



Wednesday 22 June 2016 - Morning

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A/FURTHER ADDITIONAL SCIENCE A

A173/01 Module C7 (Foundation Tier)

Candidates answer on the Question Paper. A calculator may be used for this paper.

OCR supplied materials:

None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename				Candidate surname			
Centre numb	oer			Candidate nu	umber		

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer all the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do not write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil ().
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- The Periodic Table is printed on the back page.
- This document consists of **20** pages. Any blank pages are indicated.

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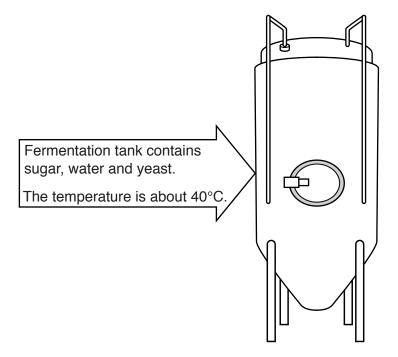
Answer all the questions.

Th	e Haber process uses nitrogen and hydrogen to make ammonia for fertilisers.	
(a)	The reaction between nitrogen and hydrogen is reversible.	
	Complete the equation for the process by drawing the symbol for a reversible reaction the box.	in
	$N_2 + 3H_2$ 2NH ₃	[1]
(b)	The Haber process uses particular conditions to increase the rate of the reaction.	
	Which conditions increase the rate?	
	Put ticks (✓) in the boxes next to the three correct answers.	
	high temperature	
	using a catalyst	
	recycling unreacted hydrogen and nitrogen	
	high pressure	
	using nitrogen from the air as a feedstock	
		[2]
	[Total:	3]

1

2 Whisky is an alcoholic drink that contains ethanol.

The first stage in making whisky is fermentation.



(a) Which statements about fermentation are true?

Put ticks (\checkmark) in the boxes next to the **two** correct answers.

The sugar is a waste product of the yeast.

The conditions are optimum for yeast to grow.

A very high temperature would make ethanol much faster.

Yeast uses sugar as a source of food.

[2]

				[Total: 4]
	desiccation	distillation	filtration	saturation	[1]
	Put a ring around th	e correct answer.			
	What process is used	I to make the ethanol more	concentrated?		
	After fermentation, ar	nother process makes the e	ethanol solution more	concentrated.	
(c)	Whisky contains abo	ut 40% ethanol.			
					[1]
	The water boils a	and kills the yeast.			
	The temperature	is too low.			
	There is no suga	ır left.			
	The alcohol stop	s the yeast from working.			
	Put a tick (✓) in the b	ox next to the correct answ	ver.		
	Which statement exp	lains why?			
	Fermentation cannot	be used to make the etha	nol more concentrated	d.	
(b)	Fermentation can on	y be used to make solution	ns that contain about 1	12% ethanol.	

3 A company makes chemical compounds and uses them to make products such as fertilisers and drugs.

(a) The table gives information about these products	(a)	The table	gives	information	about	these	products
--	-----	-----------	-------	-------------	-------	-------	----------

Product	Type of process	Use
fertilisers	bulk	spread on soil to help crops grow
drugs	fine	used on people and animals

(i)	What is the difference between the processes used to make bulk and fine chemicals?
	[2]
(ii)	Monitoring of purity is much more important for compounds used in drugs than for compounds used in fertilisers.
	Use the information in the table to help you to explain why.
	[2]
(iii)	Each manufacturing process has many stages.
	Chemists work in the stages that involve making the chemical compounds.
	Which stages involve making the chemical compounds?
	Put ticks (\checkmark) in the boxes next to the two correct answers.
	choosing feedstocks
	designing labels
	choosing the best reaction conditions
	deciding on how the products are advertised
	transporting the products

(b)	Millions of tonnes of hydrogen are made every year. In industry, most hydrogen is made by a
	reaction between methane gas and steam.

methane + steam
$$\rightarrow$$
 hydrogen + carbon dioxide
 $\mathrm{CH_4}$ + $\mathrm{2H_2O}$ \rightarrow $\mathrm{4H_2}$ + $\mathrm{CO_2}$

The table shows some information about the process.

Feedstocks	methane (natural gas) and water
Number of stages in process	2
Temperature needed	700–1100°C
Energy source	burning some of the methane gas
By-products	none
Waste product	carbon dioxide gas
Atom economy	15%

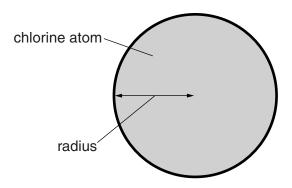
Use the information to help you to explain why this process is **not** sustainable.

The quality of written communication will be assessed in your answer.	
	6 T

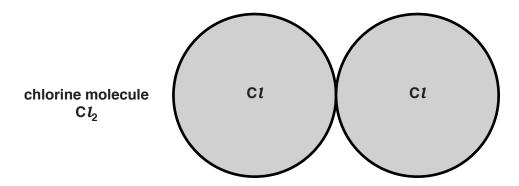
(c)

Sci	entists are wo	orking on a r	new proce	ss to produ	ce hydro	gen.			
The	new process	s splits wate	r to make	hydrogen.	A catalys	t is used i	n the prod	cess.	
		2H ₂ O	\rightarrow	2H ₂	+	O_2			
(i)	What is the	name of the	by-produ	ct of this rea	action?				
					•••••				[1]
(ii)	Using a cata	alyst reduce	s the ene	gy needed	to break	up the wa	ıter.		
	How does th	ne catalyst v	vork?						
	Put ticks (🗸)) in the boxe	es next to	the two cor	rect answ	vers.			
	The cat	talyst increa	ses the tir	ne taken fo	r the reac	ction.			
	The cat	talyst lowers	the activ	ation energy	y.				
	The cat	talyst provid	es a differ	ent route fo	r the read	ction			
	The cat	talyst is use	d up inste	ad of the wa	ater.				
									[2]
								[Total:	15]

- 4 Len looks up data about the sizes of atoms of chlorine and some other Group 7 elements.
 - (a) The size of an atom is measured by measuring its radius.



Two atoms bond together to make a molecule.

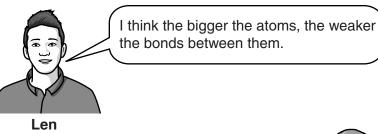


Len also finds out the **energy needed to break the bond** that holds the atoms together in a molecule.

This is his data.

Element	Radius of an atom (pm)	Energy needed to break bond (kJ/mol)
Fluorine F ₂	42	155
Chlorine Cl ₂	79	242
Bromine Br ₂	94	193
lodine I ₂	115	151

He talks about the data with Mack.



I don't agree. I think your idea is only true for some elements.



Mack

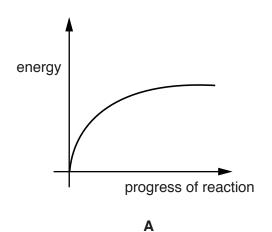
Use examples and data from the table to explain why Len's idea is only true for some elements.

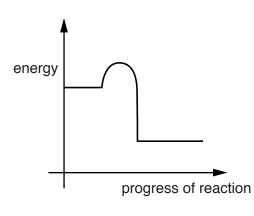
The quality of written communication will be assessed in your answer.
 [6]

(b) Shining a bright light on a mixture of chlorine gas and hydrogen gas makes it explode.

The reaction is very exothermic.

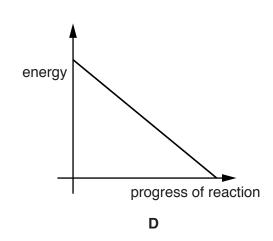
(i) Which energy level diagram, A, B, C or D, is correct for the reaction between chlorine and hydrogen?





В

energy progress of reaction C



Put a (ring) around the correct answer.

Α

В

C D

[1]

(ii) Complete the sentences about this reaction between chlorine and hydrogen by putting a (ring) around the correct words in each sentence.

To start the reaction bonds need to **break** / **form**.

To start the reaction, energy is taken in / given out.

The reaction is exothermic and so overall energy is taken in / given out.

During the reaction **more** / **less** energy is taken in than given out. [3]

[Total: 10]

5	A scientist w	orks in a quali	ty control laboratory	v for a chemical	company.
•	/ COOLLINGE W	orno iri a quaii	ly contitor laborator	y ioi a ciiciiiicai	company.

The company makes acids for use in cleaning products.

(a) The scientist tests two acids, acid A and acid B.

He does a series of titrations for each acid.

He does a rough titration. He then repeats the titration three times taking more care.

These are his results.

Acid	Volume o		nydroxide solution used n cm ³		
Acid	Rough	Repeat 1	Repeat 2	Repeat 3	
Α	25.0	24.5	24.4	24.6	
В	28.0	27.7	26.1	25.0	

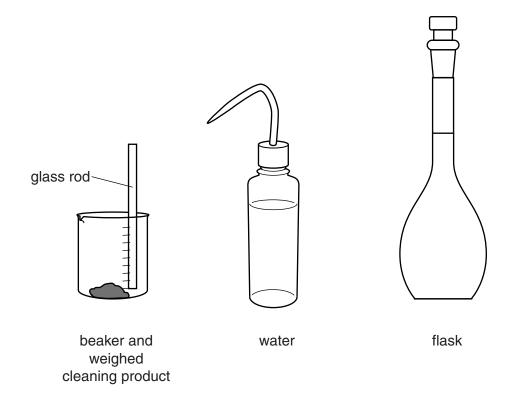
(i)	What is the range of volumes of sodium hydroxide used for the repeats for each acid	?
	range for acid A : from tocm ³	
	range for acid B : from tocm ³	[2]
(ii)	The scientist looks at the ranges to decide whether he needs to do more repeats.	
	Do you think he needs to do more repeats for acid A?	
	Do you think he needs to do more repeats for acid B?	
	Explain your reasons.	
	acid A	
	acid B	
		LJ.

(b) The scientist tests the quality of one of the cleaning products.

He makes up a standard solution of a cleaning product.

He starts by weighing some of the solid cleaning product into a beaker.

He uses this apparatus to make up his standard solution.



vvrite dov	vn now ne s	noula use th	is apparatus	to make a sta	andard solutio	on of cleaning	g product.

[Total: 8]

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Question 6 begins on page 14

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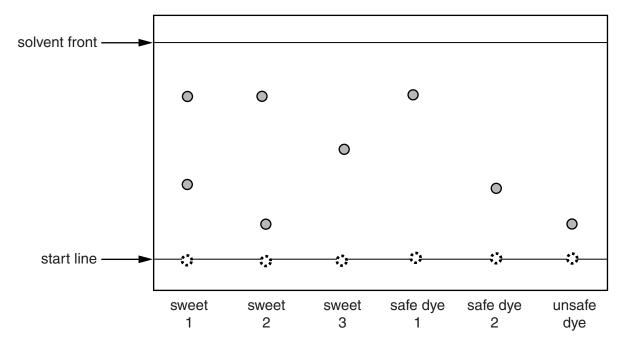
6 Alex uses chromatography to check that the food dyes used in some sweets are safe.

He tests three sweets against three known reference dyes.

Two of the references are known safe dyes.

One reference is a known unsafe dye.

Here is the chromatogram showing his results.



	13
(a)	Alex's job is to decide whether or not the sweets contain only safe dyes or if they might contain any unsafe dyes.
	What conclusions can you make about the safety of the sweets and the dyes that the sweets contain?
	Use the results of the chromatogram to explain your answer.
	The quality of written communication will be assessed in your answer.

.....

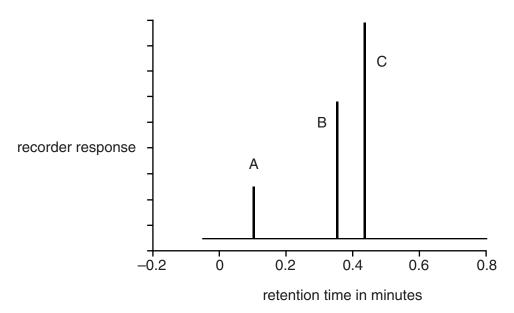
.....

......[6]

(D)	Alex decides to calculate the Al of sale dye 1.
	What measurements does he need to make from the chromatogram to use in his calculation?
	[2]
	[2]
(c)	Alex also uses chromatography to identify the flavourings used in sweets.
	At the end of his experiment he sprays his chromatogram with a locating agent.
	Why does he need to do this?
	Put a tick (✓) in the box next to the correct answer.
	To separate the spots.
	To remove the solvent.
	To see the spots.
	To speed up the movement of the solvent.
	[1]

(d) Alex decides to use a chromatography machine to analyse the dyes from a different type of sweet.

This is the printout he gets.



(i) The printout shows that three dyes have been used in the sweet.

Alex thinks that there is more of dye C in the sweet than either dye A or dye B.

How does the printout show that he is right?

Put a tick (\checkmark) in the box next to the correct answer.

Dye C has the highest peak.

Dye C has the longest retention time.

There is more than 0.4g of dye C in the sweet.

Dyes A and B both have retention times below 0.4 minutes.

[1]

(ii) Alex says that the chromatography printout gives both **qualitative** and **quantitative** information about the dyes used in the sweet.

Explain why this is true.

.....[2]

[Total: 12] Turn over 7 The table shows some information about the first four alkanes.

Name	Formula
methane	
	C ₂ H ₆
	C ₃ H ₈
butane	

(a) Complete the table by filling in the missing boxes. Use names and formulae from these lists.

ethanol	propane	butanol	ethane	methanol	
C_2H_4	CH ₄	C ₂ H ₅ OH	СН₃СООН	C ₄ H ₁₀	[3]

(b) Alkenes are another family of hydrocarbons.

The table shows the structures of some alkanes and alkenes that have the same number of carbon atoms.

Number of carbon atoms	Structure of alkane	Structure of alkene
2	H H I I H-C-C-H I I H H	H C=C H
3	H H H H C C C C C H H H H	H H H C=C-C-H
5	H H H H H H-C-C-C-C-C-H H H H H H	H H H H H H H C=C-C-C-H H H H H

(1)	what are the similarities and differ	rence	s between the	structures of	aikanes and	aikenes
						[3
(ii)	Draw the structure of an alkane an	d an a	alkene that co	ntain 6 carbo	n atoms.	
] [
	alkane			alkene		
						[2

[2]

The Periodic Table of the Elements

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3 4 5 5 6 7 0 11 12 14 16 19 20 B C N O F F Nee Intention
12 14 16 19 C N O F Carbon nitrogen oxygen fluorine 6 7 8 31 32 35.5 Si P S C1 silicon phosphorus sulfur chlorine 14 15 75 79 80 Ge As Se Br germantum arsenic selentum bromine 32 33 34 35 I19 122 128 127 Sn Sb Te I th antimony tellurium iodine 50 207 209 [209] [210] Pb Bi Po At lead bismuth polonium astatine 82 83 84 85
12 14 16 C N 0 Carbon nitrogen 6 8 Si N 28 Silicon phosphorus 8ulfur 16 T3 75 75 Ge As Se Se Semanium arsenic selentum 32 Sin Sh Te Te tin antimony tellurium 50 Pb Bi Po Pontum 82 Sin Sh Te Tellurium 50 Sin Sh Sh Tellurium 5112 Sin Sh Sh Tellurium 52 Sin Sh Sh Tellurium 58 Sin Sh Sh Sh Tellurium 58 Sin Sh
12 14 Carbon ontrogen 6 7 Si P Silicon ontrogen 7 3 Si P Silicon ontrogen 14 15 Carbon ontrogen 14 15 Carbon ontrogen 114 15 Carbon ontrogen 115 Carbon ontrogen 116 Carbon ontrogen 117 Carbon ontromptical parameter 117 Carbon ontromptical carbon ontrompticated bismuth 82 Signature 112-116 has authenticated
12 C carbon 6 Si silicon 14
111 B boron 5 27 A1 aluminium 13 70 Ga gallium 31 In indium 49 204 T1 thallium 81
65 Zn znc 30 30 1112 Cd cadmium 48 mercury 80
63.5 Cu copper 29 108 Ag silver 47 197 Au gold 79 Rg roentgentum
59 Ni Nicket 28 106 Pd patladfum 46 195 Pt platfinum 78 [271] Ds darmssadfum
59 Co cobatt 27 103 Rh rhodum 45 1192 Ir iridium 77 Mt mettnerlum
1 H H Massium 7 M H H H Massium 7 M H H H H H H H H H H H H H H H H H H
55 Ann manganese 25 [98] Tc technetium 43
E E E
relative atomic mass atomic symbol name atomic (proton) number atomic (proton) number by 51 52 24 24 251 84 184 184 184 184 184 184 184 184 184
relati' atomic atomic 48 Ti titanium 22 91 Zr zirconium 40 178 Hf hafnium 72 Rf rutherfordum
45 Sc scandium 21
9 Be beryltium 4 All All All All All All All All All Al
7 Li tithium 3 Na sodium 111 39 Kb rubidium 37 133 Cs caestum 555 Fr franctum

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.