

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in. Write in dark blue or black pen. You may use a pencil for any diagrams, graphs or rough working. Do not use staples, paper clips, highlighters, glue or correction fluid. DO NOT WRITE IN ANY BARCODES.

Answer all questions.

A copy of the Periodic Table is printed on page 16.

At the end of the examination, fasten all your work securely together. The number of marks is given in brackets [] at the end of each question or part questions.

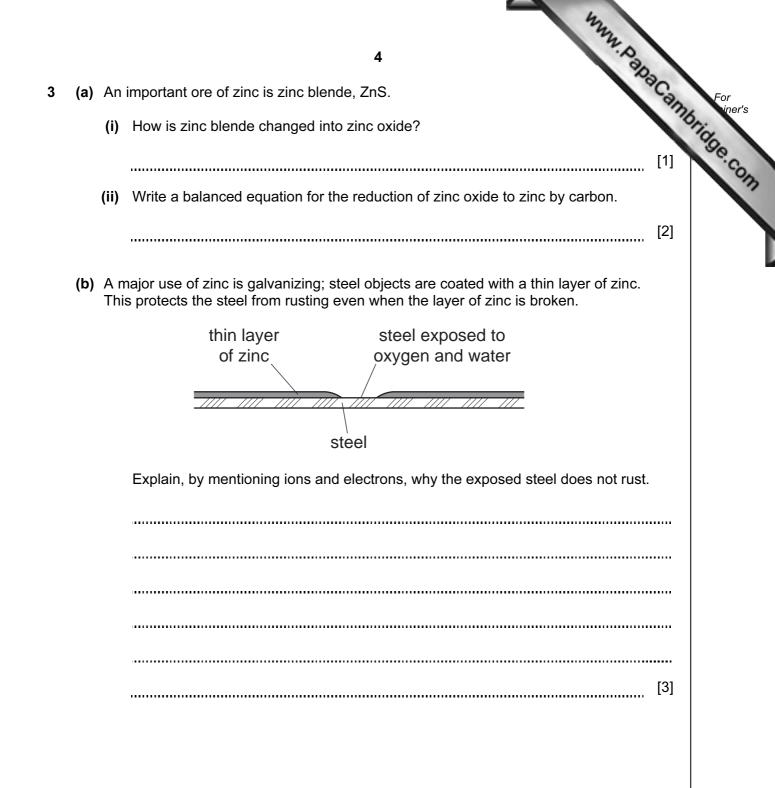
For Exam	iner's Use
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This document consists of 14 printed pages and 2 blank pages.

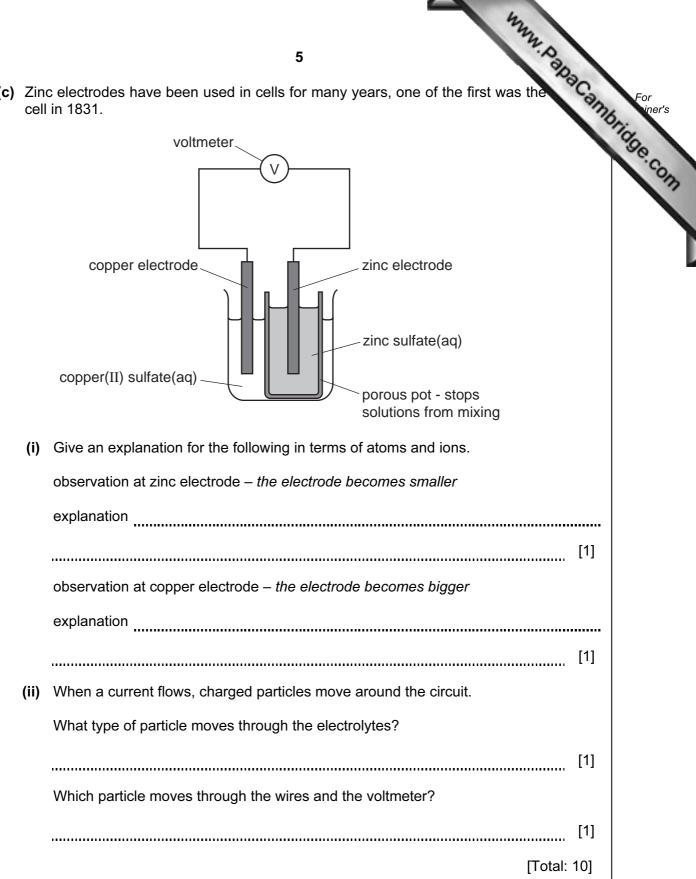


			2 e major gases in unpolluted air are 79 % nitrogen and 20 % oxygen. Name another gaseous element in unpolluted air. [1] Name two compounds in unpolluted air.	
			2	
1	(a)	The	e major gases in unpolluted air are 79% nitrogen and 20% oxygen.	For
		(i)	Name another gaseous element in unpolluted air.	Ine
				90.0
		(ii)	Name two compounds in unpolluted air.	
			[2]	
	(b)	Two	o common pollutants in air are sulfur dioxide and the oxides of nitrogen.	
	(6)	(i)	Name another pollutant in air.	
		(1)	[1]	
		(::)		
		(ii)	Describe how sulfur dioxide is formed.	
			[2]	
		(iii)	How are the oxides of nitrogen formed?	
			[2]	
	(c)	Hov	w is oxygen obtained from air?	
		•••••	[2]	
			[Total: 10]	

www.papacambridge.com 3 Oxides are classified as acidic, basic, neutral and amphoteric. 2 (a) Complete the table. type of oxide pH of solution of oxide example acidic basic neutral [6] (b) (i) Explain the term *amphoteric*. [1] (ii) How could you distinguish between an acidic oxide and an amphoteric oxide using hydrochloric acid and aqueous sodium hydroxide? [2] [Total: 9]



(c) Zinc electrodes have been used in cells for many years, one of the first was the cell in 1831.



www.papaCambridge.com 6 The distinctive smell of the seaside was thought to be caused by ozone, O_3 . 4 Ozone is a form of the element oxygen. (a) A mixture of oxygen and ozone is formed by passing electric sparks through oxygen. $3O_2 \rightleftharpoons 2O_3$ Suggest a technique that might separate this mixture. Explain why this method separates the two forms of oxygen. technique explanation _____ [2] (b) Ozone is an oxidant. It can oxidise an iodide to iodine. $2I^{-} + O_3 + 2H^{+} \rightarrow I_2 + O_2 + H_2O$ What would you see when ozone is bubbled through aqueous acidified potassium (i) iodide? [2] (ii) Explain in terms of electron transfer why the change from iodide ions to iodine molecules is oxidation. [1] (iii) Explain, using your answer to b(ii), why ozone is the oxidant in this reaction. [1]

(c)		7 now known that the smell of the seaside is due to the chemical dimethyl $J_3)_2S$. Draw a diagram that shows the arrangement of the valency electrons in one molecule of this covalent compound. Use x to represent an electron from a carbon atom. Use o to represent an electron from a hydrogen atom. Use • to represent an electron from a sulfur atom.	Combridge Com	
	(ii)	Name the three compounds formed when dimethyl sulfide is burnt in excess oxygen.	[3]	

[Total: 11]
[Total: 11]

- 5 The first three elements in Group IV are carbon, silicon and germanium. The elements and their compounds have similar properties.
 - (a) The compound, silicon carbide, has a macromolecular structure similar to that of diamond.
- www.papaCambridge.com (i) A major use of silicon carbide is to reinforce aluminium alloys which are used in the construction of spacecraft. Suggest three of its physical properties.

..... _____ [3]

(ii) Draw a diagram to show the arrangement of silicon atoms around one carbon atom in silicon carbide. Label this diagram 1.

Draw a diagram to show the arrangement of carbon atoms around one silicon atom in silicon carbide. Label this diagram 2.

[3]

(b) Germanium(IV) oxide, GeO₂, has the same macromolecular structure as silicon(IV) oxide. Draw the structural formula of germanium(IV) oxide.

[2]

- (c) Germanium forms a series of hydrides comparable to the alkanes.
- www.papacambridge.com (i) Draw the structural formula of the hydride which contains three germanium atom per molecule.

(ii)	Predict the products of the complete combustion of this hydride.	[1]
		[2]
	[Total:	11]

		4	
		10 furic acid is made by the Contact process. $2SO_2 + O_2 \rightleftharpoons 2SO_3$ s is carried out in the presence of a catalyst at 450 °C and 2 atmospheres pressur Sulfur dioxide is made by burning sulfur. Name a source of sulfur.	
6	(a) Sul	furic acid is made by the Contact process.	Cal
		$2SO_2 + O_2 \rightleftharpoons 2SO_3$	
	Thi	s is carried out in the presence of a catalyst at 450 $^\circ$ C and 2 atmospheres pressur	e.
	(i)	Sulfur dioxide is made by burning sulfur. Name a source of sulfur.	
			[1]
	(ii)	Give another use of sulfur dioxide.	
			[1]
	(iii)	Name the catalyst used.	
			[1]
	(iv)	If the temperature is decreased to 300 °C, the yield of sulfur trioxide increases. Explain why this lower temperature is not used.	
			[1]
	(v)	Sulfur trioxide is dissolved in concentrated sulfuric acid. This is added to water to make more sulfuric acid. Why is sulfur trioxide not added directly to water?)
			[1]

www.papaCambridge.com 11 (b) Sulfuric acid was first made in the Middle East by heating the mineral, green vitrice FeSO₄.7H₂O. The gases formed were cooled. $FeSO_4.7H_2O(s)$ FeSO₄(s) $7H_2O(g)$ \rightarrow + green crystals yellow powder $2FeSO_4(s) \rightarrow Fe2O_3(s) + SO_2(g) + SO_3(g)$ On cooling SO_3 + $H_2O \rightarrow H_2SO_4$ sulfuric acid SO_2 + $H_2O \rightarrow H_2SO_3$ sulfurous acid (i) How could you show that the first reaction is reversible? [2] (ii) Sulfurous acid is a reductant. What would you see when acidified potassium manganate(VII) is added to a solution containing this acid? [2] (iii) Suggest an explanation why sulfurous acid in contact with air changes into sulfuric acid. [1] (c) 12.16 g of anhydrous iron(II) sulfate was heated. Calculate the mass of iron(III) oxide formed and the volume of gases, at r.t.p., formed. $2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$ mass of one mole of $FeSO_4 = 152 g$ number of moles of FeSO₄ used = number of moles of Fe_2O_3 formed = mass of one mole of Fe_2O_3 = ____g mass of iron(III) oxide formed = ____g total number of moles of gases formed = = _____dm³ total volume of gases formed [6]

[Total: 16]

	12 Butan-1-ol is used as a solvent for paints and varnishes, to make esters and as a fue Butan-1-ol can be manufactured from but-1-ene, which is made from petroleum. Biobutanol is a fuel of the future. It can be made by the fermentation of almost any form of biomass - grain, straw, leaves etc.	
7	Butan-1-ol is used as a solvent for paints and varnishes, to make esters and as a fuer Butan-1-ol can be manufactured from but-1-ene, which is made from petroleum.	Cant
	Biobutanol is a fuel of the future. It can be made by the fermentation of almost any form of biomass - grain, straw, leaves etc.	of
	(a) But-1-ene can be obtained from alkanes such as nonane, C_9H_{20} , by cracking.	
	(i) Give the reaction conditions.	
		[2]
	(ii) Complete an equation for the cracking of nonane, C_9H_{20} , to give but-1-ene.	
	$C_9H_{20} \rightarrow$	[2]
	(iii) Name the reagent that reacts with but-1-ene to form butan-1-ol.	
		[1]
	(b) (i) Balance the equation for the complete combustion of butan-1-ol.	
	$\label{eq:c4H9OH} \underbrace{C_4H_9OH}_{H_9OH} + \underbrace{O_2}_{H_2O} \rightarrow \underbrace{CO_2}_{H_2O} + \underbrace{H_2O}_{H_2O}$	[2]
	(ii) Write a word equation for the preparation of the ester butyl propanoate.	
		[2]

- www.papaCambridge.com (c) The fermentation of biomass by bacteria produces a mixture of products which in biobutanol, propanol, hydrogen and propanoic acid.
 - (i) Draw the structural formula of propanol and of propanoic acid. Show all the bonds.

propanol

propanoic acid

			[2]
	(ii)	Why is it important to develop these fuels, such as biobutanol, as alternatives to petroleum?	
			[1]
(d)		w could you show that butanol made from petroleum and biobutanol are the sau mical?	me
			[1]
		[Total: /	131



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	>		4 Z	8	²³ 7 33 Phosphorus 15 86	75 7 AS Self 33 Arsenic Self 34	122 1 Sb 7 Antimony 52	209 Bi Bismuth 83 84		167 1 Er Th 68 Erbium 69	Fermium 100 101	
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_	≡		≂ Ø	5 Boron	27 Aluminium 13	70 Ga 31	115 In Indium 49	g 204 T 1 Iy 81		Dysprosium 66	um B ^C Californium	and pressu
						64 65 Cu Zn ²⁹ ^{2inc}	108 112 Ag Cd Cd Silver 48	197 201 Au Hg Gold 80		157 Gd Gadolinium 63 65	Cm Curtum 96 97	The volume of one mole of any gas is 24 dm ³ at room temperature and pressure (r.t.p.).
						59 Nickel 28	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu 63	Am Americium 95	m³ at room
	-		٦			59 CO Cobalt 27	103 Rh Rhodium 45	192 Ir Iridium		150 Sa marium 62	Putonium 94	jas is 24 d
	-	Hydrogen				56 F 6 Iron	101 Ru Ruthenium 44	190 OSmium 76		n Promethium 61		le of any g
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						51 Vanadium 23	93 Niobium 41	181 Ta ^{Tantalum} 73		140 Cerium 58	232 Thorium 90	The
						48 Titanium 22	91 Zr Zirconium 40	178 Hafnium 72			omic mass nbol mic) number	
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