



## **Cambridge International Examinations**

	Cambridge International Examinations Cambridge International General Certificate of Secondary Education	
Cambridge IGCSE	Cambridge International Examinations Cambridge International General Certificate of Secondary Education	
CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	
OLIEMIOTOV	0.000/00	

**CHEMISTRY** 

0620/23

Paper 2

October/November 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.

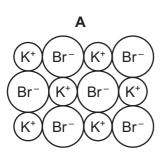
The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

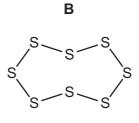
This document consists of 16 printed pages.



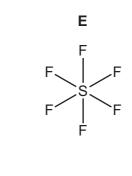
[Turn over

D





C O=C=O COM



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

and [2]	Which <b>two</b> substances are elements?	(i)
ure?[1]	Which substance has a giant ionic structor	(ii)
en a hydrocarbon is completely burnt in air?	Which substance is a product formed wh	(iii)
[1]		
a brown vapour at the anode when electrolysed?	Which substance, when molten, produces	(iv)
[1]		
[1]	Which substance is used as a lubricant?	(v)
	duce the simplest formula of substance <b>A</b> .	<b>(b)</b> De
[1]		

(c) Calculate the relative molecular mass of substance E. You must show your working.

[2]

[Total: 9]

• liq	uids have a defi	nite volume and shape, inite volume but no definite shape, finite volume or shape.	y: AddaCa
		e properties of six substances, <b>A</b> to <b>F</b> , which are eith	
at roon	n temperature.  melting point		ner solids or l
at roon	n temperature.	e properties of six substances, <b>A</b> to <b>F</b> , which are eith	ner solids or l
at roon	melting point /°C	e properties of six substances, <b>A</b> to <b>F</b> , which are eith	ner solids or l solubility in water
at roon	melting point /°C +3550	e properties of six substances, <b>A</b> to <b>F</b> , which are eithe electrical conductivity  does not conduct in any state	solubility in water insoluble
at roon substance A B	melting point /°C +3550 +44	e properties of six substances, <b>A</b> to <b>F</b> , which are eithe electrical conductivity  does not conduct in any state  does not conduct in any state	solubility in water insoluble insoluble
at roon substance A B C	melting point /°C +3550 +44 +1660	e properties of six substances, <b>A</b> to <b>F</b> , which are either electrical conductivity  does not conduct in any state  does not conduct in any state  conducts when solid or liquid	solubility in water insoluble insoluble insoluble
at roon substance A B C	melting point /°C +3550 +44 +1660 +681	e properties of six substances, <b>A</b> to <b>F</b> , which are either electrical conductivity  does not conduct in any state  does not conduct in any state  conducts when solid or liquid  only conducts when in aqueous solution or liquid	solubility in water insoluble insoluble soluble soluble

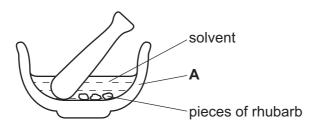
(iii) Which two substances are metals?

(iv) Which two substances are simple molecules?

		2	
(c)	Dry	air contains mainly nitrogen, noble gases and oxygen.	1
	(i)	wair contains mainly nitrogen, noble gases and oxygen.  Which one of the following shows the correct composition of dry air?  Tick one box.	STO
		nitrogen 21%, oxygen 78%, noble gases 1%	1
		nitrogen 1%, oxygen 78%, noble gases 21%	
		nitrogen 69%, oxygen 21%, noble gases 10%	
		nitrogen 78%, oxygen 21%, noble gases 1%	[1]
	(ii)	Metals can be joined together by high temperature welding. This process is sometimes carried out in the presence of argon. Suggest why welding is carried out in the presence of argon.	
			[2]

[Total: 14]

www.papaCambridge.com (a) A student separated the pigments in the rhubarb stem by chromatography. He used the apparatus shown below to extract the pigments.



(i)	State the name of the	piece of apparatus	labelled <b>A</b> .

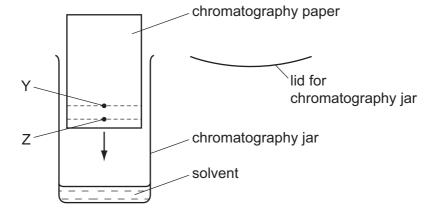
[1]
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(ii) Suggest a suitable solvent, other than water, that he could use to extract the pigments.

(iii) The solution of pigments was not concentrated enough to use for chromatography. Suggest how the student could make the solution more concentrated.

	4-
	11
	. 1

**(b)** The student carried out chromatography using the apparatus shown below.



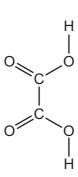
(i) A spot of the pigment mixture was placed at Y. Explain why a spot of the mixture was not placed at Z.

[1
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(ii) Describe how the rest of the procedure was carried out.

								[2]
 	161							

(c) Rhubarb leaves contain ethanedioic acid.
The structure of ethanedioic acid is shown below.



- (i) On the structure above, put a ring around a carboxylic acid group. [1]
- ......[1]
- (d) A teacher heated ethanedioic acid with concentrated sulfuric acid. The equation for the reaction is:

Deduce the molecular formula of ethanedioic acid.

$$\begin{array}{c}
\text{COOH} \\
\mid \\
\text{COOH(s)}
\end{array}
\xrightarrow{\text{H}_2\text{SO}_4} \text{CO(g)} + \text{CO}_2(g) + \mathbf{X}$$

(i) Deduce the formula of compound X.

(ii) At the end of the reaction, the contents of the test-tube contained diluted sulfuric acid only.

Explain why.

.....[1]

(iii) Carbon dioxide is a product of this reaction.

State **one** common source of the carbon dioxide in the atmosphere.

.....[1]

(iv) Explain why an increase in the concentration of carbon dioxide in the atmosphere is harmful to the environment.

......[2]

[Total: 13]

www.PapaCambridge.com

A mixture of soil and water was shaken and then filtered.

	Way.
	7
A n	nixture of soil and water was shaken and then filtered.
(a)	Draw a labelled diagram of the apparatus you would use for separating the insoluble possible from the solution.

[2]

**(b)** The filtrate was then evaporated. The table shows the composition and mass of each compound obtained by evaporating the

compound	ions present in the compound	mass of compound/g
calcium carbonate	Ca <sup>2+</sup> and CO <sub>3</sub> <sup>2-</sup>	4.0
calcium sulfate	Ca <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	5.0
magnesium sulfate	Mg <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	2.8
	K⁺ and NO₃⁻	1.2
potassium sulfate	K <sup>+</sup> and SO <sub>4</sub> <sup>2-</sup>	2.4
sodium carbonate		3.0
sodium chloride	Na⁺ and C <i>l</i> ⁻	1.6

(i)	State the name of the compound which contains K <sup>+</sup> and NO <sub>3</sub> <sup>-</sup> ions.
	[1]
(ii)	Write the symbols for the ions present in sodium carbonate.
	[1]
iii)	Which compound with a singly charged negative ion has the highest mass in the mixture?
	[1]

The table from page 7 is repeated below:

om page 7 is repeated	8 below:	mass of compound/g
compound	ions present in the compound	mass of compound/g
calcium carbonate	Ca <sup>2+</sup> and CO <sub>3</sub> <sup>2-</sup>	4.0
calcium sulfate	Ca <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	5.0
magnesium sulfate	Mg <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	2.8
	K⁺ and NO₃⁻	1.2
potassium sulfate	K <sup>+</sup> and SO <sub>4</sub> <sup>2-</sup>	2.4
sodium carbonate		3.0
sodium chloride	Na⁺ and C <i>l</i> ⁻	1.6

(iv)	Calcu	late:
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the total mass of all the compounds present in the mixture,

the percentage of magnesium sulfate by mass in the mixture.

[1]

- (c) Calcium carbonate decomposes when heated.
  - (i) Complete the symbol equation for this reaction.

$$CaCO_3 \rightarrow CaO + .....$$

[1]

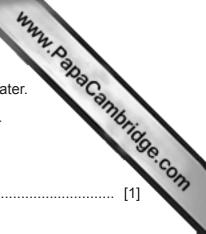
(ii) Calcium oxide, CaO, reacts with water to form a strongly alkaline solution. Which one of the following pH values is strongly alkaline? Put a ring around the correct answer.

> pH3 pH7 pH8 pH 12

> > [1]

[Total: 9]

methanol + hydrochloric acid  $\rightarrow$  chloromethane + water



(a) To which homologous series does methanol belong?

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 L

**(b)** Complete the structure of methanol below to show its functional group.

[1]

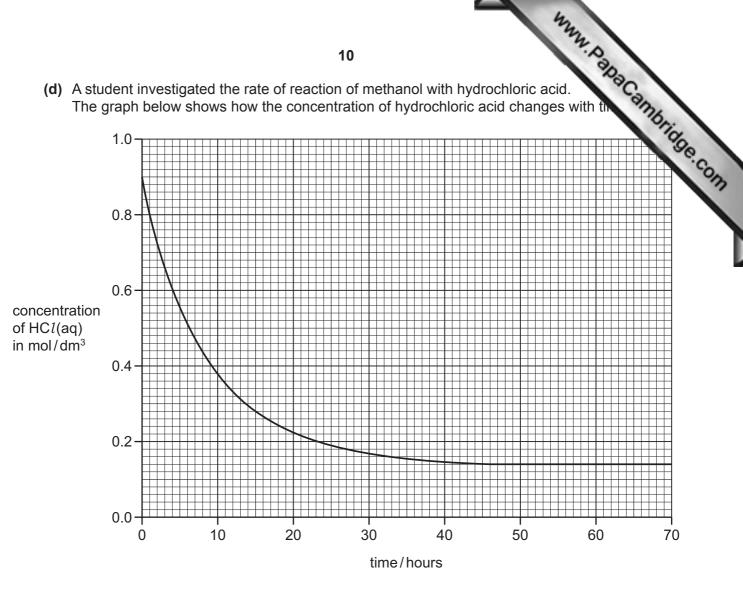
- **(c)** Methanol can be made from synthesis gas which contains carbon monoxide and hydrogen. Synthesis gas is made from methane.
  - (i) Complete the symbol equation for this reaction.

$$CH_4 + H_2O \rightarrow CO + .....H_2$$
 [1]

(ii) Suggest two hazards associated with the products of this reaction.

 	[2

(d) A student investigated the rate of reaction of methanol with hydrochloric acid. The graph below shows how the concentration of hydrochloric acid changes with the



(i)	Describe how the concentration of hydrochloric acid changes with time.	
		[2]
(ii)	Deduce the concentration of hydrochloric acid when the reaction had proceeded 15 hours.	for
		[1]
(iii)	At what time was the reaction just complete?	
		[1]

(iv) On the grid above, draw a line to show how the concentration of hydrochloric acid changes

with time when the reaction takes place at a higher temperature.

[2]

www.PapaCambridge.com (e) Hydrochloric acid is formed when hydrogen chloride gas is dissolved in water. Draw a dot-and-cross diagram to show the electron arrangement in a molecule of chloride.

Show only the outer electron shells.

Show hydrogen electrons as x.

Show chlorine electrons as •.

[2]

[Total: 13]

[Turn over

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7-	
MAN, Dabas	
1.0	
90	۹

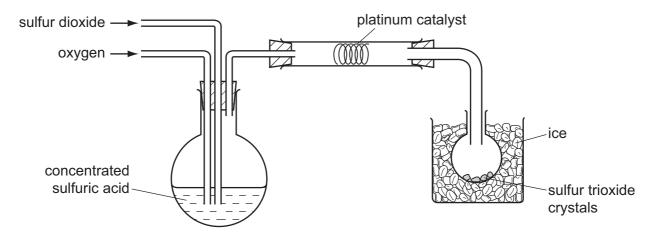
- 6 Sulfur burns in air to form sulfur dioxide.
  - (a) (i) Is sulfur dioxide an acidic or basic oxide? Give a reason for your answer.

	- [1

- (ii) Sulfur dioxide is an atmospheric pollutant.
  Explain why sulfur dioxide in the atmosphere can erode buildings made of limestone.
- (b) Sulfur dioxide reacts with oxygen to form sulfur trioxide.

  Sulfur trioxide can be made in the laboratory using the apparatus shown below.

  Sulfur trioxide has a melting point of 17 °C and a boiling point of 45 °C.



- (i) Suggest **one** safety precaution when carrying out this experiment.
  - .....[1]
- (ii) What is the purpose of the platinum catalyst?
- (iii) Complete the symbol equation for the reaction.

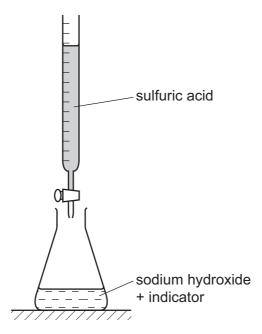
$$2SO_2 + \dots SO_3$$

(iv) Suggest why the sulfur trioxide is collected in a flask surrounded by ice.

www.PapaCambridge.com (v) When 64 g of sulfur dioxide react with excess oxygen, 80 g of sulfur trioxide Calculate the mass of sulfur trioxide formed from 160 g of sulfur dioxide.

mass =	 g	[1]

(c) Sulfur trioxide reacts with water to form sulfuric acid. A student used the apparatus shown below to determine the concentration of a solution of sodium hydroxide.



(i) Which one of these pieces of apparatus should the student use to put 25.0 cm³ of sodium hydroxide into the flask. Tick **one** box.

beaker	
measuring cylinder	
test-tube	
volumetric pipette	

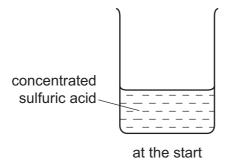
(ii)	How would the student know when the sulfuric acid had neutralised the sodium hydroxide?
	T.A.

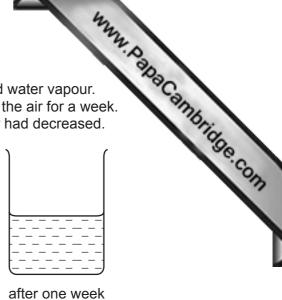
[1]

(d) Clean air contains mainly nitrogen, noble gases, oxygen and water vapour.

A teacher left a beaker of concentrated sulfuric acid open to the air for a week.

After a week, the concentration of sulfuric acid in the beaker had decreased.





Explain these results by referring to one or more of the substances present in the air.

[1]

[Total: 13]

www.PapaCambridge.com 15 7 (a) Describe the properties of chlorine, bromine and iodine. In your answer, include the trends in: their state, their colour, their reactivity. **(b)** A molecule of chlorine can be written as Cl-Cl. Which one of the following words describes this molecule? Put a ring around the correct answer. diatomic monatomic giant ionic [1] (c) Draw the electronic structure of a fluorine atom.

(d) The equation below describes the reaction of a halogen with a halide.

$$Br_2 + 2KI \rightarrow I_2 + 2KBr$$

Write a word equation for this reaction.

[2]

[2]

[Total: 9]

DATA SHEET	The Periodic Table of the Elements
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				1	6				MM. P.	De Cambrio
0	4 <b>He</b> Helium	20 Neon 10 40	<b>Ar</b> Argon	84 <b>Kr</b> Krypton 36	Xe Xenon Xenon	Rn Radon 86		175 <b>Lu</b> Lutetium 71	Lr Lawrendum 103	Cambri
		19 Fluorine 9 35.5	<b>C1</b> Chlorine	80 <b>Br</b> Bromine 35	127 <b>T</b> lodine 53	At Astatine 85		173 <b>Yb</b> Ytterbium 70	Nobelium 102	13
>		16 Oxygen 8		79 Selenium 34	128 <b>Te</b> Tellurium	<b>Po</b> Polonium 84		169 <b>Tm</b> Thulium 69	Md Mendelevium 101	
>		14 Nitrogen 7	31 <b>P</b> Phosphorus 15	75 <b>AS</b> Arsenic 33	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	Fm Fermium	
		12 Carbon 6	Silicon	73 <b>Ge</b> Germanium	Sn Tn 50	207 <b>Pb</b> Lead		165 <b>Ho</b> Holmium 67	<b>ES</b> Einsteinium 99	(r.t.p.).
=		11 Boron 5	At Aluminium 13	70 <b>Ga</b> Gallium 31	115 <b>In</b> Indium 149	204 <b>T 1</b> Thallium 81		162 <b>Dy</b> Dysprosium 66	Cf Californium 98	pressure
				65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	<b>Bk</b> Berkelium 97	ature and
				64 <b>Cu</b> Copper 29	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold 79		157 <b>Gd</b> Gadolinium 64	Curium 96	n tempera
500				59 <b>Ni</b> Nickel	106 Pd Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95	n³ at roor
5				59 Co Cobalt	Rhodium 45	192 <b>I r</b> Iridium 77		Sm Samarium 62	Pu Plutonium 94	The volume of one mole of any gas is $24\ dm^3$ at room temperature and pressure (r.t.p.).
	T Hydrogen			56 <b>Fe</b> Iron	101 <b>Ru</b> Ruthenium 44	190 <b>Os</b> Osmium 76		Pm Promethium 61	Neptunium 93	of any ga
				Manganese	Tc Technetium 43	186 <b>Re</b> Rhenium 75		Neodymium 60	238 <b>U</b> Uranium 92	one mole
				52 <b>Cr</b> Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Tungsten 74		Pr Praseodymium 59	<b>Pa</b> Protactinium 91	olume of o
				51 <b>V</b> Vanadium 23	93 <b>Nb</b> Niobium 41	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b> Cerium	232 <b>Th</b> Thorium 90	The v
				48 <b>T</b> Titanium	91 <b>Zr</b> Zirconium 40	178 <b>Hf</b> Hafnium 72			nic mass bol nic) number	
				Scandium	89 <b>Y</b>	139 <b>La</b> Lanthanum 57 *	227 <b>Ac</b> Actinium 89	l series eries	<ul> <li>a = relative atomic mass</li> <li>x = atomic symbol</li> <li>b = proton (atomic) number</li> </ul>	
=		Beerylium 4 24	Magnesium	40 <b>Ca</b> Calcium	Sr Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series	« × a □	
-		7 Lithium 3 23	Na Sodium 11	39 <b>K</b> Potassium	85 <b>Rb</b> Rubidium 37	133 <b>CS</b> Caesium 55	<b>Fr</b> Francium 87	58-71L 90-103,	Key	

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