Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1845295131

CHEMISTRY **0620/32**

Paper 3 (Extended) **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 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 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 **13** printed pages and **3** blank pages.

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CAMBRIDGE International Examinations

[Turn over

1 An important aspect of chemistry is purity and methods of purification.

(a) Give an example of substances used in everyday life which must be pure.

.... [1]

(b) A list of techniques used to separate mixtures is given below.

chromatography **crystallisation** **diffusion** **dissolving**

evaporation **filtration** **fractional distillation** **simple distillation**

(i) From the list, choose the most suitable technique to separate the following.

water from sea-water ....

helium from a mixture of helium and methane ....

ethanol from a mixture of ethanol and propanol ....

iron filings from a mixture of iron filings and water ....

a mixture of two amino acids, glycine and alanine ....
[5]

(ii) Describe how you would obtain a pure sample of copper(II) sulfate-5-water crystals from a mixture of copper(II) sulfate-5-water with copper(II) oxide using some of the techniques listed above.

....

....

....

....

.... [4]

[Total: 10]

2 Aluminium is obtained by the reduction of aluminium ions to aluminium atoms.

(a) Write an ionic equation for the reduction of an aluminium ion to an aluminium atom.

.... [2]

(b) The original method of extracting aluminium involved the reduction of aluminium chloride using the reactive metal sodium. Aluminium obtained by this method was very expensive due to the high cost of extracting sodium from sodium chloride.

(i) Complete the equation for this reduction.

$$AlCl_3 + \text{.......}Na \rightarrow \text{..........} + \text{..........}$$

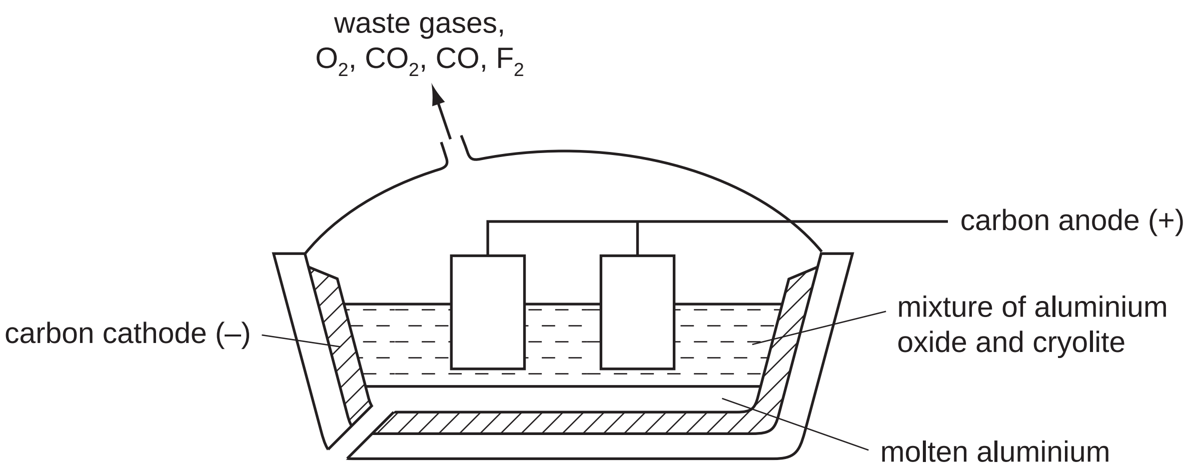
[2]

(ii) How can sodium metal be obtained from sodium chloride?

....

.... [2]

(c) In the modern method, aluminium is obtained by the electrolysis of aluminium oxide (alumina) dissolved in molten cryolite, Na_3AlF_6.



(i) The major ore of aluminium is impure aluminium oxide.
What is the name of this ore?

.... [1]

(ii) This ore is a mixture of aluminium oxide, which is amphoteric, and iron(III) oxide which is basic.
Explain how these two oxides can be separated by the addition of aqueous sodium hydroxide.

....

....

.... [2]

(iii) Give **two** reasons why the electrolyte contains cryolite.

....

....

.... [2]

(iv) The mixture of gases evolved at the positive electrode includes:

carbon dioxide
carbon monoxide
fluorine
oxygen

Explain the presence of these gases in the gaseous mixture formed at the positive electrode. Include at least **one** equation in your explanation.

....

....

....

....

.... [5]

(d) A major use of aluminium is the manufacture of pots and pans. One reason for this is its resistance to corrosion.

(i) Explain why aluminium, a reactive metal, is resistant to corrosion.

....

.... [1]

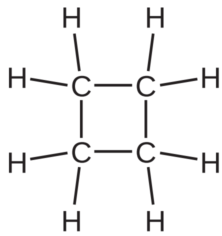
(ii) Suggest **two** other reasons why aluminium is suitable for making pots and pans.

....

.... [2]

[Total: 19]

3 **(a)** A hydrocarbon has the following structural formula.



(i) State the molecular formula and the empirical formula of this hydrocarbon.

molecular formula ....

empirical formula ....
[2]

(ii) Draw the structural formula of an isomer of the above hydrocarbon.

[1]

(iii) Explain why these two hydrocarbons are isomers.

....

.... [2]

(iv) Are these two hydrocarbons members of the same homologous series?
Give a reason for your choice.

....

.... [1]

(b) Alkenes can be made from alkanes by cracking.

(i) Explain the term *cracking*.

....

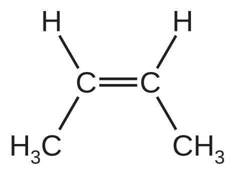
.... [2]

(ii) One mole of an alkane, when cracked, produced one mole of hexane, C_6H_{14}, and two moles of ethene.
What is the molecular formula of the original alkane?

.... [1]

(c) Alkenes are used in polymerisation reactions and addition reactions.

(i) Draw the structural formula of the product formed by the addition polymerisation of but-2-ene. Its formula is given below.



[3]

(ii) Give the name and structural formula of the addition product formed from ethene and bromine.

name ....

structural formula

[2]

[Total: 14]

4 Zinc is an important metal. Its uses include making alloys and the construction of dry cells (batteries).

(a) Name an alloy which contains zinc. What is the other metal in this alloy?

name of alloy ....

other metal in alloy ....
[2]

(b) The main ore of zinc is zinc blende, ZnS.

(i) The ore is heated in the presence of air to form zinc oxide and sulfur dioxide.
Write the equation for this reaction.

.... [2]

(ii) Give a major use of sulfur dioxide.

.... [1]

(c) Zinc can be obtained from zinc oxide in a two step process. Aqueous zinc sulfate is made from zinc oxide and then this solution is electrolysed with inert electrodes. The electrolysis is similar to that of copper(II) sulfate with inert electrodes.

(i) Name the reagent which will react with zinc oxide to form zinc sulfate.

.... [1]

(ii) Complete the following for the electrolysis of aqueous zinc sulfate.

Write the equation for the reaction at the negative electrode.

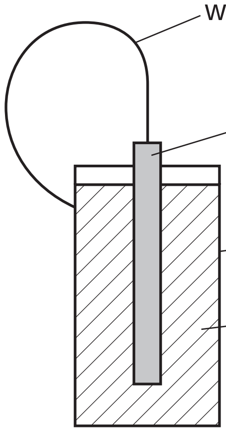
....

Name the product at the positive electrode.

....

The electrolyte changes from zinc sulfate to ....
[3]

(d) A dry cell (battery) has a central rod, usually made of graphite. This is the positive electrode which is surrounded by the electrolyte, typically a paste of ammonium chloride and manganese(IV) oxide, all of which are in a zinc container which is the negative electrode.



(i) Draw an arrow on the diagram to indicate the direction of electron flow. [1]

(ii) Suggest why the electrolyte is a paste.

.... [1]

(iii) The following changes occur in a dry cell.
For each change, decide if it is oxidation or reduction and give a reason for your choice.

Zn to Zn^{2+}

....

manganese(IV) oxide to manganese(III) oxide

....
[2]

[Total: 13]

5 **(a)** Glucose, sucrose and starch are all carbohydrates. Their formulae are:

glucose, $C_6H_{12}O_6$,
sucrose, $C_{12}H_{22}O_{11}$,
starch, $(C_6H_{10}O_5)_n$.

(i) Identify **two** common features in the formulae of these carbohydrates.

....

.... [2]

(ii) Draw the structure of a complex carbohydrate, such as starch. The formula of glucose, can be represented by

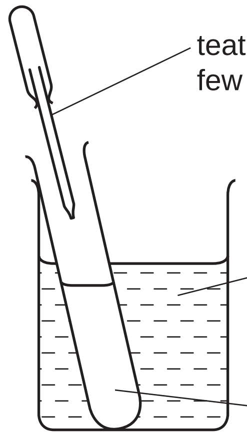
Include **three** glucose units in the structure.

[2]

(b) Starch hydrolyses to glucose in the presence of the enzyme, amylase.
What is meant by the term *enzyme*?

.... [2]

(c) The effect of temperature on this reaction can be studied by the experiment shown below.
Starch and iodine form a blue-black colour.
Glucose and iodine do not form a blue-black colour.



The experiment is set up as in the diagram and the time measured for the mixture to change from blue-black to colourless. The experiment is repeated at different temperatures.
Typical results of this experiment are given in the table below.

experiment	temperature / °C	time for blue-black colour to disappear / min
A	20	30
B	40	15
C	70	remained blue-black

(i) Put the experiments in order of reaction rate – slowest first and fastest last.

.... [2]

(ii) Explain why the reaction rates in experiments A and B are different.

....

....

....

.... [3]

(iii) Suggest why the colour remains blue-black in experiment C.

.... [1]

[Total: 12]

6 Sulfuric acid is an important acid, both in the laboratory and in industry.
Sulfuric acid is manufactured in the Contact Process. Originally, it was made by heating metal sulfates and by burning a mixture of sulfur and potassium nitrate.

(a) Give a major use of sulfuric acid.

.... [1]

(b) A group of naturally occurring minerals have the formula of the type $FeSO_4.xH_2O$ where x is 1, 4, 5, 6 or 7. The most common of these minerals is iron(II) sulfate-7-water.

(i) When this mineral is heated gently it dehydrates.

$$\underset{\text{green}}{FeSO_4.7H_2O} \rightleftharpoons \underset{\text{pale yellow}}{FeSO_4} + 7H_2O$$

Describe how you could show that this reaction is reversible.

....

....

.... [2]

(ii) When the iron(II) sulfate is heated strongly, further decomposition occurs.

$$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$$

The gases formed in this reaction react with water and oxygen to form sulfuric acid.
Explain how the sulfuric acid is formed.

....

.... [2]

(iii) A mineral of the type $FeSO_4.xH_2O$ contains 37.2% of water.
Complete the calculation to determine x.

mass of one mole of H_2O = 18 g

mass of water in 100 g of $FeSO_4.xH_2O$ = 37.2 g

number of moles of H_2O in 100 g of $FeSO_4.xH_2O$ = ...

mass of $FeSO_4$ in 100 g of $FeSO_4.xH_2O$ = ... g

mass of one mole of $FeSO_4$ = 152 g

number of moles of $FeSO_4$ in 100 g of $FeSO_4.xH_2O$ = ...

x = ...

[4]

(c) When a mixture of sulfur and potassium nitrate is burned and the products are dissolved in water, sulfuric acid is formed.

(i) The sulfuric acid formed by this method is not pure. It contains another acid.
Deduce the identity of this acid.

.... [1]

(ii) The heat causes some of the potassium nitrate to decompose.
Write the equation for the action of heat on potassium nitrate.

.... [2]

[Total: 12]

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											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
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	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
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	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
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	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

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

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

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.).