Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6390889396

CHEMISTRY **0620/22**

Paper 2 **May/June 2014**

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.

This document consists of **15** printed pages and **1** blank page.

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1 The diagram shows part of the Periodic Table. Only some of the elements are shown.

							H								
Li													C	N	O
Na												Al			
K							Fe	Co	Ni	Cu	Zn				
Rb															
Cs													Pb		

(a) Answer the following questions using **only** the elements shown in the diagram.
Each element may be used once, more than once or not at all.

(i) Which element has a giant covalent structure? ..... [1]

(ii) Which element has the highest relative atomic mass? ..... [1]

(iii) Which **two** elements are formed when molten aluminium oxide is electrolysed?

..... and ..... [1]

(iv) Which element in Group I reacts most rapidly with water? ..... [1]

(v) Which element oxidises in the presence of water to form rust? ..... [1]

(vi) Which element burns in oxygen to form water? ..... [1]

(b) Rubidium reacts with oxygen to form rubidium oxide, Rb_2O.
Complete the symbol equation for this reaction.

$$....Rb + ... \rightarrow 2Rb_2O$$

[2]

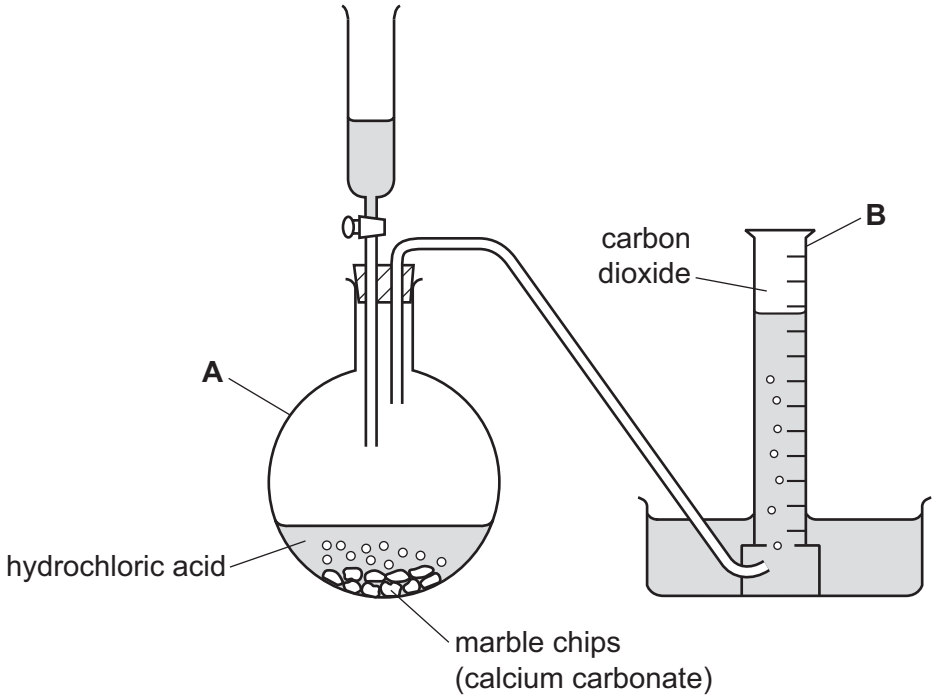
(c) Lead compounds are atmospheric pollutants.
State **one** adverse effect of lead compounds on health.

..... [1]

[Total: 9]

[Turn over

2 Carbon dioxide can be prepared in the laboratory using the apparatus shown below.



(a) State the names of the pieces of apparatus labelled **A** and **B**.

A .....

B .....

[2]

(b) Complete the word equation for this reaction.

calcium carbonate + hydrochloric acid → ..... + carbon dioxide + ...

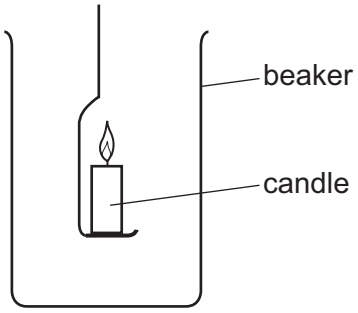
[2]

(c) Carbon dioxide is slightly soluble in water.
What effect will this have on the volume of carbon dioxide collected?
Tick **one** box.

The volume is lower than expected.	☐
The volume is higher than expected.	☐
The volume is the same as expected.	☐
No carbon dioxide is collected.	☐

[1]

(d) A burning candle is lowered into a beaker of carbon dioxide.



(i) The flame goes out.
Explain why the flame goes out.

..... [1]

(ii) After 20 seconds, the candle is removed and relit.
It is then lowered into the same beaker again.
The flame goes out again.
What does this tell you about the density of carbon dioxide compared to air?

..... [1]

(iii) After 40 minutes, the candle is removed and relit.
It is then lowered into the same beaker again.
The candle stays alight.
Explain why the candle stays alight.

.....

.....

..... [2]

[Total: 9]

[Turn over

3 River water contains a variety of ions and gases, and insoluble materials such as soil particles.

(a) Describe how you could remove the insoluble materials from a sample of river water. Include a labelled diagram.

.....

.....

.....

..... [4]

(b) The table shows the ions present in a sample of river water.

name of ion	formula of ion	concentration in mg / dm^3
calcium	Ca^{2+}	0.6
chloride	Cl^-	14.0
hydrogen carbonate	HCO_3^-	1.5
iron(III)	Fe^{3+}	0.5
magnesium	Mg^{2+}	1.0
potassium	K^+	3.0
sodium	Na^+	11.0
	SO_4^{2-}	0.4

(i) Which ion with a charge of 2+ is present in the highest concentration?

..... [1]

(ii) State the name of the ion with the formula SO_4^{2-}.

..... [1]

(iii) Calculate the total mass of ions present in 1 dm^3 of river water.

..... mg [1]

(iv) Use your answer to part **(iii)** to calculate the total mass of ions in 50 cm^3 of river water.

..... mg [1]

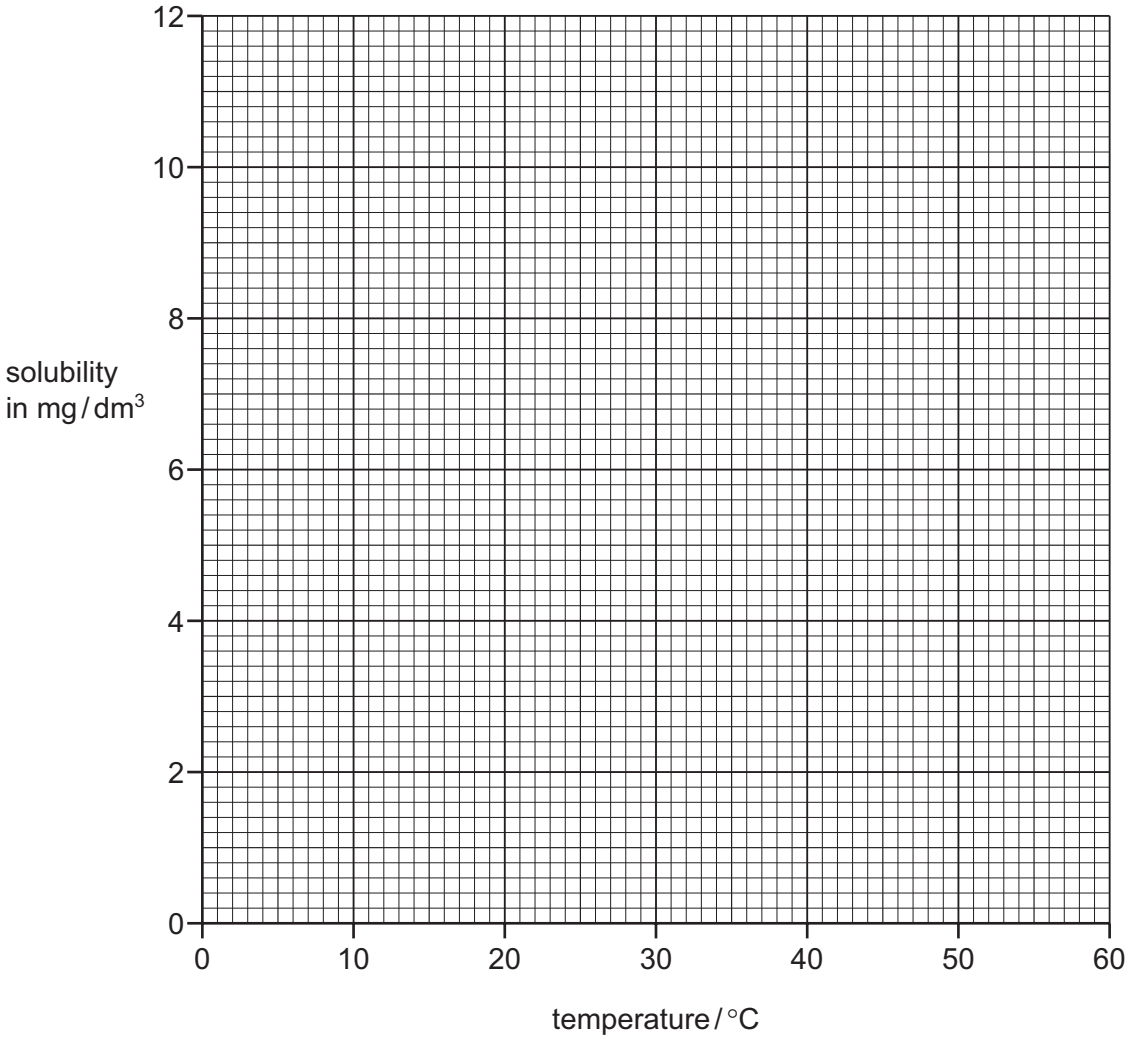
(v) A student evaporated the sample of river water to leave a solid containing a number of different compounds.
Use the information in the table to suggest the name of the compound present in the greatest amount.

..... [1]

(c) The table shows the solubility of oxygen in river water at different temperatures.

temperature / °C	0	10	20	30	40	50	60
solubility in mg / dm^3	11.0	8.8	7.2	6.0	4.9	4.2	3.6

(i) On the axes below, plot a graph to show how the solubility of oxygen changes with temperature. Draw a curve of best fit through the points.



[3]

(ii) Deduce the solubility of oxygen in river water at 25 °C.

..... [1]

(iii) State the approximate percentage of oxygen **in the air**.

..... [1]

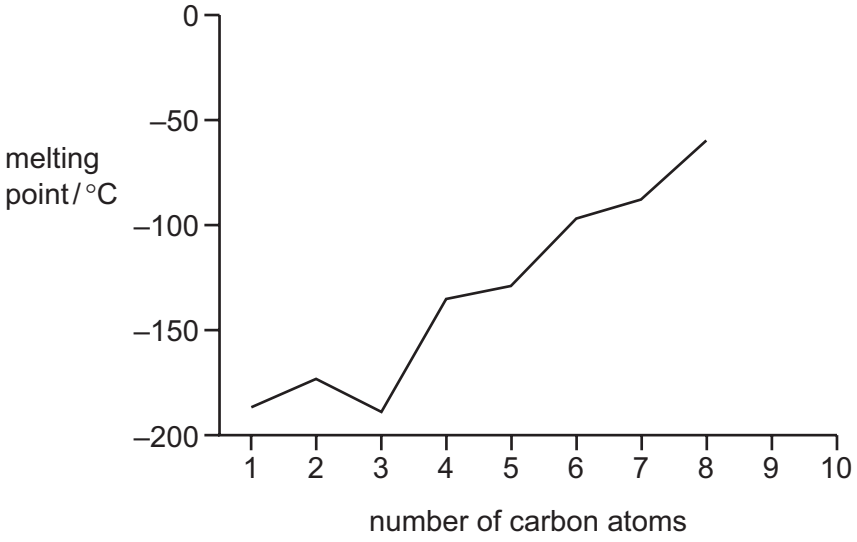
[Total: 14]

4 The alkanes are a homologous series of hydrocarbons.

(a) Name another homologous series of hydrocarbons.

..... [1]

(b) The graph below shows how the melting points of the first eight alkanes vary with the number of carbon atoms.



(i) Describe how the melting points of these alkanes vary with the number of carbon atoms.

.....

.....

..... [2]

(ii) **On the graph above**, continue the line to show the melting points of the hydrocarbons having 9 and 10 carbon atoms. [2]

(c) The first member of the alkane homologous series is methane.

(i) State **one** source of the methane in the atmosphere.

..... [1]

(ii) State **one** adverse effect of methane in the atmosphere.

..... [1]

(d) Complete the symbol equation to show the complete combustion of methane.

$$CH_4 + ...O_2 \rightarrow ..... + 2H_2O$$

[2]

[Total: 9]

[Turn over

5 Iron from a blast furnace contains carbon, sulfur, silicon and phosphorus as impurities.

(a) Iron is converted into steel in a basic oxygen converter.
The impurities undergo oxidation.
What is meant by the term *oxidation*?

..... [1]

(b) Carbon is oxidised to carbon dioxide. Sulfur is oxidised to sulfur dioxide.
Explain why these oxides are easily removed from the molten iron.

..... [1]

(c) Phosphorus is converted to phosphorus(V) oxide.

(i) Complete the symbol equation for this reaction.

$$.....P + 5O_2 \rightarrow 2P_2O_5$$

[1]

(ii) Is phosphorus(V) oxide an acidic or basic oxide?
Give a reason for your answer.

.....

..... [1]

(d) Phosphorus(V) oxide is a solid.
Explain how this oxide is removed from the molten iron.

.....

.....

..... [3]

(e) Steel is an alloy.

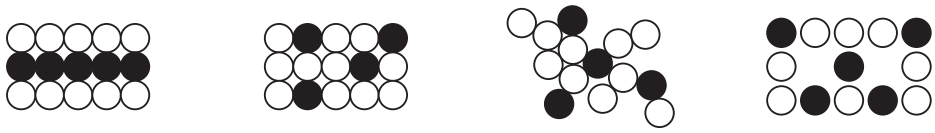
(i) State **one** use of:

mild steel, ...

stainless steel. .....

[2]

(ii) Which diagram, **A**, **B**, **C** or **D**, best represents an alloy?
Put a ring around the correct answer.



A **B** **C** **D**

[1]

(f) The table shows the composition of some different brasses.

composition of the brass		strength / 10^8 Pa
% zinc	% copper	
10	90	2.6
20	80	3.0
30	70	3.3
40	60	3.6

How does the composition of brass affect its strength?

..... [1]

(g) A student dissolved a sample of brass in concentrated nitric acid.
Nitrogen dioxide, NO_2, was released.

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

(i) Write a word equation for this reaction.

[2]

(ii) The student added aqueous ammonia to the solution formed until the ammonia was in excess.
Describe what the student would observe.

.....

.....

..... [3]

(iii) State **one** source of the nitrogen dioxide in the atmosphere.

..... [1]

[Total: 17]

[Turn over

6 In the 1860s, John Newlands listed the elements in order of increasing atomic mass. Part of his table is shown.

H 1	Li 2	Be 3	B 4	C 5	N 6	O 7
F 8	Na 9	Mg 10	A*l* 11	Si 12	P 13	S 14
C*l* 15	K 16	Ca 17	Cr 18	Ti 19	Mn 20	Fe 21

(a) (i) Describe the differences between Newlands' table and the Periodic Table we use today.

.....

.....

.....

.....

..... [3]

(ii) What evidence is there, from Newlands' table, that some elements with similar properties are grouped together?

.....

..... [1]

(b) The table below shows some properties of some of the halogens.

halogen	melting point / °C	boiling point / °C	colour
chlorine	–101	–7	yellow-green
bromine	–7		red-brown
iodine	+114	+184	grey-black
astatine	+302	+337	

Deduce:

the colour of astatine, ...

the boiling point of bromine, ...

the state of iodine at 190 °C. .....

[3]

(c) Aqueous chlorine reacts with aqueous potassium bromide.

$$Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$$

(i) Describe the colour change you would observe in this reaction.

..... [1]

(ii) State the name of the salt formed in this reaction.

..... [1]

(iii) Explain why aqueous bromine does not react with aqueous potassium chloride.

.....

..... [1]

(iv) The halogens exist as diatomic molecules.
What is meant by the term *diatomic*?

..... [1]

[Total: 11]

7 Ethanol is an alcohol.

(a) Complete the structure of ethanol showing all atoms and bonds.

–C–O–H

[1]

(b) State the name of the products formed when ethanol undergoes **incomplete** combustion.

..... and ..... [2]

(c) Ethanol can be manufactured by fermentation or by the hydration of ethene.

(i) Complete the word equation for the manufacture of ethanol from ethene.

ethene + ... → ethanol

[1]

(ii) What conditions are needed for the manufacture of ethanol from ethene?
Tick **two** boxes.

temperature above 100 °C	☐
room temperature	☐
presence of inorganic catalyst	☐
presence of yeast	☐
presence of hydrogen	☐

[2]

(iii) When ethanol is prepared by fermentation, the fermentation mixture produced contains ethanol and water.
The boiling point of ethanol is 78 °C.
Describe how fractional distillation can be used to separate ethanol from water.
In your answer, refer to:

- the apparatus used,
- changes in state,
- differences in boiling points.

You may use a diagram.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 11]

DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 **He** Helium 2
					1 **H** Hydrogen 1						11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
	7 **Li** Lithium 3	9 **Be** Beryllium 4									27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
	23 **Na** Sodium 11	24 **Mg** Magnesium 12									70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
	39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	112 **Cd** Cadmium 48	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
	85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
	133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81					
	Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **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
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).