Cambridge IGCSE
Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

* 3 2 2 6 5 3 8 2 3 2 *

CHEMISTRY **0620/31**

Paper 3 (Extended) **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 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.

IB14 06_0620_31/2RP

CAMBRIDGE International Examinations

1 The table below gives the composition of six particles which are either atoms or ions.

particle	number of protons	number of neutrons	number of electrons
A	33	40	33
B	19	20	18
C	34	45	36
D	33	42	33
E	13	14	13
F	24	28	21

(a) Which particles are atoms? Explain your choice.

....

.... [2]

(b) Which particle is a negative ion and why has this particle got a negative charge?

....

.... [2]

(c) Which particles are positive ions?

.... [1]

(d) Explain why particle **A** and particle **D** are isotopes.

....

.... [2]

[Total: 7]

2 **(a)** Water is needed for industry and in the home.

(i) Rain water is collected in reservoirs. How is it treated before entering the water supply?

....

.... [2]

(ii) State **two** industrial uses of water.

....

.... [2]

(iii) State **two** uses of water in the home.

....

.... [1]

(b) In many regions, drinking water is obtained by the distillation of sea-water. Explain how distillation separates the water from sea-water.

....

....

.... [2]

[Total: 7]

3 **(a)** Different gases diffuse at different speeds.

(i) What is meant by the term *diffusion*?

....

.... [1]

(ii) What property of a gas molecule affects the speed at which it diffuses?

.... [1]

(b) Helium is a gas used to fill balloons. It is present in the air in very small quantities. Diffusion can be used to separate it from the air.

Air at 1000 °C is on one side of a porous barrier. The air which passes through the barrier has a larger amount of helium in it.

(i) Why does the air on the other side of the barrier contain more helium?

.... [1]

(ii) Why is it an advantage to have the air at a high temperature?

....

.... [1]

(c) Most helium is obtained from natural gas found in the USA. Natural gas contains methane and 7% helium. One possible way to obtain the helium would be to burn the methane.

(i) Write an equation for the complete combustion of methane.

.... [1]

(ii) Suggest why this would **not** be a suitable method to obtain the helium.

....

.... [1]

(iii) Suggest another method, other than diffusion, by which helium could be separated from the mixture of gases in natural gas.

.... [1]

[Total: 7]

4 In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) **(i)** Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	A*l*	Si	P	S	C*l*
number of valency electrons							
valency							

[2]

(ii) What is the relationship between the group number and the number of valency electrons?

....

.... [1]

(iii) Explain the relationship between the number of valency electrons and the valency

for the elements Na to A*l*,

....

....

....

for the elements P to C*l*.

....

....

....

[4]

(b) Across a period, the elements change from metallic to non-metallic.

(i) Describe how the type of oxide changes across this period.

....

.... [2]

(ii) Describe how the type of bonding in the chlorides formed by these elements changes across this period.

....

.... [2]

[Total: 11]

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5 Zinc is obtained from the ore, zinc blende, ZnS.

(a) Describe the extraction of zinc from its ore, zinc blende. Include at least one balanced equation in your description.

....

....

....

....

.... [5]

(b) State **two** major uses of zinc.

....

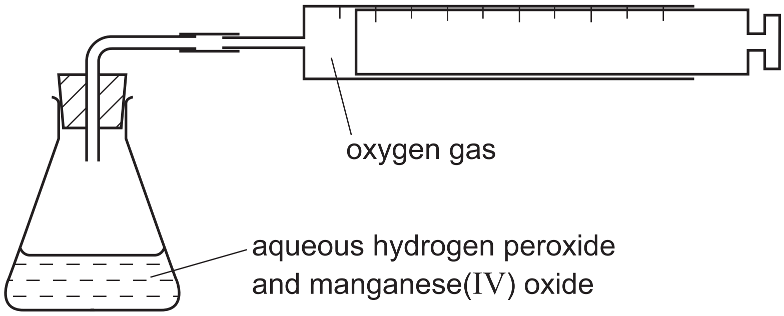
.... [2]

[Total: 7]

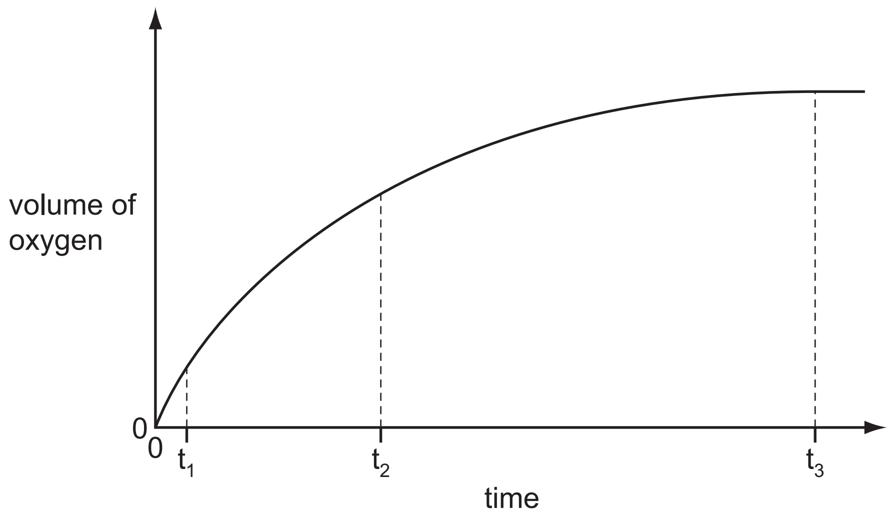
6 Hydrogen peroxide decomposes to form water and oxygen. This reaction is catalysed by manganese(IV) oxide.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The rate of this reaction can be investigated using the following apparatus.



40 cm^3 of aqueous hydrogen peroxide was put in the flask and 0.1 g of small lumps of manganese(IV) oxide was added. The volume of oxygen collected was measured every 30 seconds. The results were plotted to give the graph shown below.



(a) **(i)** How do the rates at times t_1, t_2 and t_3 differ?

....

.... [2]

(ii) Explain the trend in reaction rate that you described in **(a)(i)**.

....

....

.... [2]

(b) The experiment was repeated using 0.1 g of finely powdered manganese(IV) oxide. All the other variables were kept the same.

(i) On the axes opposite, sketch the graph that would be expected. [2]

(ii) Explain the shape of this graph. ....

....

....

.... [2]

(c) Describe how you could show that the catalyst, manganese(IV) oxide, was not used up in the reaction. Manganese(IV) oxide is insoluble in water.

....

....

....

....

.... [4]

(d) In the first experiment, the maximum volume of oxygen produced was 96 cm^3 measured at r.t.p. Calculate the concentration of the aqueous hydrogen peroxide in mol / dm^3.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

number of moles of O_2 formed = ... [1]

number of moles of H_2O_2 in 40 cm^3 of solution = ... [1]

concentration of the aqueous hydrogen peroxide in mol / dm^3 = ...

.... [1]

[Total: 15]

7 One way of establishing a reactivity series is by displacement reactions.

(a) A series of experiments was carried out using the metals lead, magnesium, zinc and silver. Each metal was added in turn to aqueous solutions of the metal nitrates.

The order of reactivity was found to be:

magnesium	most reactive
zinc	↓
lead	
silver	least reactive

(i) Complete the table.

✓ = reacts
✗ = does not react

	metal			
aqueous solution	lead Pb	magnesium Mg	zinc Zn	silver Ag
lead(II) nitrate		✓	✓	✗
magnesium nitrate				
zinc nitrate				
silver nitrate				

[3]

(ii) Displacement reactions are redox reactions.
On the following equation, draw a **ring** around the reducing agent and an **arrow** to show the change which is oxidation.

$$Zn + Pb^{2+} \rightarrow Zn^{2+} + Pb$$

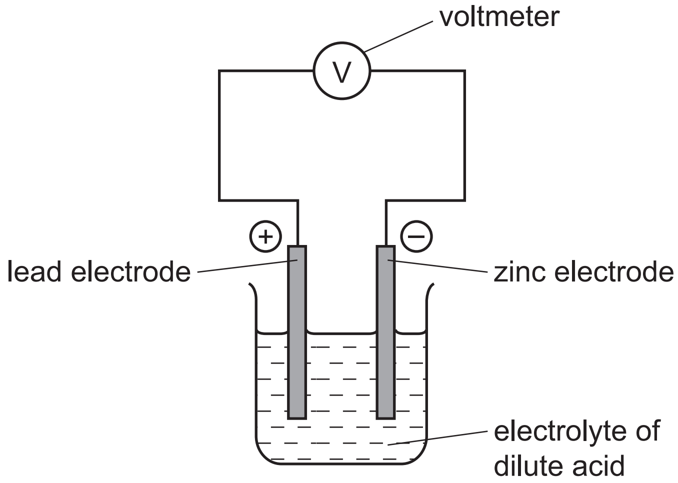
[2]

(iii) Complete the following ionic equation.

$$Zn + 2Ag^{+} \rightarrow .... + ...$$

[1]

(b) Another way of determining the order of reactivity of metals is by measuring the voltage and polarity of simple cells. The polarity of a cell is shown by which metal is the positive electrode and which metal is the negative electrode. An example of a simple cell is shown below.



(i) Mark on the above diagram the direction of the electron flow. [1]

(ii) Explain, in terms of electron transfer, why the more reactive metal is always the negative electrode.

....

....

.... [2]

(iii) The following table gives the polarity of cells using the metals zinc, lead, copper and manganese.

cell	electrode 1	polarity	electrode 2	polarity
A	zinc	–	lead	+
B	manganese	–	lead	+
C	copper	+	lead	–

What information about the order of reactivity of these four metals can be deduced from the table?

....

....

.... [2]

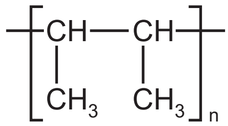
(iv) What additional information is needed to establish the order of reactivity of these four metals using cells?

.... [1]

[Total: 12]

8 Polymers are made by the polymerisation of simple molecules called monomers.

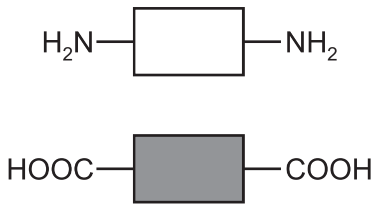
(a) **(i)** The structural formula of a polymer is given below.



This polymer is made by addition polymerisation. Draw the structural formula of its monomer.

[1]

(ii) The two monomers shown below form a nylon which is a condensation polymer.



Draw its structural formula showing one repeat unit of the polymer.

[3]

(iii) Name the natural macromolecule which contains the same linkage as nylon.

.... [1]

(iv) Explain the difference between addition polymerisation and condensation polymerisation.

....

....

.... [2]

(b) Many polymers are non-biodegradable.

(i) Explain the term *non-biodegradable*.

....

.... [2]

(ii) State **three** problems caused by the disposal of non-biodegradable polymers.

....

....

.... [3]

(c) Storage tanks for cold water are now made from polymers because they are cheaper than metal tanks. Suggest **two** other advantages of making cold water tanks from polymers.

....

.... [2]

[Total: 14]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	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.).