

CANDIDATE NAME

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

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CENTRE NUMBER	CANDIDATE NUMBER	
CHEMISTRY		0620/23
Paper 2	Octobe	r/November 2011

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 need to use a pencil for any diagrams, graphs or rough working.

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

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

A copy of the Periodic Table is printed on page 20.

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.

For Exam	iner's Use
1	
2	
3	
4	
5	
6	
7	
Total	

1 hour 15 minutes

This document consists of 19 printed pages and 1 blank page.



1 The diagram shows five different pieces of laboratory glassware, A, B, C, D and E.

www.PapaCambridge.com Α В Ε D

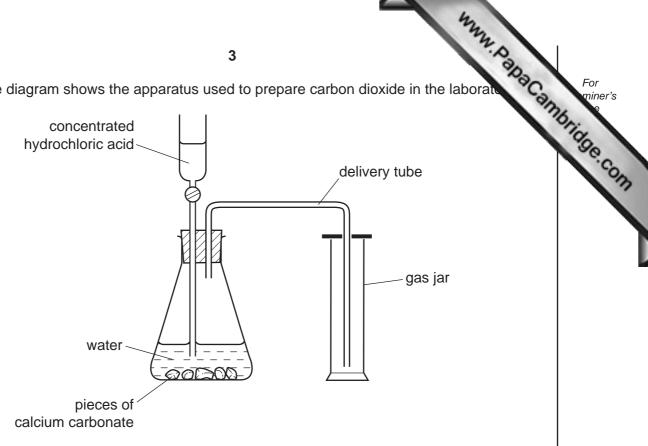
(a) Choose from A, B, C, D or E to answer the following questions. Each letter may be used once, more than once or not at all.

Which piece of glassware is best used to

(i) measure out a volume of liquid accurately, (ii) place a spot of liquid on chromatography paper, (iii) condense a liquid with a low boiling point, (iv) shake two solutions together to mix them, (v) deliver a variable volume of solution when performing a titration?

[Total: 9]

(b) The diagram shows the apparatus used to prepare carbon dioxide in the laborate



(i)	State the name of a rock which is made up largely of calcium carbonate.	
		[1]
(ii)	Which one of these statements about carbon dioxide is correct? Tick one box.	
	Carbon dioxide is lighter than air.	
	Carbon dioxide is a liquid at room temperature.	
	Carbon dioxide is heavier than air.	
	Carbon dioxide has the same density as air.	[1]
iii)	Complete the equation for the reaction of calcium carbonate with hydrochloric a	cid.
	$CaCO_3 +HCl \rightarrow CaCl_2 + CO_2 +$	[2]

2

		the elements in the Periodic Table are metals.	-
Ма	ny of	f the elements in the Periodic Table are metals.	C
(a)	Sta	te one common use for each of the following metals.	-
	(i)	copper	[1]
	(ii)	platinum	[1]
	(iii)	aluminium	[1]
(b)	Lea	nd is a metal in Group IV of the Periodic Table.	
	(i)	State one adverse effect of lead on health.	
			[1]
	(ii)	Lead has several isotopes. One isotope of lead is	
		²⁰⁷ ₈₂ Pb	
		State the number of protons and neutrons in this isotope of lead.	
		number of protons	[1]
		number of neutrons	[1]
(c)	Soc	dium is a very reactive metal.	
	(i)	A student added a few drops of litmus solution to a large beaker of water. She the dropped a small piece of sodium into the beaker. Describe what the student would observe during the reaction.	en
			[3]
	(ii)	Complete the word equation for the reaction of sodium with water.	
		sodium + water \rightarrow +	
			[2]

(iii) Sodium chloride is formed when sodium burns in chlorine. Sodium chloride is an ionic compound. Complete the following sentences about this reaction using words from the list.

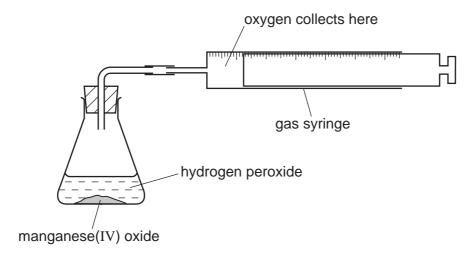
0 1		5			WWW. Papac
Sodium	chloride is an	ionic compound	um burns in chlo d. out this reaction		dh
	electron	gains	ion	loses	`
	molecule	negative	positive	proton	
When s	odium burns i	n chlorine, each	sodium atom lo	ses an	and
become	es a sodium .		Each chlorin	e atom	an
electror	n and becomes	s a	ion.		[4]

[Total: 15]

Hydrogen peroxide decomposes slowly at room temperature to form water and oxyg 3 The reaction is catalysed by manganese(IV) oxide.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

www.PapaCambridge.com A student used the apparatus shown below to study how changing the concentration of hydrogen peroxide affects the speed of this reaction.



(a)	part from the volume of hydrogen peroxide, state two things that the student must ke	ep
	ne same in each experiment.	

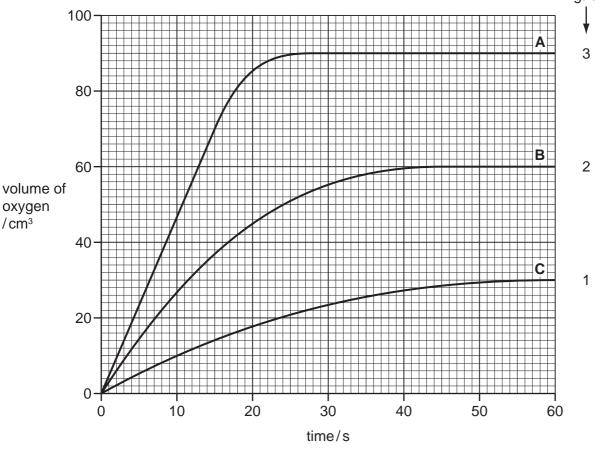
1	 	 	 	
2				[2

(b) The student measured the volume of oxygen produced using three different concerof hydrogen peroxide.

The results are shown on the graph below.

oxygen /cm³

www.PapaCambridge.com concentration of hydrogen peroxide



(י)	peroxide.
	[1]
(ii)	Explain why the final volume of oxygen given off is less for graph B than for graph A .
	[1]
(iii)	From the graph, determine
	the time taken for the reaction to be completed when $3\mathrm{g}/\mathrm{dm^3}$ hydrogen peroxide (line A) was used.
	[1]
	the volume of oxygen produced by $2\mathrm{g}/\mathrm{dm}^3$ hydrogen peroxide (line B) in the first 15 seconds.

www.PapaCambridge.com (c) The student then tested various compounds to see how well they catalysed the He used the same concentration of hydrogen peroxide in each experiment. The table shows the time taken to produce 20 cm³ of oxygen using each compound as a catalyst.

compound	time taken to produce 20 cm ³ of oxygen/s
copper(II) oxide	130
lead(IV) oxide	15
magnesium oxide	did not produce any oxygen
manganese(IV) oxide	18

Put these compounds in order of their effectiveness as catalysts.

worst catalyst —		-	best catalyst

[1]

[Total: 7]

www.PapaCambridge.com Natural gas and the hydrocarbons obtained from the distillation of petroleum are in fuels. (a) State the name of the main substance present in natural gas. **(b)** Petroleum is a thick liquid. Describe the liquid state in terms of how close the particles are to each other, the arrangement of the particles, the movement of the particles. (c) The diagram shows a distillation column used to separate petroleum into fractions. fractions refinery gas gasoline kerosene fuel oil lubricating oil - bitumen (i) On the diagram, draw an arrow to show where the petroleum vapour enters the column. [1]

(ii) What do you understand by the term fraction?

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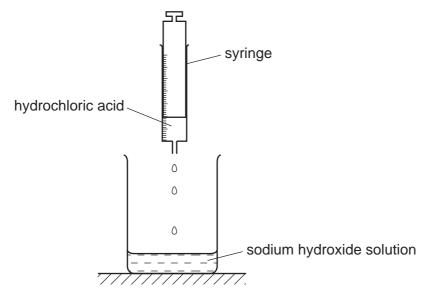
	10 In the diagram on page 9, two fractions have not been named. State the name of	
	10	00
iii)	In the diagram on page 9, two fractions have not been named. State the name of	aC ^d
	fraction X	
	fraction Y	[2]
iv)	One of the refinery gases is ethane. Draw the structure of ethane showing all atoms and bonds.	
		[1]
		[,]
(v)	Which one of these phrases describes ethane correctly? Tick one box.	
	Ethane is an unsaturated hydrocarbon.	
	Ethane is a saturated hydrocarbon.	
	Ethane polymerises to form poly(ethene).	
	Ethane is an alkene.	
		[1]
	Т	otal: 11]

5

www.PapaCambridge.com (a) Match the phrases on the left with the definitions on the right. The first one has been done for you. an atom that has relative formula mass become charged the smallest part of an element molecule which can take part in a chemical change two or more atoms atom covalently bonded together the sum of the relative atomic ion masses in a compound [3] (b) Sodium hydroxide, NaOH, is an ionic compound which dissolves in water to form a strongly alkaline solution. (i) Which **one** of the following best describes the pH of a concentrated aqueous solution of sodium hydroxide? Put a ring around the correct answer. pH 2 pH 5 pH 7 pH 13 [1] 8 Hq (ii) Calculate the relative formula mass of sodium hydroxide. [1] (iii) The equation describes how sodium hydroxide reacts with hydrochloric acid. NaOH + HC $l \rightarrow NaCl + H_2O$ What type of chemical reaction is this?

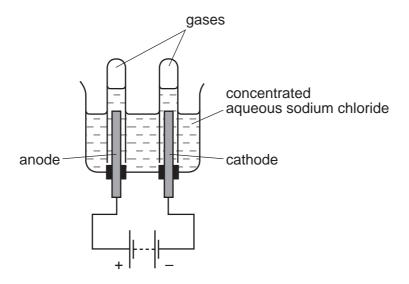
www.PapaCambridge.com (iv) A student used a syringe to add 1 cm³ portions of hydrochloric acid to an a solution of sodium hydroxide.





Describe how the pH of the solution in the beaker changes as the hydrochloric acid is added until the acid is in excess.
[2]

www.PapaCambridge.com (c) The diagram shows the apparatus used to electrolyse concentrated aqueous chloride.



Give a description of this electrolysis. In your description include

- what substance the electrodes are made from and the reason for using this substance
- what you would observe during the electrolysis
- the names of the substances produced at each electrode.

 [6]
 [0]

[Total: 14]

www.PapaCambridge.com When coal is heated in the absence of air, coke is formed together with a gas called by and a liquid which contains ammonia. (a) Coke is largely carbon. State one use of coke in industry.[1] **(b)** Two other forms of carbon are diamond and graphite. (i) Use your knowledge of the structure of diamond and graphite to explain why graphite is a good lubricant.[1] why diamond is very hard.[1] (ii) Give one use of diamond that depends on its hardness.[1]

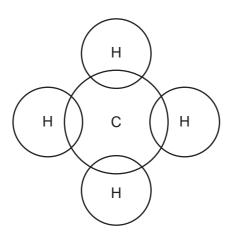
(i) Complete the word equation for this reaction ammonia + sulfuric acid → [1]

(ii) Which one of the following elements do most fertilisers contain? Put a ring around the correct answer.

(c) The liquid which contains ammonia can be reacted with sulfuric acid.

chlorine nitrogen sodium sulfur [1]

(d) Coal gas contains methane. Complete the diagram to show how the electrons are arranged in a molecule of methane.



(e)	When coal is burnt, sulfur dioxide is given off. Which two of the following statements about sulfur dioxide are correct? Tick two boxes.	Paca
	Sulfur dioxide is an acidic oxide.	,
	About 20% of the air is sulfur dioxide.	
	Most of the sulfur dioxide in the air comes from car exhausts.	
	Sulfur dioxide contributes to acid rain.	
		[2]
		[Total: 9]

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- 7 Ethanol, C₂H₅OH, is a member of the alcohol homologous series.
 - (a) (i) Give two characteristics of a homologous series.

	*www.
16	3.0
C ₂ H ₅ OH, is a member of the alcohol homologous series.	For miner's
Give two characteristics of a homologous series.	THICK
1	46.CO.
2	[2]

(ii) Draw the structure of ethanol showing all atoms and bonds.

[1]

(b) One use of ethanol is as a solvent.

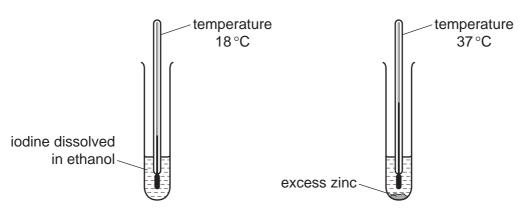
A pupil studied the reaction of iodine with zinc.

She first dissolved a few crystals of iodine in ethanol and recorded the temperature of the solution.

The temperature was 18 °C.

She then added excess powdered zinc and recorded the temperature again.

The new temperature was 37 °C.

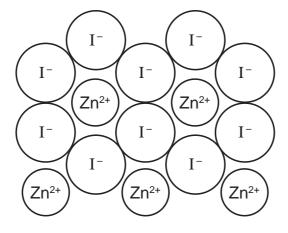


(i)	Is this reaction endothermic or exothermic? Explain your answer.	
/::\	What colour is called inding?	[1]
(ii)	What colour is solid iodine?	[1

(c) The equation for the reaction is

	The equation for the reaction is
)	The equation for the reaction is
	${\sf zinc} \ + \ {\sf iodine} \ \to \ {\sf zinc} \ {\sf iodide}$ When the reaction is complete, the mixture contains zinc iodide dissolved in ethanol and
	When the reaction is complete, the mixture contains zinc iodide dissolved in ethanol and unreacted zinc powder. Suggest how you can get crystals of zinc iodide from the reaction mixture.
	[2]

(d) The diagram shows the structure of zinc iodide.



(i) What is the simplest formula for zinc iodide?

(ii) The list below shows four different types of structure. What type of structure is zinc iodide? Put a ring around the correct answer.

giant covalent

giant ionic

metallic

molecular

[1]

(e)	The equation for the reaction of zinc with dilute nitric acid is
	$4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + NH_4NO_3 + 3H_2O$
	Write a word equation for this reaction.
	[3]
(f)	Describe a test for ammonium ions.
	test
	result
	[3]

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[Total: 15]

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The Periodic Table of the Elements **DATA SHEET**

	0	4 He lium	20 Ne Neon	40 Ar Ar Argon	84 Krypton 36	131 Xenon Xenon	Radon 86		175 Lu Lutetium
	=		19 Fluorine	35.5 C1 Chlorine	80 Br Bromine 35	127 I lodine 53	At Astatine 85		173 Yb Ytterbium
	5		16 Oxygen 8	32 S Sulfur 16	79 Selenium	128 Te Tellurium	Po Polonium 84		169 T m Thulium
	>		14 N Nitrogen 7	31 P	75 AS Arsenic 33	122 Sb Antimony 51	209 Bi Bismuth		167 Er Erbium
	2		12 Carbon	28 Si Silicon	73 Ge Germanium 32	Sn In 50	207 Pb Lead		165 Ho
	=		11 B Boron 5	27 A 1 Aluminium 13	70 Ga Gallium 31	115 In Indium	204 T 1 Thallium		162 Dy Dysprosium
					65 Zn Zinc 30	Cadmium 248	201 Hg Mercury 80		159 Tb
					64 Copper	108 Ag Silver 47	197 Au Gold		157 Gd Gadolinium
Group					59 Nickel	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium
Ď			1		59 Co Cobalt	Rhodium 45	192 Ir Iridium		Samarium
		1 Hydrogen			56 Fe Iron	Ruthenium	190 Os Osmium 76		Pm Promethium
					Mn Manganese	Tc Technetium 43	186 Re Rhenium 75		144 N eodymium
					52 Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		141 Pr Praseodymium
					51 V Vanadium 23	Nobium 41	181 Ta Tantalum		140 Ce
					48 T Titanium	91 Zr	178 H Hatnium		
					45 Sc Scandium 21	89 × Yttrium	139 La Lanthanum s	227 Ac Actinium 4	series eries
	=		Be Beryllium	24 Mg Magnesium	40 Ca Calcium	88 St Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series
	_		7 L.i Lithium	23 Na Sodium	39 K Potassium 19	85 Rb Rubidium 37	133 Cs Caesium 55	Fr Francium 87	*58-71 L ₂

www.papaCambridge.com **T** ğ Fm Fermium Erbium 운 Es ٥ ರ Bk Berkelium Ferbium Gadolinium Gd **Curium** Am En Sm Pu **Neptunium** Š Ра ቯ 232 **Th** Thorium **Cerium** 28 06 b = proton (atomic) number a = relative atomic mass X = atomic symbol

в ×

Key

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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