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## 545/2 **S4 CHEMISTRY**

Exam 5

## PAPER 2

**DURATION: 2 HOUR** 

## **Instructions:**

- Section A consists of 10 structured questions. Attempt all questions in this section.

  Answers to these questions must be written in the spaces provided **ONLY.**
- Section B consists of 4 semi-structured questions. Attempt **ONLY TWO** questions from this section. Answers to the questions must be written in the answer booklets provided
- In both sections all working must be shown clearly

	FOR EXAMINER'S USE ONLY													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

## **SECTIOIN A: 50 MARKS**)

1.	(a) Write	f water									
			(1 mark)								
	(b) State	one physical and one chemical method of removing permanent hard	dness of water.								
	Physi	ical method.	(½ mark)								
		nical method	(1 mark)								
	(c) Write	(c) Write equation for the reaction that takes place during removal of permanent hardness of									
	water by	chemical method.	(1 ½ marks)								
	(d) State one advantage and one disadvantage of hard water.										
		(1/ manula)									
		ıntages	(½ mark)								
		dvantage	( ½ marks)								
2.	(a) During the laboratory preparation of hydrogen at room temperature, zinc metal is reacted										
	with sulp	phuric acid or hydrochloric acid but not nitric or ethanoic acid									
	(i)	Write an ionic equation for the reaction leading to the formation	of hydrogen								
			(1 ½ marks)								
			• • • • • • • • • • • • • • • • • • • •								
	(ii)	State the condition for the reaction in (a) (i)	( ½ mark)								
	(iii)	State the method of collecting hydrogen	(½ mark)								

	using;	
	- nitric acid	(½ mark)
	- Ethanoic acid	( ½ mark)
	(b) Write equation for the reaction that	would take place if dry hydrogen is passed overheated
	copper (II) oxide.	(1 ½ marks)
3.		d through a solution containing a cation X, a white
	heated, but recrystallized on cooling the	rmed. The precipitate dissolved when the mixture was
	(i) State the identity of X.	(1 mark)
		reaction that took place between hydrogen chloride
	and X.	( 1 ½ mark)
	(b) Silver nitrate can react with sodium of following equation:	chloride to form silver chloride according to the
	$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \longrightarrow AgCl$	.(s)
	Calculate the maximum mass of silve	er chloride that would be formed if excess sodium
	chloride solution was added to 20.0cm	m <sup>3</sup> of a 0.5M silver nitrate solution
	(Ag = 108, Cl = 35.5)	
		(2 ½ marks)

Give a reason why laboratory preparation of hydrogen from zinc cannot be done

(iv)

(i)	phuric acid can react with ethanol to produce ethene Write equation for the reaction leading to the fo	rmation of ethene (1 mark)
(ii)	State the conditions for the reaction in a (i)	( 1 ½ marks)
(iii)	Write equation for the reaction of ethene leading	g to formation of
	1, 2 – dibromoethane.	(1 mark)
(b) Wh	nen butane is burnt in oxygen, the reaction is accomplowing equation: $\frac{10}{10} + 13O_{2(g)} \longrightarrow 10H_2O_{(l)} + 8CO_{2(g)}$	
	ggest one use of butane.	(½ mark)
	lculate the heat energy change obtained when 5.6dm	
	p (1 mole of a gas occupies 22.4dm <sup>3</sup> at s.t.p)	(2 marks)
•••••		
•••••		
Warm	dilute nitric acid was added to a mixture of lead (II)	oxide and copper (II) oxide and
the solu	ution formed divided into two portions.	
(a) To	the first portion was added dilute sodium hydroxide	drop wise until in excess and
	ered.	
	entify the cation in the	
(i)	Filtrate	(1 mark)

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(ii)	Residue	(1 mark)
(iii)	Write equation for the reaction that led to the for	
		(1 ½ marks)
	ne second portion was added aqueous ammonia dro ur of the;	p wise until in excess. State the
(i)	Residue	(½ mark)
(ii)	Filtrate	( ½ mark)
	e the formula of the cation that was in the filtrate.	(1 mark)
During l	aboratory preparation of carbon dioxide, calcium ca	arbonate reacts with dilute
hydroch	loric acid according to the following equation.	
CaCO <sub>3(s)</sub>	$_{0} + 2HCl_{(aq)}$ $\longrightarrow$ $CaCl_{2(aq)} + CO_{2(g)} + H_{2}O_{(l)}$	)
	ulate the maximum volume of carbon dioxide in converature if dilute hydrochloric acid reacted complete	
	onate.	(3 marks)
(C =	12, $O = 16$ , $Ca = 40$ , 1 mole of a gas occupies 24.0	dm <sup>3</sup> at room temperature)

(i)	State how the maximum volume of carbon dioxid	e produced would compare
	your answer in (a)	(1 mark)
(ii)	Give a reason for your answer in (b) (i)	(1 mark)
	ic numbers of elements Q, R and W are 15, 17 and	19 respectively.
	the electronic configuration of	(1/ 1)
(i)	Q	( ½ mark)
(ii)	R	( ½ mark)
(iii)	W	( ½ mark)
) R can	combine with Q and W to form compounds Y and .	
bond (i)	in Y	( ½ mark)
(ii)	Z	( ½ mark)
e) State	one property in which	
(i)	Y resemble Z	(1 mark)
(ii)	Y differs from Z	(1 mark)

(b) A quantity of dilute sulphuric acid having the same hydrogen ion concentration as that of

8.	(a) Name one allotrope of carbon that is used;										
	(i) in extraction of iron	(½ mark)									
	(ii) as an electrode	( ½ mark)									
	(b) State one property of the allotrope of carbon that you have named in (a) which is the										
	reason for its use;										
	(i) In extraction of iron	(1 mark)									
	(ii) As an electrode	(1 mark)									
	(c) Carbon – 12 and carbon – 14 are the two common atoms of carbon and carbon – 14 is used extensively in determining ages of old objects,										
	State										
	(i) One word, which means the relationship between ato	oms like carbon – 12 and									
	Carbon – 14	(1 mark)									
		,									
	(ii) The property of carbon – 14 that is applied when it is used in determining the ages of										
	old objects.	(1 mark)									
9.	Both carbon and sulphur can burn in air to form oxides										
	(a) Name the product of complete combustion of										
	(i) Sulphur	( ½ mark)									
	(ii) Carbon										
	(b) The products of combustion in (a) were carefully collected										
	and burning magnesium introduced in each. State what wa	as observed in the boiling tube									
	containing the product of combustion of										
	(i) Sulphur	(1 mark)									
		• • • • • • • • • • • • • • • • • • • •									

(ii) Carbon			(1 mark)
(c) Write equation to illustrate your	observation in		
(i) (b) (i)			(1 ½ marks)
(ii) (b) (ii)			(1 ½ marks)
Concentrated Sodium chloride - solution		+ Electrode	· A
The diagram above is IL tube voltan	notor for the alex	tralizais of apparatrated	l godium ahlarida

The diagram above is U-tube voltameter for the electrolysis of concentrated sodium chloride solution

a)	Identit	.y
	(i)	Gas X

(½ mark)

( ½ mark

	(iii)	The material electrode A is made of	(	1 mark)
	•••••			
(b)	Give a	reason why electrode A should be made of the material	you have	identified in
	(a) (iii)		(	1 mark)
(c)	State w	why each of the gases X and Y is collected as shown in the	he diagrai	n (1 mark)
(d)	Litmus	s paper was dropped into the solution near the cathode.		
	(i)	State what was observed.	(	½ mark)
	(ii)	Give a reason for your observation in (d) (i)	(	½ mark)
	•••••		•••••	•••••
		SECTION B:		
Answer an	y two q	uestions only in this section. Extra questions answered	d will not	be marked.
11. (a) Bu	ning su	lphur was lowered into a jar of oxygen.\		
(i)	State w	hat was observed.	(1 mark)	)
(ii)	Write 6	equation for the reaction that took place.	(1 mark)	)
(b) Th	e major	product of combustion of sulphur is sulphur dioxide		
(i)	Name o	one reagent, which can be used to test for sulphur dioxide	e. (	1 mark)
(ii)	State w	hat would be observed if the reagent which you have na	amed in (b	o) (i) was
	tested v	with sulphur dioxide and give a reason for your observat	tion (	1 ½ marks)
(c) U1	nder cer	tain temperature and pressure conditions in the presence	e of a suita	able catalyst,
sulphu	r dioxid	e can be converted into sulphuric acid on a large scale the	hrough an	industrial
process	s known	as the Contact process.		
(i) Usin	ng equa	tions to illustrate your answer, outline the reactions that	lead to co	onversion of
sulphu	r dioxid	e to sulphuric acid by the Contact process.	(	5 ½ marks)

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- (ii) Describe the temperature and pressure conditions used during the contact process; and briefly explain their effects on the reaction(s) where they are applied. (4 marks)
- (iii) Name the suitable catalyst in modern day contact process and give a reason for its suitability.
- 12. (a) (i) Write equation for reaction that takes place when excess carbon dioxide is bubbled through concentrated sodium hydroxide solution (1 ½ marks)
  - (ii) Briefly describe how a pure dry sample of the product of the reaction in (a) (i) can be obtained in the laboratory.  $(2 \frac{1}{2} \text{ marks})$
  - (b) State what would be observed and write equation for the reaction that would take place if
    - (i) to the solution of the dry sample in (a) (ii) was added aqueous lead (II) nitrate solution.

(2 marks)

- (ii) to some of the dry sample in (a) (ii) was added dilute sulphuric acid (2 marks)
- (d) The Table below shows the variation in volume of carbon dioxide evolved when dilute hydrochloric acid solution was added to several weighed samples of a carbonate with formula, MCO<sub>3</sub> at s.t.p

Mass of MCO <sub>3</sub> (g)	0.025	0.050	0.100	0.150	0.200	0.300	0.40
Volume of CO <sub>2</sub> at s.t.p (cm <sup>3</sup> )	4.0	11.0	21.0	33.0	44.5	56.0	56.0

- (i) Plot a graph of volume of carbon dioxide evolved (vertical axis) against mass of the carbonate, MCO<sub>3</sub> used (horizontal axis. (3 marks)
- (ii) Determine the number of moles of the carbonate, MCO<sub>3</sub> that gave maximum volume of carbon dioxide evolved. (2 marks)
- (iii) Calculate the atomic mass of M in the carbonate, MCO<sub>3</sub> (C=12,O=16) (2 marks)
- 13. Spathic iron is one of the major ores of iron
  - (a) Write the chemical name and formula of spathic iron (1 mark)
  - (b) During the extraction of iron, spathic iron is first roasted in air before being transferred into the Blast furnace. State the purpose of roasting the ore in air (1 mark)
  - (c) Name;
    - (i) the major impurity in iron ore (1 mark)
    - (ii) two substances, which are fed into the Blast furnace together with roasted iron ore (1 mark)

	(111)	any other substance that is also led into the furnace, and describe	where from the
		substance is let into the furnace	(1 mark)
(d)	) Using	equations only, outline reactions which take place inside the Blast	furnace up to
	(i)	Formation of iron	(3 ½ marks)
	(ii)	Removal of the major impurity in the ore	(2 marks)
(e)	State 1	the importance of slag during extraction of iron in the furnace.	(1 mark)
(f)	Descr	ibe how iron reacts with	
	(i)	Water	(2 marks)
	(ii)	Chlorine	(2 marks)
14. (a)	) Draw	a labeled diagram for the setup of apparatus that can be used to prep	oare a dry
sa	mple of	ammonia in the laboratory	(4 marks)
(b)	) Explai	in each of the following and write equation to illustrate your explana	ation
	(i) An	nmonia gives dense white fumes with hydrogen chloride	(3 ½ marks)
	(ii) Fu	ised calcium chloride is not a suitable drying agent for ammonia	(2 marks)
(c)	Descri	ibe the reactions of ammonia with oxygen.	(5 ½ marks)

**END**