

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

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CANDIDATE NAME									
CENTRE NUMBER						NDIDA MBER			

CHEMISTRY 0620/33

Paper 3 (Extended)

October/November 2012

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 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				
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7				
Total				

This document consists of 14 printed pages and 2 blank pages.



2

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	3	a l
1	For each of the following, select an element from Period 4, potassium to krypton, matches the description.	TO CAMBO
	(a) A metal that reacts rapidly with cold water to form a compound of the type M(Ol hydrogen.	xtrapaper
		[1]
	(b) Its only oxidation state is 0.	[1]
	(c) It has a macromolecular oxide, XO ₂ , which has similar physical properties to the diamond.	nose of
		[1]
	(d) This is one of the metals alloyed with iron in stainless steel.	[1]
	(e) It can be reduced to an ion of the type X ⁻ .	[1]
	(f) It can form a covalent hydride having the formula H ₂ X	[1]
	(g) Its soluble salts are blue and its oxide is black.	[1]
	(h) It is a liquid at room temperature.	[1]
	דן	otal: 8]
2	(a) State a use for each of the following gases.	
	(i) chlorine	[1]
	(ii) argon	[1]
	(iii) ethene	[1]
	(iv) oxygen	[1]
	(b) Describe how oxygen is obtained from air.	
		[2]
	דן	otal: 6]

3 (a) A small amount of liquid bromine is added to a container which is then sealed.

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$$Br_2(I) \rightarrow Br_2(g)$$

Use the ideas of the Kinetic Theory to explain why, after about an hour, the bromine molecules have spread uniformly to occupy the whole container.

(b) The diagrams below show simple experiments on the speed of diffusion of gases.

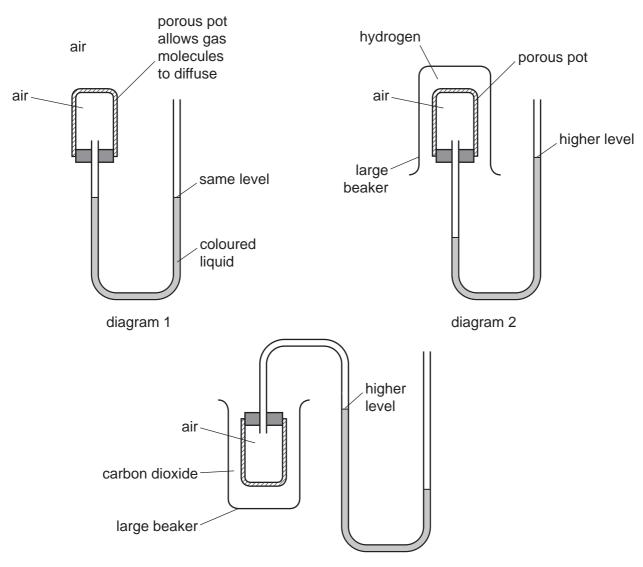


diagram 3

Complete the following explanations. Diagram 1 has been done for you.

Diagram 1

r into the pot is and outside the f the tube. There is air inside and outside the porous pot so the rate of diffusion of air into the pot is the same as the rate of diffusion of air out of the pot. The pressure inside and outside the pot is the same so the coloured liquid is at the same level on each side of the tube.

Diagram 2	
	[3]
	r-3
Diagram 3	
	[3]
	[Total: 9]

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34
O.

(a) (i)	Explain the phrase zinc alloy.
	[1]
(ii)	Making alloys is still a major use of zinc. State one other large scale use of zinc.
	[1]
(iii)	Describe the bonding in a typical metal, such as zinc, and then explain why it is malleable. You may use a diagram to illustrate your answer.
	[3]
(iv)	Suggest why the introduction of a different atom into the structure makes the alloy less malleable than the pure metal.

(b) Zinc metal is made by the reduction of zinc oxide. The major ore of zinc is zinc blende, ZnS. Zinc blende contains silver and lead compounds as well as zinc sulfide. Zinc blende is converted into impure zinc oxide by heating it in air.

2ZnS +
$$3O_2 \rightarrow 2ZnO + 2SO_2$$

(i) Describe how zinc oxide is reduced to zinc.

.....[1]

(ii) Some of the zinc oxide is dissolved in sulfuric acid to make aqueous zinc sulfate. Write a balanced symbol equation for this reaction.

.....[2]

[4]

[Total: 18]

iii)	This impure solution of zinc sulfate contains zinc ions, silver(I) ions and lea Explain why the addition of zinc powder produces pure zinc sulfate solution. Include at least one ionic equation in your explanation.
	[4]
iv)	Describe how zinc metal can be obtained from zinc sulfate solution by electrolysis. A labelled diagram is acceptable. Include all the products of this electrolysis. The electrolysis is similar to that of copper(II) sulfate solution with inert electrodes.

Propenoic acid is an unsaturated carboxylic acid. The structural formula of propenoic 5 given below.

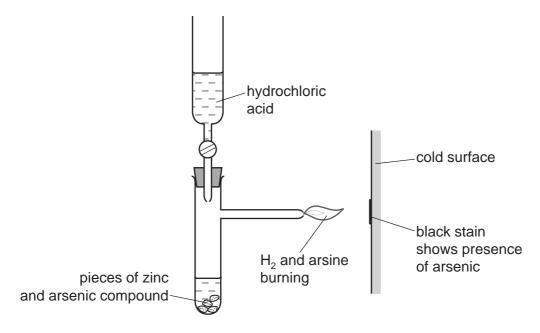
(a)	(i)	Describe how you could show that propenoic acid is an unsaturated compound.
		test
		result
		[2]
	(ii)	Without using an indicator, describe how you could show that a compound is an acid.
		test
		result
		[2]
(b)		penoic acid reacts with ethanol to form an ester. Deduce the name of this ester. Draw structural formula.
	nan	ne of ester
	stru	ctural formula showing all bonds
		[3]
(c)		organic compound has a molecular formula $\rm C_6H_8O_4$. It is an unsaturated carboxylic d. One mole of the compound reacts with two moles of sodium hydroxide.
	(i)	Explain the phrase <i>molecular formula</i> .
		[2]

(ii)	One mole of this carboxylic acid reacts with two moles of sodium hydroxide. How many moles of –COOH groups are there in one mole of this compound?	For miner's e
(iii)	What is the formula of another functional group in this compound?	SE.CO.
		[1]
(iv)	Deduce a structural formula of this compound.	

[1]

[Total: 12]

- 6 Until recently, arsenic poisoning, either deliberate or accidental, has been a frequent of death. The symptoms of arsenic poisoning are identical with those of a common illustrated that the symptoms of arsenic poisoning are identical with those of a common illustrated. A reliable test was needed to prove the presence of arsenic in a body.
 - (a) In 1840, Marsh devised a reliable test for arsenic.



Hydrogen is formed in this reaction. Any arsenic compound reacts with this hydrogen to form arsine which is arsenic hydride, AsH₃.

The mixture of hydrogen and arsine is burnt at the jet and arsenic forms as a black stain on the glass.

(i) Write an equation for the reaction which forms hydrogen.

.....[2]

(ii) Draw a diagram which shows the arrangement of the outer (valency) electrons in one molecule of the covalent compound arsine.

The electron distribution of arsenic is 2 + 8 + 18 + 5.

Use x to represent an electron from an arsenic atom.

Use o to represent an electron from a hydrogen atom.

				11	`	12		
(b)	Another hydride of arsenic has the composition below. arsenic 97.4% hydrogen 2.6%							
		arsenic	97.4%	hydrogen	2.6%	13		
	(i)	Calculate the Show your w	•	ormula of this hydric	le from the above data.			
						[2]		
	(ii)	The mass of	one mole of	this hydride is 154	g. What is its molecular fo	ormula?		
						[1]		
	(iii)	Deduce the s	tructural for	mula of this hydride).			
						[1]		
(c)	a m	•	of a person's	exposure to arsen	n the body. Analysis of the ic. To release the absorb			

......[1]

(i) What is the name of the linkage in proteins?

(ii) Name a reagent which can be used to hydrolyse proteins.

(iii) What type of compound is formed by the hydrolysis of proteins?

		12 www.xtrapapers.co	m
(d)	and	he 19th Century, a bright green pigment, copper(II) arsenate(V) was used to miner's d insects. In damp conditions, micro-organisms can act on this compound to provery poisonous gas, arsine.	
	(i)	Suggest a reason why it is necessary to include the oxidation states in the name of the compound.	-
			\

(ii) The formula for the arsenate(V) ion is ${\sf AsO_4^{3-}}$. Complete the ionic equation for the formation of copper(II) arsenate(V).

.....Cu²⁺ +AsO₄³⁻
$$\rightarrow$$

[2]

[Total: 14]

		www.x	rapar
		ia is made by the Haber process. $N_2(g) \ + \ 3H_2(g) \ \rightleftharpoons \ 2NH_3(g)$ te one major use of ammonia.	
Am	mon	ia is made by the Haber process.	aCar
		$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	13
(a)	Sta	te one major use of ammonia.	
			[1]
(b)	Des	scribe how hydrogen is obtained for the Haber process.	
			[3]
(c)		s reaction is carried out at a high pressure, 200 atmospheres.	
	Sta	te, with an explanation for each, two advantages of using a high pressure.	
			[5]
(d)	(i)	What is the difference between an endothermic and an exothermic reaction?	

ount or miner's e

(ii) Bond breaking is an endothermic process. Bond energy is the amount of needed to break or form one mole of the bond. Complete the table and explain the forward reaction is exothermic.

$$N \equiv N + 3 H \longrightarrow 2 H \longrightarrow N \longrightarrow H$$

bond	bond energy kJ/mol	energy change kJ	exothermic or endothermic
N≡N	944	+944	endothermic
н—н	436	3 × 436 = +1308	
N—H	388		

.....[3]

[Total: 13]

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

				16		No Pievium 102 Co. Lawrendum 103 Co. Lawrendum 1
	0	4 He lium	Neon Neon Argon	Krypton Kepton Xenon	Fadon 175 Lutetium	Lawrendum 33 states of the sta
	IIV		19 Fluorine 10 35.5 C1 Chlorine 18		485 straine 86 86 87 173 Y.b. Ytterblum 77 77 770	Nobelium 102 102 102 102 102 102 102 102 102 102
	N		16 OOxygen 8 32 Suffur 16	79 Se Selentium 34 128 Tellurium 52 Po	169 Tablium 69	Mandelevium 101
	>		14 Nitrogen 7 31 97 Phosphorus 15	75	B3 smuth 167 Er Erblum 68	Fermum 100
	>		Carbon 6 Carbon 8 Silicon 14	73 Ge Germanium 32 119 50 Tin 50 Pb	165 HO Homium 67	Einsteinburn 99 (F.1.D.).
	Ξ		11 Baron 5 27 At Aluminium 13	70 Ga 31 31 115 116 1 n 149 204	162 Dy Dysprosium 66	The volume of one mole of any gas is 24 dm ³ at room temperature and pressure (r.t.p.).
				65 Zn Znc 30 Znc Cd Cadmium 48 Pg	159 Tb Tb Tb Terbium 65	Br. Berkelum 97 ature and
				64 Copper 29 Copper 108 Ag Silver 197 Au	157 GG Gadolinium 64	Cm 96 m temper
Group				28 Nickel 28 Paladium 46 Paladium 195 Pt	152 Eu Europium 63	Am Americum 95 at rool
ั้ว			1	59 Cobalt 27 Cobalt 103 Rhodium 45 Pt 192 L C	150 Sm Samarium 622	Pu Putorium 944 as is 24 d
		1 H ydrogen		86 Fe Iron 26 Iron 44 Ruthenium 8 Ruthenium 90 OS	Pm Promethium 61	Np Neptunium 93 of any gi
				Mn Manganese 25 T Tochnetium 43 Re	75 X 60 8	U Urankum 92
				52 Cromium 24 Mo Moybdenum 42 W	74 Iungsten 141 Pr Praseodymium 59	Pa Protectinum 91
				8 4	73 Innatum 73 (740 Certum 58 Certum 58 Certum 140 Certum 140 Certum 158 Certum 140 Certum 158 Certum 140 Certum 158 Certu	L 06
				Tritanium 22 P1 ST Coorbium 40 T78 T78 T78	* 72 Hamum	mbol number
				Scandium 2.1 Scand	-	X = atomic symbol b = proton (atomic) number
	=		Be Beryllium 4 24 Mg Magnesium 12	Caechum 20 Caechum 20 St Caechum 38 Romainum 38 BB	Francium Separation Separ	¬ ×
	_		7 Lithium 3 23 23 Na Sodium 11	39 Potassium 19 85 Rb Rbdidum 37 Rabidium 37 CS	Francium 87 *58-71 L 190-103	Ye key

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