

P525/1
CHEMISTRY
Paper 1
July/Aug. 2023
2 ¾ hours



KALUSSA MOCK EXAMINATIONS BOARD
Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

Duration: 2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES:

- This paper consists of two sections A and B
- Section A is compulsory.
- Attempt only six questions in section B
- Answers must be written in the spaces provided only

For Examiner's Use Only																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

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Turn Over

SECTION A (46 marks)

1. The table below shows the enthalpies of formation of hydrogen halides and bond energy of some bonds.

Hydrogen halide	Enthalpy of formation (KJmol ⁻¹)	Bonds	Bond energy (KJmol ⁻¹)
HF	-271.2	C-H	414
HCl	-92.3	H-Cl	431
HBr	-36.2	C-Cl	242
HI	+26.5	H-H	436

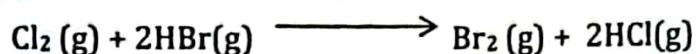
- (a) What do you understand by the term Bond energy? (1 mark)

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- (b) (i) Calculate the enthalpy of reaction of the reaction below (1½ marks)



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- (ii) Determine the bond energy of the Cl-Cl bond (2½ marks)

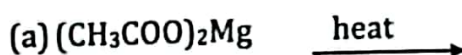
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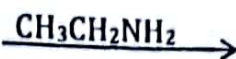
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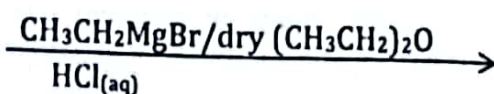
2. Complete the following organic equations and in each case name the main organic product



Name (1 mark)

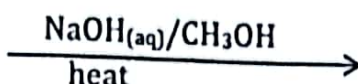
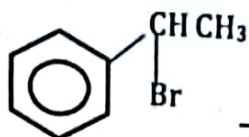


Name(1mark)



Name(1mark)

(d)

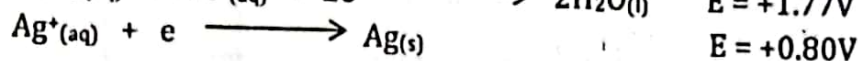
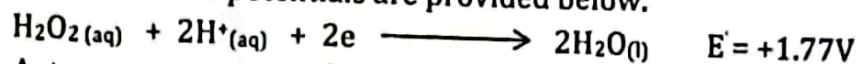


Name(1mark)

3. (a) Define the term "standard electrode potential". (1mark)

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(b) Some electrode potentials are provided below.



(i) Write the cell notation for the cell reaction of silver and hydrogen peroxide. (1mark)

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(ii) Write the equation of the reaction and calculate the emf of the cell. (2½marks)

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(iii) Comment on the feasibility of the cell reaction. (1 mks)

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4. (a) In the complex $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ State;

(i) The oxidation state of cobalt. ($\frac{1}{2}$ mark)

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(ii) The coordination number of cobalt. ($\frac{1}{2}$ markk)

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(iii) The name of the complex. (1mk)

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(b)

State what would be observed and write the equation when concentrated hydrochloric acid is added dropwise to the solution containing the complex in

(a) above and name the product. (2mks)

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5. (a) Define the term Radioactivity. (1mk)

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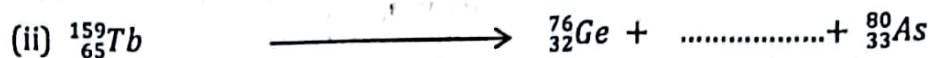
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(b) Complete the following equation and name the particle emitted.(2mks)



Name



Name

(c) Write the equation for the disintegration of $^{223}_{88}\text{Ra}$ to $^{211}_{84}\text{Po}$ with emission of alpha and beta particles. (1mks)

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(d) Give two applications of Radioactivity. (1mark)

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6. (a) Both Beryllium and calcium are group(II) elements. Write the equations of the hydrolysis of their carbides. (3marks)

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(b) Describe how you can prepare ethanol from a product of hydrolysis of beryllium carbide. (Don't use equations). (3marks)

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7. (a) Write the general outermost electronic configuration of group (III) elements. (1mark)

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(b) Even though Boron is a group (III) element it has properties similar to silicon of group(IV). List three of those properties. (1½mks)

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(c) Explain why boron and silicon have similar properties (3mks)

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8. An organic compound Q has a molecular formula $C_3H_4O_2$, it reacts with methanol in presence of concentrated sulphuric acid when heated to form a product with a sweet fruity smell and turns bromine liquid from red to colourless.

(a) Write the structural formula of Q (1mark)

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(b) Outline the mechanism for its reaction with methanol in presence of concentrated sulphuric acid when heated. (4marks)

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9. An oxide of lead has 90.66% lead.

(a) (i) Determine its molecular formula, given that the molecular formula is a multiple of one of its empirical formula. (3marks)

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(ii) Name the oxide (½mark)

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(b) (i) Write an equation of its reaction with nitric acid. (1½marks)

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(ii) State the conditions for the reaction in (b) (i) above. (1mark)

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SECTION B (54MARKS)

10. The rate equation for a reaction between substances A , B and C is of the form.

Rate = $k[A]^x[B]^y[C]^z$ where $x+y+z = 3$. The following data were obtained in a series of experiments at a constant temperature .

Expt	[A]/ moldm ⁻³	[B]moldm ⁻³	[C]moldm ⁻³	Rate (moldm ⁻³ s ⁻¹)
1	0.10	0.20	0.20	8.0×10^{-5}
2	0.10	0.05	0.20	2.0×10^{-5}
3	0.05	0.20	0.20	2.0×10^{-5}
4	0.10	0.10	0.10	T

(a) What do you understand by the term rate equation? (1 mark)

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(b) Determine the order of reaction with respect to

(i) A, B and C (3 marks)

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(ii) determine the rate constant and indicate its units. (2 marks)

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(iii) determine the value of T (1 mark)

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(iv) What would happen to the rate of reaction when the concentration of B is halved, C is doubled and A is left constant? (1 mark)

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(c) Explain how addition of a catalyst will affect the rate of reaction. (1 mark)

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11. (a) State a reagent that gives the same observation for both Methanoic acid and Methanal and give the observation for both. Write the equation of reaction of reaction of the reagent with methanoic acid. (3marks)

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(b) Using appropriate reagents distinguish between the following compounds and in each case give the observation.

(i) 2-Bromomethylbenzene from Bromomethylbenzene (3marks)

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(ii) Propanone from Butanal (3marks)

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12. (a) Sulphuric acid is prepared by the contact process. Write the equations for the production of sulphuric acid from sulphur trioxide.(3marks)

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(b) Describe the reactions of sulphuric acid with;

(i) carbon(2marks)

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(ii) Tin (2marks)

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(iii) Lead(2marks)

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13. (a) State Raoult's Law. (1mark)

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(b) (i) Water and ethanol form a solution that deviates from Raoult's law. The solution has a constant boiling point mixture at 68.17°C and it contains 4% water. Sketch a boiling point composition diagram given that water boils at 100°C and ethanol at 78°C . (3marks)

(ii) Explain why the solution deviates from Raoult's law. (2marks)

(c) A solution containing 30% ethanol and 70% 1-propanol doesn't deviate from Raoult's law. Give that the vapour pressure of pure ethanol and 1-propanol is 7.83kPa and 2.8kPa respectively. Calculate the total pressure of the solution and the composition of vapour. (3marks)

14. When 5.0g of an organic compound R were burnt in oxygen, it gave 7.658.18cm³ of carbon dioxide and 2.88g of water at room temperature.
(a) Calculate the molecular formula of R, given that the vapour density of R is 47 times that of hydrogen gas. (4marks)

(b) Show how R can be synthesized from ethyne. (5marks)

15. Silicon, sulphur and phosphorous are period 3 elements.

(a) Describe how the elements react with nitric acid. (4½marks)

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(b)(i) Write the formulae of the chlorides of Sulphur, Silicon and Phosphorous. (1½mks)

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(ii) Write the hydrolysis of the chlorides in (b)(i) above. (3mks)

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16. State what would be observed if the following are mixed and outline the mechanism of reaction.

(a) Propanal and brady's reagent. (4marks)

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(b) 1-Bromocyclohexene and bromine water (2½ marks)

(c) Propanone and sodium hydrogensulphite (2½ marks)

17. Explain the following observations

(a) Hydrofluoric acid is a weaker acid than hydro bromic acid. (3 marks)

(b) The pH of a solution of Aluminium chloride is less than 7. (3 marks)

(c) Phenylamine is a weaker base than ethylamine. (3 marks)

THE PRIODIC TABLE

I	II											III	IV	V	VI	VII	VIII	
1.0 H 1																		4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10	
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.5 Cl 17	40.0 Ar 18	
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	63.5 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36	
35.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54	
133 Cs 55	137 Ba 56		178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86	
223 Fr 87	226 Ra 88																	
			139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Ln 71	
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	252 Es 99	257 Fm 100	258 Md 101	259 No 102	260 Lm 103	

END