

Thursday 24 May 2012 – Morning**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A****A323/02** Unit 3: Ideas in Context plus C7 (Higher Tier)

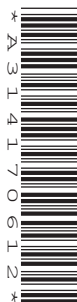
Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:

- Insert (supplied)

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename						Candidate surname					
Centre number						Candidate number					

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- 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 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 **55**.
-  Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
- 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 This question is based on the article, 'Do plasticizers make boys more feminine?'

- (a)** Tests have shown that plasticizers are present in most people.

Explain how plasticizers get into people's bodies.

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

- (b)** A recent research study into boys' play activities suggests that phthalates may make boys more feminine.

Some scientists have little confidence in the data from this study.

Suggest why.

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

- (c)** The two scientists quoted in the article have opposite opinions on the health risks of phthalate plasticizers.

They disagree even though they have both looked at the same data.

Suggest why they have different opinions.

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

3

- (d) Authorities in the EU and the USA have banned the use of phthalates in toys for babies and young children.

Explain how this is an example of the **precautionary principle**.

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..... [2]

- (e) Plasticizers change the properties of polymers such as PVC.

Use ideas about forces and energy to explain how plasticizers change the properties of a polymer.

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..... [3]

- (f) Products made of plasticized PVC deteriorate with time.

Explain why this happens.

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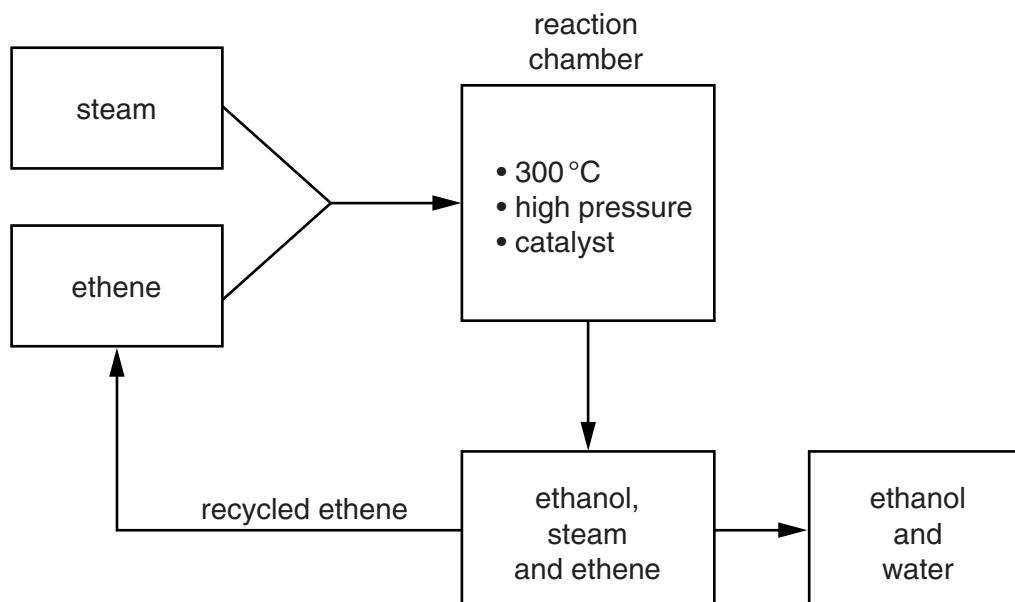
..... [2]

[Total: 13]

2 Ethanol is manufactured from ethene and steam.



The flow diagram shows the process.



(a) The reaction produces a mixture of ethanol, unreacted steam and ethene.

Ethanol and water are separated from the reaction mixture.

(i) Ethene, ethanol and water leave the reaction chamber at 300 °C.

The table shows their boiling points.

	Boiling point in °C
Ethene	−104
Ethanol	78
Water	100

How is ethene separated from ethanol and steam?

Use data from the table to help you.

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.....

..... [2]

5

- (ii) The atom economy of the reaction between ethene and steam is 100%.

Explain what this means.

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

- (iii) Although the atom economy of the reaction is 100%, the overall yield of the process is only 95%.

Suggest a reason for this difference.

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

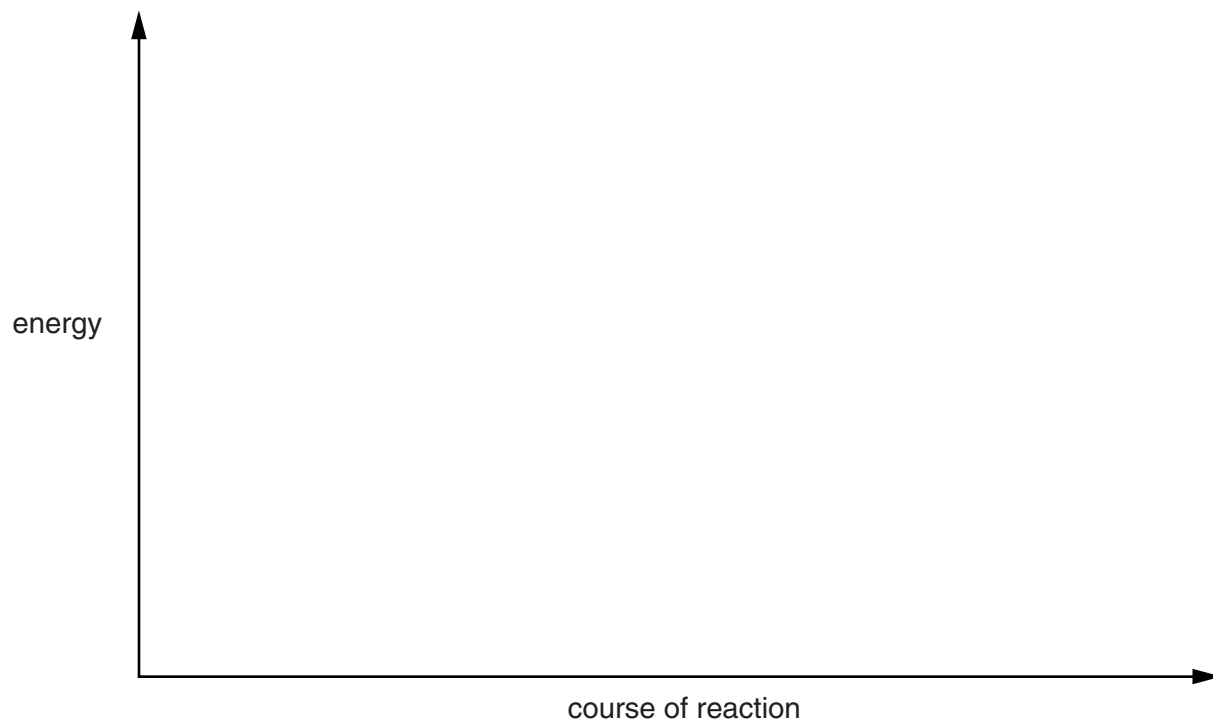
- (b) If ethene and steam are mixed and left for a long time, a dynamic equilibrium is formed.

What is meant by the term dynamic equilibrium?

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

- (c) The reaction between ethene and steam is exothermic.

Use the axes below to draw and label an energy level diagram for this reaction.



[3]

6

- (d) Ethene does not react with water at room temperature.

Ethene does react with steam at a high temperature.

Use ideas about activation energy to explain this difference.

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..... [2]

- (e) A catalyst is used to speed up the reaction between ethene and steam.

Explain how a catalyst speeds up a reaction.

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..... [2]

[Total: 13]

7

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Question 3 begins on page 8

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- 3 Vegetable oils can be changed into bio-diesel for use in diesel engines.

Bio-diesel contains methyl esters.

Gas chromatography is used to identify the methyl esters in a sample of bio-diesel.

The gas chromatography apparatus is first calibrated using a standard mixture of methyl esters.

The table shows the retention times for five methyl esters.

Methyl ester	Number of carbon atoms	Retention time in min
Lauric	12	1.6
Myristic	14	2.2
Palmitic	16	3.1
Heptadecanoic	17	3.5
Stearic	18	3.9

- (a) (i) Why is it important to find the retention times for a standard mixture of the methyl esters?

.....
 [1]

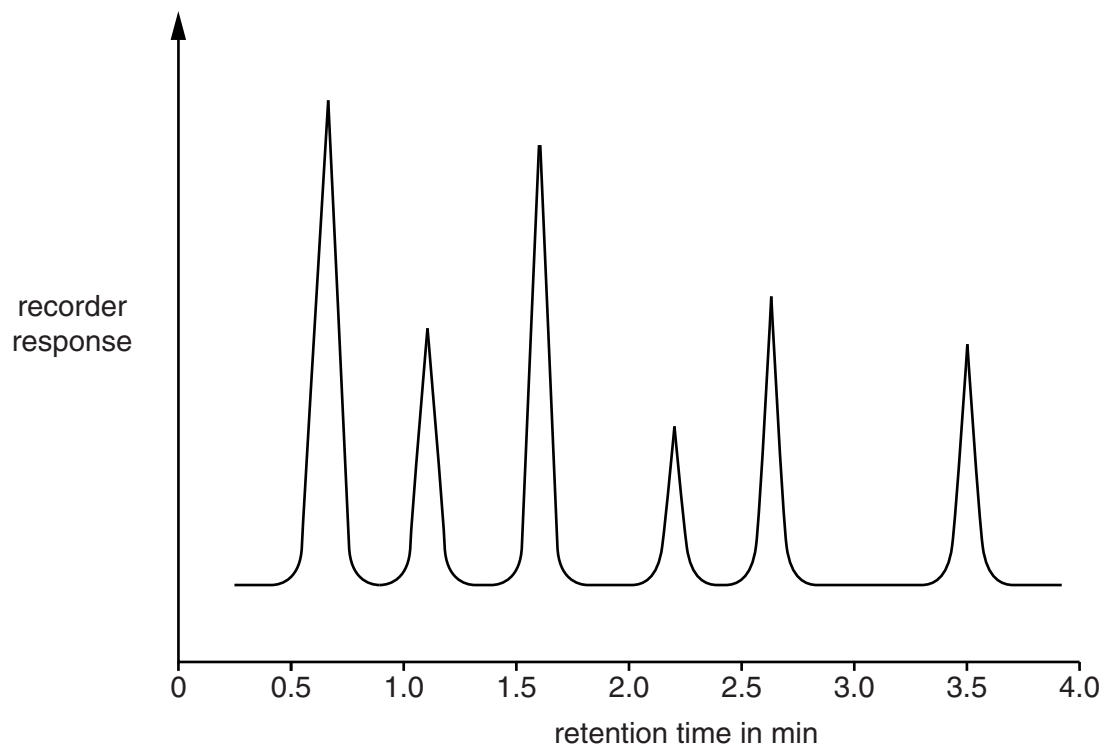
- (ii) The data in the table show a correlation.

Describe this correlation.

.....
 [1]

(b) The gas chromatography trace from one sample of bio-diesel is shown below.

The sample contains methyl esters and impurities.



(i) Which three methyl esters are present in the sample of bio-diesel?

1

2

3

[2]

(ii) There are only three methyl esters in this sample of bio-diesel.

Explain why there are more than three peaks on the gas chromatography trace.

.....

..... [1]

(iii) Which methyl ester was present in the **lowest** concentration?

..... [1]

10

- (c) During the gas chromatography each methyl ester forms an equilibrium between the mobile phase and stationary phase.

Use this information to help you explain how the methyl esters in the sample of bio-diesel are separated.



One mark is for the correct use of scientific terms.

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..... [3+1]

[Total: 10]

11

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Question 4 begins on page 12

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12

- 4 Amy works in the quality control department of a company that makes aspirin tablets.

The tablets are made in batches. Each batch contains millions of tablets.

Amy uses titration to get a best estimate of the mass of aspirin per tablet in each batch.

This is what she does.

- A** She measures out the correct volume of a stock solution containing 40g/dm^3 of sodium hydroxide. She mixes this with water to make 1dm^3 of a standard solution containing 4.0g/dm^3 sodium hydroxide.
- B** She crushes an aspirin tablet and mixes it with 25cm^3 of water in a conical flask.
- C** She titrates the aspirin mixture with the 4.0g/dm^3 sodium hydroxide solution using an indicator.
- D** She repeats the titration several times using more aspirin tablets from the same batch.
- E** She works out the mean of her results and uses this to calculate a best estimate for the mass of aspirin in each tablet.

- (a) (i) In step **A**, what volumes of stock solution and water should Amy use?

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..... [2]

- (ii) Describe what the indicator does and explain why it is used in step **C**.

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

13

(b) Amy works out the mass of aspirin in each tablet.

(i) Aspirin has a relative formula mass of 180.

Show that the relative formula mass of sodium hydroxide, NaOH, is 40.

Use the Periodic Table to help you.

[2]

(ii) In the equation for the reaction, one molecule of aspirin reacts with one molecule of sodium hydroxide.

The average of Amy's titration results for one batch of aspirin tablets is 27.4 cm³ of 4.0 g/dm³ sodium hydroxide solution.

Work out the mass of aspirin in each tablet.

Show your working.

mass of aspirin in each tablet = g [3]

(iii) Amy assesses the **degree of uncertainty** in the value she works out for the mass of aspirin in each tablet.

Describe how she can use her titration results to do this.

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..... [2]

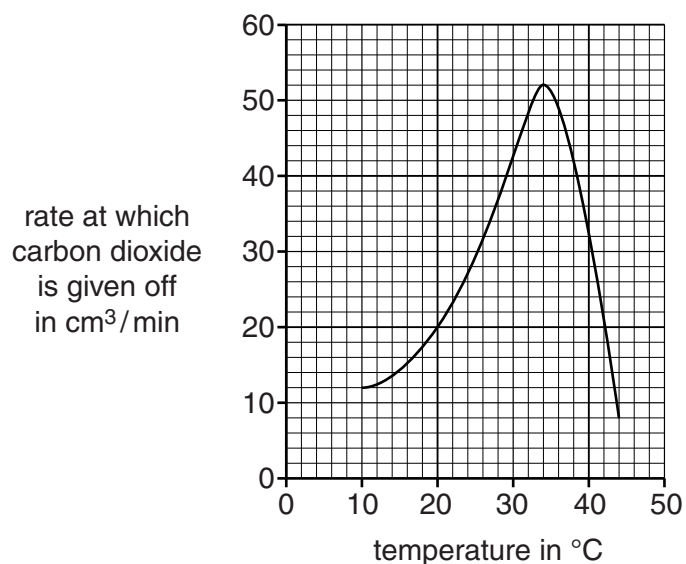
[Total: 11]

5 Ethanol can be made by fermentation using yeast.

Joe carries out fermentation reactions at each of several different temperatures. He keeps all other conditions the same each time.

He measures the rate at which carbon dioxide is given off at each temperature.

His results are shown in the graph.



(a) Use the graph to suggest an optimum temperature for the fermentation of glucose by yeast.

optimum temperature = °C [1]

(b) In the reaction glucose, $C_6H_{12}O_6$, is converted to ethanol and carbon dioxide.

Write a balanced equation for this reaction.

..... [2]

15

(c) A solution containing 60g glucose is fermented by yeast.

(i) Show that if all of this glucose is fermented the mass of ethanol formed is 30.7g.

Show your working.

(Relative atomic masses: H, 1; C, 12; O, 16.)

[3]

(ii) The actual mass of ethanol formed by fermentation of this solution is less than 30.7g.

Explain why.

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

[Total: 8]

END OF QUESTION PAPER**Copyright Information**

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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.