



## **Cambridge International Examinations**

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME				
CENTRE NUMBER		CANDIDATE NUMBER		

CHEMISTRY 0620/33

Paper 3 (Extended)

1 hour 15 minutes

May/June 2014

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.



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] (b) It polymerises to form a poly(alkene). ..... [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]

	3	
Ex	xplain each of the following in terms of the kine	ic particle theory.
(a)	) The rate of most reactions increases at high	er temperatures.
		[3]
(b)	A liquid has a fixed volume but takes up the of the container but it does not have a fixed v	shape of the container. A gas takes up the shape olume.
	liquid	gas
		[3]

3	(a)	Bio	logical 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)	Pea	a seeds grow in pods on pea plants.
		Giv rea	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. If may represent the sugar by the formula:  HO————OH
		stru	octural formula of the polymer
		oth	er product[3]

(c)	Des	scribe how the pea plant makes a sugar such as glucose.
		[3]
		[Total: 9]
Mos	st of	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?	
			[3]
(-)	<b>(:</b> )	NA/low in the irran patalyst yeard on a first recorder?	
(C)	(1)	Why is the iron catalyst used as a fine powder?	
	(ii)	Give <b>two</b> reasons why a catalyst is used.	ניו
	(,	ene the reasons my a saturyer is used.	
			r01

(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

. [2

(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 stitution.
(a)	(i)	What is meant by the term <i>hydrocarbon</i> ?
		[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)	Cra	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)	Chl	orine 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]

Aluı	minium is obtained from purified alumina, $Al_2O_3$ , by electrolysis.						
(a)	Alumina is obtained from the main ore of aluminium. State the name of this ore.						
		[1]					
(b)	Describe the extraction of aluminium from alumina. Include the electrolyte, the electrode the reactions at the electrodes.	es and					
		[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 alur object as the anode. The thickness of the oxide layer is increased. Complete the equ for the reactions at the aluminium anode.						
	$OH^- \rightarrow O_2 + 2H_2O +e^-$						
	$\dots$ A $l$ + $\dots$ → $\dots$ $Al_2O_3$	[4]					
	[To	tal: 12]					

DATA SHEET
The Periodic Table of the Elements

	0	4 <b>He</b> Helium	20 Neon 10 40 Ar Argon	84 <b>Kr</b> Krypton 36	131 <b>Xe</b> Xenon 54	Radon 86		175 <b>Lu</b> Lutetium 71	<b>Lr</b> Lawrendum 103	
Group	II/		19 Fluorine 9 35.5 <b>C 1</b>	80 <b>Br</b> Bromine	1	At Astatine 85		173 <b>Yb</b> Ytterbium 70	Nobelium 102	
	M		16 Oxygen 8 32 <b>S</b> Sulfur	Selenium Selenium 34	1			169 <b>Tm</b> Thulium 69	Mendelevium 101	
	>		Nitrogen 7 31 97 Phosphorus 15	75 <b>AS</b> Arsenic 33	Sb Antimony 51	1		167 <b>Er</b> Erbium 68	Fm Fermium	
	Ν			12 Carbon 6 Silicon 14	73 <b>Ge</b> Germanium 32	119 <b>Sn</b> In 50	207 <b>Pb</b> Lead		165 <b>Ho</b> Holmium 67	<b>ES</b> Einsteinium 99
	≡		11 <b>B</b> Boron 5 27 <b>A1</b> Aluminium 13	70 <b>Ga</b> Gallium 31	115 <b>In</b> Indium 49	204 <b>T.t</b> Thallium		162 <b>Dy</b> Dysprosium 66	Cf Californium 98	
		'	·	65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48	1		159 <b>Tb</b> Terbium 65	<b>Bk</b> Berkelium 97	
				64 Copper	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold		157 <b>Gd</b> Gadolinium 64	<b>Cm</b> Curium	
				59 <b>X</b> Nickel	Pd Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95	
				59 Cobalt 27	Rhodium 45	192 <b>Ir</b> Irdium		Samarium 62	<b>Pu</b> Plutonium	
		1 <b>H</b> Hydrogen 1		56 <b>Fe</b> Iron 26	Ruthenium	190 <b>Os</b> Osmium 76		<b>Pm</b> Promethium 61	Neptunium	
				Mn Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		Neodymium 60	238 <b>U</b> Uranium 92	
				Cr Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Yangsten 74		Pr Praseodymium 59	Pa Protactinium 91	
				51 V Vanadium 23	93 <b>Nb</b> Niobium	181 <b>Ta</b> Tananum		140 <b>Ce</b> Cerium 58	232 <b>Th</b> Thorium	
				48 <b>T</b> Titanium 22	91 Zr Zirconium 40	178 <b>Hf</b> Hafnium 72			nic mass bol nic) number	
				Scandium	89 <b>≺</b> Yttrium	La Lanthanum 57 *	Actinium teges	l series eries	<ul><li>a = relative atomic mass</li><li>X = atomic symbol</li><li>b = proton (atomic) number</li></ul>	
	=		Beryllium 4 24 Magnesium 12	40 <b>Ca</b> Calcium 20	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium	*58-71 Lanthanoid series 190-103 Actinoid series	« <b>×</b> ≈	
	_		7 Li Lithium 3 23 Na Sodium 11	39 <b>K</b> Potassium	Rb Rubidium 37	133 <b>Cs</b>	Francium 87	*58-71 L	Key	

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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