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Wednesday 21 June 2017 - 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	per			Candidate nu	ımber		

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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do not write in the barcodes.

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.



Answer all the questions.

- 1 Dee works for a company that uses sodium hydrogencarbonate to make medicines.
 - (a) Dee uses several stages to make a standard solution of sodium hydrogencarbonate.

Each stage uses different equipment.

Draw straight lines to join each **stage** with the correct **equipment needed**.

Stage	Equipment needed
	burette
measure mass of solid	volumetric flask
dissolve solid in water and stir	beaker and glass rod
make solution up to exactly 250 cm ³	balance
	thermometer

[3]

(b) The company makes tablets from the sodium hydrogencarbonate to sell as medicines.

The tablet making process goes on all day, every day, to make a very large number of tablets.

Dee's job is to choose representative samples of tablets, make them into a solution and test them to check that they all contain the same amount of sodium hydrogencarbonate.

Write down some standard procedures for Dee to follow to make sure that her tests are fair.

Your answer should include:

- how she chooses which tablets to sample
- how she stores and handles the tablets
- what she should control when she makes each tablet into a solution.

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

(c) Medicines that contain sodium hydrogencarbonate are used to neutralise excess acid in the stomach.

In the stomach, sodium hydrogencarbonate reacts with hydrochloric acid.

(i) Complete the word and symbol equation for the reaction.

sodium hydrogencarbonate	+	hydrochloric acid	→		+	carbon dioxide	+	water
NaHCO ₃	+	HC1	→	NaC <i>l</i>	+		+	H ₂ O
								[2]

(ii) One of the side-effects of taking medicines which contain sodium hydrogencarbonate is pain caused by a build-up of gas in the stomach.

Use the equation to explain how sodium hydrogencarbonate causes a build-up of gas in the stomach.
[2]

[Total: 13]

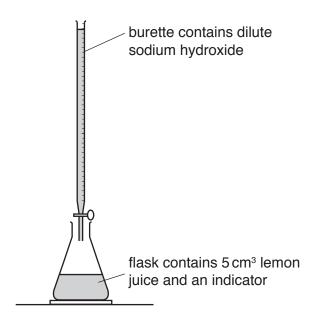
2 Lemon juice contains an acid.

Joe does some titrations to find the concentration of acid in a bottle of lemon juice from a shop.

He uses a measuring cylinder to measure 5 cm³ samples of lemon juice.

He adds an indicator to the lemon juice, then does a titration using dilute sodium hydroxide.

The diagram shows how he sets up his titration.



For each sample of lemon juice, Joe does a rough titration and then several titration repeats.

These are Joe's results.

	Pough		Titration repeats				
	Rough	1	2	3	4		
Volume dilute sodium hydroxide used (cm ³)	25.0	24.0	26.5	27.0	19.0		

(a)	(i)	Joe thinks that the data from his titrations is poor quality.
		Explain why he is right.

.....[2]

(ii)	Joe thinks that his data is poor quality because the measuring cylinder does not give a precise measurement of small amounts of lemon juice.
	What could Joe use to measure the lemon juice more precisely?

a larger measuring cylinder
a pipette
a small beaker

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

[1]

(b) Joe repeats his titrations.

These are his new results.

a different indicator

	Pough		Titration repeats				
	Rough	1	2	3	4		
Volume dilute sodium hydroxide used (cm ³)	23.0	21.0	25.0	20.5	21.5		

(i) Joe thinks one of his results is an outlier.

He ignores the outlier and uses three titration results to calculate the mean of the true volume of dilute sodium hydroxide used.

Put a ring around the **three** results in the table he uses.

[1]

(ii) Use the results to calculate a mean for the volume of dilute sodium hydroxide.

mean =cm³ [2]

(c) Joe completes similar titrations to test samples from a bottle of fruity lemon drink. The juice has this label.

Fruity drink contains 5% lemon juice

Joe uses his titration results to work out a best estimate of the volume of sodium hydroxide needed.

Best estimate = 20.0 cm³

Joe uses the following equation to work out the concentration of the lemon juice in the drink.

concentration of lemon juice in drink = $\frac{\text{best estimate}}{5}$ %

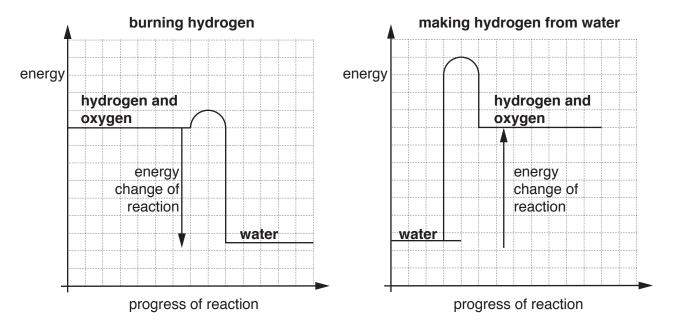
Use the equation to find out if Joe's best estimate gives the same concentration of lemon juice as the label. Explain your answer.

 	 [2]

[Total: 8]

3 Hydrogen can be burned as a fuel. It can be made from water.

The energy level diagrams below show the energy changes when hydrogen burns and when it is made from water.



Describe and explain the **similarities** and **differences** between the energy changes shown on the two diagrams.

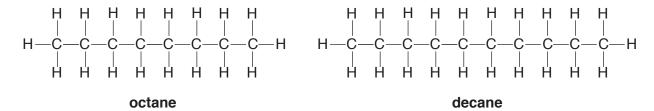
The quality of written communication will be assessed in your answer.
[6]

9

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- 4 Octane and decane are alkanes that are used in car fuels.
 - (a) The diagrams show the structures of octane and decane.



(i) The formula for octane is C_8H_{18} .

Write down the formula for decane. [2]

(ii) Which statements about octane and decane are true and which are false?Put a tick (✓) in one box in each row.

	True	False
decane has a higher relative formula mass than octane		
both molecules contain double bonds		
both molecules are hydrocarbons		
both molecules give off carbon dioxide gas when they burn		

[3]

(b) Cracking is a reaction used in a petrol refinery to make smaller molecules from long-chain alkanes.

The diagram shows what happens when cracking is used to make two molecules of ethene from an octane molecule.

One other molecule is also made.

In the box provided **draw** the structure and give the **name** of the other molecule.

[Total: 7]

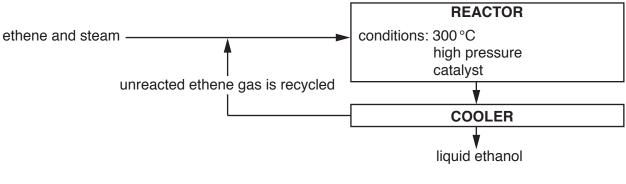
[2]

5 Ethene is used in an industrial process to make ethanol.

This is the equation for the main reaction in the process.

$$C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$$

This flow diagram summarises the process.



liquid ethanol	
(a) What does the symbol ← in the equation mean?	
	[1]
(b) Explain why ethene gas needs to be recycled in the process.	
(c) How is the rate of the reaction increased during the process?	
	[2]
(d) The ethanol leaves the reactor as a gas.	
What happens to the ethanol so that it changes into liquid ethanol?	

.....[2]

(e)	Ethanol can be made in other processes.		
	Which two processes can be used to make ethanol?		
	Put ticks (\checkmark) in the boxes next to the two correct answers.		
	fermentation of sugar		
	using genetically modified bacteria on biomass		
	in the Haber process		
	using gas chromatography		
	by titration		[2]
			[Total: 9]

6 The alkanes are a family of chemical compounds.

Some alkanes are used in car fuel.

When choosing a car fuel it is important to think about its state, its flashpoint and the energy it gives out when it is burned.

Fuels with low flashpoints ignite more easily than fuels with higher flashpoints. Fuels with flashpoints above 20 °C do not ignite easily at room temperature. Fuels with very low flashpoints are very flammable and may cause a fire risk.

The table shows some information about three alkanes: methane, octane and decane.

Name of alkane	Formula	State at room temperature	Flashpoint in °C	Energy given out when burned in kJ/mol
methane	CH ₄	gas	-188	840
octane	C ₈ H ₁₈	liquid	14	4800
decane	C ₁₀ H ₂₂	liquid	46	6800

Use the table to discuss the benefits and risks of using methane, octane and decane in car fuel.

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

[Total: 6]

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7 Over 10 million tonnes of phenol are made worldwide every year. Phenol is used to make many plastic products for buildings and packaging.

Phenol has been manufactured for over 100 years. The table gives information about an older process to make phenol and a modern process.

	Older process	Modern process		
Raw materials	Benzene (from fossil fuels) Sulfuric acid Sodium hydroxide	Benzene Propene (both from fossil fuels)		
Yield	82%	87%		
Atom economy	37%	100%		
Waste products	Sodium sulfite (toxic)	None, by-products are useful		
Conditions	High temperature and pressure	High temperature and pressure		

(a)	Use the information to explain why the atom economy of the two processes are different.	
		[2]
(b)	The modern process involves more green chemistry than the older process.	
	Use the information to explain why.	
		. [3]

(c)	A team of scientists are investigating how to make the modern process even greener.				ener.
	(i)	What factors could they investigate to ma	ake the process r	nore green?	
		Put ticks (✓) in the boxes next to the two	correct answers		
		Using renewable raw materials.			
		Using a higher temperature and pre	ssure.		
		Finding more uses for phenol.			
		Finding ways to increase the yield o	of phenol.		[2]
	(ii)	Scientists in the team share their data w	ith each other.		
		Why do they do this?			
		Put ticks (✓) in the boxes next to the two	correct answers		
		To make sure that other scientists d	o not take credit f	or their work.	
		To reduce the safety risks during the	eir experiments.		
		So that other scientists can check the	neir data.		
		So that they can discuss their concl	usions.		
		To stop other scientists from working	g on the same ide	ea.	[2]
(d)	Sor	me green chemical processes use enzyme	es as catalysts		[2]
(4)		ich statements are advantages and which	·	les of using enzy	me catalysts?
		a tick (\checkmark) in one box in each row.	ano diodavantas	job of doing only	no oataryoto .
	ı uı	a non (V) in one box in each rew.		.	7
			Advantage	Disadvantage	_
		Enzymes speed up reactions			
		Reactions with enzymes can work at a lower temperature			
		Enzymes only work in narrow ranges of ph and temperature			
		Enzymes can be denatured			
					[2]

[Total: 11]

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ADDITIONAL ANSWER SPACE

must be cle	early shown in the margin(s).

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The Periodic Table of the Elements

0 4 He helium 2	20 Ne neon 10	40 Ar argon 18	84 Kr krypton 36	131 Xe xenon 54	[222]	t fully
7	19 F fluorine 9	35.5 Cl chlorine 17	80 Br bromine 35	127 I iodine 53	[210] At astatine 85	irted but no
9	16 0 0xygen 8	32 S sulfur 16	79 Se selenium 34	128 Te tellurium 52	[209] Po potentium 84	ve been repo
5	14 N nitrogen 7	31 P phosphorus 15	75 As arsenic 33	122 Sb antimony 51	209 Bi bismuth 83	Elements with atomic numbers 112-116 have been reported but not fully authenticated
4	12 C carbon 6	28 Si silicon	73 Ge germanium 32	119 Sn tin 50	207 Pb tead 82	mic numbers a
8	11 B boron 5	27 A1 aluminium	70 Ga gallium 31	115 In indium 49	204 Tt thatlium 81	nts with atoı
·			65 Zn zinc 30	112 Cd cadmium 48	201 Hg	Eleme
			63.5 Cu copper 29	108 Ag silver 47	197 Au gold 79	Rg roentgenium
			59 Ni nicket 28	106 Pd palladium 46	195 Pt platinum 78	[271] Ds darmstadtium 110
			59 Co cobalt 27	103 Rh rhodium 45	192 Ir iridium 77	[268] Mt meitnerium 109
T hydrogen			56 Fe iron 26	101 Ru ruthenium 44	190 Os osmium 76	[277] Hs hassium 108
			55 Mn manganese 25	[98] Tc technetium 43	186 Re rhenium 75	[264] Bh bohrium 107
	mass ool number		52 Cr	96 Mo motybdenum 42	184 W tungsten 74	Sg seaborgium 106
Key	relative atomic mass atomic symbol _{name} atomic (proton) number		51 V vanadium 23	93 Nb niobium 41	181 Ta tantalum 73	[262] Db dubnium 105
	relati atc atomic		48 Ti titanium 22	91 Zr	178 Hf hafnium 72	Rf rutherfordium 104
'			45 Sc scandium 21	89 Y yttrium 39	139 La* tanthanum 57	[227] Ac* actinium 89
2	9 Be berytlium 4	24 Mg magnesium 12	40 Ca calcium 20	88 Sr strontium 38	137 Ba barium 56	[226] Ra radium 88
-	7 Li lithium 3	23 Na sodium 11	39 K potassium 19	85 Rb rubidium 37	133 Cs caesium 55	[223] Fr francium 87
					_	

* 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.