

Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	
CHEMICTRY		0620/22



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.

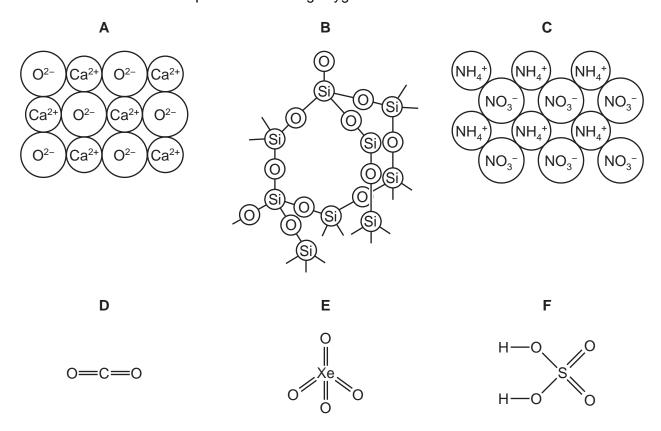
At the end of the examination, fasten all your work securely together.

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]
(v)	Which two compounds are ionic?	[1]
(vi)	Which two compounds react to form calcium sulfate?	[1]

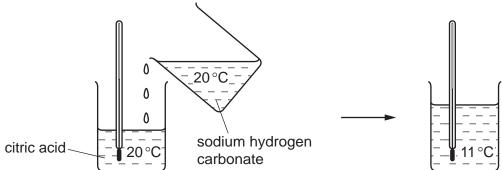
(b) Complete the symbol equation for the reaction of compound A with hydrochloric acid.

CaO +HC
$$l \rightarrow CaCl_2$$
 +[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 con	taining two or mor	e 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.



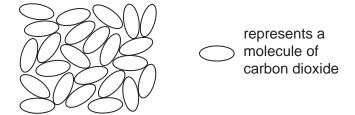
	carbonate
(a)	Explain how this experiment shows that the reaction is endothermic.
	[1]
(b)	Citric acid reacts with sodium hydroxide to form the soluble salt sodium citrate.
	Describe how you could prepare pure dry crystals of sodium citrate from citric acid and sodium hydroxide.
	[3]
(c)	Citric acid 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]

(d)	Complete the structure of ethanol to show all atoms and all bonds.
	—О—Н
	[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.
	carbonate catalyst
	hydrogen proton steam
	Ethanol can be made by reacting ethene with in the presence of
	a

[Total: 9]

Wh	en so	odium hydrogen carbonate is heated at 60°C, carbon dioxide is given off.	
(a)	(i)	Complete the equation for this reaction.	
		NaHCO $_3$ \rightarrow Na $_2$ CO $_3$ + CO $_2$ +	[2]
	(ii)	What type of chemical reaction is this?	
		Tick one box.	
		addition	
		neutralisation	
		oxidation	
		thermal decomposition	[1]
(b)	۸n	aqueous solution of sodium hydrogen carbonate is slightly alkaline.	ניו
(D)			
		ich 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	king 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.		
		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.



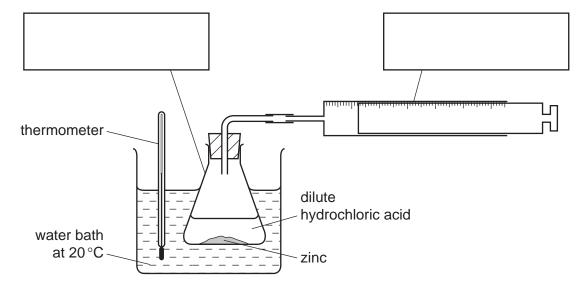
What is the state of carbon dioxide under these conditions?

he 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.

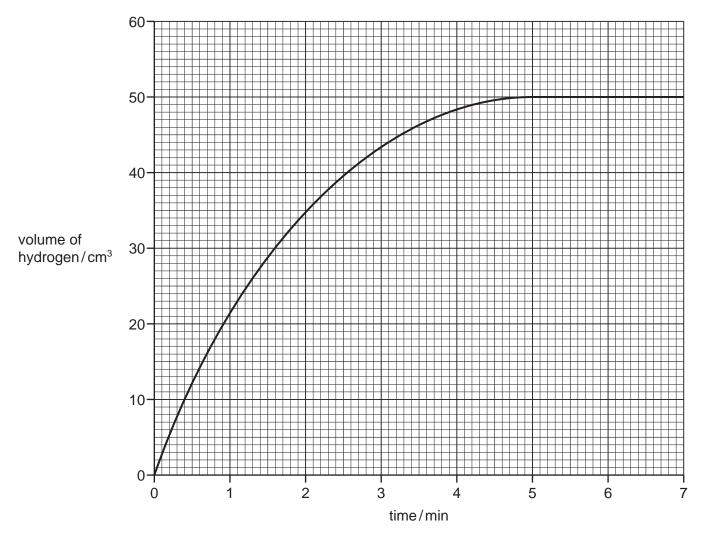
$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

(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)	Describe h	ow the volume	of hydroaen	changes	with time
111		OW LITE VOIGITIE		Unidingus	***********

.....

.....[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 c	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]

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 unsaturated?	
Describe a test for an unsaturated compound.	

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

$$\mathrm{C_6H_5CH=CHCOOH} \ + \ \mathrm{2NaOH} \ \rightarrow \ \mathrm{C_6H_5CH=CH_2} \ + \ \mathrm{Na_2CO_3} \ + \ \mathrm{H_2O}$$

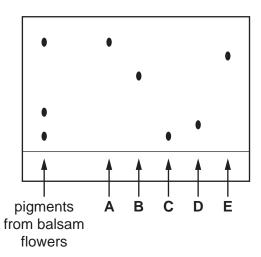
Complete the word equation for this reaction.

[2]

		11
(d)	Styı	rene is used to make the polymer poly(styrene).
	Poly	(ethene) is also a polymer.
	Des	scribe how poly(ethene) is made.
	In y	our answer include the words:
	•	addition ethene monomer polymerisation
		[3]
(e)	Bals	sam flowers contain a mixture of pigments.
	(i)	Describe how you could obtain a solution of this mixture of pigments from balsam flowers.

(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.



which of the pightents A, B, C, D and L are present in balsan nowers:
[1]

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 refe specific property of transition elements given in the table.	rring to a
(b)	Use the information in the table to suggest	
	(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)		
	Calcium chloride is a compound of a Group II metal.	
	Describe one difference between cobalt chloride and calcium chloride.	

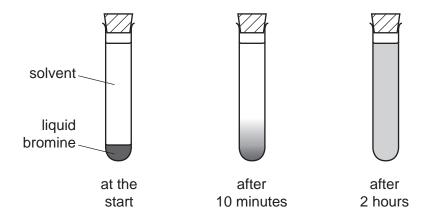
(d) The table below shows some observations about the reaction of four metals with water or steam.

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 of their reactivity.

		,	
	leas	st reactive	most reactive
			 [1]
(e)	Wh	nen iron is heated with steam, hydrogen is given off.	
		$3\text{Fe} + 4\text{H}_2\text{O} \rightleftharpoons \text{Fe}_3\text{O}_4 + 4\text{H}_2$	
	(i)	What does the sign ← mean?	
			[1]
	(::)		
	(ii)	Describe a test for hydrogen.	
		test	
		result	
			[2]
(f)	Ste	eel is an alloy of iron. Write about alloys of iron.	
	In y	your 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.	
			[4]

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.
	ļ:

(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.	
	[1

	(11)	Describe how the melting point changes down Group VII.
		[1]
	(iii)	Estimate the density of bromine.
		[1]
	(iv)	Deduce the number of completely filled electron shells in an atom of chlorine.
		[1]
(c)	-	leous bromine reacts with aqueous potassium iodide to form iodine and potassium mide.
	(i)	Complete the equation for this reaction.
		$Br_2 + 2KI \longrightarrow \dots + 2KBr$ [1]
		ניז
	(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	ow all your working.

[2]

[Total: 11]

The Periodic Table of the Elements DATA SHEET

	0	4 H Helium	20 Se	40 Ar Argon	84 K rypton	131 Xe Xenon 54	222 Rn Radon 86		175 Lu
	II/		19 Huorine	35.5 C1 Chlorine			210 At Astatine 85		173 Yb
	I		16 Oxygen	32 S Sulfur 16	Selenium	128 Te Tellurium	209 Po Pokenium 84		169 Tm
	>		14 N itrogen 7	31 P Phosphorus 15	AS Arsenic	122 Sb Antimony 51	209 Bi Bismuth		167 Er
	ΛΙ		12 C Carbon 6	28 Si Silicon	73 Ge Germanium 32	Sn Tin 50	207 Pb Lead		165 Ho
	=		11 Boron 5	27 A t Aluminium 13	70 Ga Gallium 31	115 n	204 T (Thallium		162 DV
					65 Zn Zinc 30	112 Cd Cadmium 48	201 Hg Mercury 80		159 Tb
					64 Copper	108 Ag Siver 47	197 Au Gold		157 Gd
Group					59 Nickel 28	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu
Gre					59 Co Cobalt	103 Rh Rhodium	192		150 Sm
		1 Hydrogen			56 Fe Iron	101 Ru Ruthenium 44	190 OS Osmium 76		147 Pm
					55 Wn Manganese 25	Tc Technetium 43	186 Re Rhenium 75		44 D
					Cr Chromium	96 Mo Molybdenum 42	184 W Tungsten 74		141 P
					51 V Vanadium 23	93 Nb Nobium 41	181 Ta Tantalum		140 Ce
					48 T Trtanium	91 Zr Zirconium	178 Hf Hafnium		
					Sc Scandium	89 Yttrium 39	139 La Lanthanum 57	227 Ac Actinium	d series
	=		9 Be Beryllium	Mg Magnesium	40 Ca Calcium	Strontium	137 Ba Barium 56	226 Ra Radium 88	* 58–71 Lanthanoid series
	_		7 L ithium	23 Na Sodium	39 X Potassium	85 Rb Rubidium	133 Cs Caesium 55	223 Fr Francium 87	58-71 L

8		59	09	61	62	63	64	65	99	29	89	69
a = relative atomic mass 2:	232	231	238	237	244	243	247	247	251	252	257	258
X = atomic symbol	ᄕ	Ра	>	d	Pu	Am	Cm	B	ర	Es	Fm	Md
b = atomic (proton) number 90	horium	Protactinium 91	Uranium 92	Neptunium 93	Plutonium 94	Americium 95	Curium 96	Berkelium 97	Californium 98	Einsteinium 99	Fermium 100	Mendeleviur 101
_	The vo	lume of c	one mole	The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)	s is 24dr	า³ at room	ı tempera	ture and	pressure	(r.t.p.).		

Key

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