

## **Cambridge International Examinations**

Cambridge International General Certificate of Secondary Education

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CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

**CHEMISTRY** 0620/33

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 12.

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 12 printed pages.



1 Choose a gas from the following list to answer the questions below. Each gas may be used once, more than once or not at all.

## ammonia carbon dioxide carbon monoxide fluorine hydrogen nitrogen propene sulfur dioxide krypton (a) It is a product of respiration. [1] (d) It is the main component of air. ..... [1] (e) It is a very reactive non-metal. [1] (f) It is used to kill micro-organisms in fruit juice. ...... [1] [Total: 7]

	S .
Ex	plain each of the following in terms of the kinetic particle theory.
(a)	The rate of most reactions increases at higher temperatures.
	[3
(b)	A liquid has a fixed volume but takes up the shape of the container. A gas takes up the shape of the container but it does not have a fixed volume.
	liquid gas
	.621.
	A
	[3

(a) Biol	ogical catalysts produced by microbes cause food to deteriorate and decay.
(i)	What is the name of these biological catalysts?
(-)	
	[1]
(ii)	Freezing does not kill the microbes. Suggest why freezing is still a very effective way of preserving food.
	[2]
<b>(b)</b> Pea	seeds grow in pods on pea plants.
Give read	shly picked pea seeds contain a sugar. The sugar can form a polymer.  e the structural formula of the polymer and name the other product of this polymerisation ction.
You	may represent the sugar by the formula:
	но— — он
stru	ctural formula of the polymer
othe	er product[3]

(c)	De	scribe how the pea plant makes a sugar such as glucose.
		[3]
		[Total: 9]
Mo use	st of ed to	n a blast furnace contains about 5% of the impurities – carbon, silicon, phosphorus and sulfur. this impure iron is used to make steels, such as mild steel, and a very small percentage is make pure iron.
(a)		cium oxide and oxygen are used to remove the impurities from the iron produced in the st furnace.
	(i)	State how these chemicals are manufactured.
		calcium oxide
		oxygen
		[3]
	(ii)	Describe how these two chemicals remove the four impurities. Include at least one equation in your answer.
		[5]

(b) (i)	Describe the structure of a typical metal such as iron. You may include a diagram.
	[2]
(ii)	Explain why pure iron is malleable.
	[2]
(iii)	Mild steel is an alloy of iron and carbon. Suggest why mild steel is harder than pure iron.
	[2]
	[Total: 14]

5 Ammonia is made by the Haber process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

The conditions in the reaction chamber are:

- a pressure of 200 atmospheres,
- a catalyst of finely divided iron,
- a temperature of 400 to 450 °C.

(a)	Wha	at are the <b>two</b> advantages of using a high pressure? Give a reason for both.	
	adv	antage 1	
	reas	son	
	adv	antage 2	
	reas	son	
			[4]
(b)		gher temperature would give a faster reaction rate. y is a higher temperature <b>not</b> used?	
(c)	(i)	Why is the iron catalyst used as a fine powder?	
	(ii)	Give <b>two</b> reasons why a catalyst is used.	ניו
			[2]

(d) The equilibrium mixture leaving the reaction chamber contains 15% ammonia. Suggest how the ammonia could be separated from the mixture.

	boiling point/°C
hydrogen	-253
nitrogen	-196
ammonia	-33

		- 12

**(e)** Ammonia is used to make nitrogen trifluoride, NF<sub>3</sub>. Nitrogen trifluoride is essential to the electronics industry. It is made by the following reaction.

Determine if the above reaction is exothermic or endothermic using the following bond energies and by completing the following table. The first line has been done as an example. Bond energy is the amount of energy, in kJ/mole, needed to break or make one mole of the bond.

bond	bond energy in kJ/mole
N-H	390
F-F	155
N-F	280
H-F	565

bond	energy change/kJ
N-H	(3 × 390) = 1170
F-F	
N-F	
H-F	

[4

[Total: 16]

	anes are a family of saturated hydrocarbons. Their reactions include combustion, cracking ostitution.
(a) (i)	What is meant by the term hydrocarbon?
	[1]
(ii)	What is meant by the term saturated?
	[1]
(b) (i)	What is the general formula for the homologous series of alkanes?  [1]
(ii)	Calculate the mass of one mole of an alkane with 14 carbon atoms.
	[2]
(c) The	e complete combustion of hydrocarbons produces carbon dioxide and water only.
(i)	Write the equation for the complete combustion of nonane, $C_9H_{20}$ .
	[2]
(ii)	20 cm³ of a gaseous hydrocarbon was mixed with an excess of oxygen, 200 cm³. The mixture was ignited. After cooling, 40 cm³ of oxygen and 100 cm³ of carbon dioxide remained. Deduce the formula of the hydrocarbon and the equation for its combustion. All volumes were measured at r.t.p
	[3]

(d)	cking is used to obtain short-chain alkanes, alkenes and hydrogen from long-chain alkanes.							
	(i)	Give a use for each of the three products listed above.						
		short-chain alkanes						
		alkenes						
		hydrogen[3]						
	(ii)	Write an equation for the cracking of decane, $C_{10}H_{22}$ , which produces two different alkenes and hydrogen as the only products.						
		[1]						
(e) Chlorine reacts with propane in a substitution reaction to form 1-chloropropane.								
		$CH_3-CH_2-CH_3 + Cl_2 \rightarrow CH_3-CH_2-CH_2-Cl + HCl$						
	(i)	What is the essential condition for the above reaction?						
		[1]						
	(ii)	There is more than one possible substitution reaction between chlorine and propane. Suggest the structural formula of a different product.						
		[1]						
		[Total: 16]						

Alui	mınıı	um is obtained from purified alumina, $Al_2O_3$ , by electrolysis.						
(a)	(a) Alumina is obtained from the main ore of aluminium. State the name of this ore.							
		[1]						
(b)		scribe the extraction of aluminium from alumina. Include the electrolyte, the electrodes and reactions at the electrodes.						
		[6]						
(c) Aluminium is resistant to corrosion. It is protected by an oxide layer on its surface The thickness of this oxide layer can be increased by anodising.								
	(i)	State a use of aluminium due to its resistance to corrosion.						
		[1]						
	(ii)	Anodising is an electrolytic process. Dilute sulfuric acid is electrolysed with an aluminium object as the anode. The thickness of the oxide layer is increased. Complete the equations for the reactions at the aluminium anode.						
		$OH^- \rightarrow O_2 + 2H_2O + \dots e^-$						
		$\dots Al + \dots Al_2O_3 $ [4]						
		[Total: 12]						

DATA SHEET
The Periodic Table of the Elements

	0	4 <b>H</b> Helium	Neon 10 Neon 10 At Argon 18		Rn Radon 86		j .
			19 Fluorine 9 35.5 <b>C t</b> Chlorine		Astatine	Yb Yb Ytterblum 70	2
	5		16 Oxygen 8 32 <b>S</b> Sulfur	Selenium 34 128 Te	Po Polonium 84	Tm Thulium	<u> </u>
	>		Nitrogen 7 31 <b>P</b> Phosphorus 15	As Arsenic 33 122 Sb Antimony		167 <b>Er</b> Erbium 68	Ē
	2		Carbon 6 Carbon 8 Silicon 14	Germanium 32 119 Sn	207 P <b>b</b> Lead 82	165 Holmium 67	ũ
Group	=		11 B Boron 5 27 A1 Auminium 13	70 <b>Ga</b> Gallium 31 115   I n	<u>8</u> 8	162 Dysprosium 66	5
				2nc 2nc 30 Zinc 112 Cd	201 Hg Mercury 80	159 Tb Terbium 65	2
				64 Cu Copper 29 108 Ag Silver		_	5
				Nickel 28 106 Pd Palladium	96 195 Platinum 78	152 Europium 63	Ī
				Cooatt 27 103 Rhodium	192   <b>F</b>   Iridium 77	Sm Samarium 62	
		T Hydrogen		Fe Iron 26 101 Ru Ruthenium		Pm Promethium 61	2
				Mn Mn Manganese Tc	43 186 <b>Re</b> Rhenium 75	Neodymium 60 238	)
				Chromium N 24 25 96 96 Molybdenum T	184 <b>W</b> Tungsten 74	141 Praseodymium 59	ם
				V Nadium 93 Nb liobium	181 <b>Ta</b> Tantalum 73	140 <b>Ce</b> Cerium 58 232 <b>Th</b>	Ξ
				48 TI TI  Titanium 22 91 Zr  Zrconium	40 178 <b>Hf</b> Hetnium 72	nic mass	5
				Scandium 21 89 Y	227 Actinium 89 T 139	oid series   series a = relative atomic mass	- aronno ozni
	=		Beeryllium 4 24 Mg Magnesium 12	Calcium 20 88 Sr	137 <b>Ba</b> Barium 56  226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series  a a relative a	
	_		Lithium 3 23 8 8 Sodium 11	39  K Potassium 19 85 Rb Rubidium	37 133 Caesium 55 Fr	*58-71 Le	_ ا

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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