FORM TP 2013153



MAY/JUNE 2013

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

CHEMISTRY

UNIT 1 - Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

- 1. This paper consists of SIX questions in two sections. Answer ALL questions.
- 2. For Section A, write your answers in the spaces provided in this booklet.
- 3. For Section B, write your answers in the spaces provided at the end of each question in this booklet.
- 4. ALL working MUST be shown.
- 5. You may use a silent, non-programmable calculator to answer questions.
- 6. A data booklet is provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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SECTION A

Answer ALL questions in this section.

Write your answers in the spaces provided in this booklet.

MODULE 1

FUNDAMENTALS IN CHEMISTRY

1.	(a)	Defin tl	he terms
		(i)	oxidation
		(ii)	reduction .
			[2 marks]
	(b)		n acidifie solution of potassium manganate(VII) is added to hydrogen peroxide a action occurs and the observations include effervescence and a colour change.
		(i)	State the colour change observed.
		-	[1 mark]
			Write the TWO half equations for the reaction, indicating the changes in oxidation number.
		-	
		1	
			[6 marks]
	×	(iii)	State the roles of the two reagents, potassium manganate(VII) and hydrogen peroxide.
		•	[2 marks]

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Total 15 marks

KINETICS AND EQUILIBRIA

2.	(a)	Defin t	the term 'buffer solution'.	
				V
				[2 marks]
	(b)		n, using relevant equations, how a buffer solution containing ammonia e reacts in the following circumstances:	and ammonium
		(i)	Contamination of the buffer with a small quantity of base	
			-	
				[2 marks]
		(ii)	Contamination of the buffer with a small quantity of acid	
		1		
				[2 marks]

(c)	Calculate the pH of a buffer solution made from 20.00 cm ³ of 0.10 mol dm ⁻³ propanoic acid (CH ₃ CH ₂ COOH) and 40.00 cm ³ of 0.050 mol dm ⁻³ sodium propanoate (CH ₃ CH ₂ COONa).
	(The acid dissociation constant, K_a , for propanoic acid is 1.22×10^{-5} .)
(d)	[5 marks] The experimental determination of the pH of the buffer solution in 2 (c) was carried out by a
	group of students. (i) List TWO relevant pieces of apparatus and/or materials that may have been used to carry out the experiment.
	[2 marks] (ii) Describe TWO relevant steps taken by the students to determine the pH of the buffer.
Ň	[2 marks]
00	[2 marks]
	Total 15 marks
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CHEMISTRY OF THE ELEMENTS

3.	(a)	(i)	Outline TWO reasons why aqueous hydroxide ions, OH ⁻ (aq), are used in the identificatio of cations.
			[2 marks]
		(ii)	Table 1 shows an incomplete list of a number of cations with the expected results of their respective flam tests.
			Complete the table.

TABLE 1: FLAME TEST RESULTS

Element	Na ⁺	K ⁺	Ca ²⁺	Ba ²⁺	Cu ²⁺
Colour of Flame		2			Green

[2 marks]

(b) M is a mixture of a soluble and an insoluble salt. Table 2 is an incomplete laboratory report of tests carried out on M.

Complete Table 2 by writing the relevant observations.

TABLE 2: LABORATORY REPORT

No.	Tests	Observations	Inferences
(i)	Add dil. HCl to M and warm.	•	SO ₂ evolved
(ii)	Shake M with water and then filte. To the colourless filtrate, add acidifie $Cr_2O_7^{2-}$ (aq).		SO ₃ ²⁻ (aq) present
(iii)	Dissolve residue from (ii) in dil. HNO ₃ . Add a) KI (aq) and b) boil for 1 minute.		Pb ²⁺ present PbI ₂ formed

[5 marks]

X	V		
A .		recitify the suits in mixture ivi.	
	(ii)	Identify the salts in mixture M.	
			[4 marks
		·	r.4 1
(c)	(i)	Write half equations to explain the observation in test (b) (ii).	
/ \	/ · \	TTT 1: 1 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	

[2 marks]

Total 15 marks

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SECTION B

Answer ALL questions.

Write your answers in the spaces provided at the end of each question.

MODULE 1

FUNDAMENTALS IN CHEMISTRY

4.		m oxide, quicklime, is produced by roasting limestone. Quicklime is used to new of soils.	tralize the
	(a)	Defin the term 'standard enthalpy of formation'.	[2 marks]
	(b)	Write a balanced equation for formation of CaO(s).	[1 mark]
	(c)	Construct a Born-Haber cycle for the formation of CaO(s) showing clearly, using the steps of the enthalpy changes involved.	equations, [6 marks]
	(d)	Distinguish between 'exothermic enthalpy change' and 'endothermic enthalpy charge enthalpy changes from your Born-Haber cycle in (c) to support your answer.	nge', citing [4 marks]
	(e)	Explain, by writing an equation, how the data from the Born-Haber cycle can calculate the lattice energy of CaO(s).	be used to [2 marks]
Write	the ansv	Wer to Question 4 here.	15 marks
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Vrite the answer to Question 4 here.	<u> </u>
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KINETICS AND EQUILIBRIA

- 5. (a) With the aid of appropriate Boltzmann distribution curves, (using the axes provided on page 12) describe the effect of EACH of the following on reaction rates:
 - (i) Temperature [4 marks]
 - (ii) Catalyst [3 marks]
 - (b) The values of initial rates measured for the reaction below are recorded in Table 3.

$$S_2O_8^{2-} + 2I^- \longrightarrow 2SO_4^{2-} + I_2$$

TABLE 3: INITIAL RATES DATA

Experiment	[S ₂ O ₈ ²⁻] (mol dm ⁻³)	[I ⁻] (mo) dm ⁻³)	Initial Rate (mol dm ⁻³ min ⁻¹)
1	0.15	0.25	1.4 × 10 ⁻⁵
2	0.15	0.50	5.6 × 10 ⁻⁵
3	0.075	0.50	2.8 × 10 ⁻⁵
4	0.075	0.25	7.0×10^{-6}

- (i) Use the information from the table to deduce the rate equation and calculate the overall order of the reaction. [5 marks]
- (ii) Calculate the
 - a) rate constant

[2 marks]

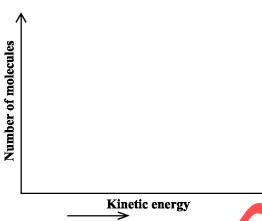
b) initial rate of the reaction when $[S_2O_8^{2-}]_0 = 0.13$ mol dm⁻³ and $[I^-]_0 = 0.32$ mol dm⁻³.

[1 mark]

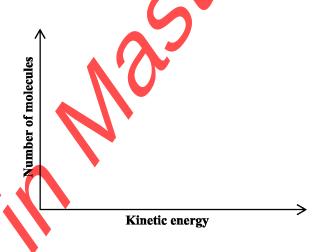
Total 15 marks

Write the answer to Question 5 here.





(ii) Catalyst



Write the answer to Question 5 here.	
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CHEMISTRY OF THE ELEMENTS

6.	(a)	The atomic radii across the firs row of transition elements show a gra	ndual decrease.
		Outline the reasons for this trend.	[2 marks]
	(b)	(i) State the FULL electronic configuratio for the ions, Ti ³⁺ ; Fe ²	+; Ct ³⁺ . [3 marks]
		(ii) Explain, in terms of electronic configuration why iron(II) iron(III).	is readily converted to [2 marks]
	(c)	When aqueous copper ions are treated separately with aqueous amphydrochloric acid, the complex ions $[Cu(NH_3)_4(H_2O)_2]^{2^4}$ and $[CuCl_4]^2$	
		State the name of the shape for	
		(i) EACH of the complex ions	[2 marks]
		(ii) a complex ion of the formula $[ML_4]^4$ where M is the central the ligand.	metal and L represents [1 mark]
	(d)	When titanium(III) chloride is dissolved in water, a purple solution is	formed.
		Explain carefully how the colour is produced.	[5 marks]
Write	the ans	swer to Question 6 here.	Total 15 marks
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