

Thursday 20 June 2013 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY 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	
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Centre number						Candidate number				
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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

- Your 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**.
- This document consists of **20** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.

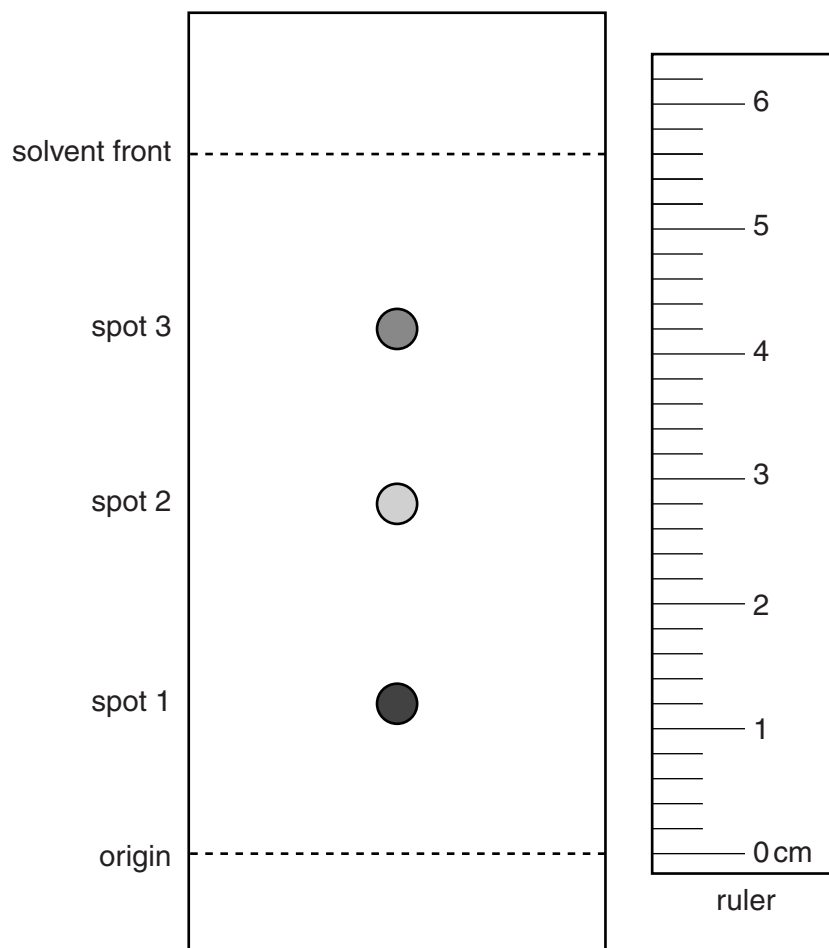
Answer **all** the questions.

- 1 Peter is testing the food colourings in soft drinks made by different companies.

He wants to find out if any of these drinks contain banned food colourings.

Peter uses chromatography.

Here is a diagram of the chromatogram from soft drink **A**.



- (a) Use the ruler on the diagram.

Work out the R_f value for **spot 3** on this chromatogram.

Use the formula in the box.

$$R_f = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent}}$$

Show your working.

R_f value for spot 3 = [2]

(b) Peter tests five soft drinks.

Write your Rf value for spot 3 of soft drink **A** in the table with the others.

Soft drink	Rf value spot 1	Rf value spot 2	Rf value spot 3
A	0.21	0.50	
B	0.38	0.65	0.72
C	0.38	0.72	0.88
D	0.29	0.65	0.82
E	0.38	0.44	0.65

Peter does a chromatogram of the banned food colouring.

He finds that it gives two spots, with Rf values 0.38 **and** 0.65.

Which of the soft drinks contain the banned food colouring?

answer [2]

(c) Peter does another chromatogram of the banned food colouring.

This time he uses alcohol instead of water as the solvent.

The table shows his results.

Solvent	Rf values for spots
water	0.38 and 0.65
alcohol	0.25 and 0.90

He writes this conclusion.

Both of the dyes in the food colouring move further when alcohol is used.

Do you think Peter's conclusion is correct? Explain your reasoning.

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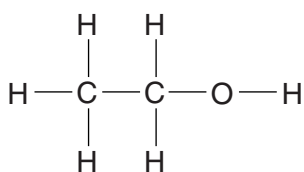
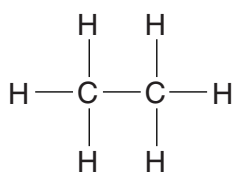
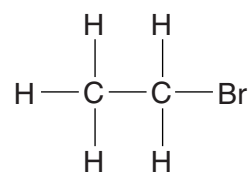
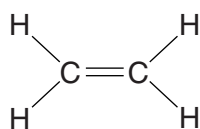
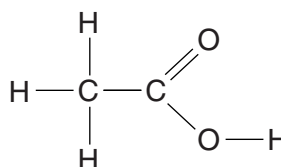
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..... [2]

[Total: 6]

Turn over

2 Look at the formulae of these five organic compounds.

**A****B****C****D****E**

Use the letters **A**, **B**, **C**, **D** and **E** to answer the questions.

(a) Which compound is a saturated hydrocarbon? answer [1]

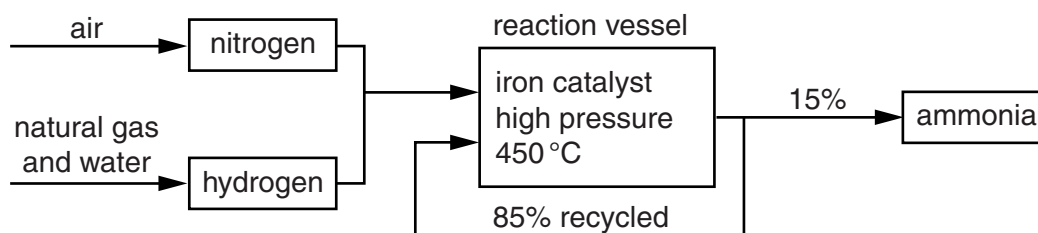
(b) Which compound is an unsaturated hydrocarbon? answer [1]

(c) Which two compounds react with each other to make an ester?
answer and [2]

(d) Which compound is a weak acid? answer [1]

[Total: 5]

3 Ammonia, NH_3 , is made by the Haber process.



(a) The Haber process uses:

- a catalyst
- a temperature of 450 °C
- a high pressure
- recycling of unreacted gases.

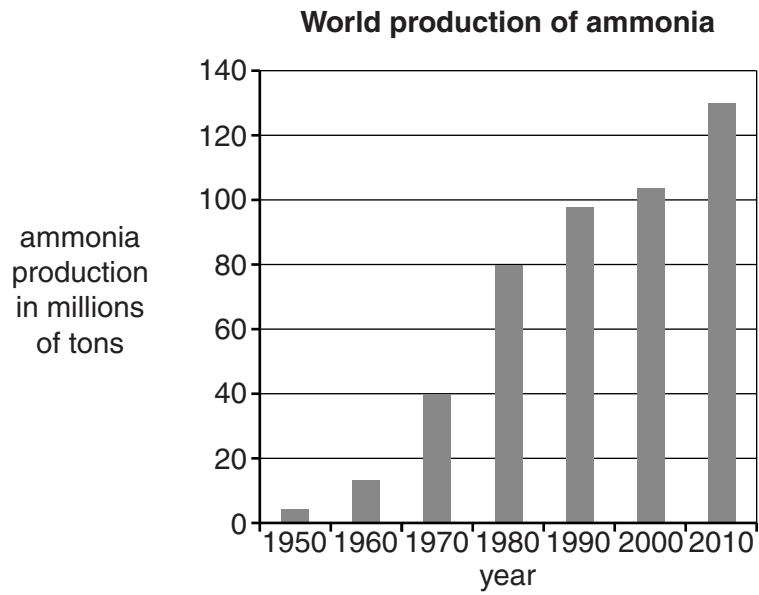
Explain how these help to make more ammonia.



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

..... [6]

(b) Look at the bar chart.



The main use of ammonia is to make fertilisers.

Large scale use of fertilisers made from ammonia causes environmental problems.

Write about these problems, and explain why they have got worse over the last 60 years.

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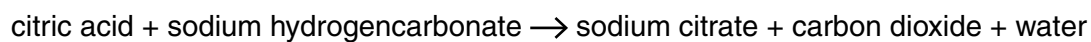
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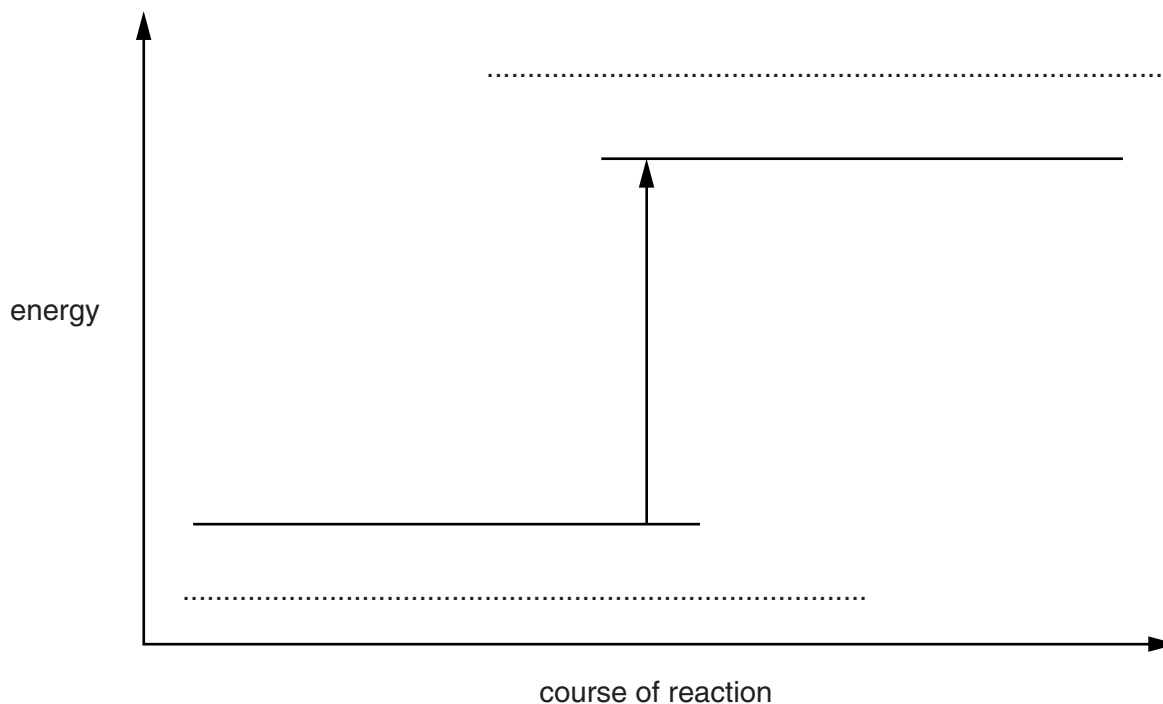
..... [3]

[Total: 9]

- 4 Citric acid reacts with sodium hydrogencarbonate.



The diagram shows the energy change that takes place in this reaction.



- (a) Write the names of the reactants and the products of the reaction in the correct places on this diagram. [2]
- (b) Finish these sentences to describe what happens in the reaction.

Use words or phrases from the list.

endothermic

exothermic

gained from

less

lost to

more

The reactants have energy than the products, so during the reaction, energy is the surroundings.

The reaction is

[3]

- (c) A solution of citric acid is added to a solution of sodium hydrogencarbonate in a test tube.

Sam says that the solution will bubble and the tube will get hot.

Sally says that there will be no bubbles and the tube will get cold.

Both are wrong. Explain why.

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..... [2]

[Total: 7]

5 Titration is a technique used for quantitative analysis.

- (a) (i) Describe the general procedure for carrying out an acid-base titration and explain the purpose of each step.



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

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..... [6]

- (ii) How can the uncertainty in a set of repeated titration results be assessed?

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..... [2]

- (b) Emma works for a company making indigestion tablets.

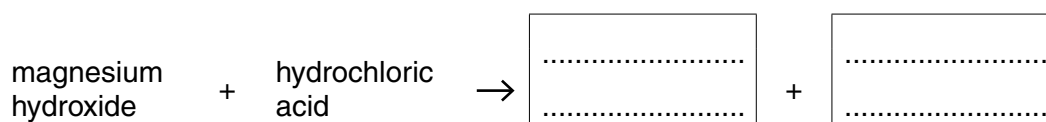
Her job is to test tablets from each batch.

- (i) The tablets contain magnesium hydroxide.

Emma titrates each tablet with hydrochloric acid.

This reaction makes a salt and water.

Finish this word equation for the reaction.



[1]

- (ii) Work out the relative formula mass (RFM) of magnesium hydroxide, $\text{Mg}(\text{OH})_2$.

Show your working.

(Relative atomic masses: $\text{H} = 1$; $\text{Mg} = 24$; $\text{O} = 16$)

RFM of magnesium hydroxide = [1]

- (iii) Emma uses hydrochloric acid with 73.0g of hydrogen chloride in each 1.0dm³ of the acid solution.

It takes 15.1 cm³ of this hydrochloric acid to react with the tablet.

Look at the formula in the box.

$$\text{mass of hydrogen chloride} = \text{volume in cm}^3 \times \frac{\text{mass in 1.0 dm}^3}{1000}$$

Use the formula to work out the mass of hydrogen chloride in 15.1 cm³ of this hydrochloric acid.

Give your answer to the nearest 0.1 g.

Show your working.

mass of hydrogen chloride in 15.1 cm³ solution = g [2]

- (iv) Look at the formula in the box below.

$$\text{mass of Mg(OH)}_2 = \text{mass of hydrogen chloride in 15.1 cm}^3 \text{ solution} \times \frac{\text{RFM Mg(OH)}_2}{73}$$

Use this formula, and your answers to (ii) and (iii), to work out the mass of magnesium hydroxide in the tablet.

Show your working.

mass of magnesium hydroxide in the tablet = g [2]

- (c) Emma analyses six tablets from each batch.

The table shows Emma's results for four batches of tablets.

Tablet number	Mass of magnesium hydroxide in g					
	1st	2nd	3rd	4th	5th	6th
Batch A	0.95	0.93	0.95	0.96	0.94	0.93
Batch B	0.88	0.86	0.89	0.87	0.89	0.87
Batch C	1.13	1.16	1.14	1.15	1.13	1.16
Batch D	1.03	1.13	1.05	1.04	1.15	1.03

The label on each pack of indigestion tablets says that each tablet contains 1.0 g of magnesium hydroxide.

The standard set by the company is that each tablet must be within 0.1 g of this figure.

For each batch decide whether it meets the standard and explain your answers.

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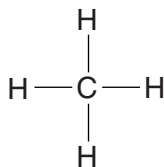
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..... [4]

[Total: 18]

6 Methanol has the formula CH₃OH.

(a) (i) This is the structural (displayed) formula for methane, CH₄.



Draw the structural (displayed) formula for methanol, CH₃OH.

[1]

(ii) To which type of organic compound does methanol belong?

Put a ring around the correct answer.

alcohol

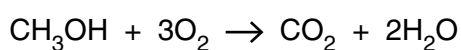
alkane

carboxylic acid

ester

[1]

(b) Methanol burns to make carbon dioxide and water.



Finish this table to show the number of **molecules** of each chemical in the equation.

	methanol	oxygen	carbon dioxide	water
number of molecules in the equation				

[2]

(c) Give a use of methanol.

..... [1]

[Total: 5]

$$\begin{array}{ccccc} \text{C}_2\text{H}_4 & + & \text{H}_2\text{O} & \rightarrow & \text{C}_2\text{H}_5\text{OH} \\ \text{ethene} & & \text{steam} & & \text{ethanol} \end{array}$$

The ethene is reacted with steam at about 300 °C and 60 atmospheres pressure.

$$\begin{array}{ccccc} \text{C}_6\text{H}_{12}\text{O}_6 & \rightarrow & 2\text{C}_2\text{H}_5\text{OH} & + & 2\text{CO}_2 \\ \text{sugar} & & \text{ethanol} & & \text{carbon dioxide} \end{array}$$

The sugar is fermented with yeast at a temperature of about 30 °C.

One of these factors is the renewability of raw materials.

Consider this, and other factors, to compare the sustainability of making ethanol by these two methods.



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

..... [6

(b) Fermentation makes a solution containing less than 20% of ethanol.

- (i) Which of these statements explains why it is not possible to make a more concentrated solution?

Put a tick (✓) in the box next to the best statement.

Yeast stops making ethanol when it runs out of sugar.

☐

The reaction is too slow at 30 °C.

☐

Yeast is killed by a high concentration of ethanol.

☐

Too much carbon dioxide is made.

☐

[1]

- (ii) What process is used to concentrate the ethanol solution?

Put a ring around the correct answer.

crystallisation

distillation

filtration

reduction

[1]

(c) The reaction of ethene with steam is carried out at about 300 °C.

Fermentation is carried out at about 30 °C.

Suggest reasons for this difference.

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..... [2]

[Total: 10]

END OF QUESTION PAPER

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* 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.