Surname _____

Other Names _____

Centre Number_____

Candidate Number_____

For Examiner's Use

Candidate Signature _____

ASSESSMENT AND QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education
Foundation Tier
June 2010

Chemistry

Unit Chemistry C3

CHY3F

Wednesday 26 May 2010 9.00 am

For this paper you must have:
- **a pencil**
- **a ruler**
- **the Data Sheet enclosed.**

You may use a calculator.

TIME ALLOWED
- **45 minutes plus your additional time allowance.**

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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INSTRUCTIONS

- Use black ink or black ball-point pen.
- Answer ALL questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

INFORMATION

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

ADVICE

- In all calculations, show clearly how you work out your answer.

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

1 **The table shows some information about acids and alkalis.**

NAME OF ACID OR ALKALI	TYPE	IONS PRODUCED IN SOLUTION		pH	EFFECT ON UNIVERSAL INDICATOR
Hydrochloric acid	Strong acid	H^+	Cl^-	1	Goes red
Sodium hydroxide	Strong alkali	Na^+	OH^-	13	Goes purple

Use the information in the table to help you answer parts (a) and (b).

1 (a) **Draw a ring around the correct answer to complete each sentence.**

1 (a) (i) **Hydrochloric acid is acidic.**

This is because it contains [Cl^- / H^+ / OH^-] **ions.**

[1 mark]

1 (a) (ii) Sodium hydroxide solution is alkaline.

This is because it contains

H^+
Na^+
OH^-

ions.

[1 mark]

1 (a) (iii) The pH of acids is

higher than
lower than
the same as

the pH of alkalis. [1 mark]

1 (b) Ethanoic acid is a weak acid.

Universal Indicator can be used to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration.

Explain how. [2 marks]

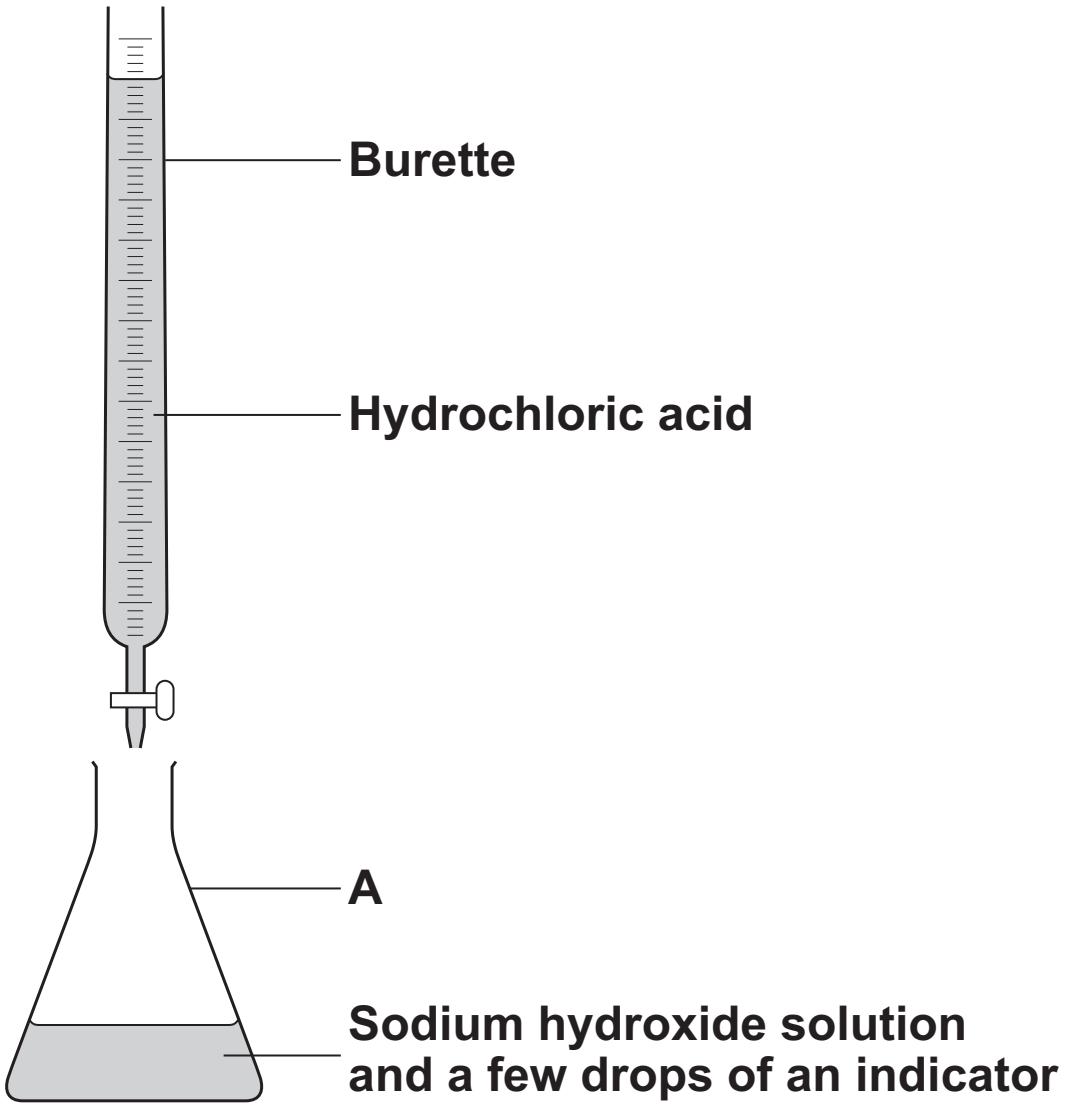
[Question 1 continues on the next page]

1 (c) **Draw a ring around the correct answer to complete this sentence. [1 mark]**

Strong acids and strong alkalis

are | **completely** / **not** / **partially** | **ionised in water.**

1 (d) **The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25·0 cm^3 of sodium hydroxide solution.**



1 (d) (i) **Which ONE of the following is the correct name for A? [1 mark]**

Draw a ring around your answer.

beaker **conical flask** **pipette**

1 (d) (ii) **Use the correct word from the list to complete the sentence. [1 mark]**

distillation **filtration** **titration**

The method used to find the volume of acid that reacts with a known volume

of alkali is _____ .

1 (d) (iii) **Suggest ONE way to make the results more reliable. [1 mark]**

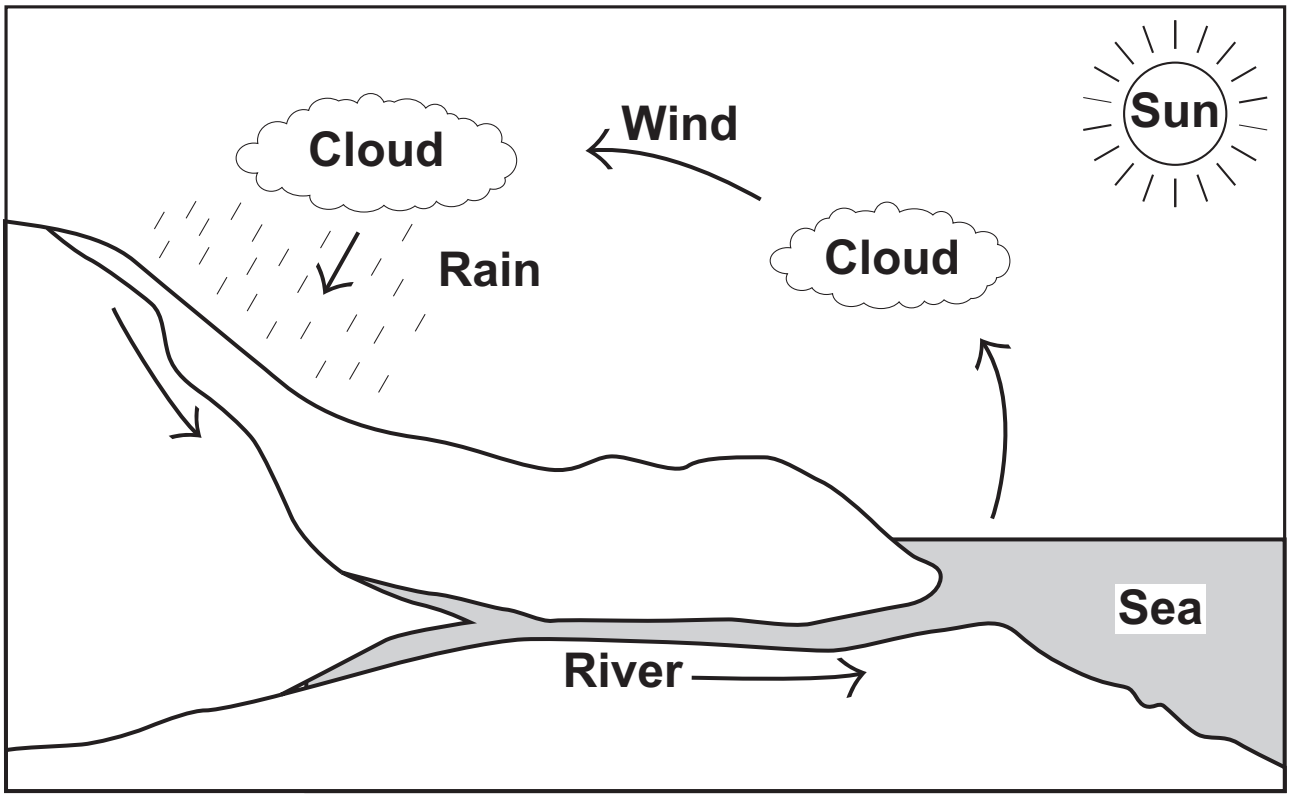
_____

_____

9

[Turn over for the next question]

2 **The diagram shows part of the Water Cycle.**



2 (a) **Draw a ring around the correct answer to complete each sentence about the Water Cycle. [2 marks]**

Heat from the Sun causes water in the sea to

boil.
condense.
evaporate.

This forms water vapour that rises in the atmosphere. As it rises the water vapour cools.

This forms clouds because the water vapour

boils.
condenses.
evaporates.

2 (b) Suggest why sea water is NOT suitable as drinking water. [1 mark]

_____

_____

_____

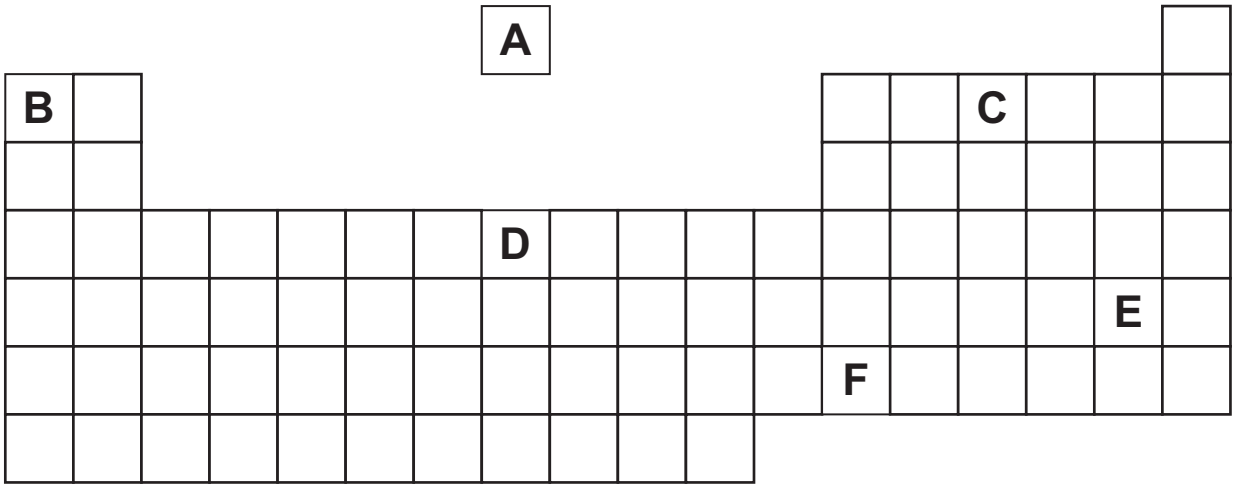
3

[Turn over for the next question]

3 (a) **Use the periodic table on the Data Sheet to help you answer these questions.**

Part of the periodic table is shown below.

The letters are NOT the symbols of the elements.



Choose your answers ONLY from the letters shown in the periodic table above.

Which letter, A, B, C, D, E or F, represents

3 (a) (i) **hydrogen [1 mark]** **Letter** ☐

3 (a) (ii) **a Group 3 element [1 mark]** **Letter** ☐

3 (a) (iii) **a halogen [1 mark]** **Letter** ☐

3 (a) (iv) the element with atomic (proton) number of 7

[1 mark] Letter ☐

3 (a) (v) an element with one electron in its outer shell?

[1 mark] Letter ☐

[Question 3 continues on the next page]

3 (b) The table shows the melting points of the Group 1 metals arranged in alphabetical order.

GROUP 1 METAL		
NAME	**SYMBOL**	**MELTING POINT IN ºC**
Caesium	Cs	29
Francium	Fr	27
Lithium	Li	180
Potassium	K	64
Rubidium	Rb	39
Sodium	Na	98

3 (b) (i) Arrange these metals in order of increasing melting point. Three have been done for you. [1 mark]

Fr Cs _____ _____ _____ Li

Lowest ⟶ Highest

3 (b) (ii) Use the periodic table on the Data Sheet AND your answer in part (b)(i) above to complete this sentence about how the melting points change. [1 mark]

Going down Group 1, the melting points

_____

_____ .

3 (c) **The transition metals are a block of elements between Groups 2 and 3 of the periodic table. Transition metals have different properties to Group 1 metals.**

Put ticks (✓) next to the THREE correct statements about transition metals in the table below. [3 marks]

(✓)	STATEMENT
	They are harder than Group 1 metals
	They have lower densities than Group 1 metals
	They have higher melting points than Group 1 metals
	They are more reactive with water than Group 1 metals
	They often form coloured compounds but Group 1 compounds are usually white

10

[Turn over for the next question]

4 **Chemical tests can be used to detect and identify elements and compounds.**

A jar of a chemical from 1870 is shown.

Copperas was a name used for iron(II) sulfate, $FeSO_4$. It does not contain any copper!

4 (a) **A student tested solutions of copperas to show which ions it contained.**

Draw a ring around the correct answer to complete each sentence. [3 marks]

4 (a) (i) **The student tested for iron(II) ions, Fe^{2+}**

The student added a solution of

barium chloride.
silver nitrate.
sodium hydroxide.

The colour of the precipitate formed was

green.
red.
white.

The precipitate was a

liquid.
gas.
solid.

4 (a) (ii) The student tested for sulfate ions, SO_4^{2-}

The student added dilute hydrochloric acid

and

barium chloride
silver nitrate
sodium hydroxide

solution.

The colour of the precipitate formed

was

green.
red.
white.

Sulfuric acid (H_2SO_4) should NOT be used instead of hydrochloric acid (HCl) when testing for sulfate ions. This is because

sulfuric acid contains

chloride ions, Cl^-
nitrate ions, NO_3^-
sulfate ions, SO_4^{2-}

[3 marks]

[Question 4 continues on the next page]

4 (b) **A flame test can be used to identify the metal ions in a compound.**

How do you carry out a flame test? [1 mark]

_____

_____

_____

4 (c) **The elements in a compound can also be detected and identified using instrumental methods of analysis.**

State ONE advantage of using instrumental methods compared with chemical tests. [1 mark]

_____

_____

_____

8

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TURN OVER FOR THE NEXT QUESTION

5 The table gives some information about the composition of three samples of water from wells in the Canary Islands, Crete and Cyprus.

	MINERAL CONTENT OF WATER IN mg per litre		
IONS	**CANARY ISLANDS**	**CRETE**	**CYPRUS**
Calcium, Ca^{2+}	28	82	18
Magnesium, Mg^{2+}	14	41	13
Sodium, Na^{+}	53	7	22
Chloride, Cl^{-}	7	143	39
Hydrogencarbonate, HCO_3^{-}	281	5	93
Sulfate, SO_4^{2-}	2	14	16

5 (a) Describe and explain how ions get into these samples of water. [2 marks]

_____

_____

_____

_____

_____

_____

5 (b) **The sample of water from Crete is harder than the other two.**

Use the information in the table to explain why. [1 mark]

_____

_____

_____

5 (c) **People who use hard water can expect higher costs than people who use soft water.**

Explain why. [2 marks]

_____

_____

_____

_____

_____

_____

5 (d) **Hard water can be made soft by removing the ions that cause hardness.**

State ONE way these ions can be removed. [1 mark]

_____

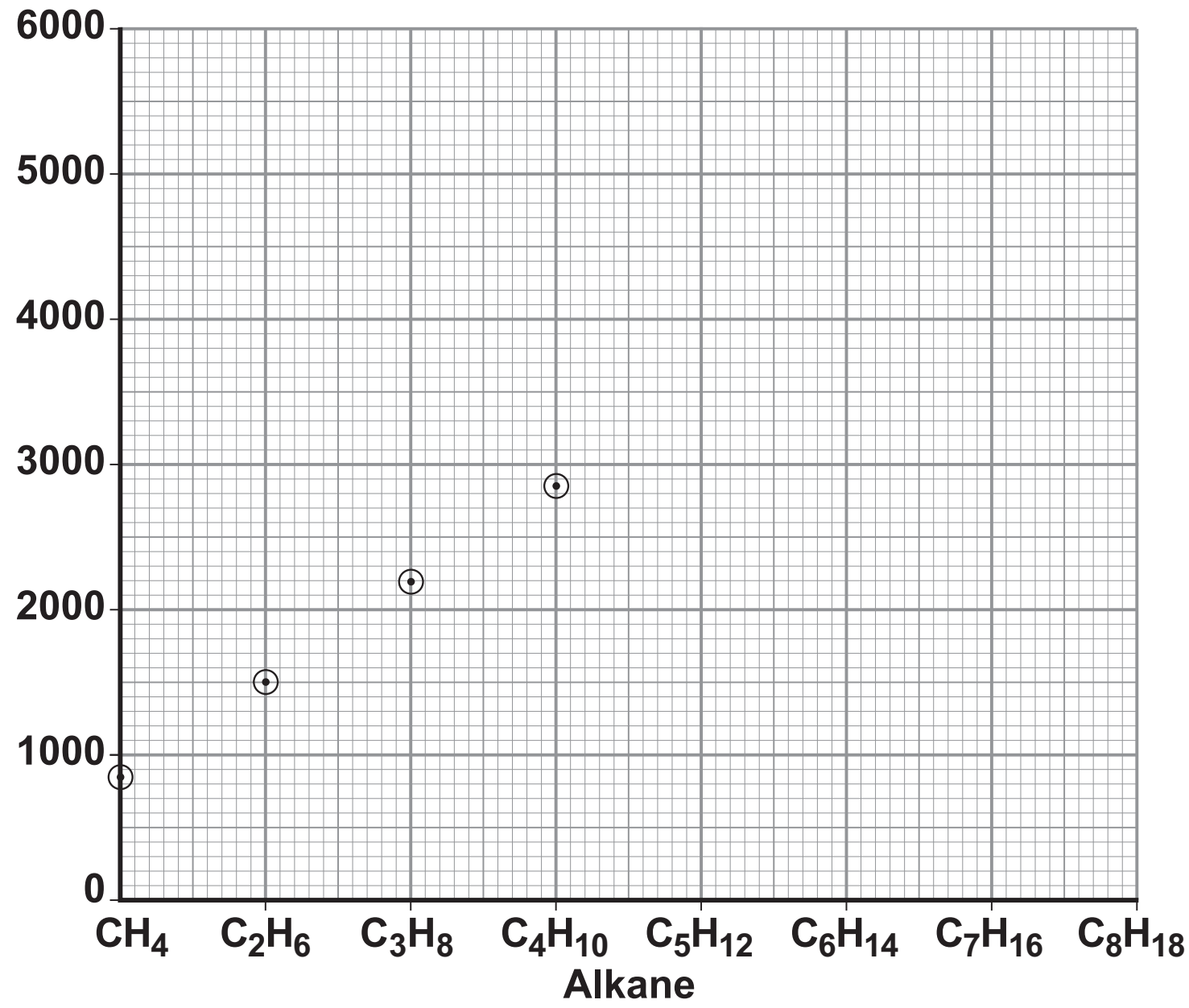
_____

_____

6

6 (a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



6 (a) (i) Draw a line through the points and extend your line to the right-hand edge of the graph. [1 mark]

6 (a) (ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned. [1 mark]

Energy released = _____ kJ

6 (a) (iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}). [1 mark]

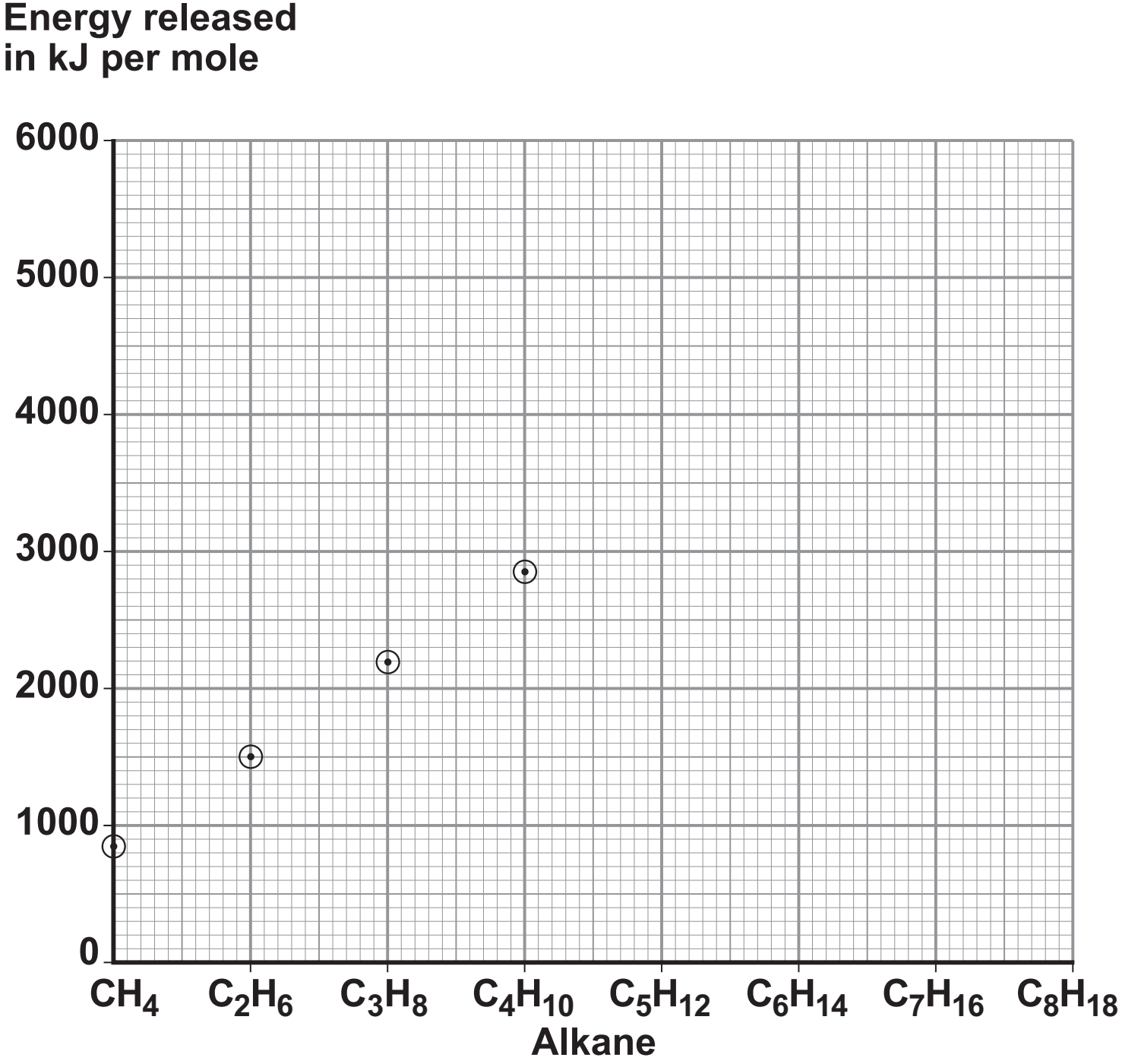
_____

_____

_____

[Question 6 continues on the next page]

The graph is repeated from page 20.



6 (a) (iv) **A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as butane (C_4H_{10}), and made the following prediction:**

"When burned, 1 mole of octane releases twice as much energy as 1 mole of butane."

Use the graph to decide if the student's prediction is correct. You MUST show your working to gain credit. [2 marks]

[Question 6 continues on the next page]

6 (b) Some information about four fuels is given in the table.

			COMBUSTION PRODUCTS			
FUEL	**TYPE**	**HEAT RELEASED IN kJ per g**	**CO_2**	**SO_2**	**H_2O**	**TYPE OF FLAME**
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct AND explain your answer.

6 (b) (i) "Renewable fuels release more heat per gram than non-renewable fuels." [2 marks]

_____

_____

_____

6 (b) (ii) "Non-renewable fuels are better for the environment than renewable fuels." [2 marks]

9

END OF QUESTIONS

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Examiner's Initials	
Question	Mark
1	
2	
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4	
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