



Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/22
Paper 2		1	February/March 2015
			1 hour 15 minutes
Candidates answ	wer on the Question Paper.		
No Additional Ma	aterials are required.		

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

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

You may lose marks if you do not show your working or if you do not use appropriate units.

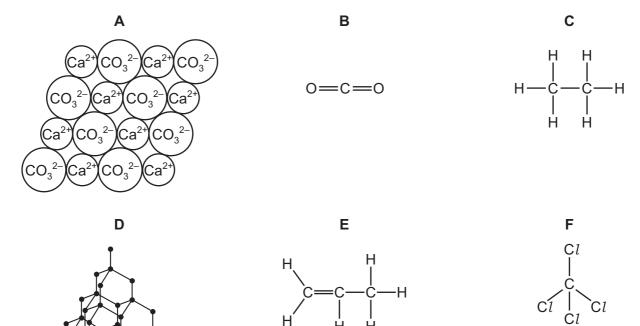
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.



1 The diagram shows the structures of some substances containing carbon.



Answer the following questions about these substances. Each substance may be used once, more than once or not at all.

(a) Which substance, A, B, C, D, E or F

(i)	is a saturated hydrocarbon,
(ii)	has an ionic structure,
` '	,
(iii)	is a product of respiration,
()	to a product of reophation,
(iv/)	is in the same homologous series as methane,
(17)	is in the same nomologous series as methane,
(- ·)	in the old for suffice O
(V)	is used for cutting?
	[5]

(b) Substance **D** is an element.

Explain why substance **D** is an element. [1]

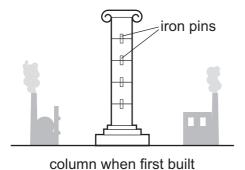
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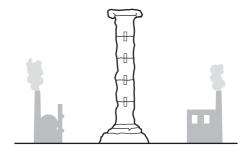
2 Some properties of the halogens are shown in the table.

halogen	boiling point /°C	state at room temperature and pressure
fluorine	-188	
chlorine	–35	gas
bromine	+59	liquid
iodine	+184	solid
astatine		solid

(a)	Use	e the information in the table to deduce	
	(i)	the boiling point of astatine,	
			[1]
	(ii)	the state of fluorine at room temperature and pressure.	
			[1]
(b)	Wh	en chlorine reacts with aqueous potassium iodide, the solution turns brown.	
	(i)	Write a word equation for this reaction.	
			[2]
	(ii)	Explain why iodine does not react with aqueous potassium chloride.	
			[1]
(c)	Wh	en sodium reacts with iodine, energy is released.	
	(i)	What is the name given to a reaction which releases energy?	
			[1]
	(ii)	Explain what happens in terms of electron transfer when a sodium atom reacts with a iodine atom.	an
			[2]
		[Total:	8]

3 The diagram shows a limestone column in an industrial town. Limestone is largely calcium carbonate.





the same column after 40 years

- (a) Describe and explain the changes to the column over 40 years. In your answer refer to
 - the change to the limestone,
 - the name of a pollutant causing this change,
 - the chemistry involved in this change.

	[4]
(b)	The sections of the column are joined with iron pins which rust when exposed to the atmosphere.
	Describe two methods of rust prevention and explain how they prevent rusting.
	[3]

(C) IIOII IS A HAIISHOII CICIIIC	ent	em	el	ransition	а	is	Iron	(c)	(
----------------------------------	-----	----	----	-----------	---	----	------	-----	---

Give two properties of tr such as magnesium.	ansition elements tha	it make them different	t from non-transition me	etals
				[2]

(d) An isotope of iron has 58 nucleons.

Complete the table to show

- the number of electrons and neutrons in this isotope of iron,
- the relative charges on each particle.

particle	number of each particle present	relative charge on the particle
electron		
neutron		no charge
proton	26	

[4]

(e) Iron reacts with hydrochloric acid to form iron(II) chloride and a gas which 'pops' with a lighted splint.

Complete the symbol equation for this reaction.

Fe +
$$HCl \rightarrow FeCl_2$$
 + [2]

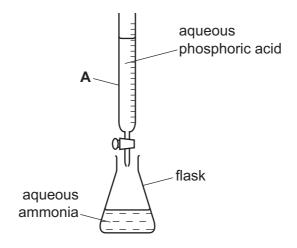
[Total: 15]

4	Ammonium	phosphate,	$(NH_4)_3PO_4$	is a	fertiliser.
---	----------	------------	----------------	------	-------------

(a)	which two	elements in	ammonium	pnospnate	are important to	or plant growth?	

(b) Aqueous ammonium phosphate can be made in the laboratory by reacting aqueous ammonia with aqueous phosphoric acid.

...... and [1]



(i) State the name of the piece of apparatus labelled A.

r.	41
	Ή

(ii) Suggest the pH value of aqueous phosphoric acid.

r	741	
	111	

(iii) Describe how the pH of the mixture in the flask changes as the acid is added.

(iv) Which **one** of the following best describes the reaction of aqueous ammonia with aqueous phosphoric acid?

Put a ring around the correct answer.

combustion	decomposition	neutralisation	reduction	
	•			[1]

(c) When sodium hydroxide is added to ammonium phosphate, ammonia is released.

Complete the symbol equation for this reaction.

$$(NH_4)_3PO_4 + 3NaOH \rightarrow Na_3PO_4 +NH_3 + 3$$
 [2]

[Total: 7]

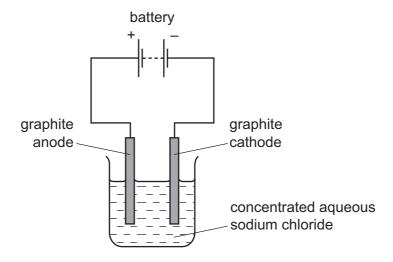
5 The table shows the concentration of some ions present in a sample of seawater.

name of ion	formula of ion	concentration in g/dm³
bromide	Br-	0.06
calcium	Ca ²⁺	0.30
chloride	Cl-	20.00
	I-	0.04
magnesium	Mg ²⁺	1.00
potassium	K ⁺	0.50
sodium	Na ⁺	11.00
sulfate	SO ₄ ²⁻	0.80

(a) (i)	Which positive ion in the table has the lowest concentration?
	[1]
(ii)	Give the name of the ion with the formula I^- .
	[1]
(iii)	Which two ions in the table are formed from elements in Group II of the Periodic Table?
	and[1]
(iv)	Give the names of two ions in the table which move towards the anode (positive electrode) when a sample of this seawater is electrolysed.
	and [2]

(b) Sodium chloride can be extracted from seawater.

Concentrated aqueous sodium chloride is electrolysed using the apparatus shown.



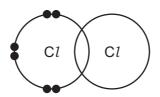
(i)) Sug	gest ı	why t	the and	ode an	d cat	hode	are	mad	e of	f grapl	nit	е
-----	-------	--------	-------	---------	--------	-------	------	-----	-----	------	---------	-----	---

	. [1]
Give the name of the product formed at the cathode (negative electrode).	
	. [1]

(iii) Chlorine is formed at the anode.

(ii)

Complete the electronic structure of a chlorine molecule. Show only the outer shell electrons.



[2]

(c) Molten magnesium bromide is electrolysed.

Predict the products at the anode (positive electrode) and cathode (negative electrode).

anode

cathode[2]

[Total: 11]

6

(i) What	is the meaning of the te	
(ii) Write	a word equation for the	reaction of zinc oxide with carbon.
(iii) Expla	in why, in the laboratory,	the reaction should be carried out in a fume cupboard
) The table	shows how easy it is to	reduce various metal oxides by heating with carbon.
	metal oxide	ease of reduction with carbon
	land syide	apply raduced at 200 °C
	lead oxide	easily reduced at 300 °C
	magnesium oxide	not reduced at 900 °C
	magnesium oxide	not reduced at 900°C
Use the in	magnesium oxide nickel oxide zinc oxide	not reduced at 900 °C easily reduced at 500 °C
Use the in least reac	magnesium oxide nickel oxide zinc oxide formation in the table to	not reduced at 900 °C easily reduced at 500 °C fairly easily reduced at 900 °C
	magnesium oxide nickel oxide zinc oxide formation in the table to	not reduced at 900 °C easily reduced at 500 °C fairly easily reduced at 900 °C put the metals in order of their reactivity.
	magnesium oxide nickel oxide zinc oxide formation in the table to	not reduced at 900 °C easily reduced at 500 °C fairly easily reduced at 900 °C put the metals in order of their reactivity.
least reac	magnesium oxide nickel oxide zinc oxide formation in the table to	not reduced at 900 °C easily reduced at 500 °C fairly easily reduced at 900 °C put the metals in order of their reactivity. most reactive

(e)	Pu zin	re dry crystals of zinc sulfate can be made by the reaction of dilute sulfuric acid with excess c.
	(i)	How is excess zinc removed from the reaction mixture?
	(ii)	Describe how you would obtain pure dry crystals of zinc sulfate from an aqueous solution of zinc sulfate.
	(iii)	Zinc sulfate can be made from the reaction of sulfuric acid with zinc oxide or zinc.
	. ,	Give the name of another compound that reacts with sulfuric acid to produce zinc sulfate.
		[1]
(f)		tudent reacts zinc with excess sulfuric acid. e obtains 16.1g of zinc sulfate from 6.5g of zinc.
	(i)	Calculate the mass of zinc sulfate she would obtain from 26.0 g of zinc.
	(ii)	Calculate the relative formula mass of zinc sulfate, ${\rm ZnSO_4}$.
		[2]
		[Total: 15]

7 Petroleum is separated into useful fractions by fractional distillation.

refinery gas refinery gas gasoline fraction T kerosene fraction diesel oil fuel oil lubricating fraction bitumen

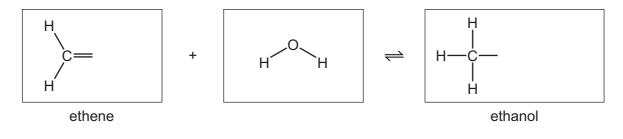
(a) (i)	Put an X on the diagram to show where the temperature in	the column is the highest.	[1]
(ii)	Give the name of the fraction labelled T .		
			[1]
(iii)	The lubricating fraction is used to make lubricants.		
	Give one other use of this fraction.		
			[1]
(b) Ead	ch fraction contains alkanes.		
	ich two of the following statements are correct? k two boxes.		
	Alkanes burn to form carbon dioxide and hydrogen.		
	Ethene is an alkane with two carbon atoms.		
	Alkanes polymerise to form poly(alkanes).		
	Alkanes are generally unreactive apart from burning.		
	Methane is an alkane present in natural gas.		[2]
			[4]

(c)	Hydrogen	can be	made	by	cracking.

(ii) Complete the equation for the cracking of propane.

$$C_3H_8 \rightarrow + H_2$$
 [1]

- (d) Ethanol is formed by the catalytic addition of steam to ethene.
 - (i) Complete the structures of ethene and ethanol in the equation below, showing all atoms and bonds.



(ii) What does the symbol \rightleftharpoons mean?

......[1

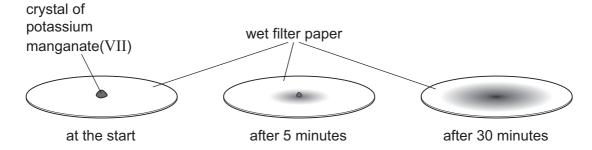
[Total: 11]

[2]

8 A student placed a crystal of purple potassium manganate(VII) on a filter paper which had been soaked in water.

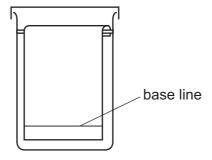
After 5 minutes, a purple colour had spread out from the crystal.

After 30 minutes, the purple colour had spread further out.



(a)	Use the kinetic particle theory to explain these observations.
	[3]
(b)	Describe the closeness and motion of the particles in a crystal of potassium manganate(VII). closeness
	motion
	[2]

(c) Mixtures of dyes can be separated by paper chromatography using the apparatus shown below.



On the diagram above

draw a line to show the solvent level at the beginning of the experiment,

• put a cross to show where the spot of dye mixture is placed at the beginning of the experiment.

[2]

[Total: 7]

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The Periodic Table of the Elements **DATA SHEET**

								Gr	Group								
_	=											≡	≥	>	>	=	0
							Hydrogen										4 He Helium
Lithium 3 23 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Be Beryllum 4 24 Mg	_ E				-						11 B Boron 27 A1 Aluminium	Carbon 6 Carbon 8 Silicon	Nitrogen 7 31 97 Phosphorus	16 Oxygen 8 32 Suffur Suffur	19 Fluorine 9 35.5 C1	20 Neon 10 Neon 40 Ar Argon
39 X Potassium		Sc Scandium	48 T Titanium	51 V	52 Cr Chromium	55 Mn Manganese	. Fe	59 Co	59 Nickel	64 Copper	65 Zn Zinc	70 Gal lium	73 Ge Germanium				84 K rypton
Rb Rubidium 37		89 ×	91 Zr Zirconium 40	93 b mildo	Mo Molybdenum 42	Tc Technetium	Ru Ru	103 Rh hodium	106 Pd Palladium	108 Ag silver	112 Cd Cadmium 48	115 In Indium		5 b	128 Te Tellunum	127 I lodine	Xe Xenon 54
133 Cs Caesium 55		139 La Lanthanum 57 *	178 Hf Hafnium * 72	181 Ta Tananum 73	184 W Tungsten 74	186 Re Rhenium 75			195 Pt Platinum 78	197 Au Gold	201 Hg Mercury 80	204 T (Thallium 81	207 Pb Lead			At Astatine 85	Rn Radon
Fr Francium 87	226 Ra m Radium	Actinium Actinium †															
*58-71 190-10	*58-71 Lanthanoid serie 190-103 Actinoid series	*58-71 Lanthanoid series 190-103 Actinoid series		140 Ce Cerium	Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
Key	ъ × в	a = relative atomic mass X = atomic symbol b = proton (atomic) number	nic mass bol nic) number	232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Neptunium	Pu Plutonium	Am Americium 95	Carrium 96	BK Berkelium 97	Californium 98	Es Einsteinium 99	Fm Fermium 100	Mendelevium 101	Nobelium	Lr Lawrendum 103

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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