Pearson Edexcel Certificate
Pearson Edexcel International GCSE

Centre Number

Candidate Number

Chemistry

Unit: KCH0/4CH0
Paper: 2C

Tuesday 10 June 2014 – Afternoon
Time: 1 hour

Paper Reference
KCH0/2C
4CH0/2C

You must have:
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

THE PERIODIC TABLE

Group

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
86 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	99 **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	179 **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	210 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89																

Period 1, 2, 3, 4, 5, 6, 7

Key

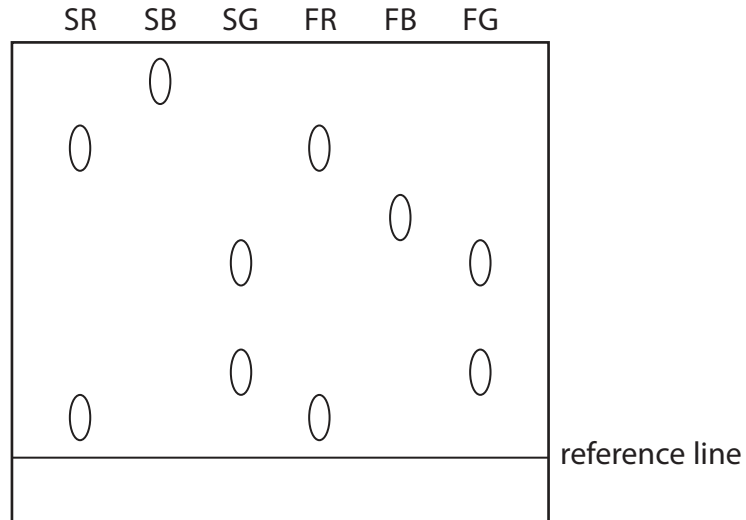| Relative atomic mass |
|---|
| **Symbol** |
| Name |
| Atomic number |

P 4 2 8 6 6 A 0 2 2 4

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Answer ALL questions.

1   A student investigates some food colourings, each of which is made up of one or more dyes.

She produces a chromatogram using the safe colourings red (SR), blue (SB) and green (SG) and food colourings red (FR), blue (FB) and green (FG).

The diagram shows her chromatogram.

(a) How many dyes are there in SR?

(1)

☒ **A**   1   ☒ **B**   2   ☒ **C**   3   ☒ **D**   4

(b) Complete the table by placing ticks (✓) next to the two food colourings that are definitely safe to use.

Explain your answer.

(2)

Food colouring	Safe to use?
FR	
FB	
FG	

explanation...

....

....
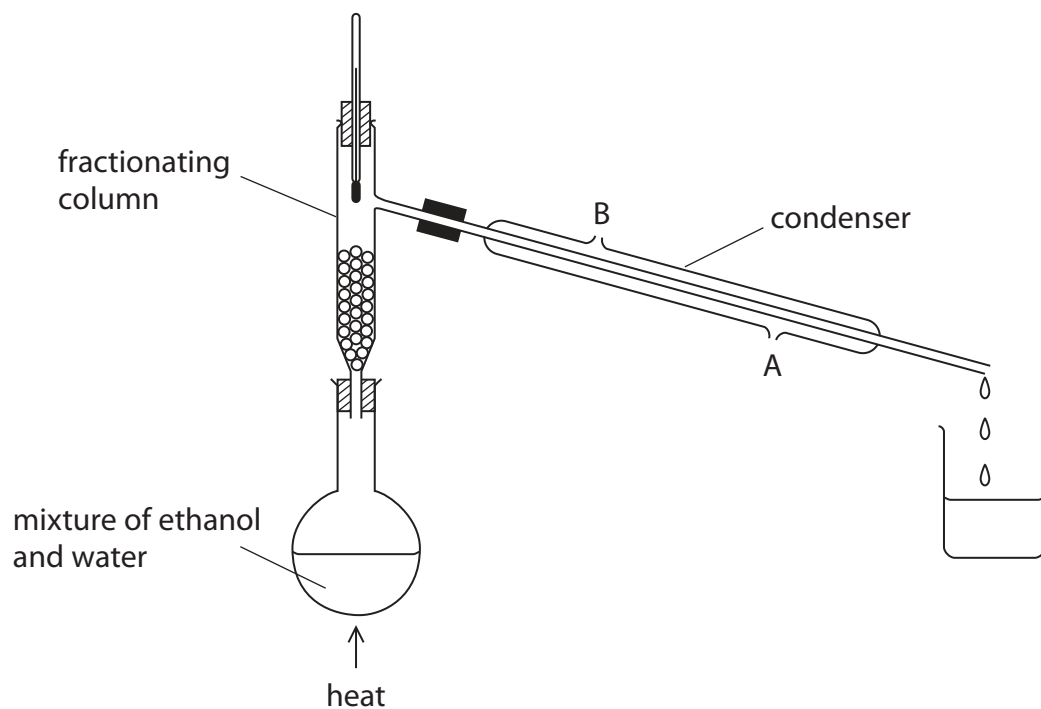
(Total for Question 1 = 3 marks)

2 This apparatus is used to separate a mixture of ethanol (boiling point 78 °C) and water (boiling point 100 °C).

(a) What is the name of this method of separation?

(1)

....

(b) Why can ethanol and water be separated by this method?

(1)

....

....

(c) Suggest why water should enter the condenser at A rather than B.

(1)

....

....

(d) Explain why the first liquid to be collected in the beaker is mostly ethanol.

(1)

....

....

....

(Total for Question 2 = 4 marks)

3 The diagram shows a section of the Periodic Table and the symbols for the first 20 elements.

												H					He

Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca																

(a) (i) What name is given to a horizontal row of elements such as Na to Ar?

(1)

....

(ii) Name two metals in the row Na to Ar.

(1)

.... and ....

(iii) Which is the least reactive element in the row Na to Ar?

Explain your answer.

(2)

least reactive element..

explanation...

....

....

(b) State, in terms of electronic configurations, why the elements in the column Li to K have similar chemical properties.

(1)

....

....

(c) (i) Which element has atomic number 6?

(1)

....

(ii) Which element has atoms with an electronic configuration of 2.8.6?

(1)

....

(d) An atom has atomic number 8 and mass number 18.

How many protons, neutrons and electrons does this atom contain?

(2)

protons ....

neutrons ....

electrons ....

(Total for Question 3 = 9 marks)

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4 A student investigates the rate of reaction between sodium thiosulfate and hydrochloric acid at 25 °C.

The equation for the reaction is

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

She uses this method.

- pour 50 cm³ of sodium thiosulfate solution into a conical flask
- place the conical flask on top of a sheet of paper with a cross drawn on it
- add 10 cm³ of hydrochloric acid and start the timer
- stop the timer when the cross can no longer be seen and record the time taken

The student repeats the experiment five times with different volumes of sodium thiosulfate solution. She adds water as necessary to keep the total volume of reaction mixture constant.
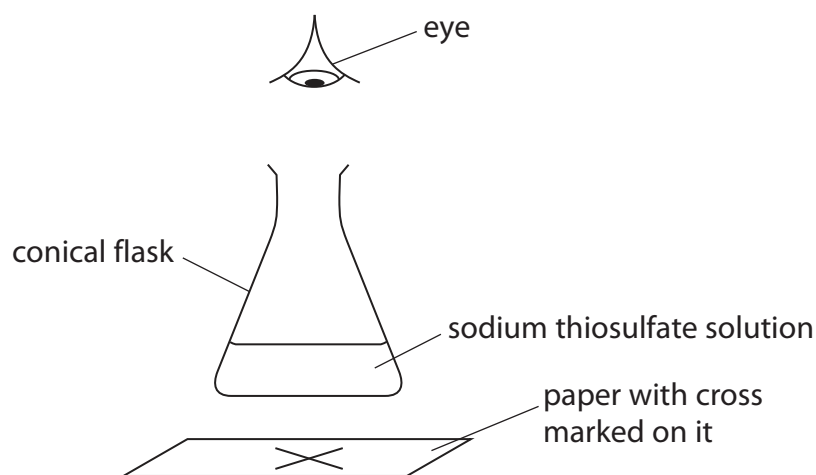
(a) Why can the student no longer see the cross at the end of each experiment?

(1)

....

....

(b) The student keeps the total volume of the reaction mixture constant in each experiment.

Explain how this makes each experiment a fair test.

(1)

....

....

(c) The table shows the student's results.

Experiment	Volume of $Na_2S_2O_3$ solution in cm³	Volume of water in cm³	Time in seconds
1	50	0	45
2	40	10	60
3	30	20	80
4	20	30	130
5	15	35	180
6	10	40	255

Why is it important for the student to add the water before the acid in experiments 2 to 6?

(1)

....

....

....

(d) Sulfur dioxide gas is given off in the reaction.

Suggest a safety precaution that the student should take when doing this experiment.

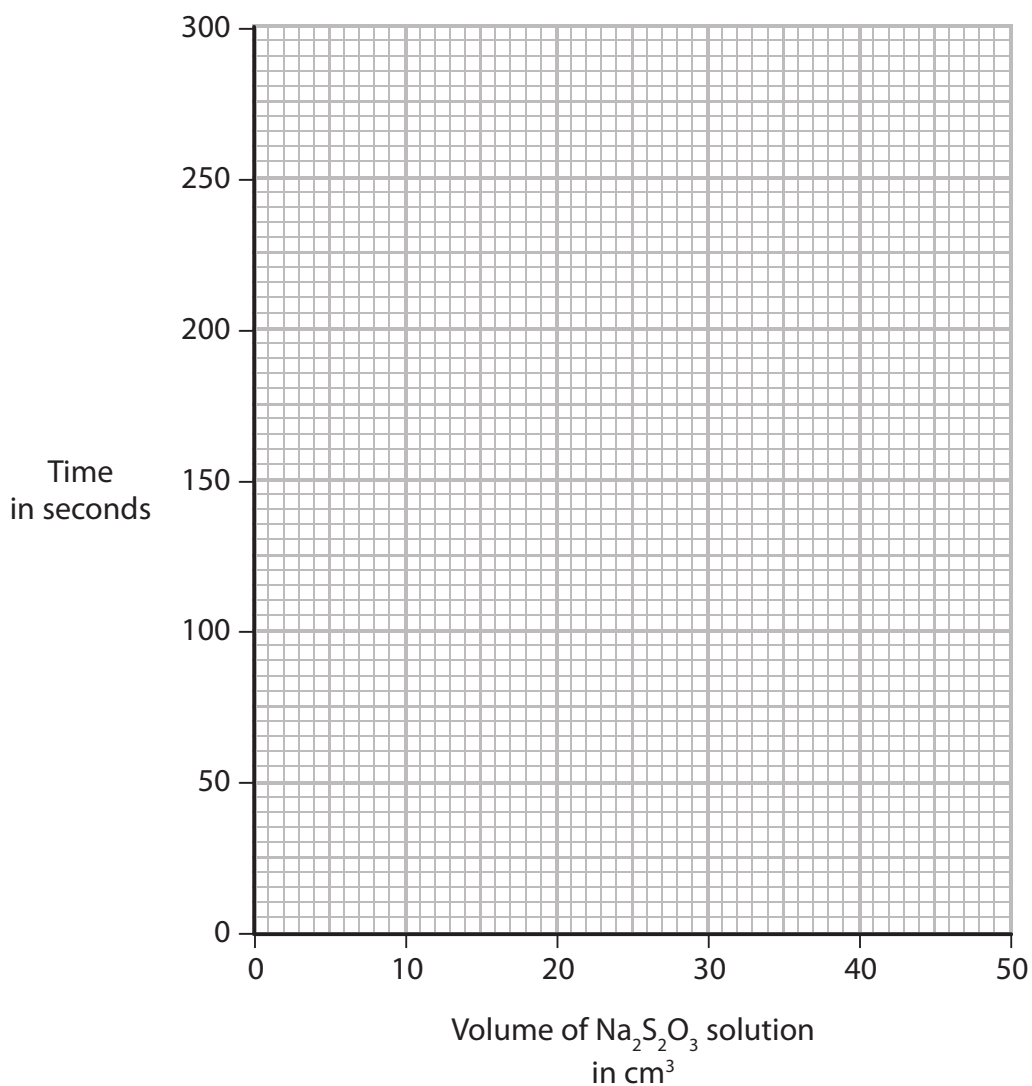Explain your answer.

(2)

precaution...

explanation...

....

(e) (i) Plot the student's results on the grid and draw a curve of best fit.

(3)

Time in seconds (y-axis, 0 to 300)
Volume of Na$_2$S$_2$O$_3$ solution in cm^3 (x-axis, 0 to 50)

(ii) On the grid, sketch the curve that you would expect if the investigation were repeated at 40 °C.
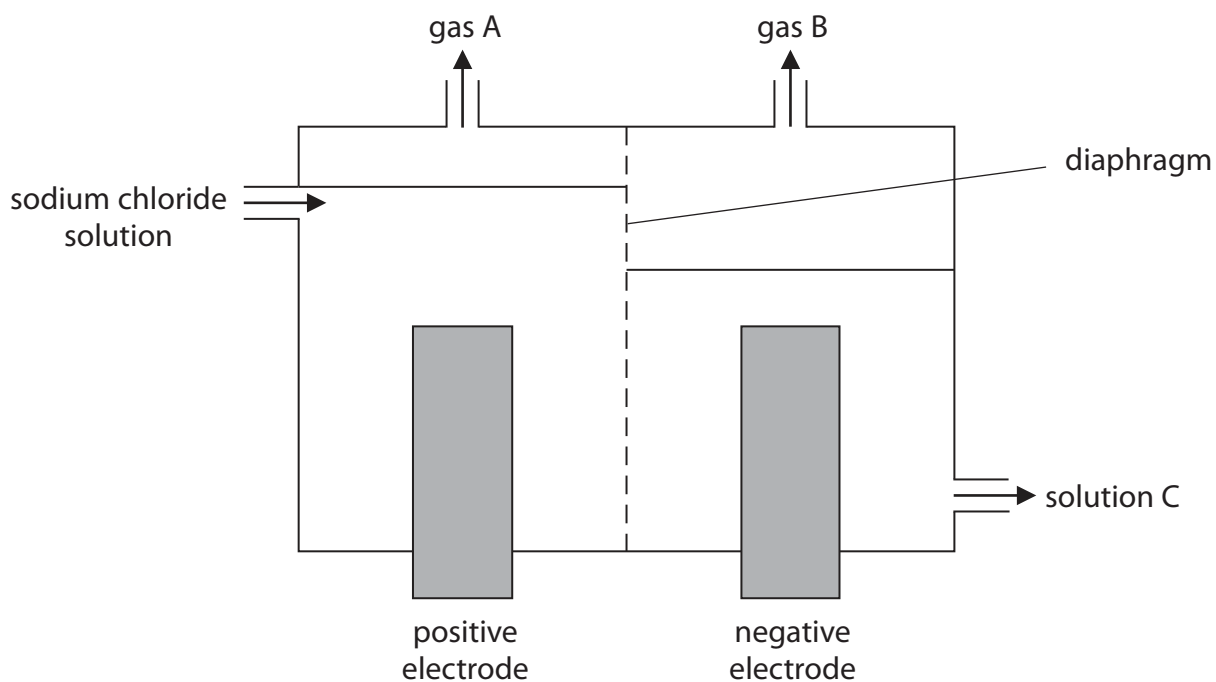
Assume all other factors remain constant.

(2)

(Total for Question 4 = 10 marks)

5   The diagram shows the diaphragm cell used in the electrolysis of concentrated sodium chloride solution, NaCl(aq).

(a) Explain what is meant by the term **electrolysis**.

(2)

....

....

....

....

(b) Identify gas A, gas B and solution C.

(3)

gas A...

gas B...

solution C...
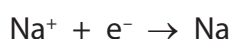
(c) Sodium is manufactured by the electrolysis of molten sodium chloride, NaCl(l).

Sodium is produced at the negative electrode and chlorine is produced at the positive electrode.

(i) Why does the sodium chloride have to be molten before it will conduct electricity?

(1)

....

....

(ii) The ionic half-equation for the formation of sodium is

$$Na^+ + e^- \rightarrow Na$$

Write the ionic half-equation for the formation of chlorine from chloride ions.

(2)

....

(Total for Question 5 = 8 marks)

6 Solid X contains two cations (positive ions) and one anion (negative ion).

One of the cations is Fe^{3+}

(a) The table describes the tests carried out on an aqueous solution of X and some of the observations made.

Complete the table by giving the missing observation.

(1)

Test	Observation
add sodium hydroxide solution then heat the mixture and test the gas given off with damp red litmus paper	.... litmus paper turns blue
add dilute hydrochloric acid, then add a few drops of barium chloride solution	white precipitate forms

(b) (i) Which cation, other than Fe^{3+}, is present in X?

Explain your answer.

(2)

cation...

explanation..

....

(ii) Identify the anion present in X.

(1)

....

(c) When zinc is added to a solution containing Fe^{3+} ions, a reaction occurs.

The ionic equation for this reaction is

$$Zn(s) + 2Fe^{3+}(aq) \rightarrow Zn^{2+}(aq) + 2Fe^{2+}(aq)$$
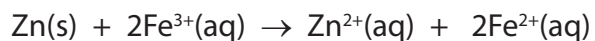
Identify the reducing agent in this reaction and explain your choice.

(2)

reducing agent...

explanation...

....

....

(Total for Question 6 = 6 marks)

7 (a) The first two members of the homologous series of alcohols are methanol and ethanol.

(i) Give two characteristics of the compounds in a homologous series.

(2)

1 ....

....

2 ....

....

(ii) The displayed formula for methanol is

$$
\begin{array}{c}
\text{H} \\
| \\
\text{H}\!-\!\text{C}\!-\!\text{O}\!-\!\text{H} \\
| \\
\text{H}
\end{array}
$$
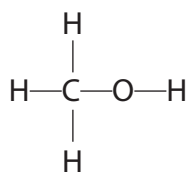
Suggest a displayed formula for ethanol, CH_3CH_2OH

(1)

(b) The table shows the two different processes for making ethanol on a large scale.

Process	Explanation
batch process	the fermentation of sugars with yeast
continuous process	the hydration of ethene (produced from crude oil) with steam

Compare the two processes in terms of

- the rate at which the ethanol can be produced
- the purity of the product
- the use of finite resources

(3)

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P 4 2 8 6 6 A 0 1 7 2 4

(c) The equation for the fermentation of glucose is

$$C_6H_{12}O_6 \rightarrow 2CH_3CH_2OH + 2CO_2$$
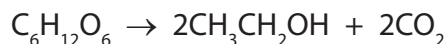
A mass of 3600 kg of glucose was completely fermented.

(i) Calculate the amount, in moles, of glucose that was fermented.
(M_r of glucose = 180)

(2)

amount of glucose = ... mol

(ii) Deduce the amount, in moles, of ethanol produced in this reaction.

(1)

amount of ethanol = ... mol

(iii) Calculate the volume, in dm^3 at rtp, of carbon dioxide produced in this reaction.
(1 mol of carbon dioxide occupies 24 dm^3 at rtp)

(2)

volume of carbon dioxide = ... dm^3

(Total for Question 7 = 11 marks)

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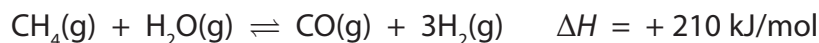
8 The hydrogen needed for the manufacture of ammonia is made by a process called steam reforming.

In this process, a mixture of methane and steam is passed over a nickel catalyst.

The equation for the reaction is

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g) \qquad \Delta H = +210 \text{ kJ/mol}$$

(a) In this part of the question, assume that the reaction reaches a position of equilibrium.

(i) Predict whether a high or low temperature would produce the highest yield of hydrogen.

Give a reason for your choice.

(1)

prediction ....

reason ....

....

(ii) Predict whether a high or low pressure would produce the highest yield of hydrogen.

Give a reason for your choice.

(1)

prediction ....

reason ....

....

(b) Explain how a catalyst increases the rate of a reaction.

(2)

....

....

....

....

P 4 2 8 6 6 A 0 2 0 2 4

(c) Some of the carbon monoxide produced is removed in another reaction.

In this reaction, carbon monoxide is mixed with steam and passed over a heated catalyst.

The reaction is reversible and the carbon monoxide is oxidised to carbon dioxide.

(i) Write a chemical equation for this reaction.

(2)

....

(ii) Explain why the carbon in carbon monoxide is oxidised in this reaction.

(1)

....

....

(iii) The carbon dioxide produced can be removed by passing the gas through a solution of potassium carbonate, K_2CO_3

The potassium carbonate reacts with carbon dioxide and water to form potassium hydrogencarbonate, $KHCO_3$

Write a chemical equation for this reaction.

(2)

....

(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 60 MARKS

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