Candidate's Name:……..……..... Index No: …….

Signature……. School ……

P525/1
CHEMISTRY
Paper 1
July/ August 2019
2¾ hours

BUGANDA EXAMINATION COUNCIL MOCKS – 2019

UGANDA ADVANCED CERTIFICATE OF EDUCATION

CHEMISTRY
Paper 1
2 Hours 45 minutes

INSTRUCTIONS TO CANDIDATES

*Answer **all** questions in section **A** and **six** questions in section **B**.*
All questions must be answered in the spaces provided.
The Periodic Table, with relative atomic masses, is supplied.
Mathematical tables (3-figure table) are adequate or non-programmable scientific electronic calculators may be used.
Illustrate your answers with equations where applicable.
Where necessary, use the following:
Molar gas constant, R $= 8.31\ JK^{-1}mol^{-1}$.
Molar volume of gas at s.t.p is $=22.4$ *litres.*
Standard temperature $= 273\ K$
Standard pressure $= 101325\ Nm^{-2}$

For Examiners' use Only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

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Section A: (46 marks)

Answer **all** questions from this section

1. (a) Complete the following equations.

(i) $^{27}_{13}Al + {}^{1}_{0}n \rightarrow \beta +$ ……. (01 mark)

(ii) $4^{1}_{1}H \rightarrow {}^{4}_{2}He +$ ……. (01 mark)

(iii) $^{239}_{92}U \rightarrow {}^{239}_{91}U +$ ……. (01 mark)

(b) An element **X** has two naturally occurring isotopes with isotopic masses and relative abundances as shown below.

Isotopic mass	**Relative atomic mass**
79	50.5
81	49.5

(i) State what is meant by the term **relative atomic mass**. (01 mark)

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(ii) Calculate the average atomic mass of **X**. (02 marks)

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2. Write equation for the reaction between hot concentrated aqueous sodium hydroxide solution and.

(a) Aluminium oxide. (1½ marks)

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(b) Beryllium oxide. (1½ marks)

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(c) Lead(IV) oxide. (1½ marks)

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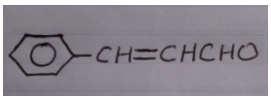
3. An organic compound **R** has the structure



(a) Name the functional groups present in **R**. (02 marks)

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(b) Write equation for the reaction between **R** and

(i) bromine in tetrachloromethane. (01 mark)

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(ii) saturated sodium hydrogensulphite solution. (01 mark)

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(c) State what would be observed in (b)(i). (01 mark)

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4. (a) Define the term **heat of formation**. (1 mark)

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(b) The enthalpies for formation of some selected compounds are shown in the table below.

Compound	$H_2O(g)$	$CO(g)$	$C_8H_{18}(g)$
Enthalpy of formation (kJ mol^{-1})	-242	-111	-169

Calculate the enthalpy change for the following reaction.

$8CO(g) + 17H_2(g) \xrightarrow{Fe/CO\ catalyst} C_8H_{18}(g) + 8H_2O(g)$ (03 marks)

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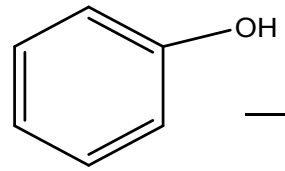
5. Complete the following reaction equations and write the IUPAC names of the main organic product in each case.

(a)  $\xrightarrow[200^oC]{H_2/Ni}$ .....(0.5 mark)

Name of product..... (0½ mark)

(b) $HCO_2H + CH_3CH_2CH_2OH \xrightarrow[reflux]{dry\ HCl}$ ... ...(01 mark)

Name of product.....(0½ mark)

(c) $C_6H_5Br + CH_3I \xrightarrow[dry\ ether]{Na(s)}$ ... ...(01 mark)

Name of product.....(0½ mark)

(d) $CH_3CH = CH_2 \xrightarrow{Br_{2/H_2O}}$ ... ...(01 mark)

Name of product.....(0½ mark)

6. Compound **Q** is a green solid which dissolves in water to give a pale green solution. The solution of **Q** formed a red precipitate with butanedionedioxime solution and a reddish brown solution when a few drops of iron(III) chloride solution were added to it. When **Q** was heated with concentrated sulphuric acid, methanoic acid was formed.

(a) Identify **Q**..... (01 mark)

(b) Write equation for the reaction that took place when **Q** was heated with concentrated sulphuric acid. (1½ marks)

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(c) Write equation(s) for the reaction(s) that take place when excess ammonia solution is added to a solution of **Q**. (2½ marks)

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7. **20 cm^3** of a hydrocarbon **Z** (C_xH_y) was exploded with 200 cm^3 of oxygen. On cooling to room temperature, the residual gases occupied 160 cm^3. When the residual gases were passed through sodium hydroxide solution, the volume reduced to 20 cm^3.

(a) (i) Write equation for the reaction between **Z** and oxygen. (01 mark)

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(ii) Determine the molecular formula of **Z**. (2½ marks)

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(b) Compound **Z** burns with a sooty flame. When **Z** was treated with hot alkaline potassium managnate(VII) solution followed by dilute hydrochloric acid, compound T was formed. T reacts with magnesium ribbon liberating hydrogen gas.

(i) Identify: (1 mark)

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(ii) Write equation to show how **Z** can be can obtained from an alkyne. (1½ marks)

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8. (a) State what is meant by the term an **ideal solution**. (01 mark)

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(b) The vapour pressure of water and methanol are 3.173kPa and 16.785kPa respectively at 293K.

Assuming that the mixture of the two liquids behaves as an ideal solution and that it contains 0.88 mole fraction of water.

Calculate the:

(i) vapour pressure of the mixture. (2½ marks)

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(ii) percentage of methanol in the vapour. (01 mark)

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9. During the manufacture of sulphuric acid by Contact process, sulphur dioxide is catalytically oxidized to sulphur trioxide according to the following equation:
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_2(g), \Delta H^{\theta} = -197\ kJ\ mol^{-1}$

The sulphur trioxide formed is then absorbed in 98% sulphuric acid to form compound T.

(a) State the industrial conditions used to obtain maximum yield of sulphur trioxide. (1½ marks)

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(b) Write equation to show how compound **T** can be converted into sulphuric acid. (01 mark)

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(c) Write equation for the reaction between hot concentrated sulphuric acid and

(i) carbon. (01 mark)

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(ii) hydrogen iodide. (01 mark)

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(d) State what would be observed in (c)(i). (0½ marks)

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Section B: (54 marks)

Answer **six** questions from this section.
Additional questions will **not** be marked.

10. State what would be observed and write equation for the reaction that would take place when

(a) a mixture of acidified potassium manganate(VII) and sodium ethanedioate is heated. (2½ marks)

Equation

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Observations

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(b) acidified potassium chromate(VI) solution is added to hydrogen peroxide. (2½ marks)

Equation

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Observations

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(c) 3-4 drops of bromine water is added to phenylamine. (02 marks)

Equation

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Observations

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(d) benzoic acid is added to a saturated solution of sodium hydrogencarbonate.(02 marks)

Equation

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Observations

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11. (a) State what is meant by the term **freezing point constant** of a substance. (01 mark)

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(b) The table below shows the freezing point of various concentrations of a non−volatile solute D in water at 760 mmHg.

Concentration of D $/g\ dm^{-3}$	0	30	60	90	120	150
Freezing point/℃	0	-0.16	-0.32	-0.49	-0.65	-0.81

Plot a graph of freezing point depression against concentration of D.
(*Use the graph paper provided*) (04marks)

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(c) Determine the

(i) slope of the graph you have drawn in (b). (1½ marks)

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(ii) relative molecular mass of D. (2½marks)

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12. Write a mechanism for the reaction that occurs between a mixture of

(a) ethanol and concentrated sulphuric acid at 140°C. (2½marks)

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(b) boiling methylbenzene and chlorine in the presence of ultraviolet light. (03 marks)

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(c) propanal and phenylhydrazine. (3½ marks)

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13. Write equations to show how each of chlorine and iodine react with:

(a) sodium iodide solution.

(i) Chlorine. (1½ marks)

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(ii) Iodine. (1½ marks)

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(b) sodium thiosulphate solution.

(i) Chlorine. (1½ marks)

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(ii) Iodine. (1½ marks)

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(c) hot concentrated potassium hydroxide solution.

(i) Chlorine. (1½ marks)

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(ii) Iodine. (1½ marks)

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14. (a) State the **two** methods by which the solubility of a sparingly soluble salt may be determined. (01 mark)

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(b) Copper(II) iodate is sparingly soluble in water.

Write

(i) an equation for the solubility of copper(II) iodate. (01 mark)

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(ii) an expression for the solubility product, K_{sp}, of copper(II) iodate. (0½ mark)

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(c) The solubility product of copper(II) iodate at 25℃ is $1.4 \times 10^{-7} mol^{-3} dm^{-9}$.

Calculate the solubility in grams per litre at 25℃ of copper(II) iodate in

(i) water. (2½ marks)

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(ii) a 0.1 M potassium iodate. (2½ marks)

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(d) Comment on your answer in (c) above. (1½ marks)

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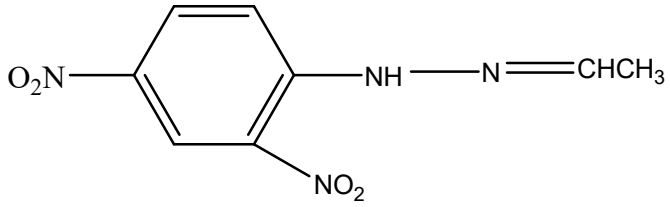
15. Write equations to show how the following compounds can be synthesized. Indicate the condition(s) for the reaction(s).

(a)  from ethene (02 marks)

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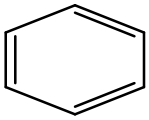
(b)  from phenylmethanol. (2½ marks)

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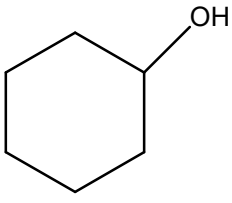
(c)  from ethyne (4.5 marks)

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16. (a) State how the following anhydrous chlorides can be prepared.

(i) Tin(II) chloride. (01 mark)

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(ii) Tin(IV) chloride. (01 mark)

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(b) State why tin(IV) chloride is formed but tin(IV) bromide is not.
(02 marks)

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(c) Write equation for the reaction between water and the chloride in (a)

(i) tin(II) chloride. (01 mark)

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(ii) tin(IV) chloride. (01 mark)

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(d) (i) State what would be observed and write equation for the reaction that would take place when tin(II) chloride is added to acidified aqueous solution of sodium dichromate(VII).

Observation. (01 mark)

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Equation. (1½ marks)

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(ii) Give a reason for your answer in (d)(i). (0½ mark)

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17. (a) Rubber is a natural polymer whose monomer is 2−methylbuta−1,3−diene.
Write the structure of

(i) the monomer of rubber. (0½ mark)

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(ii) the structural formula of rubber. (01 mark)

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(b) Name the type of polymerization involved in the formation of rubber.
(0½ mark)

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(c) State how

(i) vulcanization of natural rubber is carried out. (01 mark)

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(ii) vulcanization improves the properties of natural rubber. (03 marks)

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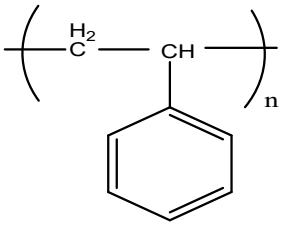
(d) The structural formula of a polymer **R** is



The osmotic pressure of a solution containing 5.5 $g\ dm^{-3}$ of R in benzene is 106.39 Pa at 20℃.

(i) Calculate the relative molecular mass of R. (02 marks)

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(ii) Determine the number of monomers that formed the polymer R.
(01 mark)

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..... **END**

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