

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CHEMISTRY



Paper 3

0620/03

October/November 2004

1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials required.

Candidate
Name

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Centre
Number

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Candidate
Number

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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 a pencil for any diagrams, graphs or rough working.

WRITE IN THE BOXES PROVIDED ON THE QUESTION PAPER

DO **NOT** WRITE IN THE BARCODE.

DO **NOT** WRITE IN THE GREY AREAS BETWEEN THE PAGES.

Do not use staples, paper clips, highlighters, glue or correction fluid.

You may use a calculator.

Answer **all** questions.

The number of marks is given in brackets [] at the end of each question or part questions.

A copy of the Periodic Table is printed on page 16.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

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



- 1 (a) Two of the gases in air are nitrogen and oxygen. Name **two** other gases present in unpolluted air.

	[2]
--	-----

- (b) Two common pollutants present in air are sulphur dioxide and lead compounds. State the source and harmful effect of each.

sulphur dioxide

source	
harmful effect	[3]

lead compounds

source	
harmful effect	[2]

- (c) Respiration and photosynthesis are two of the processes that determine the percentage of oxygen and of carbon dioxide in the air.

- (i) Name another process that changes the percentages of these two gases in air.

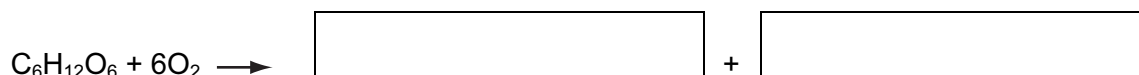
	[1]
--	-----

- (ii) The equation for photosynthesis is given below.



This is an endothermic reaction.

Complete the reaction for respiration.

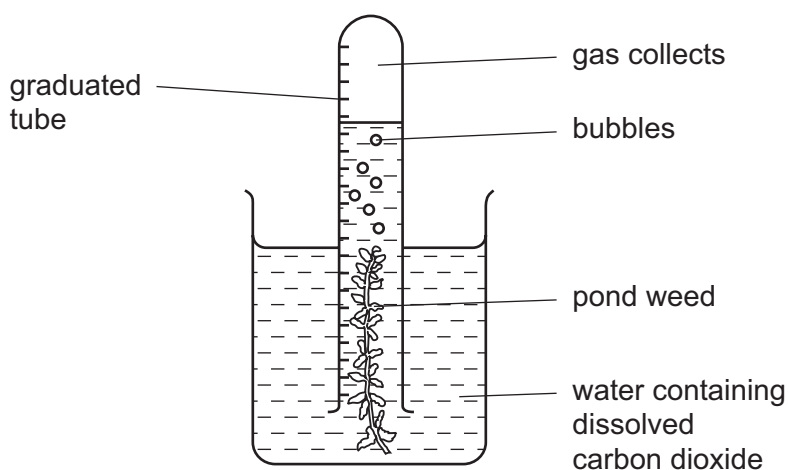


This is an reaction.

[2]

- (d) The rate of photosynthesis of pond weed can be measured using the following experiment.

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- (i) Describe how you could show that the gas collected in this experiment is oxygen.

[1]

- (ii) What measurements are needed to calculate the rate of this reaction?

[2]

- (iii) What would be the effect, and why, of moving the apparatus further away from the light?

[2]

- 2 The salt copper(II) sulphate can be prepared by reacting copper(II) oxide with sulphuric acid.

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Complete the list of instructions for making copper(II) sulphate using **six** of the words below.

blue cool dilute filter
saturated sulphate white oxide

Instructions

- 1 Add excess copper(II) oxide to sulphuric acid in a beaker and boil it.

- 2 to remove the unreacted copper(II) oxide.

- 3 Heat the solution until it is .

- 4 the solution to form

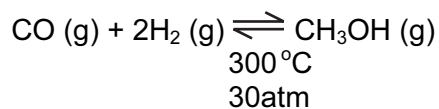
coloured crystals of copper (II)

.

[6]

3 The simplest alcohol is methanol.

(a) It is manufactured by the following reversible reaction.



(i) Reversible reactions can come to equilibrium. Explain the term *equilibrium*.

[1]

(ii) At 400 °C, the percentage of methanol in the equilibrium mixture is lower than at 300 °C. Suggest an explanation.

[2]

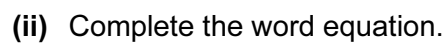
(iii) Suggest two advantages of using high pressure for this reaction.
Give a reason for each advantage.

advantage	
reason	

advantage	
reason	
[5]	

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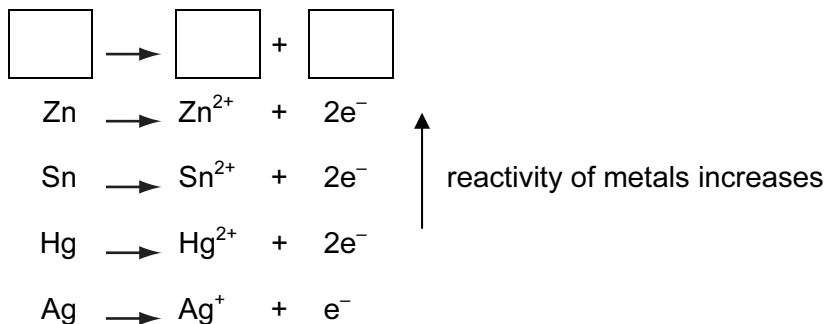
[2]



+

[1]

- 4 In the following list of ionic equations, the metals are in order of reactivity.



- (a) (i) In the space at the top of the series, write an ionic equation that includes a more reactive metal. [1]

- (ii) Define *oxidation* in terms of electron transfer.

[1]

- (iii) Explain why the positive ions are likely to be oxidising agents.

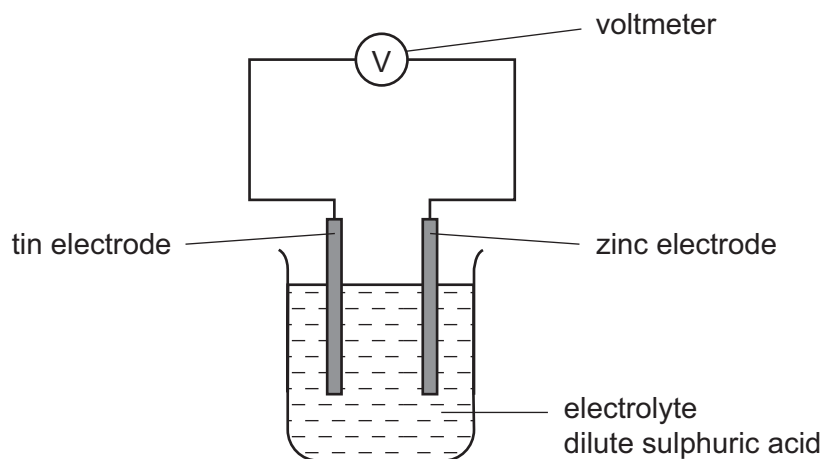
[1]

- (iv) Which positive ion(s) can oxidise mercury metal (Hg)?

[1]

(b) The following diagram shows a simple cell.

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- (i) Predict how the voltage of the cell would change if the tin electrode was replaced with a silver one.

	[1]
--	-----

- (ii) Which electrode would go into the solution as positive ions? Give a reason for your choice.

	[1]
--	-----

- (iii) State how you can predict the direction of the electron flow in cells of this type.

	[1]
--	-----

- 5 Strontium and sulphur chlorides both have a formula of the type XCl_2 but they have different properties.

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property	strontium chloride	sulphur chloride
appearance	white crystalline solid	red liquid
melting point / °C	873	-80
particles present	ions	molecules
electrical conductivity of solid	poor	poor
electrical conductivity of liquid	good	poor

- (a) The formulae of the chlorides are similar because both elements have a valency of 2. Explain why Group II and Group VI elements both have a valency of 2.

[2]

- (b) Draw a diagram showing the arrangement of the valency electrons in one covalent molecule of sulphur chloride.
Use x to represent an electron from a sulphur atom.
Use o to represent an electron from a chlorine atom.

[3]

- (c) Explain the difference in electrical conductivity between the following.

- (i) solid and liquid strontium chloride

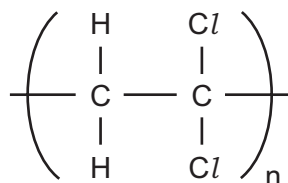
[1]

- (ii) liquid strontium chloride and liquid sulphur chloride

[1]

- 6 Polymers are extensively used in food packaging. Poly(dichloroethene) is used because gases can only diffuse through it very slowly. Polyesters have a high thermal stability and food can be cooked in a polyester bag.

(a) (i) The structure of poly(dichloroethene) is given below.



Draw the structural formula of the monomer.

[1]

- (ii) Explain why oxygen can diffuse faster through the polymer bag than carbon dioxide can.

[2]

- (b) (i) A polyester can be formed from the monomers HO-CH₂CH₂-OH and HOOC-C₆H₄-COOH. Draw the structure of this polyester.

[2]

- (ii) Name a naturally occurring class of compounds that contains the ester linkage.

	[1]
--	-----

- (iii) Suggest what is meant by the term *thermal stability*.

	[1]

- (c) (i) Describe **two** environmental problems caused by the disposal of plastic (polymer) waste.

	[2]

- (ii) The best way of disposing of plastic waste is recycling to form new plastics. What is another advantage of recycling plastics made from petroleum?

	[1]
--	-----

- 7 (a) (i) Write a symbol equation for the action of heat on zinc hydroxide.

[2]

- (ii) Describe what happens when solid **sodium** hydroxide is heated strongly.

[1]

- (b) What would be **observed** when copper(II) nitrate is heated?

[3]

- (c) Iron(III) sulphate decomposes when heated. Calculate the mass of iron(III) oxide formed and the volume of sulphur trioxide produced when 10.0 g of iron(III) sulphate was heated.

Mass of one mole of $\text{Fe}_2(\text{SO}_4)_3$ is 400 g.



Number of moles of $\text{Fe}_2(\text{SO}_4)_3$ =	
Number of moles of Fe_2O_3 formed =	
Mass of iron(III) oxide formed =	g
Number of moles of SO_3 produced =	
Volume of sulphur trioxide at r.t.p. =	dm^3

[5]

8 The alkenes are a homologous series of unsaturated hydrocarbons.

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- (a) The table below gives the names, formulae and boiling points of the first members of the series.

name	formula	boiling point / °C
ethene	C ₂ H ₄	-102
propene	C ₃ H ₆	-48
butene	C ₄ H ₈	-7
pentene	C ₅ H ₁₀	30
hexene		

- (i) Complete the table by giving the formula of hexene and by predicting its boiling point.

[2]

- (ii) Deduce the formula of the alkene which has a relative molecular mass of 168. Show your working.

[2]

- (b) Describe a test that will distinguish between the two isomers, but-2-ene and cyclobutane.

test
.....
result with but-2-ene
.....
result with cyclobutane

[3]

(c) Alkenes undergo addition reactions.

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- (i) What class of organic compound is formed when an alkene reacts with water?

	[1]
--	-----

- (ii) Predict the structural formula of the compound formed when hydrogen chloride reacts with but-2-ene.

	[1]
--	-----

- (iii) Draw the structure of the polymer formed from but-2-ene.

	[2]
--	-----

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DATA SHEET
The Periodic Table of the Elements

Group																		
I	II											III	IV	V	VI	VII	0	
		<div>1 H Hydrogen 1</div>																<div>4 He Helium 2</div>
<div>7 Li Lithium 3</div>	<div>9 Be Beryllium 4</div>											<div>11 B Boron 5</div>	<div>12 C Carbon 6</div>	<div>14 N Nitrogen 7</div>	<div>16 O Oxygen 8</div>	<div>19 F Fluorine 9</div>	<div>20 Ne Neon 10</div>	
<div>23 Na Sodium 11</div>	<div>24 Mg Magnesium 12</div>											<div>27 Al Aluminium 13</div>	<div>28 Si Silicon 14</div>	<div>31 P Phosphorus 15</div>	<div>32 S Sulphur 16</div>	<div>35.5 Cl Chlorine 17</div>	<div>40 Ar Argon 18</div>	
<div>39 K Potassium 19</div>	<div>40 Ca Calcium 20</div>	<div>48 Ti Titanium 22</div>	<div>51 V Vanadium 23</div>	<div>52 Cr Chromium 24</div>	<div>55 Mn Manganese 25</div>	<div>56 Fe Iron 26</div>	<div>59 Co Cobalt 27</div>	<div>59 Ni Nickel 28</div>	<div>64 Cu Copper 29</div>	<div>65 Zn Zinc 30</div>	<div>70 Ga Gallium 31</div>	<div>73 Ge Germanium 32</div>	<div>75 As Arsenic 33</div>	<div>79 Se Selenium 34</div>	<div>80 Br Bromine 35</div>	<div>84 Kr Krypton 36</div>		
<div>85 Rb Rubidium 37</div>	<div>88 Sr Strontium 38</div>	<div>91 Zr Zirconium 40</div>	<div>93 Nb Niobium 41</div>	<div>96 Mo Molybdenum 42</div>	<div>101 Ru Ruthenium 44</div>	<div>103 Rh Rhodium 45</div>	<div>106 Pd Palladium 46</div>	<div>108 Ag Silver 47</div>	<div>112 Cd Cadmium 48</div>	<div>115 In Indium 49</div>	<div>119 Sn Tin 50</div>	<div>122 Sb Antimony 51</div>	<div>127 I Iodine 53</div>	<div>128 Te Tellurium 52</div>	<div>131 Xe Xenon 54</div>			
<div>133 Cs Caesium 55</div>	<div>137 Ba Barium 56</div>	<div>178 Hf Hafnium 72</div>	<div>181 Ta Tantalum 73</div>	<div>184 W Tungsten 74</div>	<div>186 Re Rhenium 75</div>	<div>190 Os Osmium 76</div>	<div>192 Ir Iridium 77</div>	<div>195 Pt Platinum 78</div>	<div>197 Au Gold 79</div>	<div>201 Hg Mercury 80</div>	<div>204 Tl Thallium 81</div>	<div>207 Pb Lead 82</div>	<div>209 Bi Bismuth 83</div>	<div>210 Po Polonium 84</div>	<div>210 At Astatine 85</div>	<div>222 Rn Radon 86</div>		
<div>226 Fr Francium 87</div>	<div>226 Ra Radium 88</div>																	
<div>*58-71 Lanthanoid series 90-103 Actinoid series</div>																		
		<div>a = relative atomic mass X = atomic symbol b = proton (atomic) number</div>																
Key																		