

Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

CHEMISTRY

0620/22

Paper 2

May/June 2015

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials 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.

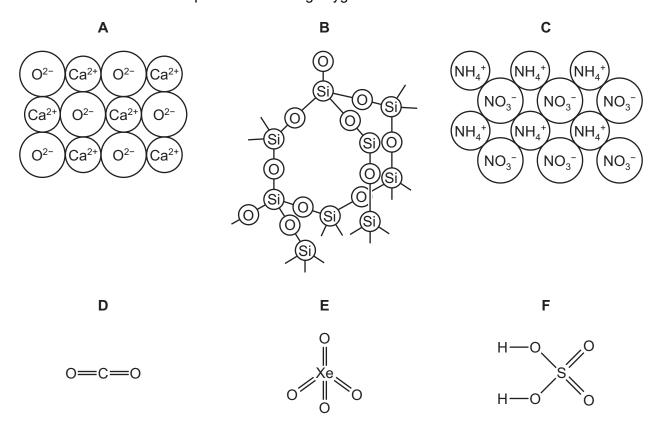
At the end of the examination, fasten all your work securely together.

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 structures of six compounds containing oxygen are shown below.



- (a) Answer the following questions about these compounds. Each compound, A, B, C, D, E or F, may be used once, more than once or not at all.
 - (i) Which compound is a compound of a noble gas?[1]
 - (ii) Which compound can be used as a fertiliser?[1]
 - (iii) Which compound can be used to neutralise acidic soil?[1]
 - (iv) Which compound is a greenhouse gas?[1]

(h)	Complete the s	vmbol equation	for the reaction	of compound A	with h	vdrochloric acid
1	IJ,	Complete the 3	ymbol Equation	ioi liie reaction			yuruuriibiib abiu

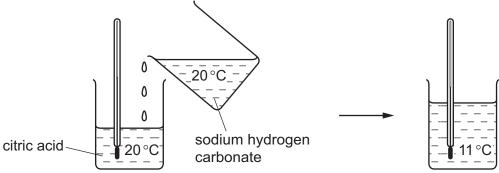
$$CaO +HCl \rightarrow CaCl_2 +$$
 [2]

(c) Complete the following sentence about compounds using words from the list below.

	atoms	combined	mixtures			
	molecules	separated	unreactive			
A compound is a substance containing two or more different which are						
chemically				[2]		

[Total: 10]

2 An aqueous solution of sodium hydrogen carbonate is added to an aqueous solution of citric acid. The mixture is stirred. The temperature is measured before and after the addition.



(a)	Explain how this experiment shows that the reaction is endothermic.
	[1]
(b)	Citric acid reacts with sodium hydroxide to form the soluble salt sodium citrate.
	Describe how you could prepare pure dry crystals of sodium citrate from citric acid and sodium hydroxide.
	[3]
(c)	Citric acid can be made by fermentation.
	Ethanol can also be made by fermentation.
	Which of the following are required to make ethanol by fermentation?
	Tick two boxes.
	enzymes from yeast
	temperature above 100 °C
	high pressure
	concentrated sulfuric acid
	glucose
	[2]

1	4	Campalata	the structure	of othernal t	الم بينمطم م	0+0000 000	مام مما الما
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[1]

(e) Ethanol can be made from ethene.

Complete the following sentence about the formation of ethanol from ethene using words from the list below.

catalyst

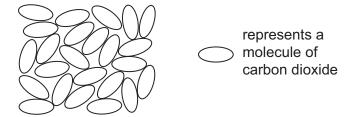
carbonate

			•
	hydrogen	proton	steam
Ethanol can be	e made by reacting	ethene with	in the presence of
a			[2]
			[Total: 9]

3

Wh	en so	odium hydrogen carbonate is heated at 60°C, carbon dioxide is given off.
(a)	(i)	Complete the equation for this reaction.
		\dots NaHCO ₃ \rightarrow Na ₂ CO ₃ + CO ₂ + \dots [2]
	(ii)	What type of chemical reaction is this?
		Tick one box.
		addition
		neutralisation
		oxidation
		thermal decomposition [1]
4.		
(b)	An	aqueous solution of sodium hydrogen carbonate is slightly alkaline.
	Whi	ch one of the following pH values is slightly alkaline?
	Put	a ring around the correct answer.
		pH 2 pH 7 pH 8 pH 13 [1]
(c)	Bak	ing powder contains sodium hydrogen carbonate and crystals of a weak acid.
	Wh	en water is added, the acid reacts with the sodium hydrogen carbonate.
	(i)	Complete the general equation for the reaction of an acid with a carbonate.
		acid + carbonate → carbon dioxide + [2]
	(ii)	The diagram below shows bread baked with and without the addition of baking powder. All other conditions were kept the same.
		broad baked
		bread baked bread baked without baking powder with baking powder
		Why is the bread baked with baking powder bigger?
		[1]
	(iii)	Explain why the sodium hydrogen carbonate used in breadmaking must be pure.
		[1]

(d) The diagram shows the arrangement of carbon dioxide molecules at −25 °C and 100 atmospheres pressure.



What is the state of carbon dioxide under these conditions?

Use the kinetic particle theory and the information in the diagram to explain your answer.

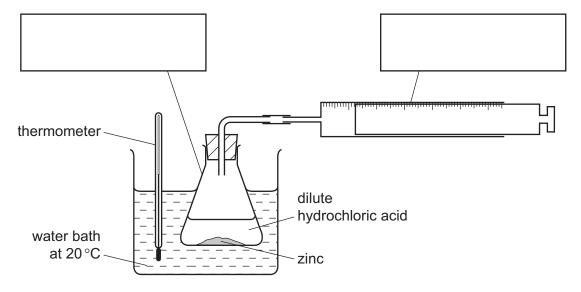
[3

[Total: 11]

4 A student investigated the rate of reaction of zinc with dilute hydrochloric acid.

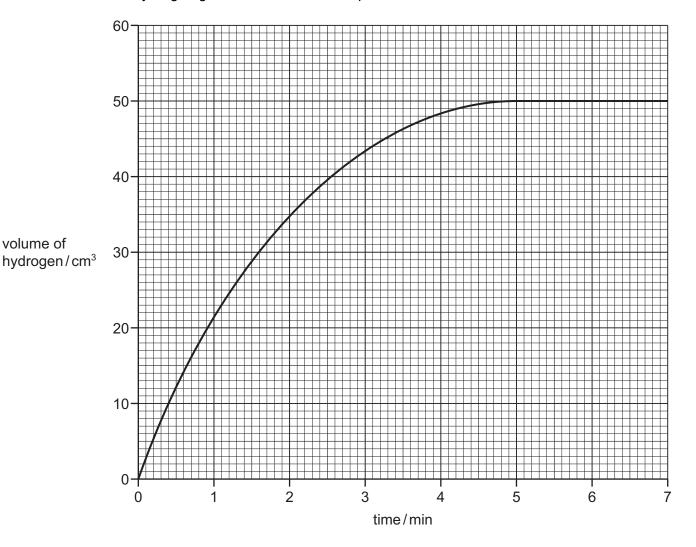
$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

(a) Complete the labelling of the apparatus by filling in the two boxes.



[2]

(b) The student carried out the reaction at 20 °C using small pieces of zinc. She measured the volume of hydrogen given off as the reaction proceeded.



(i)	Doccribo	how tho	volume of	hydrogon	changes	with time
 ,	DESCRIBE	HOW LITE	volulle of	HVUIUUEII	CHAHUES	will lille

.....

.....[2]

(ii) At what time did the reaction stop?

.....[1]

(iii) What volume of gas was produced over the first two minutes of the reaction?

.....[1]

(iv) On the graph above draw a line to show how the volume of hydrogen changes when the reaction was carried out at 30 °C. All other conditions remain the same. [2]

(c)	Hov	v does the rate of reaction change when larger pieces of zinc are used?
	All	other conditions remain the same.
		[1]
(d)	Mol	ten zinc chloride can be electrolysed using graphite electrodes.
	(i)	State the names of the product formed at:
		the anode
		the cathode.
	/::\	[2]
	(ii)	Graphite conducts electricity. Give one other reason why graphite electrodes are used.
		[1]
		[Total: 12]

[2]

5 Cinnamic acid is found in plants called balsams.

The structure of cinnamic acid is shown below.

$$C = C$$
 $C = C$
 $C =$

- (a) On the structure of cinnamic acid above, put a ring around the carboxylic acid functional group. [1]
- (b) Cinnamic acid is an unsaturated compound.

(i)

(ii)

What is the meaning of the term unsa	turated?
	[1
Describe a test for an unsaturated cor	mpound.

(c) Cinnamic acid reacts with sodium hydroxide to form styrene.

$${\rm C_6H_5CH=CHCOOH} \ + \ 2{\rm NaOH} \ \longrightarrow \ {\rm C_6H_5CH=CH_2} \ + \ {\rm Na_2CO_3} \ + \ {\rm H_2O}$$

Complete the word equation for this reaction.

(d)	Styr	rene is used to make the polymer poly(styrene).
	Poly	v(ethene) is also a polymer.
	Des	scribe how poly(ethene) is made.
	In y	our answer include the words:
	•	addition ethene monomer polymerisation
(e)	Rale	sam flowers contain a mixture of pigments.
(c)	(i)	Describe how you could obtain a solution of this mixture of pigments from balsam flowers.
	(1)	Describe now you could obtain a solution of this mixture of pigments from balsain howers.
		[3]
	(ii)	A student uses chromatography to separate the pigments in balsam flowers. He puts the pigment mixture on a sheet of chromatography paper as well as 5 spots of pure pigments A , B , C , D and E .
		The diagram below shows the results after chromatography.
		<u> </u>
		pigments A B C D E from balsam flowers
		Which of the pigments A, B, C, D and E are present in balsam flowers?
		[1]
		[Total: 13]

6 The table shows some properties of aluminium, copper, iron and sodium.

metal	electrical conductivity	density in g/cm ³	melting point/°C	strength	colour
aluminium	very good	2.70	660	fairly strong	silver
copper	very good	8.92	1083	very strong	pink-brown
iron	good	7.86	1535	very strong	silver
sodium	good	0.97	98	weak	silver

(a)	Which two metals in the table are transition elements? Explain your answer by referring to specific property of transition elements given in the table.	a
(b)	Use the information in the table to suggest	ر ک.
	(i) why overhead electricity cables are made from aluminium with a steel core,	
	(ii) one reason why sodium is not used for electricity cables.	
(c)	Cobalt chloride is a transition element compound.	
	Calcium chloride is a compound of a Group II metal.	
	Describe one difference between cobalt chloride and calcium chloride.	
		[1]

(d) The table below shows some observations about the reaction of four metals with water or steam.

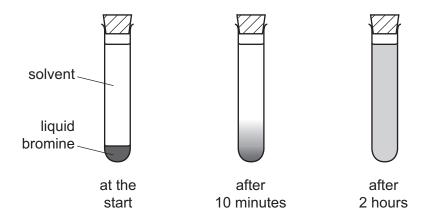
metal	observations
aluminium	reacts with steam when strongly heated
lithium	reacts rapidly with cold water
magnesium	reacts very slowly with cold water but rapidly with steam
silver	does not react with steam

Place these	metals	in	order	∩f	their	reactivit	'n
riace lilese	IIICIAIS	111	Oluci	OI.	นาษแ	reactivii	L۷.

	leas	et reactive most reactive	[1]
(e)	Wh	en iron is heated with steam, hydrogen is given off.	ניו
		$3\text{Fe} + 4\text{H}_2\text{O} \Longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$	
	(i)	What does the sign ← mean?	
			.[1]
	(ii)	Describe a test for hydrogen.	
		test	
		result	 [2]
(f)	Ste	el is an alloy of iron. Write about alloys of iron.	
	In y	our answer refer to:	
	•	the meaning of the term alloy, why alloys are used instead of pure iron, an example of the use of an alloy of iron.	

[Total: 14]

7 A teacher placed a few drops of liquid bromine in the bottom of a test-tube containing a solvent.
After 10 minutes, the brown colour of the bromine had spread a little way through the solvent.
After 2 hours, the brown colour had spread throughout the solvent.



(a)	Use the kinetic particle theory to explain these observations.
	[3]

(b) Bromine is a halogen in Group VII.

The properties of some halogens are given in the table below.

halogen	melting point/°C	boiling point/°C	density at boiling point in g/cm ³	electron arrangement of halogen atom
fluorine	-220	-188	1.51	2,7
chlorine	-101	-35	1.56	2,8,7
bromine	-7	+59		2,8,18,7
iodine	+114	+184	4.93	2,8,18,18,7

Use the information in the table to:

(i)	Deduce the state of fluorine at -200 °C.	

	(11)	Describe now the melting point changes down Group VII.
	(iii)	Estimate the density of bromine.
	(iv)	Deduce the number of completely filled electron shells in an atom of chlorine.
		[1]
(c)	-	eous bromine reacts with aqueous potassium iodide to form iodine and potassium nide.
	(i)	Complete the equation for this reaction.
		$Br_2 + 2KI \rightarrow \dots + 2KBr$ [1]
	(ii)	Explain why aqueous bromine does not react with an aqueous solution of potassium chloride.
		[1]
(d)	Bro	mine reacts with fluorine to form bromine trifluoride, BrF ₃ .
	Cal	culate the relative molecular mass of bromine trifluoride.
	Sho	w all your working.

[2]

[Total: 11]

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

DATA SHEET
The Periodic Table of the Elements

=								ğ	Group			Ξ	≥	>	5	5	C
,												■	2	>	>		0
							+ Hydrogen										4 He lium
l ω w ≥	9 Be Beryllium					_		_				11 Boron	12 Carbon 6	14 N itrogen	16 Oxygen	19 T Fluorine	20 Ne Neon 10
Å ≥ i	Mg Magnesium											27 A 1 uminium	28 Si Silicon	31 Phosphorus 15	32 S Sulfur		40 Ar Argon
40 Ca Calcium 20		Sc candium	48	51 V Vanadium 23	Cr Chromium	Mn Manganese	56 Fe Iron	59 Cobalt	59 Nickel	64 Copper	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium	75 AS Arsenic	Selenium	80 Br Bromine 35	84 Kr Krypton 36
Strontiu	86 8	89 ≺ (ttrium	2r Zrconium 40	93 Nobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	Cd Cadmium 48	115 In Indium 49	Sn Tin	122 Sb Antimony 51	128 Te Tellurium	127 T lodine 53	131 Xe Xenon 54
137 Ba Barium 56		139 La nthanum * 72	178 Hf Iafnium	181 Ta Tartalum	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium		197 Au Gold 79	201 Hg Mercury 80	204 T 1 Thallium 81	207 Pb Lead	209 Bi Bismuth 83	209 Polonium 84	210 At Astatine 85	222 Rn Radon 86
22 Radi B 88	226 Ra Radium A	AC Actinium															
nth Ctii	* 58–71 Lanthanoid series † 90–103 Actinoid series	series rries		140 Ce Cerium 58	Pr Praseodymium 59	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 Thullum 69	173 Yb Ytterbium 70	Lu Lutetium 71
в Х	a = relk X = atc b = atol	a = relative atomic mass X = atomic symbol b = atomic (proton) number		232 Th Thorium	Pa Protactinium 91	238 U Uranium 92	Np Neptunium	244 Pu Putonium	243 Am Americium 95	247 Cm Ourium	247 BK Berkelium	Californium	252 ES Einsteinium 99		258 Md Mendelevium 101	259 Nobelium 102	260 Lr Lawrencium 103

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