write the formula of their ions. (2marks)

   _____

   _____

   (b) Explain what the presence of ions in sodium chloride indicates about its bonding and formation. (2marks)

_____
_____
_____
_____

4. A group of students went for field study in one of the largest limestone quarries in Tororo, Eastern Uganda. Limestone is used in the production of cement.
   (a) Write the formula of the main compound in limestone used for cement manufacture. (1 mark)

_____
_____

   (b) Describe the major steps involved in making cement from limestone. (3 marks)

_____
_____
_____
_____
_____

5. In Uganda, there are many industries that manufacture soaps and detergents. Some of the common detergent brands include OMO, ARIEL, NOMI and VIM. Explain why you would prefer to use powdered detergents such as those mentioned above to bar soap? (4 marks)

_____
_____
_____
_____
_____
_____
_____

6. A group of students found out that different metals react differently. They observed this when some metals were made to react with cold water and steam. The changes they observed are summarised in the table below.

Metal	Reaction with water	Reaction with steam
Sodium	Reacts rapidly	Reacts violently
Calcium	Slow reaction	Fast reaction
Copper	No reaction	No reaction
Magnesium	Very slowly	Relatively fast
Iron	Too slow	Slow

   (a) Use the information in the table to arrange the given metals starting with the most reactive to the least reactive (1mark)

_____
_____

   (b) Explain if calcium could be suitable for making roofing sheets (2 marks)

_____
_____
_____
__

(c) Which of the metals would be most suitable for use in making water pipes? (1 mark)

_____

_____

__

7. A juice vendor makes juice by mixing passion fruit, water and sugar. The vendor separates the passion fruit seeds from the mixtures and adds sugar to make it sweet.

a) Name the process by which passion fruit seeds are separated from the mixture. (1 Mark)

_____

_____

b) Explain why it is possible to separate passion fruit juice by the process named. (2marks)

_____

_____

_____

___

c) What do you expect to have happened to the sugar crystals when added to the fruit juice? (1mark)

_____

_____

8. A carpenter was contracted to fix a door lock for a new house. He went to a hard ware shop but found different metal types of locks with handles made from iron, brass, zinc and copper. However, the carpenter opted to use locks made of brass out of the different types.

(a) What is the composition of brass? (1 mark)

_____

_____

__

(b) Explain why the carpenter preferred to use brass to the other metal materials available in the hard ware? (3 marks)

_____

_____

_____

_____

_____

_____

9. The table below shows the melting point, boiling points and densities of substances A to D.

substance	Melting point(°C)	Boiling point (°C)	Density (g/cm^3)
A	1110	2606	9.1
B	-266	-252	0.07
C	60	120	1.6
D	-14	60	0.9

State with reasons which substances are;

a) gas at room temperature (1 mark)

_____

b) liquid at room temperature (1 mark)

_____

c) solids at room temperature (1 mark)

_____

d) Comment on the relationship between melting point and density of the of the substances (1 mark)

_____

_____

__

10. A small river called Nyagak passes through the rural farming communities of Alur and Madi into river Nile, in north western Uganda. On analysis the water downstream was found to have unsuitably high levels of nitrates after passing the Alur and Madi communities.

a)(i) What practice leads to high levels of nitrates in the area. (1mark)

_____

_____

__

(ii) How do the nitrates form distant communities reach the water sources (1mark)

_____

_____

__

b) What alternative material can be used by the communities to lower the nitrate levels? Explain why. (2marks)

_____

SECTION B

Answer any four questions from this section.
Begin each question on a fresh page.

11. A student found a container of Hand sanitizer with a label shown below:

S.O HAND SANITIZER
Effective on common germs
Active component: absolute ethanol
Other components: water and Glycerine

a) State one use of hand sanitizer (1 mark)
b) Explain why the liquid is not regarded as a pure substance (2 marks)
c) Explain why the liquid is thick and less viscous (2 marks)
d) Describe a practical method that could be used to separate the components the hand sanitizer? (6 mark)
e) Describe a chemical test that can be carried out to show the presence of water in the hand sanitizer (2 marks)
f) Explain why it is not advisable to keep a hand sanitizer near a source of fire. (2 marks)

12. Large deposits of oil have been discovered in lake Albert and near Hoima city. Crude Oil contains a variety of different compounds but with similar structure. The

simplest of these compounds is methane of CH_4. The amount of energy released by the complete combustion of 1 mole of methane is 890.7 KJ/mole

a) Identify and write the general formula of the organic family to which the components of oil belong. (1 mark)

b) Name and write structural formula of the next three members of the organic family after methane (3 marks)

c) Petrol is another product of oil used as fuel but burns more slowly when samples of some lead compounds are added to it.
Draw sketch curves on same graph, of amount petrol burnt against time to represent the burning rates of unleaded and leaded petrol. (3 marks

d) (i) What mass of methane in grams of would be needed heat 1 (one) litre or water from 25^0C to 60^0C (Specific heat capacity of water =4.2 Joules/g/K, density of $1g/cm^3$) (3 marks)

(ii) If ethanol was used instead of methane to heat the same amount water, what mass of ethanol would be needed? (Enthalpy of ethanol = -1366,8 KJ/mole (3marks)

(iii) Which one between one between ethanol or methane is a more effective fuel and why? (1marks)

13. Students were asked to develop a project that would result into repair of cracked pathway. The practical report developed by the students had the following set of instructions for making concrete:
To make good, strong concrete, thoroughly mix together 4 buckets of gravel, 3 buckets of sand and one bucket of cement. When this is done then add a half bucket of water.

a) State one property of concrete that make it suitable for its uses. (1 mark)

b) Copy and complete the table below showing the percentage of each ingredient in the concrete mixture. (Give your answer to the nearest whole number)

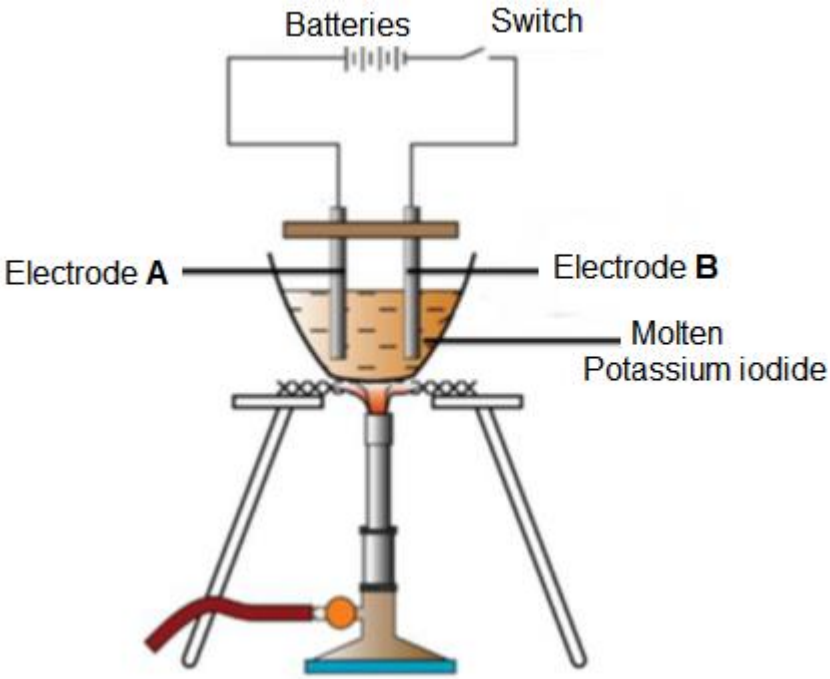
Ingredient	cement	water	sand	Gravel
Number of buckets				
Percentage				

(4 marks)

c) Describe an investigation that could be performed to determine what particular mixture of gravel, sand and cement makes the strongest concrete. (6 marks)

d) What would be varied, what would be kept the same to test the strength of the concrete and explain the effect? (4 marks)

14. A scientist discovered potassium metal by carrying out electrolysis of molten potassium iodide. Small, shiny beads of molten potassium were produced when an electric current from a battery was passed through molten potassium Iodide using graphite electrodes. The electrolytic cell is shown in the diagram below.



a) Name the electrodes A and B (1 mark)

b) Explain how the potassium metal and all other products were formed during the electrolysis. Use equation to justify your explanation. (4 marks)

c) Explain what would happen at the electrodes if 1.0 M potassium iodide solution at 25 °C was electrolysed instead of the molten one using graphite electrodes. (4 marks)

d) Many other metal elements such as aluminium are extracted from their ores by electrolysis. Using a named ore of aluminium, describe its process of extraction from the named ore. (6 marks)

15. What term can be used to describe the reaction between baking soda and acidic liquid injected by bee sting? (1mark)

a) You are given two solutions A and B. The pH of solution A is 6 and pH of solution B is 3.

(i) Which solution has more hydrogen ion concentration?

(ii) Give reason for your answer. (2 Marks)

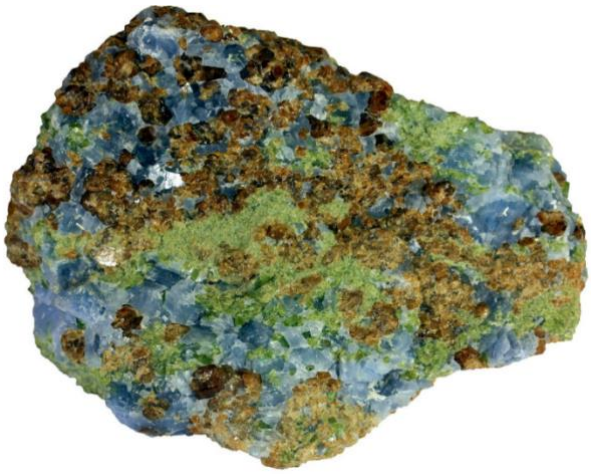
b) Explain the following:

i) Sulphuric acid is a stronger acid than carbonic acid? Use equations to support your answer (4marks)

ii) Dry hydrochloric acid (HCl) gas does not change the colour of the dry blue litmus paper. Use equation to justify your answer (4Marks)

iii) When dilute sulphuric acid is added to zinc chloride a colourless solution is observed. However, when the dilute acid is added to calcium chloride, a white precipitate is observed. (4mark)

16. The figure below shows a sample of a metamorphic rock obtained from Kilembe mines.



a) Name two observable features of the rock sample (2 marks)
b) The sample was analysed and found to contain 51.6% copper, 9.7% carbon and the rest oxygen.
   i) Calculate the percentage composition of Oxygen in the rock sample. (1mark)
   ii) What is the empirical formula of the copper compound in the rock sample (Cu=64, C=12, O=16)? (3marks)
   iii) If the molecular mass of the copper compound from the rock sample is 124, what is its molecular formula? (2 marks)
c) 6.2g of the copper compound in (b) above was heated strongly to constant mass.
   i) Write equation for the change that took place during heating. (2 marks)
   ii) Calculate the volume of the gaseous formed at stp. (molar gas volume = 22.4dm^3 at stp) (2 marks)
   iii) Calculate the change in mass of the copper compound. (3 marks)

- END -

5.2. Chemistry Practical Paper

Chemistry

Practical Paper

Paper 2

Sample paper 2021

2 hours

Uganda Certificate of Education

Chemistry Practical

Paper 2

1 hour 45 minutes

CANDIDATE NAME: _____

CANDIDATE NUMBER: _____

CENTRE NUMBER: _____

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SECTION 1

Qn 1	a	b	c	d	e	f	g	h	Total	
Max marks	1	3	1	1	10	7	5	2	30	
Actual marks										

QUESTION 1

In this experiment you will investigate the rate of reaction between sodium thiosulphate and hydrochloric acid at different concentrations.

You are provided with 0.2M sodium thiosulphate, 0.1M hydrochloric acid and all the other apparatus required for the investigation.

Carry out the investigation and write a report about your findings. Your report should include the following:

a. Aim of the experiment

b. Variables of the experiment

c. Hypothesis

d. List of apparatus and materials

e. Procedure of the experiment

f. Tabulation of data

g. A graph of concentration of sodium thiosulphate against time for the investigation

h. Conclusion from the investigation

6.0. MARKING GUIDES

6.1. Marking Guide for Chemistry Paper 1

Chemistry
Paper 1
Sample paper 2021
2 hours

Uganda Certificate of Education

Chemistry

Paper 1

2 hours

CANDIDATE NAME: _____

CANDIDATE NUMBER: _____

CENTRE NUMBER: _____

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SECTION A

Qn	1	2	3	4	5	6	7	8	9	10	Total
Max marks	4	4	4	4	4	4	4	4	4	4	40
Actual marks											

SECTION B

Qn	11	12	13	14	15	16					Total
Max marks	15	15	15	15	15	15					60
Actual marks											

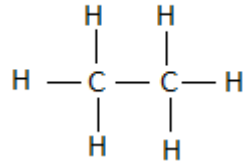
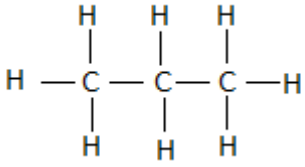
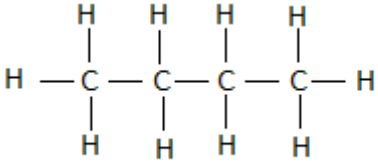
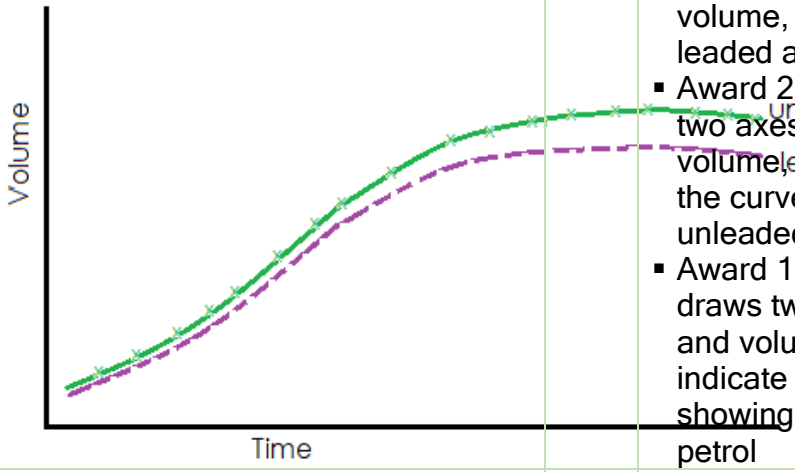
QUESTION SCORING GUIDE			
ITEM No.	DETAILS OF ANSWER	MARKS	Scoring Criteria
1	a) A chemical change is one in which new substances are formed. A physical change is one in which NO new substances are formed	1 1	▪ Award 2 marks if chemical and physical changes are clearly explained ▪ Award 1 mark if either chemical or physical change only is clearly explained
	b) Dissolving sugar in water and boiling of water are physical changes Burning of wood in air and rusting of iron are chemical changes	1 1	▪ Award 2 marks if learners correctly identify the types of changes undergone by dissolving sugar and burning wood ▪ Award 1 mark if only any of the changes is correctly identified
Total		4	
2	a) White precipitate was initially formed (turned cloudy/milky) White precipitate dissolved (cloudy/milky appearance disappeared) when excess carbon dioxide was passed through	2	▪ Award 2 marks if learner correctly mentions both the white precipitate and its dissolving in excess of carbon dioxide ▪ Award 1 mark if learner only mentions the white precipitate
	b) $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$ $CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2(aq)$	1 1	▪ Award 2 marks if both equations are correctly written, balanced with state symbols ▪ Award 1 mark if one equation is correctly written, but without state symbols
3	a) Elements; Sodium and Chlorine Ions; Na^+ and Cl^-	1 1	▪ Award 2 marks if both ions formed from the elements are correctly identified with their charges ▪ Award 1 mark if only one of the ions is correctly identified
	b) 23 + 35.5 = 58.5 $\frac{2.3}{58.5}$ = 0.039 moles	1 1	▪ Award 2 marks if RAM of sodium and chlorine are correctly added, correct substitution is done to obtain the correct number of moles ▪ Award 1 mark if RAM of NaCl is obtained, the number of moles is not correctly obtained
4.	a) $CaCO_3$	1	▪ Award 2 marks if $CaCO_3$ is mentioned, correct steps are given as mixing, heating and grinding ▪ Award 1 mark if learner only mentions $CaCO_3$, but doesn't give all the steps
	Mixing the limestone and clay Heating the mixture in the kiln Grinding and packing	1 1 1	

5	Soaps do not readily form lather when used to wash with hard water Instead, soap forms scum which can stain fabric Detergents on the other hand readily form lather but no scum and Thus, detergents are better washing agents	1 1 1 1	▪ Award 4 marks if learners clearly explain why soaps do not form lather with hard water, mentions scum as cause of stain, compares soap and detergent correctly; and states that detergents are better cleansing agents. ▪ Award 3 marks if learner clearly explain why soaps do not form lather with hard water, but doesn't mention scum as cause of stain, however, compares soap and detergent correctly; and states that detergents are better cleansing agents. ▪ Award 2 marks if learner clearly explain why soaps do not form lather with hard water, doesn't compare action of soap and detergent correctly; but states that detergents are better cleansing agents. ▪ Award 1 mark if learner only states that detergents are better cleansing agents.
6	a) Sodium, Calcium, Magnesium, Iron, Copper	1	▪ Award 1 mark if learner correctly arranges at least three of the elements
	b) Calcium is not suitable for making roofing sheets because it would react with water and get worn out	2	▪ Award 2 marks if the learner clearly explains the reason why calcium is not suitable and what would happen to it ▪ Award 1 mark if learner only mentions why calcium is not suitable, but doesn't state what exactly happens
	c) Copper because it does not react with water	1	▪ Award 1 mark if learner correctly identifies the least reactive element and gives the reason
7	a) Filtration.	1	Award 1 marks if learner identifies the correct method
	b) Because the seeds are insoluble solids that cannot pass through the sieve.	2	▪ Award 2 marks if learner identifies the residue and gives a reason ▪ Award 1 mark if learner only identifies the residue, but doesn't give a reason

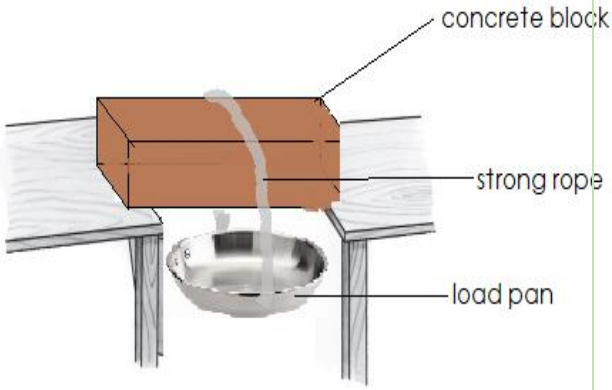
	c) The sugar crystals would dissolve in the fruit juice	1	Award 1 mark if learner correctly identifies sugar as the substance that would dissolve in the juice
8	a) Copper and tin	1	Award 1 mark if learner correctly mentions the composition of brass
	b) Brass consists of two metals with different physical properties in their pure forms. The properties of the pure metal not suitable for certain uses. Mixing the two metals to form brass improves the properties and makes the alloy a better choice for as door handles.	1 1 1	▪ Award 3 marks if learner correctly mentions that brass consists of two metals, that property of pure metal is unsuitable, and that mixture of the two metals improves properties of the alloy ▪ Award 2 marks if the learner correctly mentions that brass consists of two metals, but doesn't mention that property of pure metal is unsuitable, however, mentions that mixture of the two metals improves properties of the alloy ▪ Award 1 mark if the learner only correctly mentions that brass consists of two metals/ that property of pure metal is unsuitable/that mixture of the two metals improves properties of the alloy
9.	a) **B** because both the melting point and boiling point are below room temperature	1	▪ Award 1 mark if learner correctly states element B and gives a correct reason as boiling point are below room temperature
	b) **D** because melting point is below room temperature while the boiling point is above room temperature	1	▪ Award 1 mark if learner correctly states element D and gives a correct reason as the boiling point is above room temperature
	c) A and C because both the melting point and boiling point are above room temperature	1	▪ Award 1 mark if learner correctly states elements A and C and gives a correct reason as the boiling points are above room temperature
	d) The greater the density, the higher the melting point	1	▪ Award 1 mark if learner correctly states mentions the relationship between density and melting point
	Total	**4**	
10.	a) Application of nitrate fertilizers	1	▪ Award 1mark if learner correctly mentions application of nitrate fertilizers

	b) Run -off of rain water from settlement areas	1	▪ Award 1 mark if learner mentions run-off water from settlements
	c) Organic fertilizers such as manure	1	▪ Award 1 mark if learner mentions organic fertilizer and gives an example
	d) Materials in organic fertilizers are bio-degradable	1	▪ Award 1 mark if learner mentions that organic fertilizers are bio-degradable
Total		**4**	
11	a) To kill germs (bacteria, virus and other microorganisms)	1	▪ Award 1 mark if learner correctly mentions one use of hand sanitizer
	b) The liquid is not regarded as a chemical compound because the constituents in the liquid can be separated by physical means the composition of the components of the liquid sanitizer can be varied	1 1	▪ Award 2 marks if learner correctly explains why the liquid is not regarded as a chemical compound and gives a reason ▪ Award 1 mark if learner only mentions that the components of liquid can be separated by physical means
	c) Hand sanitizer is thick less viscous due to presence of glycerin. Thickness reduces rate of evaporation of the active component (ethanol) from skin so as to make the sanitizer be more effective action	1 1	▪ Award 2 marks if learner correctly mentions why hand sanitizer is less viscous, and the advantage of being less viscous ▪ Award 1 marks if learner correctly mentions why hand sanitizer is less viscous, but doesn't give the advantage of being less viscous
	d) - By the process of fractional distillation, based on the difference in boiling point of the three components in the liquid hand sanitizer. - When the liquid mixture of the hand sanitizer is boiled, ethanol with lowest boiling point in the mixture boils off into vapour at fastest rate. This is followed by water and then glycerin which has the highest boiling point. - The proportion of ethanol in the condensed water vapour will be the greatest, followed by water and glycerin. - When the condensed water is re-boiled, the same process of increased proportion in vapour of liquids with lower boiling point takes place.	1 1 1 1 1 1	▪ Award 5 marks if learner clearly mentions fractional distillation, how the liquid hand sanitizer is separated, the composition of hand sanitizer in water and glycerin, what happens when the water condenses, repletion of the distillation process and which separates out the highest fraction ▪ Award 3-4 marks if learner clearly mentions fractional distillation, how the liquid hand sanitizer is separated, the composition of hand sanitizer in water and glycerin, but doesn't mention what happens when the water condenses, repletion of the distillation

	- Further repeated condensing and re-boiling will result in complete separation of the components into different fractions column according to increase in their boiling points. - The liquid with the lowest boing point will separate out at the highest fraction/part of the column and the rest successively do so according their increasing boiling points		process and which separates out the highest fraction ▪ Award 1-2 marks if learner clearly mentions fractional distillation, how the liquid hand sanitizer is separated, but doesn't mention the composition of hand sanitizer in water and glycerin, what happens when the water condenses, repletion of the distillation process and which separates out the highest fraction
	e) White anhydrous copper(II)sulphate is added to the hand sanitizer A change from white to blue indicates that the liquid in the bottle contains water	1 1	▪ Award 2 marks if learner identifies anhydrous copper(II) sulphate and clearly describes the observation in colour change ▪ Award 1 mark if learner only identifies anhydrous copper(II) sulphate, but doesn't clearly describe the observation in colour change
	f) Ethanol which is the active component in hand is flammable When kept near source of fire the hand sanitizer can easily catch fire	1 1	▪ Award 2 marks if learner explains the nature of ethanol in the sanitizer as flammable and give a reason why it should not be kept near fire ▪ Award 1 mark if learner explains the nature of ethanol in the sanitizer as flammable, but doesn't give the meaning of the term flammable
Total		**15**	
12	a) Alkanes C_nH_{2n+2}	1 1	▪ Award 2 marks if learner give correct name and general formula of the alkane ▪ Award 1 mark if learner gives correct name or general formula of the alkane only
	b)	 1 1	▪ Award 3 marks if learner draws correct structures of ethane, propane and butane ▪ Award 2 marks if learner draws correct structures of any two of the alkanes: ethane, propane and butane ▪ Award 1 mark if learner draws correct structure of only one of the alkanes: ethane, propane and butane

	Ethane;  Propane;  Butane; 	1	
	c) Graph showing combustion of leaded unleaded petrol 	3	▪ Award 3 marks if learner draws two axes labeled time and volume, two curves showing leaded and unleaded petrol ▪ Award 2 marks if learner draws two axes labeled time and volume, but only shows one of the curves for leaded and unleaded petrol ▪ Award 1 marks if learner only draws two axes labeled time and volume, but doesn't indicate the two curves showing leaded and unleaded petrol
	d) Temperature change = 60 – 25 = 35, Mass of water= density x volume in cm^3 = 1 x 1000. Heat gained water = mass x specific heat capacity x temperature change: 1000 x 4.2 x 35 = 147,000 Joule (147 KJ) Molar mass of CH_4= 12+ 4 =16 890.7 KJ heat are produced by 16g of CH_4 147 KJ g of heat are produced($\frac{16}{890.7}\mathbf{x\ 147)g = 2.64g}$ of (ii) Molar mass of CH_3CH_2 OH (C_2H_6O) = (12 x 2) + (1 x 6) + (1 x 16) = 46g	1 1 1 1 1 1 1 1	▪ Award 5-6 marks if learner works out answer using first principles showing temperature difference, using correct formula for getting heat gained, finding the molar mass of methane, and heat gained by 16g of methane and then the mass that would generate heat due to the temperature rise. ▪ Award 3-4 marks if learner works out answer using first principles showing temperature difference, using correct formula for getting heat gained, but doesn't find out the molar mass of methane, and heat gained by 16g of methane and then the mass that would generate heat due to the temperature rise.

	1366.8 KJ of heat is produced by 46 g of CH_3CH_2 OH 147 KJ g of heat are produced($\frac{46}{1336,8}\mathbf{x\ 147)g = 4.95g}$ (iii) Methane because it produces more heat energy per unit mass.		▪ Award 1-2 marks if learner doesn't work out answer using first principles showing temperature difference, using correct formula for getting heat gained, doesn't find out the molar mass of methane, and heat gained by 16g of methane and then the mass that would generate heat due to the temperature rise.
Total		15	
13	a) It is hard/ not easy to break (OR it has high resistance to water)	1	▪ Award 1 mark if learner correctly states any one of the properties
	b) ingredient | cement | water | sand | Gravel Number of buckets | 1 | 1 | 3 | 4 percentage | 11.1 | 11.1 | 33.3 | 44.4 (Marks allocation Percentage of cement in the table Percentage of water in the table Percentage of sand in the table Percentage of gravel in the table)	1 1 1 1	▪ Award 4 marks if learner correctly fills in the blank spaces and obtains the correct percentages ▪ Award 2-3 marks if learner correctly fills in 2-3 spaces and obtains 2-3 of the percentages correctly ▪ Award 1mark if learner correctly fills in only one spaces and obtains one of the percentages correctly
	c) - The wooden blocks are moved close to each other with an open space between them - A concrete block is placed to rest like a bridge between the straight edges of the two wooden blocks so that either ends of the of the concrete block resting above each of the edge is the same length. - The middle part of the concrete block remains hanging in air in the space between the two straight edges of the wooden blocks so that strong rope connected load pan is suspended at the middle of the concrete block. - Several loads are added on the suspended load pan until the concrete breaks. - The procedure is repeated for the different samples of concrete blocks	1 1 1 1 3	▪ Award 6-7 marks if learner accurately describes all 4 steps to determine the strength of the concrete with illustrations and mentions repeating of the steps with different samples of concrete ▪ Award 4-5 marks if learner accurately describes all 3 steps to determine the strength of the concrete with illustrations but not mentioning repeating of the steps with different samples of concrete ▪ Award 1-3 marks if learner accurately describes all 2 steps to determine the strength of the concrete without illustrations and not mentioning repeating

	and the weights that caused them to break are compared to determine their strength  		of the steps with different samples of concrete
	d) - Cement and sand, are varied while gravel and water are kept constant/the same. - When the amount of cement is increased while that of sand is decrease at a constant amount of gravel and water, the strength of the concrete increases	1 2	▪ Award 3 marks if learner correctly mentions the constant and varied variables, giving correct explanations ▪ Award 2 marks if learner correctly mentions the constant and varied variables, without giving correct explanations ▪ Award 1 mark if learner correctly mentions only the constant or varied variables, without giving correct explanations
Total		**15**	
14	a) P is Anode, Q is Cathode	1	Award 1 mark if learner correctly names the electrodes
	b) The potassium ions being positively charged moved to the cathode and were discharged by gain of electrons. $K^+(l) + e \rightarrow K(s)$ The negatively charged iodide moved to the anode and were discharged by loss of electrons. $2I^-(l) \rightarrow I_2(s) + e$	1 1 1 1	▪ Award 4 marks if the learner accurately describes how the molten potassium is obtained, illustrating with two correctly balanced chemical equations ▪ Award 3 marks if the learner accurately describes how the molten potassium is obtained, illustrating with only one correctly balanced chemical equation ▪ Award 1-2 marks if the learner accurately describes how the molten potassium is obtained, but not illustrating with any balanced chemical equations

	c) A solution of potassium iodide contains hydrogen ions and hydroxide ion from water in addition to the potassium ions and iodide ions from the salt The positive potassium ions and hydrogen ions move to the cathode but hydrogen ions being lower in the electrochemical series are discharged in preference to potassium ions $2H^+(aq) + 2e \rightarrow H_2(g)$ The negative iodide ions and hydroxide ions move to the anode but hydroxide ions being lower in the electrochemical series are discharged in preference to iodide ions $4OH^-(aq) \rightarrow 2H_2O(g) + O_2(g) + 4e^-$	1 1 1 1 1	▪ Award 4-5 marks if learner accurately mentions the ions formed, using equations, migration of the ions to the appropriate electrodes and their discharge ▪ Award 1-2 marks if learner accurately mentions the ions formed, using equations, migration of the ions to the appropriate electrodes, but doesn't correctly explain their discharge ▪ Award 1 mark if learner accurately mentions the ions formed, without using equations, migration of the ions to the appropriate electrodes and their discharge
	d) (i) The use of molten cryolite as a solvent reduces some of the energy costs involved in extracting aluminium by allowing the ions in aluminium to move freely at a lower temperature (ii) The positive aluminium ions move to the cathode and are discharged by gaining electrons $Al^{3+}(l) + 3e \rightarrow Al(s)$ The negatively charged oxide move to the anode and are discharged by loss of electrons. $2O^{2-}(l) \rightarrow O_2(g) + 2e$	1 1 1 1 1 1	▪ Award 2 marks if correctly mentions the use of cryolite and explains the reason why it is used ▪ Award 1 mark if correctly mentions the use of cryolite, but no explanation of the reason why it is used ▪ Award 4 marks if the equations for the reactions at the cathode and anode are correctly written and balanced with state symbols ▪ Award 3 marks if the equations for the reactions at the cathode and anode are correctly written and only one of the balanced chemical equations with state symbols is correct ▪ Award 1-2 marks if the only one of the equations for the reactions at the cathode and anode is correctly written, but not balanced and without state symbols
TOTAL		**15**	
15	a) Neutralization	1	
	b) Solution B;	1 1	

	Solution B has a smaller the pH value than A, therefore solution B is more acidic than A		
	c) (i) In solution sulphuric acid is fully/completely in ionized $H_2SO_4(aq) \rightarrow 2\ H^+(aq) + \ SO_4^{2-}(aq)$ In solution carbonic acid is partially ionized $H_2CO_3(aq) \rightleftharpoons 2\ H^+(aq) + CO_3^{2-}(aq)$ (ii) - Dry hydrogen chloride gas is covalent and does not have free hydrogen ions to be acidic, when dissolved in water, it is ionized to form free hydrogen and chloride ions, - The ionization hydrogen chloride into free ions produces free hydrogen and chloride ions forming hydrochloric acid that turns red litmus blue $HCl(g) \rightarrow H^+(aq) + Cl^-(aq)$ (iii) Zinc chloride reacts with sulphuric acid to form zinc sulphate which is a soluble salt whose solution is colourless. However, calcium chloride reacts with dilute sulphuric acid to form insoluble calcium sulphate which is a white precipitate. $H_2SO_4(aq) + ZnCl_2(aq) \rightarrow 2HCl(aq) + ZnSO_4(aq)$ $H_2SO_4(aq) + CaCl_2(aq) \rightarrow 2\ HCl(aq) + CaSO_4(aq)$	1 1 1 1 1 1 1 1 1 1 1 1	
Total		15	
16	a) irregularly distributed coloured patches Crystal structure not visible	1 1	Award 2 marks if description of colour is stated as irregularly and mentions that crystal structure not visible
	b) i) 100 - (51.6 + 9.7) =100-61.3 =38.7% ii) Elements | Cu Percentages | 51.6 Moles: (Divide by atomic mass) | $\frac{51.6}{64} = 0.806$ $\frac{9.7}{12} = 0.808$ $\frac{38.7}{16} = 2.42$ Ratio of moles (divide by the smallest value) | $\frac{0.806}{0.806} = 1$ $\frac{0.808}{0.806} = 1$ $\frac{2.42}{0.806} = 3$ | (Cu : C : O	1 1 1 1	

	Empirical formula		$CuCO_3$

(iii) $(CuCO_3)\ n = 124$ — 1

$(1 \times 64)n + (1 \times 12)n + (3 \times 16)n = 124n = 124$ — 1

$n = 1$

Molecular formular is $CuCO_3$

c)

(i) $CuCO_3(s) \rightarrow CuCO_3s) + CO_2(g)$ — 1

(ii) 124 g of $CuCO_3$ produces 22,4 dm^3 — 1

1g of $CuCO_3$ produces $\frac{22.4}{124} dm^3$ — 1

2g of $CuCO_3$ produced 22,4 dm^3 — 1

$(\frac{\mathbf{22.4}}{\mathbf{124}} \mathbf{x 6.2})$ dm^3 — 1

$= \mathbf{1.12}$

dm^3

(iii) Molecular sass of residue = 16 + 64 = 80

124 g of $CuCO_3$ produced 80g of CuO

1g of $CuCO_3$ produced 22,4 dm3 $(\frac{\mathbf{80}}{\mathbf{124}} \times 6.2)$g of CuO

=4g

Change in mass = (6.2 - 4) = 2.2g

Total		15	

6.2. Sample Marking Guide for Chemistry Paper

Chemistry

Practical Paper

Paper 2

Sample paper 2021

2 hours

Uganda Certificate of Education

Chemistry Practical

Paper 2

2 hours

CANDIDATE NAME: _____

CANDIDATE NUMBER: _____

CENTRE NUMBER: _____

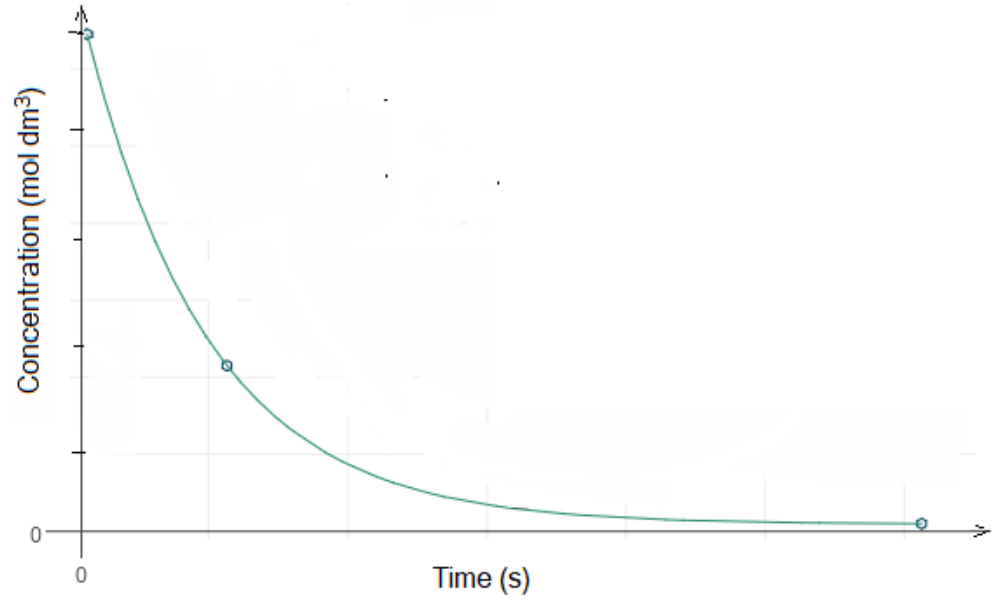
THIS PAGE IS FOR EXAMINER USE ONLY

Do not write in the boxes on this page. The examiner will use them to keep a record of your marks.

SECTION 1

Qn 1	a	b	c	d	e	f	g	h		
Max marks	1	3	1	1	10	7	5	2	30	
Actual marks										

<table>
<tr><th>Item no.</th><th>Responses</th><th>Marks</th></tr>
<tr><td>a.</td><td>Aim of the experiment
To investigate the effect of concentration on the rate of reaction between sodium thiosulphate and hydrochloric acid</td><td>1</td></tr>
<tr><td>b.</td><td>Variables of the experiment
i) Manipulated: Concentrations of sodium thiosulphate solution
ii) Responding: Time of the disappearance of “X”
iii) Controlled: Temperature and volume of sodium thiosulphate and hydrochloric acid</td><td>3</td></tr>
<tr><td>c.</td><td>Hypothesis;
The higher the concentration of sodium thiosulphate the faster the disappearance of “X”</td><td>1</td></tr>
<tr><td>d.</td><td>Apparatus:
Measuring cylinders (50cm^3 and 10 cm^3), conical flask, filter paper, stop clock (stop watch).</td><td>1</td></tr>
<tr><td>e.</td><td>Tabulation of results
<table>
<tr><td>Experiment</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Volume of sodium thiosulphate(cm^3)</td><td>50</td><td>40</td><td>30</td><td>20</td><td>10</td></tr>
<tr><td>Volume of hydrochloric acid(cm^3)</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td>Volume of water(cm^3)</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td></tr>
<tr><td>Time for disappearance of “X” t(seconds)</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>10</td></tr>
<tr><td>f.</td><td>Procedure
1. 50cm^3 of sodium thiosulphate is measured into a clean conical flask
2. The flask is placed onto a filter paper marked with “X”
3. 10cm^3 of hydrochloric acid is added onto the sodium thiosulphate as a stop clock is simultaneously started.
4. The mixture in the conical flask is swirled and the “X” mark is observed from the top of the conical flask.
5. The stop watch is stopped as soon as the” X” mark disappears from the view.
6. The conical flask is emptied and cleaned.
7. Steps 1 to 6 are repeated using different volumes of sodium thiosulphate but each time topping the deficit volume with water.</td><td>7</td></tr>
<tr><td>g.</td><td>Interpretation
A graph of concentration of sodium thiosulphate against time is drawn and has a shape below:</td><td></td></tr>
</table>

Item no.	Responses	Marks
		5
h.	Conclusion The rate of chemical reaction increases with increase in concentration of the reactants.	2
	Total	**30**