

CANDIDATE

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

www.xirenepapers.com

*	
_	
5	
∞	
0	
_	
0	
∞	
6	
∞	
0	

NAIVIE			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/32
Paper 3 (Extended)		Oct	ober/November 2012
			1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

No Additional Materials are required.

Candidates answer on the Question Paper.

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. 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 16.

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

This document consists of 13 printed pages and 3 blank pages.

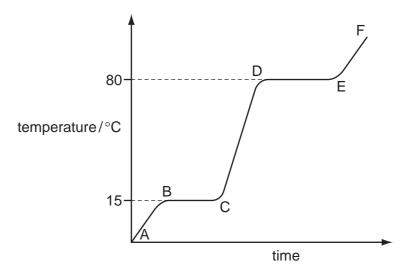


This qu	This question is concerned with the elements in Period 5, Rb to Xe.			
(a) The	electron distributions of some of these elements are given in the	following list.		
ele ele ele ele	nent A 2 + 8 + 18 + 8 + 2 nent B 2 + 8 + 18 + 18 + 8 nent C 2 + 8 + 18 + 18 + 5 nent D 2 + 8 + 18 + 18 + 6 nent E 2 + 8 + 18 + 18 + 4 nent F 2 + 8 + 18 + 18 + 7			
(i)	Identify element C.	[1]		
(ii)	Which element in the list does not form any compounds?			
		[1]		
(iii)	Which element in the list forms a chloride of the type XCl_2 ?			
(iv)	Which two elements would react together to form a compound of			
		[1]		
(v)	Which element in the list would react with cold water to form an al hydrogen?	kaline solution and		
		[1]		
	dict two differences in physical properties and two differences in coveen rubidium and the transition metal niobium.	hemical properties		
phy	sical			
che	mical			

[Total: 9]

1

2 The diagram shows a heating curve for a sample of compound X.



(a) Is X a solid, a liquid or a gas at room temperature, 20 °C?

[´	[1	1]	
----	----	----	--

(b) Write an equation for the equilibrium which exists in region BC.

[0]	
1:71	

(c) Name the change of state which occurs in region DE.

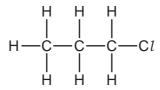
11	1	
 	-	

(d) Explain how the curve shows that a pure sample of compound X was used.

	[2]

[Total: 6]

- 3 Many organic compounds which contain a halogen have chloro, bromo or iodo in their name.
 - (a) The following diagram shows the structure of 1-chloropropane.



(i) Draw the structure of an isomer of this compound.

[1]

(ii)	Describe how	1-chloropropane	could be	made from	propane.

	•••
[2]

(iii) Suggest an explanation why the method you have described in (ii) does not produce a pure sample of 1-chloropropane.

[2]

(b) Organic halides react with water to form an alcohol and a halide ion.

$$CH_3-CH_2-I + H_2O \rightarrow CH_3-CH_2-OH + I^-$$

(i) Describe how you could show that the reaction mixture contained an iodide ion.

[0]

(ii) Name the alcohol formed when 1-chloropropane reacts with water.

[Total: 15]

(c) The speed (rate) of reaction between an organic halide and water can be measured by the following method.

A mixture of 10 cm³ of aqueous silver nitrate and 10 cm³ of ethanol is warmed to 60 °C. Drops of the organic halide are added and the time taken for a precipitate to form is measured.

Silver ions react with the halide ions to form a precipitate of the silver halide.

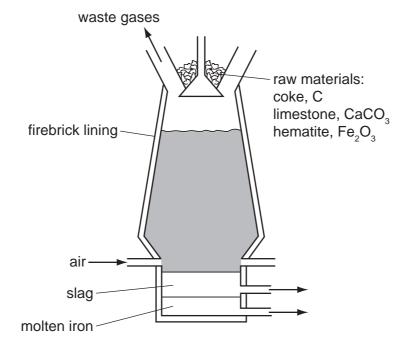
$$Ag^{+}(aq) + X^{-}(aq) \rightarrow AgX(s)$$

Typical results for four experiments, A, B, C and D, are given in the table.

experiment	organic halide	number of drops	time/min
Α	bromobutane	4	6
В	bromobutane	8	3
С	chlorobutane	4	80
D	iodobutane	4	0.1

(i)	Explain why it takes longer to produce a precipitate in experiment A than in B .
	[2]
(ii)	How does the order of reactivity of the organic halides compare with the order of reactivity of the halogens?
	[2]
(iii)	Explain why the time taken to produce a precipitate would increase if the experiments were repeated at 50 °C.
	[3]

4 Iron is extracted from its ore, hematite, in the blast furnace.



(a)		e temperature inside the blast furnace can rise to 2000 °C. te an equation for the exothermic reaction which causes this high temperature.	
			[1]
(b)	Car to i	bon monoxide is formed in the blast furnace. This reduces the ore hematite, Fe_2C ron.) ₃ ,
	(i)	Explain how carbon monoxide is formed in the blast furnace.	
			[2]
	(ii)	Write an equation for the reduction of hematite by carbon monoxide.	
			[2]
(c)	-	plain why it is necessary to add limestone, calcium carbonate, to the blast furnactude an equation in your explanation.	æ.
			[3]

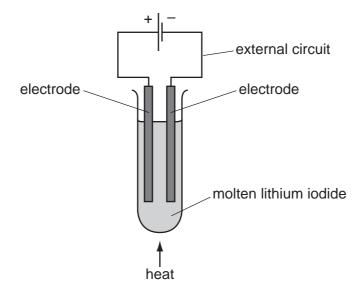
[Total: 12]

(d)		st of the iron from the blast furnace is converted into mild steel. A method of preventing steel from rusting is coating it with zinc.
	(i)	What is the name of this method of rust prevention?
		[1]
	(ii)	Explain, using the idea of electron transfer, why zinc-coated steel does not rust even when the coating is scratched and the steel is in contact with oxygen and water.
		[3]

For
Examiner's
Use

The	food additive E220 is sulfur dioxide. It is a preservative for a variety of foods and drinks.
(a)	State two other uses of sulfur dioxide.
	[2]
(b)	How is sulfur dioxide manufactured?
	[2]
(c)	Sulfur dioxide is a reductant (reducing agent). Describe what you would see when aqueous sulfur dioxide is added to acidified potassium manganate(VII).
	[2]
	[-]
(d)	Sulfur dioxide can also be made by the reaction between a sulfite and an acid.
	$Na_2SO_3 + 2HCl \rightarrow 2NaCl + SO_2 + H_2O$
	Excess hydrochloric acid was added to 3.15 g of sodium sulfite. Calculate the maximum volume, measured at r.t.p., of sulfur dioxide which could be formed. The mass of one mole of $\mathrm{Na_2SO_3}$ is 126 g.
	[3]
	[Total: 9]

- **6** During electrolysis, ions move in the electrolyte and electrons move in the external circuit. Reactions occur at the electrodes.
 - (a) The diagram shows the electrolysis of molten lithium iodide.



(i) Draw an arrow on the diagram to show the direction of the electron flow in the external circuit. [1]

Electrons are supplied to the external circuit. How and where is this done?
[2]
Explain why solid lithium iodide does not conduct electricity but when molten it is a good conductor.

(b) The results of experiments on electrolysis are shown in the following table. Complete the table. The first line has been done as an example.

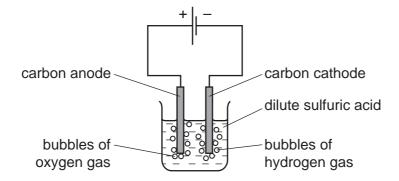
......[1]

electrolyte	electrodes	product at cathode	product at anode	change to electrolyte
molten lithium iodide	carbon	lithium	iodine	used up
aqueous copper(II) sulfate	platinum		oxygen	
concentrated aqueous potassium chloride	carbon		chlorine	

[4]

For Examiner's Use

(c) The diagram below shows the electrolysis of dilute sulfuric acid. Hydrogen is formed at the negative electrode (cathode) and oxygen at the positive electrode (anode) and the concentration of sulfuric acid increases.

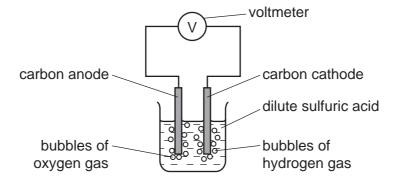


The ions present in the dilute acid are $H^+(aq)$, $OH^-(aq)$ and $SO_4^{2-}(aq)$.

- (i) Write an equation for the reaction at the negative electrode (cathode).
- (ii) Complete the equation for the reaction at the positive electrode (anode).

$$4OH^{-}(aq) \rightarrow O_{2}(g) +H_{2}O(l) +$$
 [1]

- (iii) Suggest an explanation of why the concentration of the sulfuric acid increases.
- (d) In the apparatus used in (c), the power supply is removed and immediately replaced by a voltmeter.



A reading on the voltmeter shows that electrical energy is being produced. Suggest an explanation for how this energy is produced.

[Total: 15]

For

Examiner's Use

The	alco	phols form a homologous series. The first member of this series is methanol, CH ₃ OH.	
(a)	(i)	Give the general formula of the alcohols.	
		[1]	
	(ii)	The mass of one mole of an alcohol is 116 g. What is its formula? Show your reasoning.	
		[2]	
((iii)	Draw a diagram showing the arrangement of the outer (valency) electrons in one molecule of methanol.	
		Use x to represent an electron from a carbon atom. Use o to represent an electron from a hydrogen atom. Use • to represent an electron from an oxygen atom.	
		[3]	
(b)	Me	hanol is manufactured using the following method.	
		$CH_4(g) + H_2O(g) \rightarrow CO(g) + 3H_2(g)$ reaction 1	
		$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ reaction 2	
	The	conditions for reaction 2 are:	
	cata	alyst a mixture of copper, zinc oxide and aluminium oxide	
	The	e forward reaction is exothermic.	
	(i)	Why is high pressure used in reaction 2?	
		[2]	
	(a)	(a) (i) (iii) (iii) The present terms	 (ii) The mass of one mole of an alcohol is 116 g. What is its formula? Show your reasoning. [2] (iii) Draw a diagram showing the arrangement of the outer (valency) electrons in one molecule of methanol. Use x to represent an electron from a carbon atom. Use o to represent an electron from a hydrogen atom. Use • to represent an electron from an oxygen atom. Use • to represent an electron from an oxygen atom. CH₄(g) + H₂O(g) → CO(g) + 3H₂(g) reaction 1 CO(g) + 2H₂(g) ⇒ CH₃OH(g) reaction 2 The conditions for reaction 2 are: pressure 100 atmospheres catalyst a mixture of copper, zinc oxide and aluminium oxide temperature 250 °C The forward reaction is exothermic. (i) Why is high pressure used in reaction 2?

For Examiner's Use

	(ii)	Explain why using a catalyst at 250 $^{\circ}\text{C}$ is preferred to using a higher temperature of 350 $^{\circ}\text{C}$ and no catalyst.
		[3]
(c)	Met	hanol is oxidised by atmospheric oxygen. This reaction is catalysed by platinum.
	(i)	The products of this reaction include a carboxylic acid. Give its name and structural formula.
		name
		structural formula showing all bonds
		[2]
	(ii)	Deduce the name of the ester formed by the reaction of methanol with the carboxylic acid named in (i).
		[1]
		[Total: 14]

BLANK PAGE

BLANK PAGE

BLANK PAGE

DATA SHEET
The Periodic Table of the Elements

	0	# He Helium	20 Neon 10	40 Ar Argon	84 K Krypton 36		Radon 86		175 Lu Lutetium	
			19 Fluorine	35.5 C1 Chlorine	80 Br Bromine 35	127 	At Astatine 85		Yb Ytterbium	S
	>		16 Oxygen	32 S Sulfur 16	79 Selenium 34	128 Te Tellurium	Po Polonium		169 Tm Thulium 69	Mendelevium
	>		14 X Nitrogen 7	31 Phosphorus 15	75 AS Arsenic	122 Sb Antimony 51			167 Er Erbium 68	Fm
	2		12 C Carbon 6	28 Si Silicon	73 Ge Germanium 32	Sn 119	207 Pb Lead		165 Ho Holmium 67	E insteinium
	=		11 Boron 5	27 A1 Aluminium 13	70 Ga Gallium 31	115 n Indium	204 T.1 Thallium		162 Dy Dysprosium 66	Californium
					65 Zn Zinc 30	Cd Cadmium 48			159 Tb Terbium 65	BK Berkelium
					64 Copper	108 Ag Silver 47	197 Au Gold		157 Gd Gadolinium 64	
Group					59 Nickel	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Am
Gre					59 Cobalt 27	Rhodium 45	192 r Iridium		Sm Samarium 62	
		T Hydrogen			56 Fe Iron	101 Ru Ruthenium 44	190 Os Osmium 76		Pm Promethium 61	Necturium
					Mn Manganese	Tc echnetium	186 Re Rhenium		144 Na Neodymium 60	238 Canium
					Chromium	96 Mo Molybdenum 7	184 W Tungsten 74		Pr Praseodymium 59	Pa Protectinium
					51 V Vanadium 23	93 Nb Niobium 41	181 Ta Tantalum 73		140 Ce Cerium	232 Th
					48 T Titanium	91 Zr Zirconium 40	178 Hf Hafnium 72			nic mass
					Scandium	89 ×	La Lanthanum 57 *	Ac Actinium 189	l series eries	a = relative atomic mass X = atomic symbol
	=		Beryllium	Mg Magnesium	40 Ca Calcium	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	e ×
	_		7 Li Lithium	23 Na Sodium	39 K Potassium 19	85 Rb Rubidium 37	133 Caesium 55	Francium 87	*58-71 L 190-103 ,	Key

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

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.

University of 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.