



Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME				
CENTRE NUMBER		CANDI NUMBI		

CHEMISTRY 0620/31

Paper 3 (Extended) October/November 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.

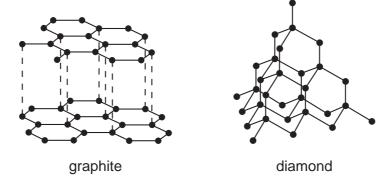


1

(a)	Match the following pH values to the solutions given below.								
		1	3	7	10	13			
	The solutions all have the	same (conce	ntratio	n.				
	solution				рН	I			
	aqueous ammonia, a weak	k base							
	dilute hydrochloric acid, a	strong	acid						
	aqueous sodium hydroxide	e, a str	ong b	ase					
	aqueous sodium chloride,	a salt							
	dilute ethanoic acid, a wea	k acid							
						[5]			
(b)	Explain why solutions of hymol/dm³, have a different p	-	loric	acid a	nd etha	noic acid with the same concentration, in			
						[2]			
(c)	Measuring pH is one way of Describe another method.	of disti	nguisl	hing be	etween	a strong acid and a weak acid.			
	method								
	results								
						[2]			
						[Total: 9]			

[Total: 8]

2 Two macromolecular forms of carbon are graphite and diamond. The structures of graphite and diamond are given below.



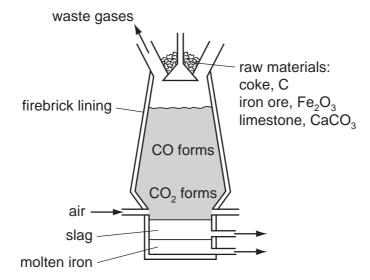
(a)	Ехр	lain in terms of its structure why graphite is soft and is a good conductor of electricity.	
			[3]
(b)	Stat	te two uses of graphite which depend on the above properties.	
	It is	soft	
	It is	a good conductor of electricity	
			[2]
(c)	Silic	con(IV) oxide also has a macromolecular structure.	
	(i)	Describe the macromolecular structure of silicon(IV) oxide.	
			[1]
	(ii)	Predict two physical properties which diamond and silicon(IV) oxide have in common.	
		ı	വ

4

The	ma	in use of sulfur dioxide is the manufacture of sulfuric acid.	
(a)	Sta	te two other uses of sulfur dioxide.	
			[2]
(b)		e source of sulfur dioxide is burning sulfur in air. scribe how sulfur dioxide can be made from the ore zinc sulfide.	
			[2]
(c)	The	e Contact process changes sulfur dioxide into sulfur trioxide.	
	280	$O_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$	
	the	forward reaction is exothermic	
	tem	perature 400 to 450 °C	
	low	pressure 1 to 10 atmospheres	
	cata	alyst vanadium(V) oxide	
	(i)	What is the formula of vanadium(V) oxide?	
			[1]
	(ii)	Vanadium(V) oxide is an efficient catalyst at any temperature in the range 400 to 450 Scientists are looking for an alternative catalyst which is efficient at 300 °C. What would be the advantage of using a lower temperature?)°C.
			[2]
((iii)	The process does not use a high pressure because of the extra expense. Suggest two advantages of using a high pressure? Explain your suggestions.	
			[4]

(d)	Sulfuric acid is made by dissolving sulfur trioxide in concentrated sulfuric acid to form oleum
	Water is reacted with oleum to form more sulfuric acid.
	Why is sulfur trioxide not reacted directly with water?
	[1
	[Total: 12

4 Iron is extracted from the ore hematite in the Blast Furnace.



(a) The coke reacts with the oxygen in the air to form carbon dioxide.

$$C + O_2 \rightarrow CO_2$$

(i)	Explain why carbon monoxide is formed higher in the Blast Furnace.
	[2]
(ii)	Write an equation for the reduction of hematite, Fe ₂ O ₃ , by carbon monoxide.
	[2]
(b) (i)	Limestone decomposes to form two products, one of which is calcium oxide. Name the other product.
	[1]
(ii)	Calcium oxide reacts with silicon(IV) oxide, an acidic impurity in the iron ore, to form slag. Write an equation for this reaction.
	[2]
(iii)	Explain why the molten iron and the molten slag form two layers and why molten iron is the lower layer.
	[2]
(iv)	Suggest why the molten iron does not react with the air.
	[1]

(c) Iron	n and steel rust. Iron is oxidised to hydrated iron(III) oxide, Fe ₂ O ₃ .2H ₂ O, which is rust.	
(i)	Name the two substances which cause iron to rust.	
(ii)	Explain why an aluminium article coated with aluminium oxide is protected from fuctorrosion but a steel article coated with rust continues to corrode.	
		[1]
(d) The	ere are two electrochemical methods of rust prevention.	
(i)	The first method is sacrificial protection.	
	Explain why the steel article does not rust.	
	connected block of zinc electrically to steel pipe	
The	e second method is to make the steel article the cathode in a circuit for electrolysis.	
	power	
	steel girder inert anode bubbles of hydrogen gas sea-water	
(ii)	Mark on the diagram the direction of the electron flow.	[1]

[Total: 19]

cathode. Give the equation for the reduction of hydrogen ions.

(iii) The steel girder does not rust because it is the cathode. Reduction takes place at the

.....[2]

unburnt hydrocarbons. They are all emitted by motor vehicles.
(a) Describe how the oxides of nitrogen are formed.
[2]
(b) Describe how a catalytic converter reduces the emission of these three pollutants.
[4]
(c) Other atmospheric pollutants are lead compounds from leaded petrol. Explain why lead compounds are harmful.
[1]
[Total: 7]

- **6** Esters, polyesters and fats all contain the ester linkage.
 - (a) Esters can be made from alcohols and carboxylic acids. For example, the ester ethyl ethanoate can be made by the following reaction.

(i) Name the carboxylic acid and the alcohol from which the following ester could be made.

name of carboxylic acid	
name of alcohol	
	[2]

- **(b)** The following two monomers can form a polyester.

Draw the structural formula of this polyester. Include two ester linkages.

[3]

(c) Fats and vegetable oils are esters. The formulae of two examples of natural esters are given below.

(i) One ester is saturated, the other is unsaturated. Describe a test to distinguish between them.

	test	
	result with unsaturated ester	
	result with saturated ester	
		 [3]
(ii)	Deduce which one of the above esters is unsaturated. Give a reason for your choice.	
(iii)	Both esters are hydrolysed by boiling with aqueous sodium hydroxide. What types of compound are formed?	
	and	[2]

[Total: 17]

7 Niti	Nitrogen can form ionic compounds with reactive metals and covalent compounds with non-metals.							
(a)	Nitr	ogen reacts with lithium to form the ionic compound lithium nitride, Li ₃ N.						
	(i)	Write the equation for the reaction between lithium and nitrogen.						
		[2]						
	(ii)	Lithium nitride is an ionic compound. Draw a diagram which shows its formula, the charges on the ions and the arrangement of the valency electrons around the negative ion.						
		Use x for an electron from a lithium atom. Use o for an electron from a nitrogen atom.						
		[0]						
		[2]						
(b)	Nitr	ogen fluoride is a covalent compound.						
	(i)	Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound nitrogen trifluoride, ${\rm NF_3}$.						
		Use x for an electron from a nitrogen atom. Use o for an electron from a fluorine atom.						
		[2]						
	(ii)	Lithium nitride has a high melting point, 813° C. Nitrogen trifluoride has a low melting point, -207° C. Explain why the melting points are different.						
		[2]						
		[Total: 8]						

DATA SHEET
The Periodic Table of the Elements

	0	4 He Helium 2	20 Neon 10 Af Afgon	84 Kr Krypton 36	131 Xe Xenon	Radon 86		175 Lu Lutetium 71	Lr Lawrendum 103
			19 Fluorine 9 35.5 C 1	80 Br Bromine	127 	At Astatine 85		173 Yb Ytterbium 70	Nobelium 102
	5		16 Oxygen 8 32 \$ \$ \$ \$ \$ \$	79 Se Setenium 34	128 Te Tellurium	Po Polonium 84		169 Tm Thulium 69	Md Mendelevium 101
	>		14 Nitrogen 7 31 9 Phosphorus 15	75 As Arsenic 33	Sb Antimony 51	209 Bi Bismuth		167 Er Erbium 68	Fm Fermium
	2		Carbon 6 28 Si con 14	73 Ge Germanium 32	119 So ⊪⊓ 50	207 Pb Lead		165 Ho Holmium 67	ES Einsteinium 99
	=		11 B 5 5 7 A1 Aluminium 13	70 Ga Gallium	115 n Indium	204 T.1 Thallium		162 Dy Dysprosium 66	Californium
				65 Zn Zinc 30	112 Cd Cadmium 48	201 Hg Mercury		159 Tb Terbium 65	BK Berkelium 97
				64 Cu Copper	108 Ag Silver 47	197 Au Gold		157 Gd Gadolinium 64	Cm Curium
Group				59 X Nickel	106 Pd Palladium	195 Pt Platinum 78		152 Eu Europium 63	Am Americium 95
Gro				59 Co Cobalt	103 Rh Rhodium	192 F Iridium		Sm Samarium 62	Pu Plutonium
		T Hydrogen		56 Fe Iron	Ruthenium	190 Os Osmium 76		Pm Promethium 61	Neptunium
			,	Mn Manganese	Tc Technetium 43	186 Re Rhenium 75		Neodymium 60	238 U Uranium 92
				Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		Pr Praseodymium 59	Pa Protactinium 91
				51 V Vanadium 23	93 Niobium 41	181 Ta Tantalum		140 Ce Cerium 58	232 Th Thorium
				48 T Titanium 22	91 Zr Zirconium 40	178 Hf Hafnium 72			nic mass bol nic) number
				45 Sc Scandium 21	89 < Y Yttrium 39	139 La Lanthanum *	227 Ac Actinium †	series eries	a = relative atomic massX = atomic symbolb = proton (atomic) number
	=		Be Beryllium 4 24 Mg Magnesium 12	40 Ca Calcium	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	а × а В
	_		7 Lithium 3 23 Na Na 11	39 K Potassium	Rubidium 37	133 Cs Caesium 55	Francium 87	*58-71 L; 190-103 /	Key

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

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