Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

* 4 2 8 4 3 0 5 9 8 8 *

CHEMISTRY **0620/43**

Paper 4 Theory (Extended) **October/November 2018**

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 on all the work you hand in.
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 12.
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 **11** printed pages and **1** blank page.

© UCLES 2018

1 Answer the following questions using only the substances in the list.
Each substance may be used once, more than once or not at all.

ammonia	**bauxite**	**carbon dioxide**	**carbon monoxide**
hematite	**oxygen**	**sodium chloride**	**sulfur dioxide**

State which substance is:

(a) an element ..... [1]

(b) an ore of iron ..... [1]

(c) used to bleach wood pulp ..... [1]

(d) used to manufacture fertilisers ..... [1]

(e) a toxic gas produced during the incomplete combustion of hydrocarbons

..... [1]

(f) an ionic compound ..... [1]

(g) a reactant in photosynthesis ..... [1]

(h) a product of photosynthesis. ..... [1]

[Total: 8]

© UCLES 2018

2 This question is about electrolysis.

(a) **(i)** What is meant by the term *electrolysis*?

.....

..... [2]

(ii) Name the type of particle responsible for the conduction of electricity during electrolysis in:

the metal wires .....

the electrolyte .....
[2]

(b) The table gives information about the products of the electrolysis of two electrolytes. Platinum electrodes are used in each case.

(i) Give **two** reasons why platinum is suitable to use as an electrode.

1 .....

2 .....
[2]

(ii) Complete the table.

electrolyte	observation at the anode (+)	name of product at the anode (+)	observation at the cathode (–)	name of product at the cathode (–)
concentrated aqueous potassium chloride			bubbles of colourless gas	
aqueous copper(II) sulfate	bubbles of colourless gas			

[6]

[Total: 12]

3 Tin is a metallic element in Group IV. Its main ore is cassiterite which is an impure form of tin(IV) oxide, SnO_2.
Tin also occurs in stannite, Cu_2FeSnS_4.

(a) Calculate the relative formula mass, M_r, of Cu_2FeSnS_4.

M_r of Cu_2FeSnS_4 = ... [1]

(b) The M_r of SnO_2 is 151.

Calculate the percentage of tin by mass in SnO_2.

percentage of tin by mass in SnO_2 = ... [1]

(c) The percentage of tin by mass in Cu_2FeSnS_4 is 27.6%.

Use this information and your answer to **(b)** to suggest whether it would be better to extract tin from SnO_2 or Cu_2FeSnS_4.
Explain your answer.

.....

..... [1]

(d) Tin can be extracted by heating tin(IV) oxide with carbon. Carbon monoxide is the other product.

Write a chemical equation for this reaction.

..... [2]

(e) The position of tin in the reactivity series is shown.

iron	most reactive
tin	↑
copper	least reactive

A student added iron to a solution containing Sn^{2+} ions.

The student then separately added tin to a solution containing Cu^{2+} ions.

Complete the ionic equations. If there is no reaction write 'no reaction'.

$Fe + Sn^{2+} \rightarrow$ .....

$Sn + Cu^{2+} \rightarrow$ .....
[2]

(f) Copper(II) nitrate, $Cu(NO_3)_2$, decomposes when it is heated. The only solid product is copper(II) oxide, CuO. There are two gaseous products. One of the gaseous products is oxygen.

(i) Describe a test for oxygen.

test .....

result .....
[2]

(ii) Name the other gaseous product. Describe its appearance.

name .....

appearance .....
[2]

(iii) Write a chemical equation for the thermal decomposition of copper(II) nitrate.

..... [1]

(g) Iron does not rust when it is completely coated with zinc. When the zinc is scratched, the iron still does not rust.

(i) Explain why the iron does **not** rust when it is completely coated with zinc.

..... [1]

(ii) Explain why the iron still does **not** rust when the zinc is scratched.

.....

.....

.....

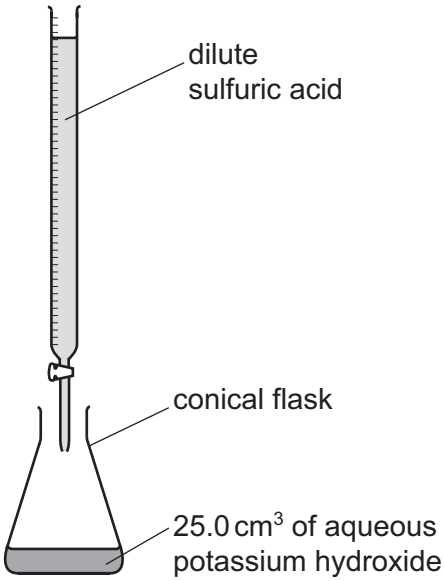
.....

.....

..... [3]

[Total: 16]

4 **(a)** Dilute sulfuric acid and aqueous potassium hydroxide can be used to make potassium sulfate crystals using a method that includes titration.



A student titrated 25.0 cm^3 of 0.0500 mol / dm^3 aqueous potassium hydroxide with dilute sulfuric acid in the presence of an indicator. The volume of dilute sulfuric acid needed to neutralise the aqueous potassium hydroxide was 20.0 cm^3.

The equation for the reaction is shown.

$$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$$

Determine the concentration of the dilute sulfuric acid.

- Calculate the number of moles of aqueous potassium hydroxide used.

..... mol

- Calculate the number of moles of dilute sulfuric acid needed to neutralise the aqueous potassium hydroxide.

..... mol

- Calculate the concentration of the dilute sulfuric acid.

..... mol / dm^3
[3]

(b) After the titration has been completed, the conical flask contains an aqueous solution of potassium sulfate and some of the dissolved indicator.

Describe how to prepare a **pure**, dry sample of potassium sulfate crystals from new solutions of dilute sulfuric acid and aqueous potassium hydroxide of the same concentrations as used in the titration. Include a series of key steps in your answer.

.....

.....

.....

.....

.....

.....

..... [5]

(c) Potassium hydrogensulfate, $KHSO_4$, is an acid salt. It dissolves in water to produce an aqueous solution, **X**, containing K^+, H^+ and SO_4^{2-} ions.

Describe what you would see when the following experiments are done.

(i) Magnesium ribbon is added to an excess of solution **X**.

.....

..... [2]

(ii) A flame test is done on solution **X**.

..... [1]

(iii) An aqueous solution containing barium ions is added to solution **X**.

..... [1]

(d) Dilute sulfuric acid reacts with bases, metals and carbonates.

Write chemical equations for the reaction of dilute sulfuric acid with each of the following:

(i) magnesium hydroxide

..... [2]

(ii) zinc

..... [2]

(iii) sodium carbonate

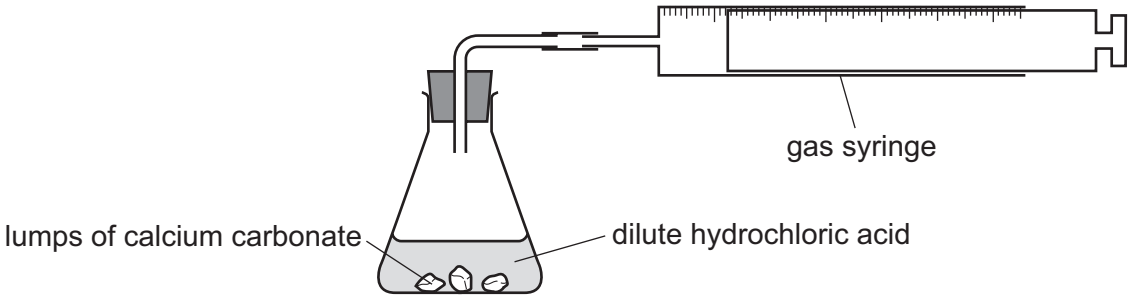
..... [2]

[Total: 18]

5 A student investigates the rate of reaction between lumps of calcium carbonate and dilute hydrochloric acid using the apparatus shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

The calcium carbonate was in excess.



(a) Which measurements should the student make during the reaction to determine the rate of reaction?

.....

..... [2]

(b) What happens to the rate of reaction as the reaction proceeds? Explain your answer.

.....

.....

.....

..... [3]

(c) The student repeated the experiment at a higher temperature. All other conditions were kept the same. The student found that the rate of reaction increased.

Explain, in terms of collisions, why the rate of reaction increased.

.....

.....

.....

.....

..... [4]

(d) Apart from using a higher temperature, suggest **two** other methods of increasing the rate of this reaction.

1 .....

2 .....
[2]

[Total: 11]

6 **(a)** Ethanol can be manufactured by fermentation and by hydration.

(i) Describe these **two** processes of ethanol manufacture.

In each case you should:
- identify the reactants
- give the reaction conditions
- write a chemical equation for the reaction which produces ethanol.

fermentation .....

.....

.....

.....

.....

hydration .....

.....

.....

.....

.....
[6]

(ii) Give **two** advantages of ethanol manufacture by fermentation compared to by hydration.

1 .....

2 .....
[2]

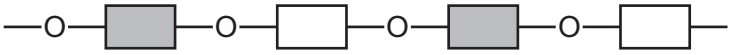
(iii) State **two** major uses of ethanol.

1 .....

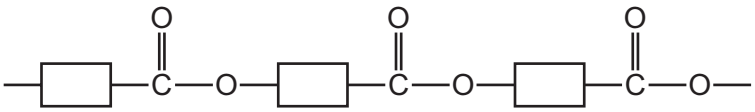
2 .....
[2]

(b) The structures of some polymers are shown.

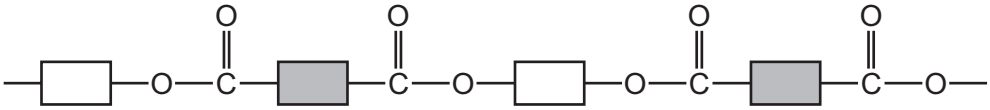
A



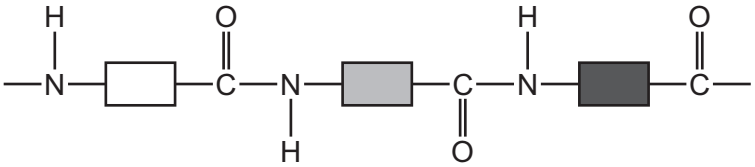
B



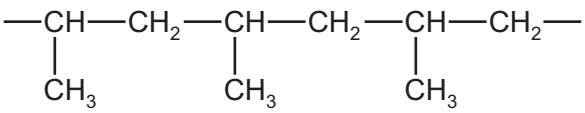
C



D



E



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

State which polymer, **A**, **B**, **C**, **D** or **E**, represents:

(i) an addition polymer ..... [1]

(ii) a protein ..... [1]

(iii) a polyester made from only **one** monomer ..... [1]

(iv) *Terylene* ..... [1]

(v) a complex carbohydrate. ..... [1]

[Total: 15]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

Group

I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

© UCLES 2018