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Pearson Edexcel Certificate Centre Number Candidate Number

Pearson Edexcel International GCSE

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Chemistry

Unit: KCH0/4CH0
Paper: 2C

Tuesday 10 June 2014 – Afternoon Time: 1 hour	Paper Reference KCH0/2C 4CH0/2C
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You must have: Calculator	Total Marks
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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 ►

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THE PERIODIC TABLE

Group 1 2 3 4 5 6 7 0

Period

4	He	Helium	2
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1	H	Hydrogen	1
---	---	----------	---

1	7	Li	Lithium	3	23	Na	Sodium	11	39	K	Potassium	19	86	Rb	Rubidium	37	133	Cs	Caesium	55	223	Fr	Francium	87
2	9	Be	Beryllium	4	24	Mg	Magnesium	12	40	Ca	Calcium	20	88	Sr	Strontium	38	137	Ba	Barium	56	226	Ra	Radium	88
3					45	Sc	Scandium	21	48	Ti	Titanium	22	91	Zr	Zirconium	40	179	Hf	Hafnium	72	227	Ac	Actinium	89
4					56	Fe	Iron	26	59	Co	Cobalt	27	101	Ru	Ruthenium	44	190	Os	Osmium	76	201	Hg	Mercury	80
5					63.5	Cu	Copper	29	59	Ni	Nickel	28	106	Pd	Palladium	46	195	Pt	Platinum	78	112	Cd	Cadmium	48
6					108	Ag	Silver	47	103	Rh	Rhodium	45	115	In	Indium	49	204	Tl	Thallium	81	127	I	Iodine	53
7					119	Sn	Tin	50	112	Cd	Cadmium	48	122	Sb	Antimony	51	207	Pb	Lead	82	128	Te	Tellurium	52
					128	Se	Selenium	34	79	Br	Bromine	35	73	Ge	Germanium	32	207	Pb	Lead	82	128	Te	Tellurium	52
					158	U	Uranium	92	122	Sb	Antimony	51	122	Sb	Antimony	51	209	Bi	Bismuth	83	128	Te	Tellurium	52
					162	Sm	Samarium	62	127	I	Iodine	53	127	I	Iodine	53	210	Po	Polonium	84	127	I	Iodine	53
					173	Lu	Lutetium	71	173	Lu	Lutetium	71	173	Lu	Lutetium	71	210	Po	Polonium	84	173	Lu	Lutetium	71
					187	Ir	Iridium	77	187	Ir	Iridium	77	187	Ir	Iridium	77	210	Po	Polonium	84	187	Ir	Iridium	77
					197	Au	Gold	79	197	Au	Gold	79	197	Au	Gold	79	210	Po	Polonium	84	197	Au	Gold	79
					201	Hg	Mercury	80	201	Hg	Mercury	80	201	Hg	Mercury	80	209	Bi	Bismuth	83	209	Bi	Bismuth	83
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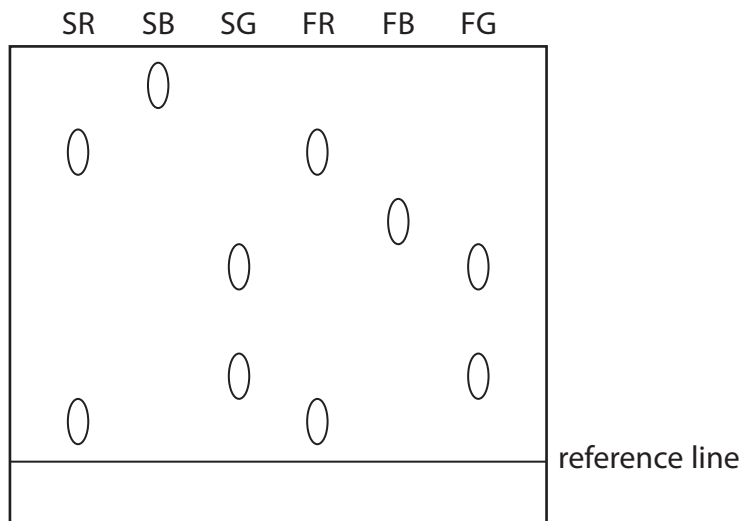


Answer ALL questions.

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

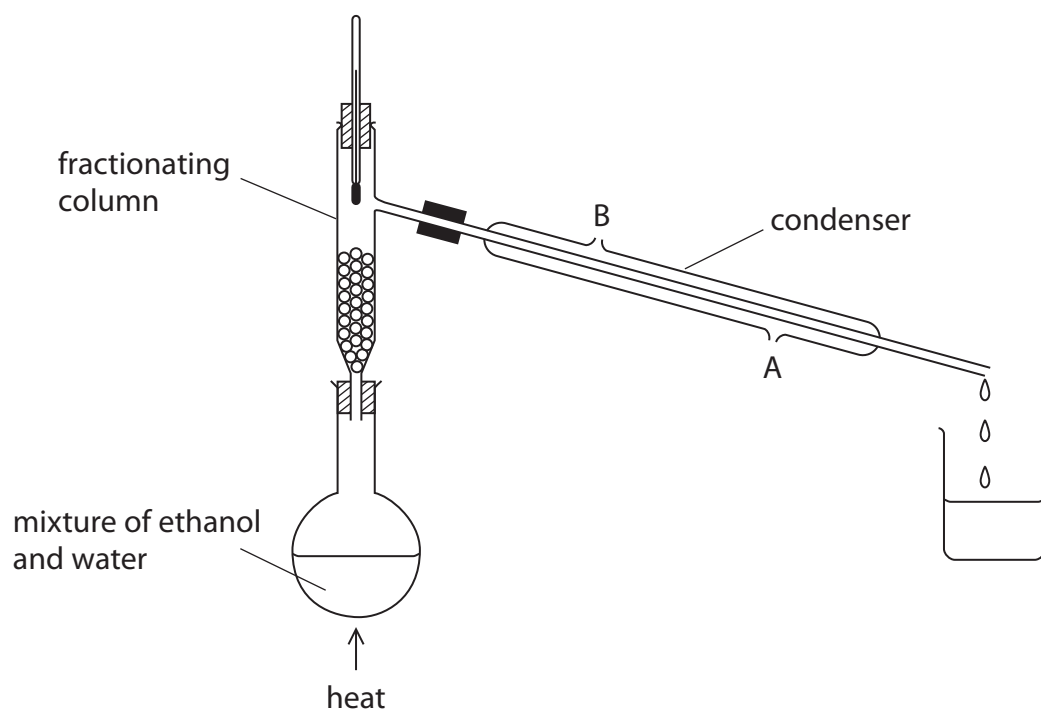
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(Total for Question 1 = 3 marks)



- 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)



P 4 2 8 6 6 A 0 7 2 4

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

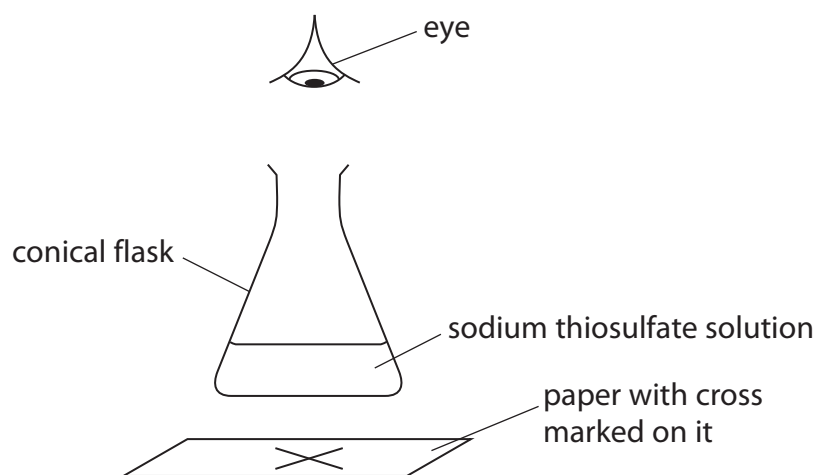
The equation for the reaction is



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 $\text{Na}_2\text{S}_2\text{O}_3$ solution in cm^3	Volume of water in cm^3	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.....

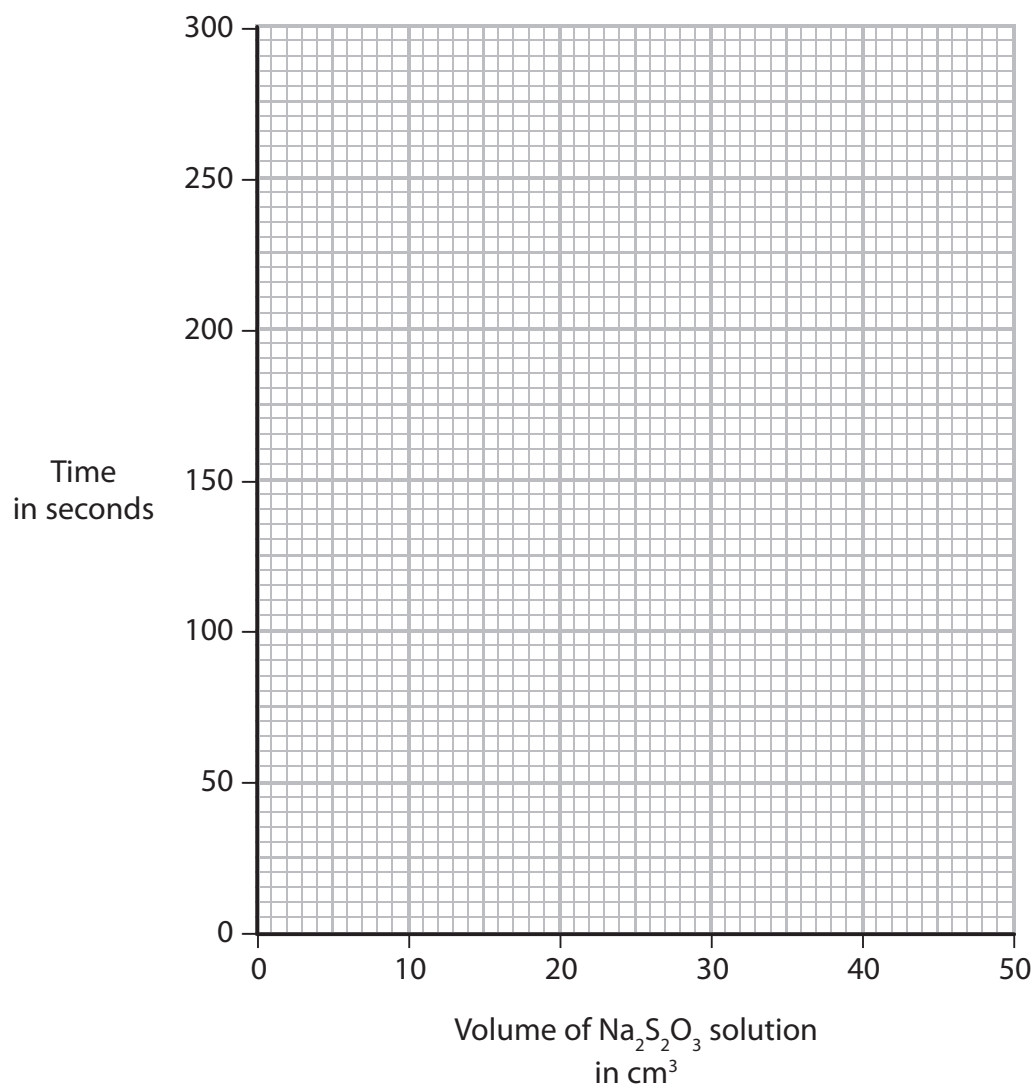
explanation.....

.....



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

(3)



(ii) On the grid, sketch the curve that you would expect if the investigation were repeated at 40°C .

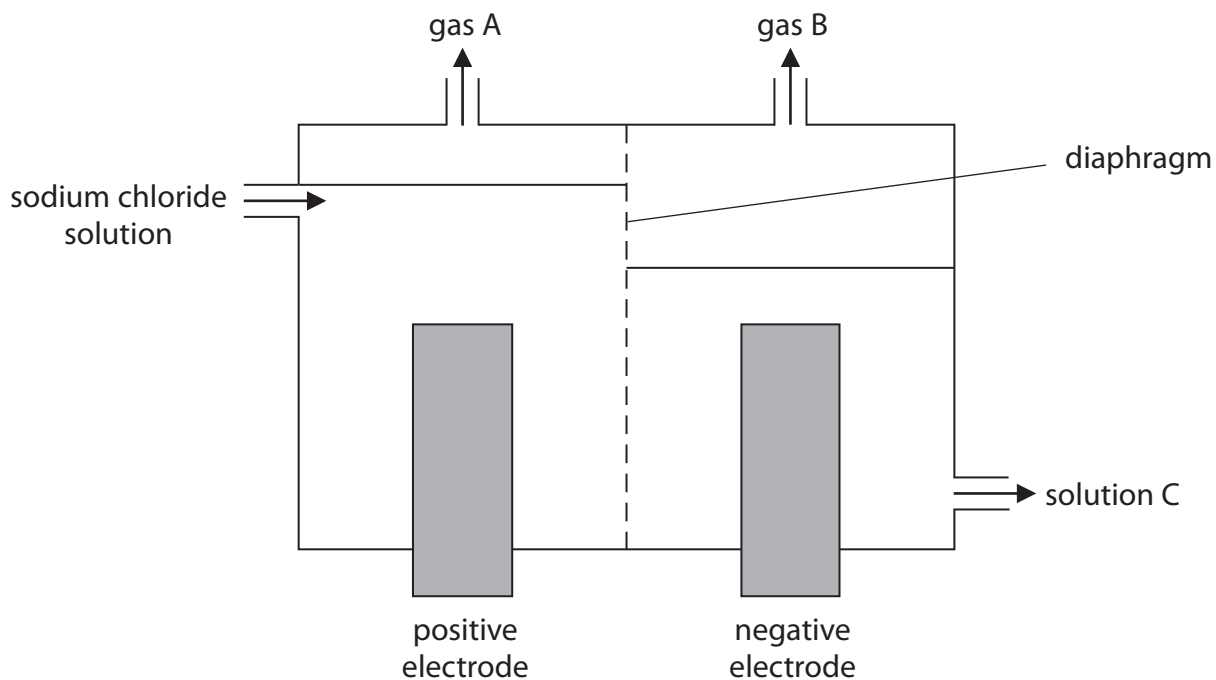
Assume all other factors remain constant.

(2)

(Total for Question 4 = 10 marks)



- 5 The diagram shows the diaphragm cell used in the electrolysis of concentrated sodium chloride solution, $\text{NaCl}(\text{aq})$.



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

(2)

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

(3)

gas A.....

gas B.....

solution C.....

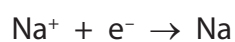


(c) Sodium is manufactured by the electrolysis of molten sodium chloride, NaCl(l).

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



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.

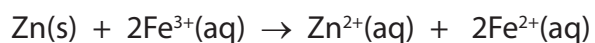
(1)

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

The ionic equation for this reaction is



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)

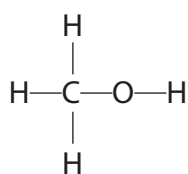
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(ii) The displayed formula for methanol is



Suggest a displayed formula for ethanol, $\text{CH}_3\text{CH}_2\text{OH}$

(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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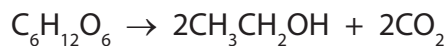
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(c) The equation for the fermentation of glucose is



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)



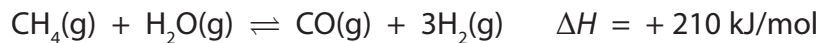
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- 8** The hydrogen needed for the manufacture of ammonia is made by a process called steam reforming.

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

The equation for the reaction is



- (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)

.....

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.....

.....



(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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