OCR

F

Thursday 19 June 2014 – Afternoon

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 number						Candidate number				

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 **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Millions of tonnes of hydrogen are made every year.

The hydrogen is usually made from methane.

The process starts with methane and steam, and makes hydrogen and carbon dioxide.

(a) Write a word equation for this process.

..... **[1]**

(b) In this process 52 tonnes of methane and steam make 8 tonnes of hydrogen.

(i) The waste product of this reaction is carbon dioxide.

What mass of carbon dioxide is made from 52 tonnes of methane and steam?

answer ..... tonnes **[1]**

(ii) Why does this suggest that the process is not very green?

.....

.....

..... **[2]**

(c) A new process for making hydrogen is by heating wood from trees.
Both processes for making hydrogen make carbon dioxide.
Suggest why this new process might be greener than the old one.

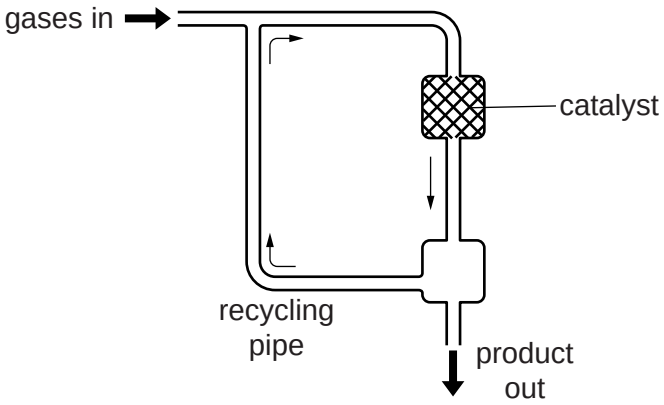
.....

.....

..... **[2]**

[Total: 6]

2 In the Haber process, nitrogen and hydrogen react to make ammonia.



Write about the Haber process.

Your answer should include:

- what happens
- why it uses a catalyst
- why the gases are recycled.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

[Total: 6]

3 Mary and Steve make an ester.

(a) Mary writes the equation for the reaction.
Use the words in the list to fill in the boxes.

ester

alcohol

carboxylic acid

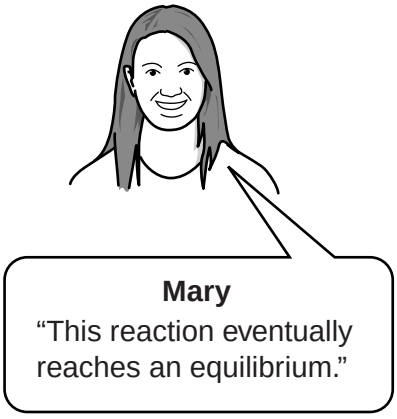
CH_3OH + C_2H_5COOH $\rightleftharpoons$ $C_2H_5COOCH_3$ + H_2O

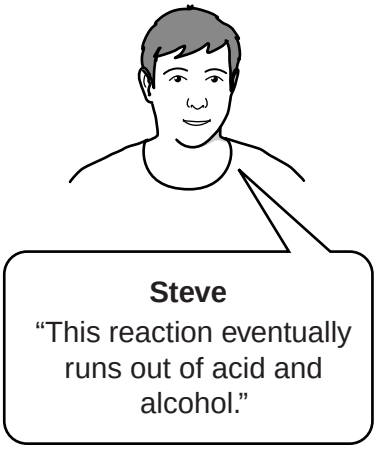
[ ] [ ] [ ]

[2]

(b) They know that one molecule of acid reacts with one molecule of alcohol to make the ester.
They start with equal amounts of acid and alcohol.
They measure the amount of the ester which is made.
However long they leave the reaction, they never get as much ester as expected.

They try to explain this.





Explain who is right and who is wrong.

.....

.....

.....

.....

.....

..... **[3]**

(c) The substance $C_2H_5COOCH_3$ is highly flammable.
When it burns in oxygen, it makes two products.
Suggest the names for these products.

..... and ..... **[2]**

[Total: 7]

4 Kate and William decide to make some ethanol.
Ethanol is an alcohol.
They add yeast to sugar solution and leave it to ferment.
Fermentation produces a dilute solution of ethanol.

(a) State two uses of ethanol.

.....

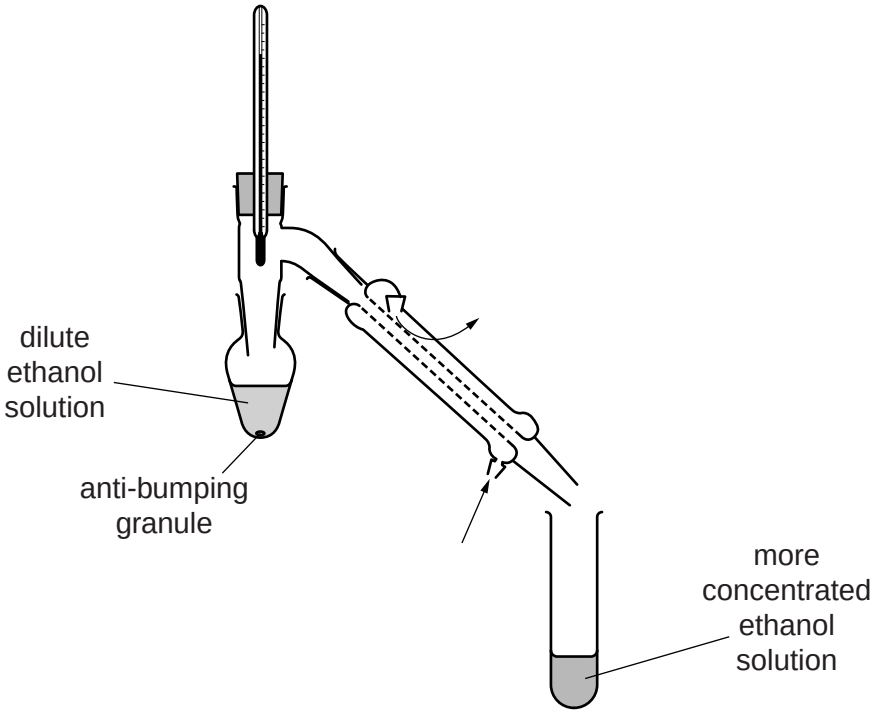
..... **[2]**

(b) Explain why fermentation will produce only a **dilute** solution of ethanol.

.....

..... **[2]**

(c) Kate and William decide to make their dilute ethanol solution more concentrated. They use this apparatus.



Describe how they use this equipment to make their dilute ethanol solution more concentrated, and why it works.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(d) An alcoholic drink is made by distilling a dilute alcohol solution.
The solution contains a mixture of alcohols.

	Boiling point	**Amount which will poison a person [in g]**
methanol	65 °C	120
ethanol	79 °C	560
propanol	97 °C	400
butanol	117 °C	350
pentanol	138 °C	120

William says that you should only make the drink from alcohol that distils at 79 °C.
He says that it isn't safe to drink alcohol that has been distilled at other temperatures.

Is he right? Explain your answer.

.....

.....

.....

..... **[3]**

(e) The formula of ethanol is C_2H_5OH.

Choose numbers from this list to complete the sentences which follow.

2 3 5 7 9

The total number of atoms in the formula is ..... .

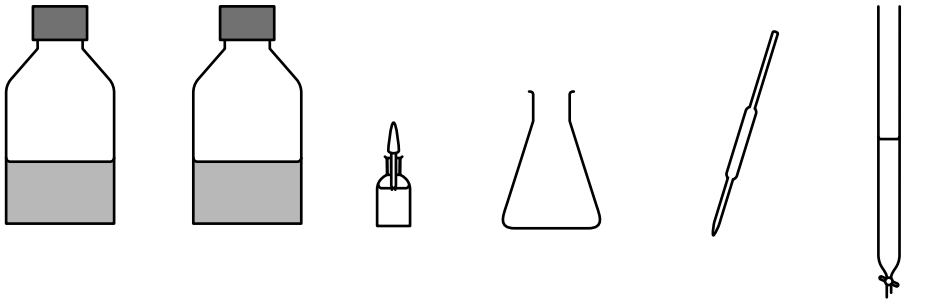
The number of different elements in the formula is ..... .

[2]

[Total: 15]

5 James does a titration with an acid and an alkali.

(a) He uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.
He has a burette and a 25.0 cm^3 pipette.



acid alkali indicator flask pipette burette

Describe how he would do a set of titrations to find out how much acid reacts with 25.0 cm^3 of the sodium hydroxide.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(b) James gets these results.

titration number	1	2	3	4
volume of acid in cm^3	26.4	25.2	25.6	25.4

James decides that the best value for the volume of acid is 25.4 cm^3.

Show how he arrived at this value.

.....

..... **[2]**

(c) A factory makes a food additive which can be analysed by titration.
They take several samples throughout the day.
They analyse each sample as soon as it has been taken.

Suggest why they do these steps.

.....

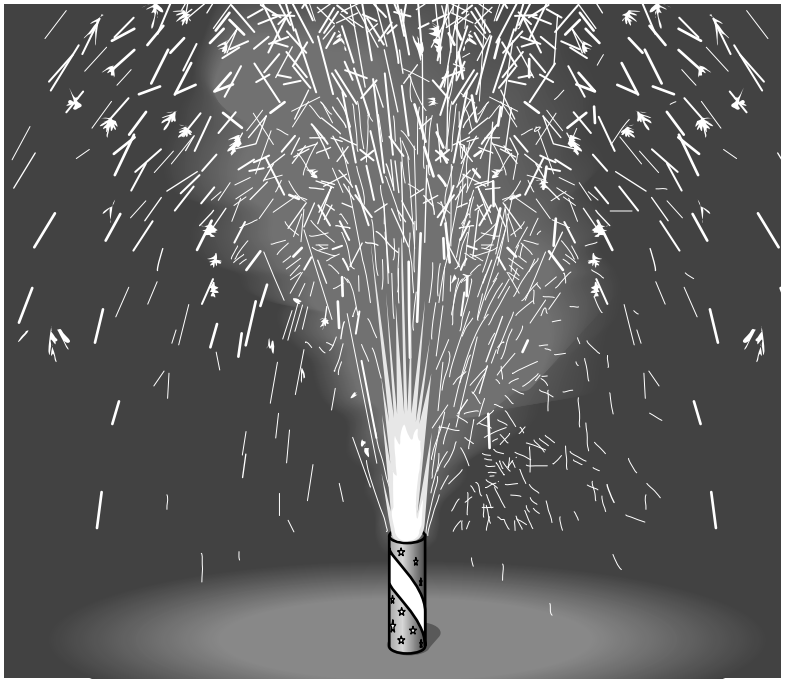
.....

.....

..... **[3]**

[Total: 11]

6 Most fireworks contain gunpowder.



When the gunpowder burns it gives out energy.

(a) What do we call a reaction which gives out energy?

Put a (ring) around the correct answer.

endothermic **equilibrium** **exothermic** **explosive** **[1]**

(b) Here are some statements about the energy changes in a firework.

Put a (ring) around the correct word in each statement or phrase.

Jo uses a match to start the reaction.

The reaction starts when energy from the match ***breaks / makes / reacts with*** chemical bonds in the gunpowder.

When new bonds are made they ***concentrate / dilute / give out / take in*** energy.

In a firework the energy change when bonds break is ***less than / the same as / more than*** when bonds are made.

The energy needed to start the reaction is the ***activation / initiation / starting*** energy.

[3]

(c) Some rockets which go into space use the reaction between hydrogen and oxygen.

$$2H_2 + O_2 \rightarrow 2H_2O$$

(i) How many molecules of water are shown in this equation?

answer ..... **[1]**

(ii) The rocket uses different masses of hydrogen and oxygen.
Two molecules of H_2 react with one molecule of O_2.
Relative atomic masses are given in the Periodic Table on the back page.

Calculate the relative masses of

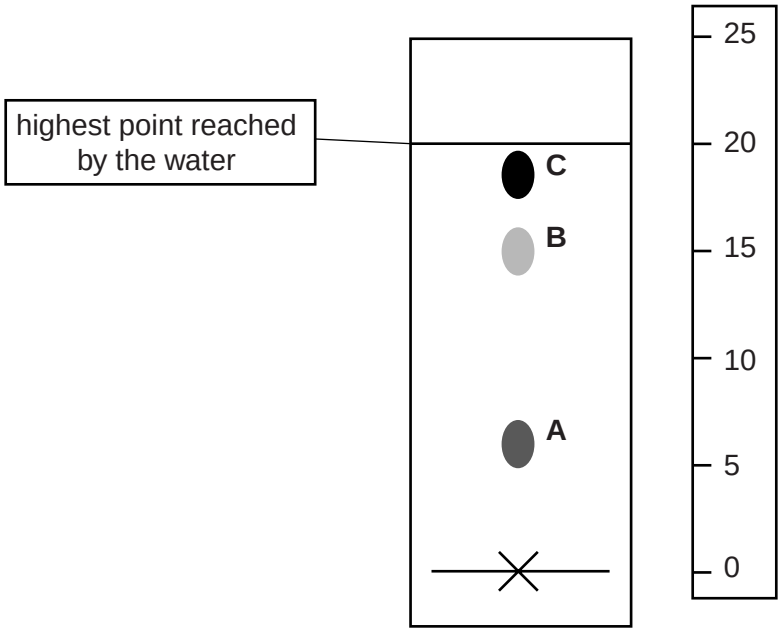
two molecules of H_2 ..... **one** molecule of O_2 ..... **[2]**

[Total: 7]

7 Alex does a chromatography experiment using the ink from her pen.

She makes an ink dot on the paper, and then puts the bottom of the paper into a dish of water.

She gets this pattern.



(a) (i) How many colours are in the ink?

answer ..... **[1]**

(ii) Alex knows that the different colours all dissolve in water.
Which colour dissolves in water the best?
Explain your answer.

.....

..... **[2]**

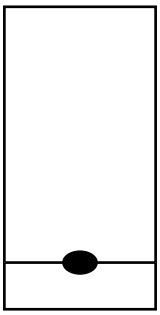
(iii) Use the formula to calculate the Rf value for colour **B**.

$$\text{Rf} = \frac{\text{distance travelled by solute}}{\text{distance travelled by solvent}}$$

Show your working.

Rf = ... **[2]**

(b) Alex tries out the ink from a different pen.
She knows that the ink contains two colours.
She gets this result when she runs the chromatogram with water.



(i) Suggest why no spots appear higher up the paper.

.....

.....

..... **[2]**

(ii) How could she change her experiment to make the two colours show up?

.....

..... **[1]**

[Total: 8]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

** 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.