

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE  
A173/02**

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

**Module C7 (Higher Tier)**

**WEDNESDAY 17 JUNE 2015: Morning**

**DURATION: 1 hour**

**plus your additional time allowance**

**MODIFIED ENLARGED 24pt**

<b>Candidate forename</b>						<b>Candidate surname</b>				
<b>Centre number</b>						<b>Candidate number</b>				

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

**OCR SUPPLIED MATERIALS:  
A copy of the Periodic Table**

**OTHER MATERIALS REQUIRED:  
Pencil  
Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. 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).**

## **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.**

**Any blank pages are indicated.**

**BLANK PAGE**

**Answer ALL the questions.**

- 1 Some 'green' buses use biodiesel fuel which is a fuel that has been made from waste fats and cooking oil.  
The fats and oils are esters.**

**(a) Most oils are made by plants. Most fats are made by animals.**

**(i) What do plants use the oils for?**

**Put a ring around the best answer.**

**for energy**

**to fight disease**

**for growth**

**for repair**

**[1]**

**(ii) Animal fats are saturated.**

**Which of the molecules opposite is saturated?**

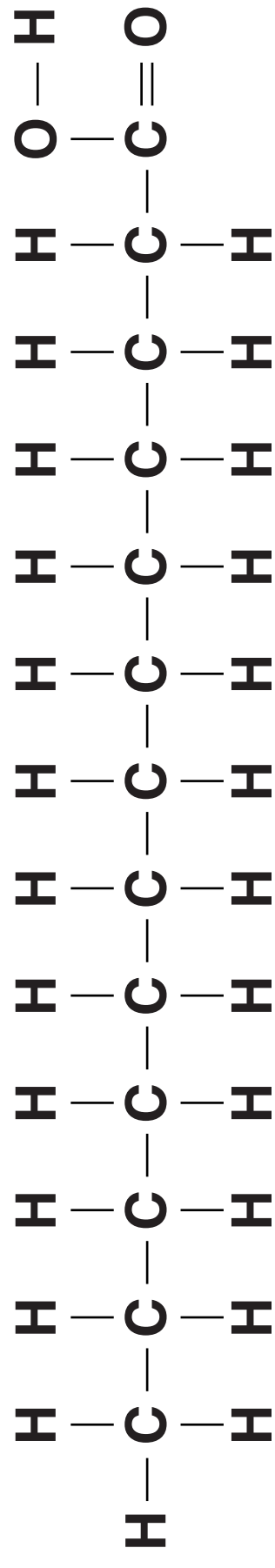
**Give a reason for your choice.**

**answer \_\_\_\_\_**

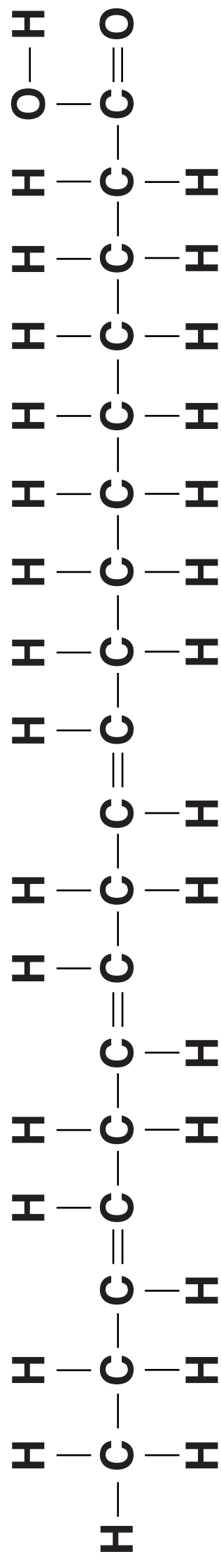
**reason \_\_\_\_\_**

**\_\_\_\_\_ [2]**

# MOLECULE A

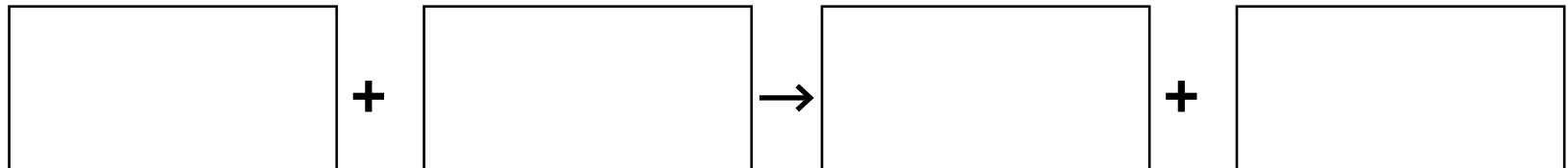


# MOLECULE B



- (b) The process for making biodiesel requires heating. Heat can be provided by burning propane,  $\text{C}_3\text{H}_8$ . When propane burns it reacts with the oxygen,  $\text{O}_2$ , in the air to make carbon dioxide and water.

Fill in the boxes to complete the **BALANCED SYMBOL EQUATION** for burning propane.



[2]

- (c) The conversion of fats and oils into biodiesel needs a catalyst. The usual catalyst is hot concentrated sodium hydroxide. Scientists are investigating a new catalyst. The new catalyst is an enzyme.

Here is some information about both catalysts.

FEATURE OF ENZYME	FEATURE OF HOT CONCENTRATED SODIUM HYDROXIDE
speeds up reaction a lot	speeds up reaction
easily damaged	not easily damaged
needs warm conditions	needs hot conditions
can be coated onto a solid surface	mixed in with the products at the end
speeds up this reaction only	speeds up other reactions of the esters as well as this reaction
expensive	very cheap

**Evaluate both catalysts. Suggest which catalyst would be best and explain why.**



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

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[6]

**[TOTAL: 11]**

**2 Fred investigates the acid  $\text{CH}_3\text{COOH}$ .**

- (a) (i) Which part of the formula shows you that  $\text{CH}_3\text{COOH}$  is a carboxylic acid?**

**Put a ring around the correct answer.**

**$\text{CH}_3$**

**CO**

**OH**

**COOH**

**[1]**

- (ii) The acid is a weak acid. What does this mean?**

**Put a tick (✓) in the box next to the correct answer.**

**Its formula contains carbon, hydrogen and oxygen.**

☐

**It is more dilute than acids such as hydrochloric acid.**

☐

**It is less reactive than acids such as hydrochloric acid.**

☐

**It is more runny than acids such as hydrochloric acid.**

☐

**[1]**

- (iii) Fred compares solutions of this weak acid with a strong acid of the same concentration.**

**How do the pH values of the two solutions compare?**

**Put a tick (✓) in the box next to the correct answer.**

**The weak acid has a higher pH.**

☐

**The weak acid has the same pH.**

☐

**The weak acid has a lower pH.**

☐

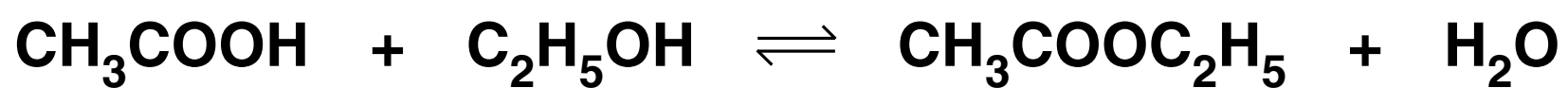
**The weak acid has a much lower pH.**

☐

**[1]**



(b) (i) Fred reacts the acid with ethanol.



What type of substance is made?

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

alcohol

☐

alkane

☐

ester

☐

fatty acid

☐

[1]

(ii) Fred calculates the theoretical yield for the reaction when he uses 6.0 g of the acid.  
The table shows some of his working.

Complete his calculation.

[Relative atomic mass of H = 1, C = 12, O = 16]

	Relative formula mass	
$\text{CH}_3\text{COOH}$	60	Mass used = 6.0 g
$\text{CH}_3\text{COOC}_2\text{H}_5$		Theoretical yield = _____ g

[2]

**(c) (i) The reaction between acid and alcohol needs a catalyst.**

**What catalyst is used?**

\_\_\_\_\_ **[1]**

**(ii) Use ideas about energy to explain why a catalyst speeds up a reaction.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[3]**

**[TOTAL: 10]**

**3 In the Haber Process, nitrogen and hydrogen react to make ammonia,  $\text{NH}_3$ .**

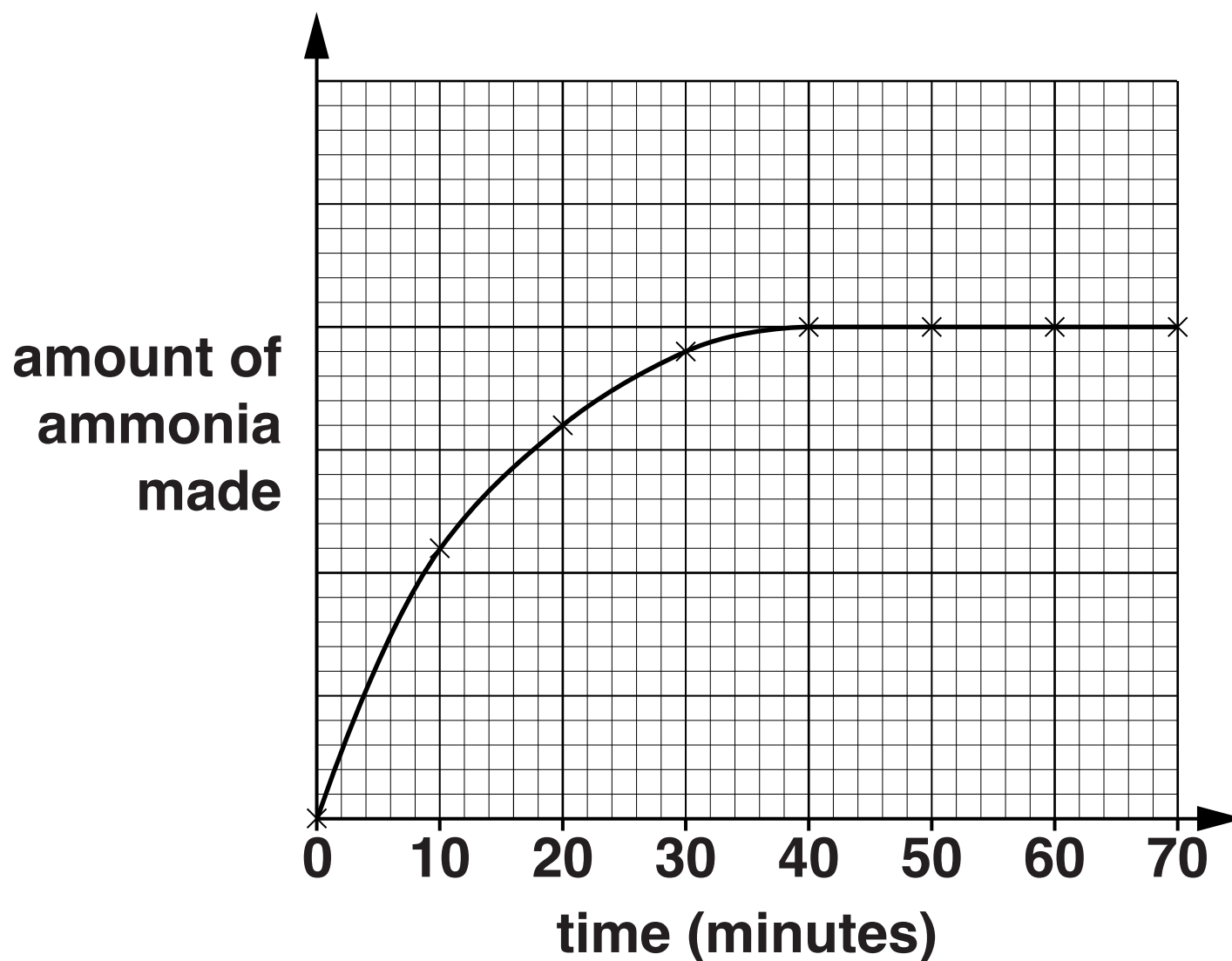
**(a) Write a balanced symbol equation for this reaction.**

\_\_\_\_\_ **[2]**

**(b) State and explain the main use of ammonia.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

- (c) The reaction between nitrogen and hydrogen is reversible and can reach an equilibrium.  
Ann heats some nitrogen and hydrogen with a catalyst in a closed container.  
She plots a graph to show how the amount of ammonia made changes with time.



- (i) At what time does the amount made stop increasing?

\_\_\_\_\_ [1]

- (ii) The amount made stops increasing when the reaction reaches equilibrium.  
At this time the reaction to make ammonia is still taking place.

Explain why the reaction to make ammonia is still taking place but the amount made is not increasing.

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[3]

- (iii) Put a tick (✓) in the box next to the name of this type of equilibrium.

active equilibrium

☐

dynamic equilibrium

☐

fixed equilibrium

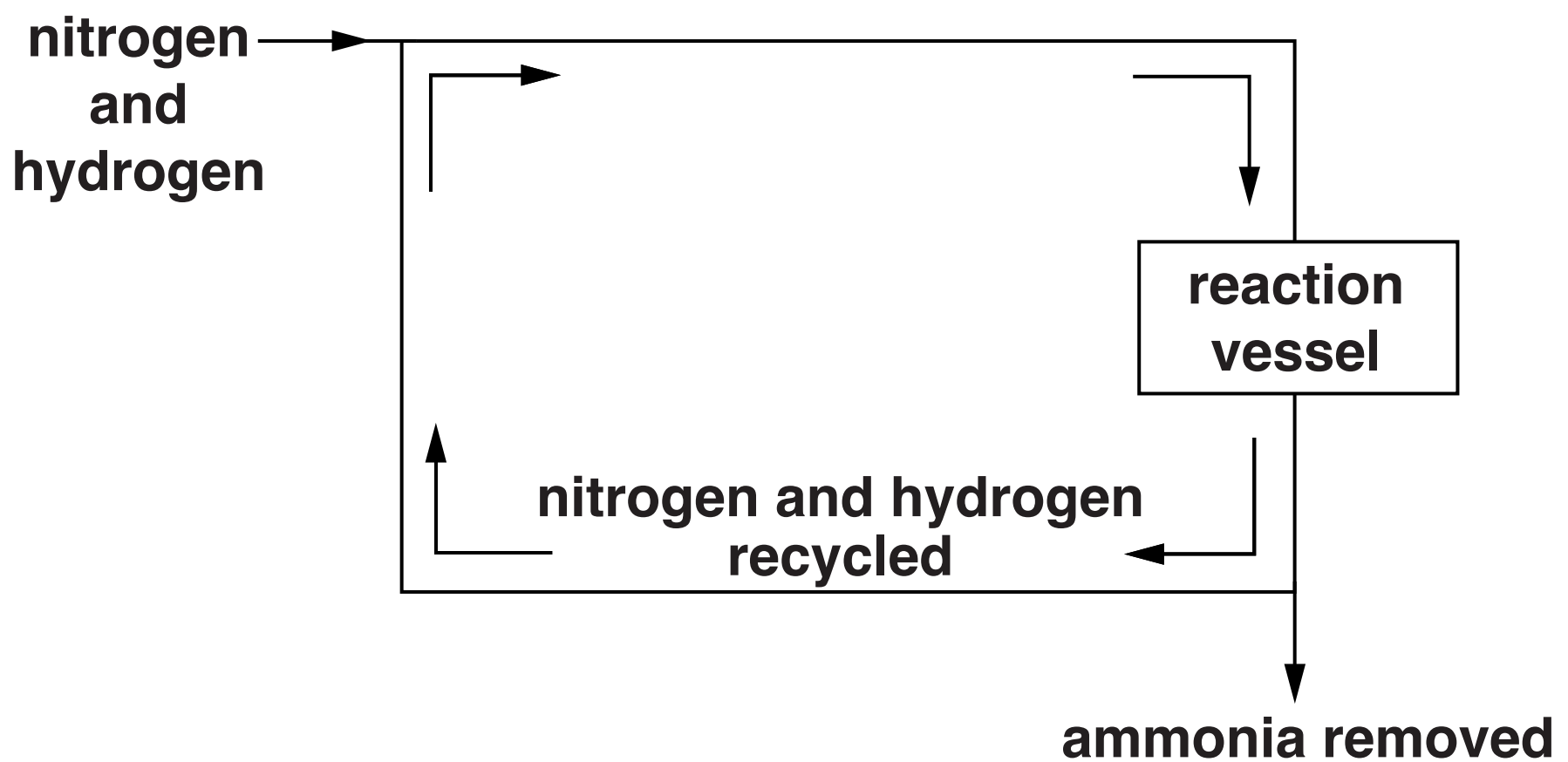
☐

static equilibrium

☐

[1]

**(d) In the Haber Process, most of the nitrogen and hydrogen has to be recycled to make the process run efficiently.**



**Explain how and why this recycling affects the total yield of the reaction, and why so much has to be recycled.**

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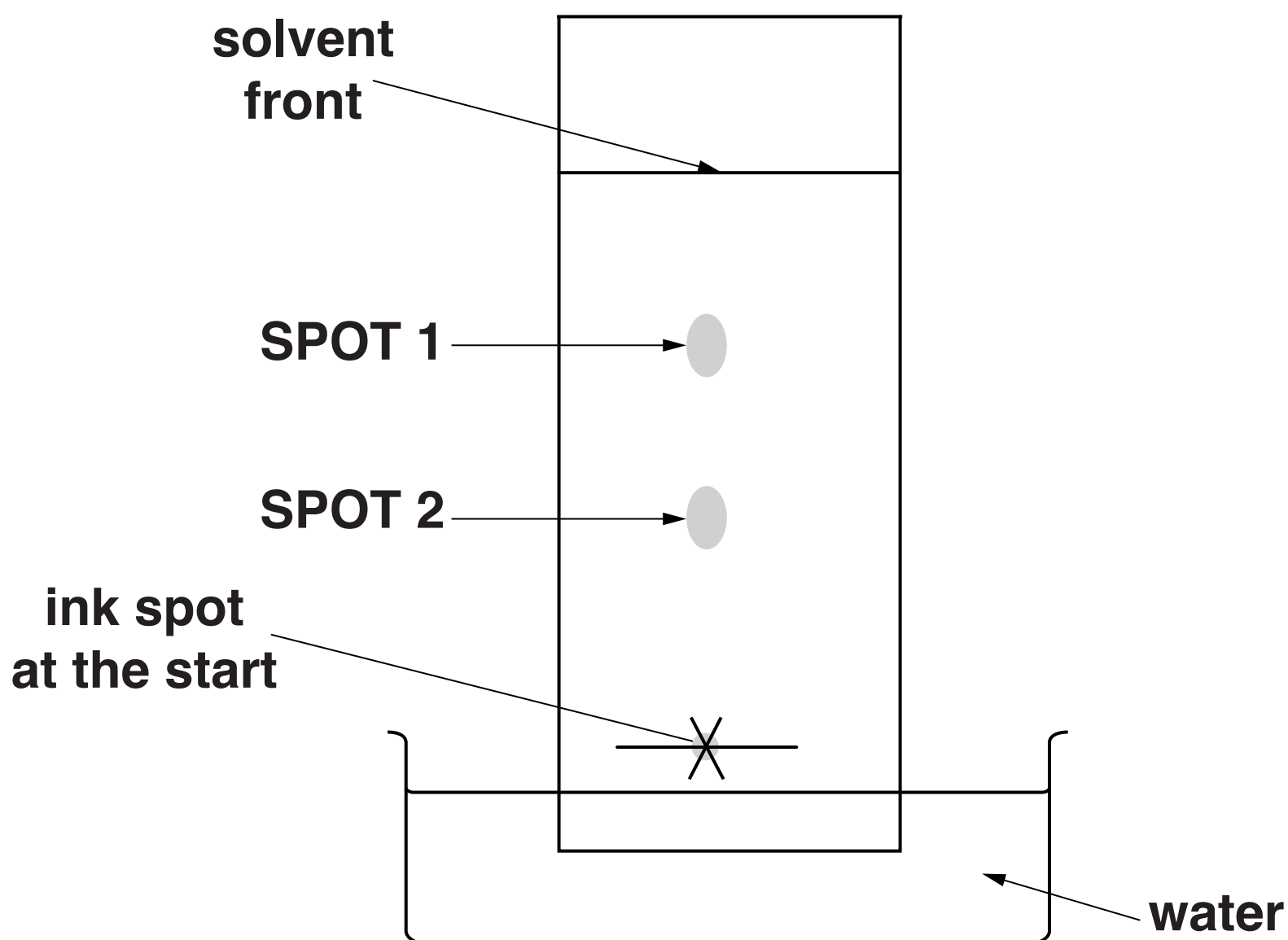
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**[3]**

**[TOTAL: 12]**

- 4 Ben uses paper chromatography to analyse the ink from his pen.  
He puts the bottom of the paper in water and leaves it for a few hours.  
The diagram shows his result.



- (a) Calculate the  $R_f$  value for SPOT 1.  
Show your working.

$R_f$  for SPOT 1 = \_\_\_\_\_ [3]

**(b) Ben knows that chromatography depends on the attractions between the ink, the solvent and the paper.**

**Explain why SPOT 1 and SPOT 2 end up in different places.**



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

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**[6]**



**(c) Thin-layer chromatography can be used instead of paper chromatography.**

**Give ONE similarity and ONE difference between the two methods.**

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[2]

**(d) A factory makes ink. The ink is made continuously throughout the day.  
Chromatography is used to test samples of the ink.**

**Jane and Mike discuss how to take the samples.**

**Jane says ‘Take 10 samples at 9 am and 10 samples at 1pm.’**

**Mike says ‘Take a sample every hour.’**

**Explain who has the best approach.**

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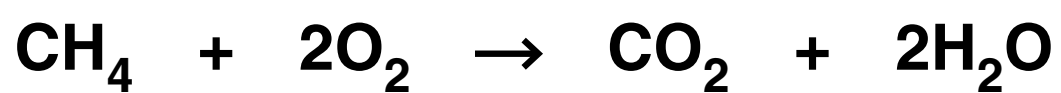
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[3]

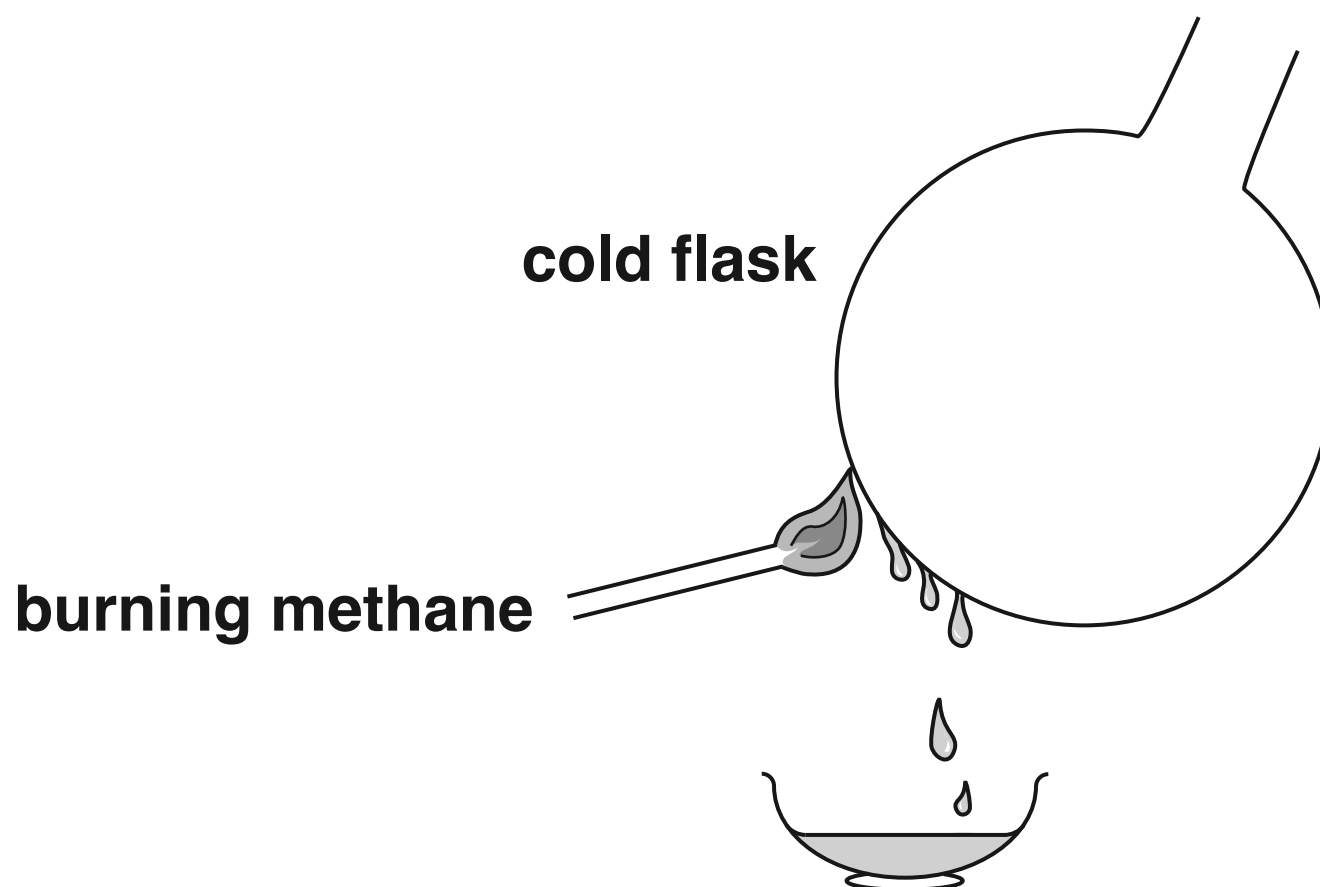
**[TOTAL: 14]**

**5 Mary investigates burning methane.**



**She directs the flame onto the surface of a cold flask.**

**(a) Where the flame touches the outside of the flask, droplets of liquid appear.**



**What is the liquid and where does it come from?**

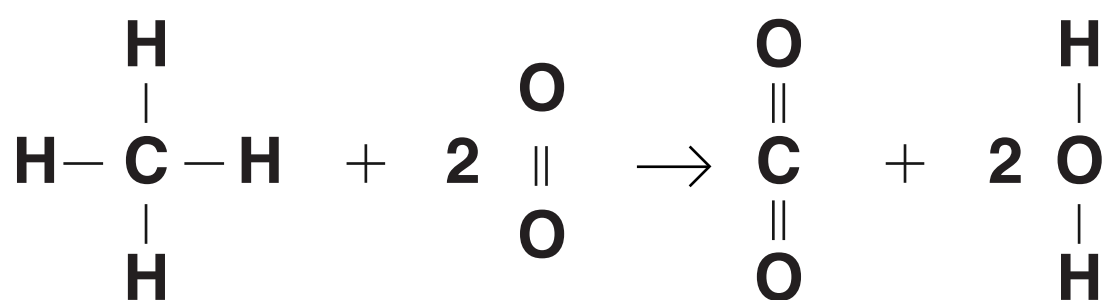
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**[2]**

(b) Mary wants to know the energy change when methane burns.

She writes out the equation to show all the chemical bonds.



(i) Complete the table to show how many of each type of bond are broken and how many are made when methane reacts with the oxygen in the air.

BONDS BROKEN			BONDS MADE	
Type of bond	Number of bonds		Type of bond	Number of bonds
C-H				
O=O	2			

[2]

**(ii) Use the table of bond energies to calculate the overall energy change when methane burns.**

<b>Bond</b>	<b>Energy to break the bond for a formula mass (kJ)</b>
<b>C–H</b>	<b>435</b>
<b>C=O</b>	<b>805</b>
<b>H–H</b>	<b>436</b>
<b>H–O</b>	<b>464</b>
<b>O=O</b>	<b>498</b>

**You must show your working.**

\_\_\_\_\_ **kJ [3]**

**[TOTAL: 7]**

**6 When chemical engineers design an industrial process, they make it as sustainable as possible.**

**To make a process more sustainable, chemical engineers use:**

## RENEWABLE feedstock

**reactions with high ATOM ECONOMY.**

**Explain what the terms RENEWABLE and ATOM ECONOMY mean, and how each can make a process more sustainable.**



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

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[6]

**[TOTAL: 6]**

**END OF QUESTION PAPER**

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