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Surname	Other names
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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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PEARSON

THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Period

4 He Helium 2

1 H Hydrogen 1

1	7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18																						
2	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36														
3	39 K Potassium 19	40 Ca Calcium 20	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54														
4	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	90 Zr Zirconium 40	91 Nb Niobium 41	92 Mo Molybdenum 42	93 Tc Technetium 43	94 Ru Ruthenium 44	95 Rh Rhodium 45	96 Pd Palladium 46	97 Ag Silver 47	98 Cd Cadmium 48	99 In Indium 49	100 Sn Tin 50	101 Sb Antimony 51	102 Te Tellurium 52	103 I Iodine 53	104 Xe Xenon 54														
5	133 Cs Caesium 55	137 Ba Barium 56	138 La Lanthanum 57	139 Ce Cerium 58	140 Pr Praseodymium 59	141 Nd Neodymium 60	142 Pm Promethium 61	143 Sm Samarium 62	144 Eu Europium 63	145 Gd Gadolinium 64	146 Tb Terbium 65	147 Dy Dysprosium 66	148 Ho Holmium 67	149 Er Erbium 68	150 Tm Thulium 69	151 Yb Ytterbium 70	152 Lu Lutetium 71	153 Hf Hafnium 72	154 Ta Tantalum 73	155 W Tungsten 74	156 Re Rhenium 75	157 Os Osmium 76	158 Ir Iridium 77	159 Pt Platinum 78	160 Au Gold 79	161 Hg Mercury 80	162 Tl Thallium 81	163 Pb Lead 82	164 Bi Bismuth 83	165 Po Polonium 84	166 At Astatine 85	167 Rn Radon 86
6	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	228 Th Thorium 90	232 U Uranium 92	238 Pu Plutonium 94	244 Pu Plutonium 94	247 Am Americium 95	251 Cm Curium 96	257 Bk Berkelium 97	261 Cf Californium 98	267 Es Einsteinium 99	271 Fm Fermium 100	285 Og Oganesson 118																		

Key

Relative atomic mass
Symbol
Name
Atomic number



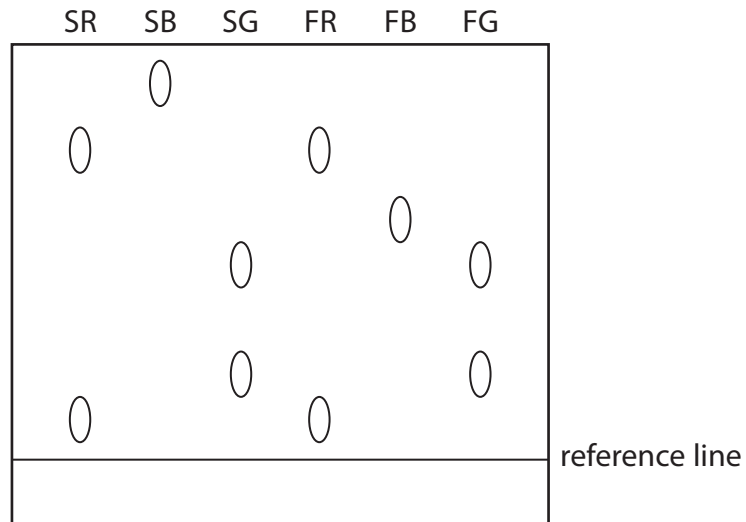
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Answer ALL questions.

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

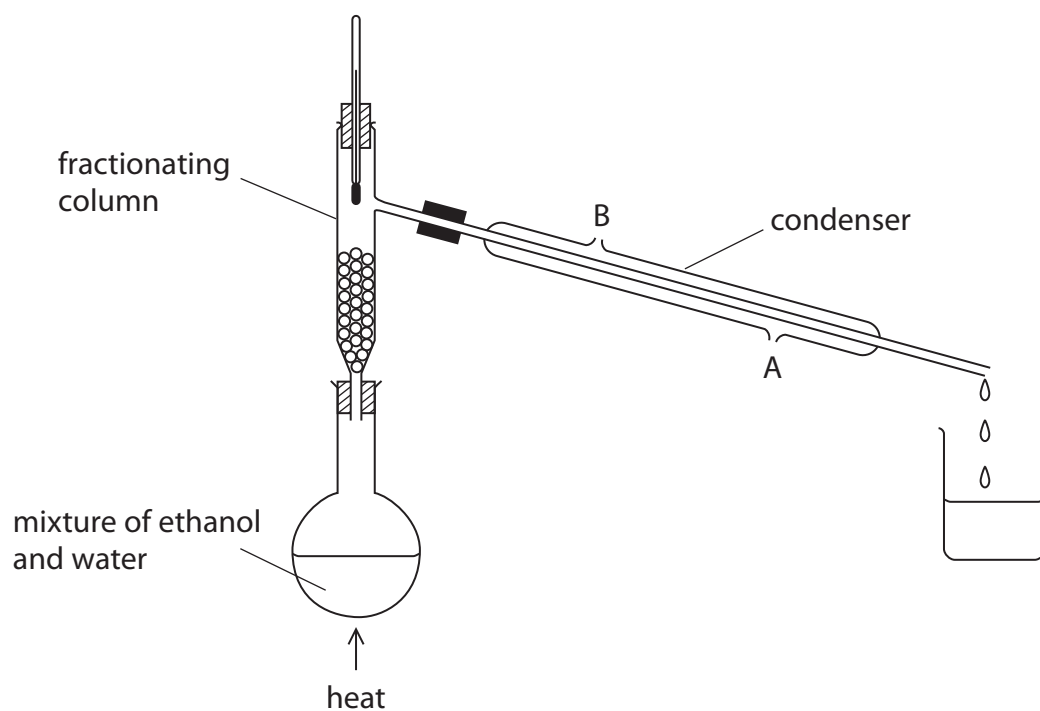
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(Total for Question 1 = 3 marks)



- 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)



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

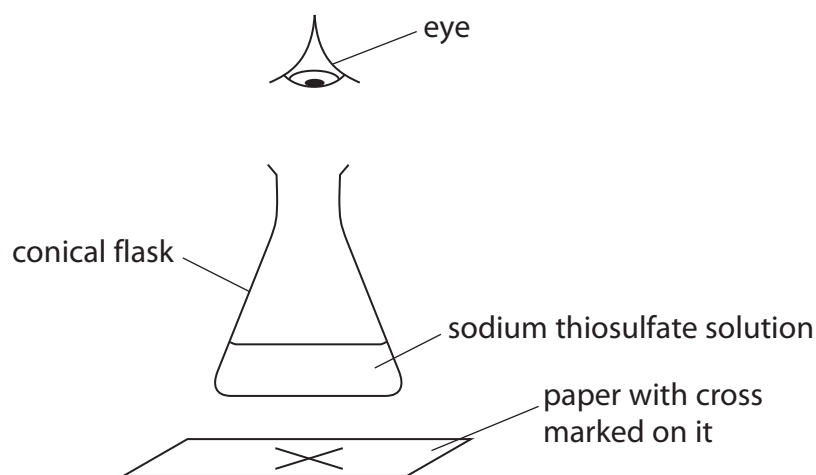
The equation for the reaction is



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)

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.....

.....

(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.....

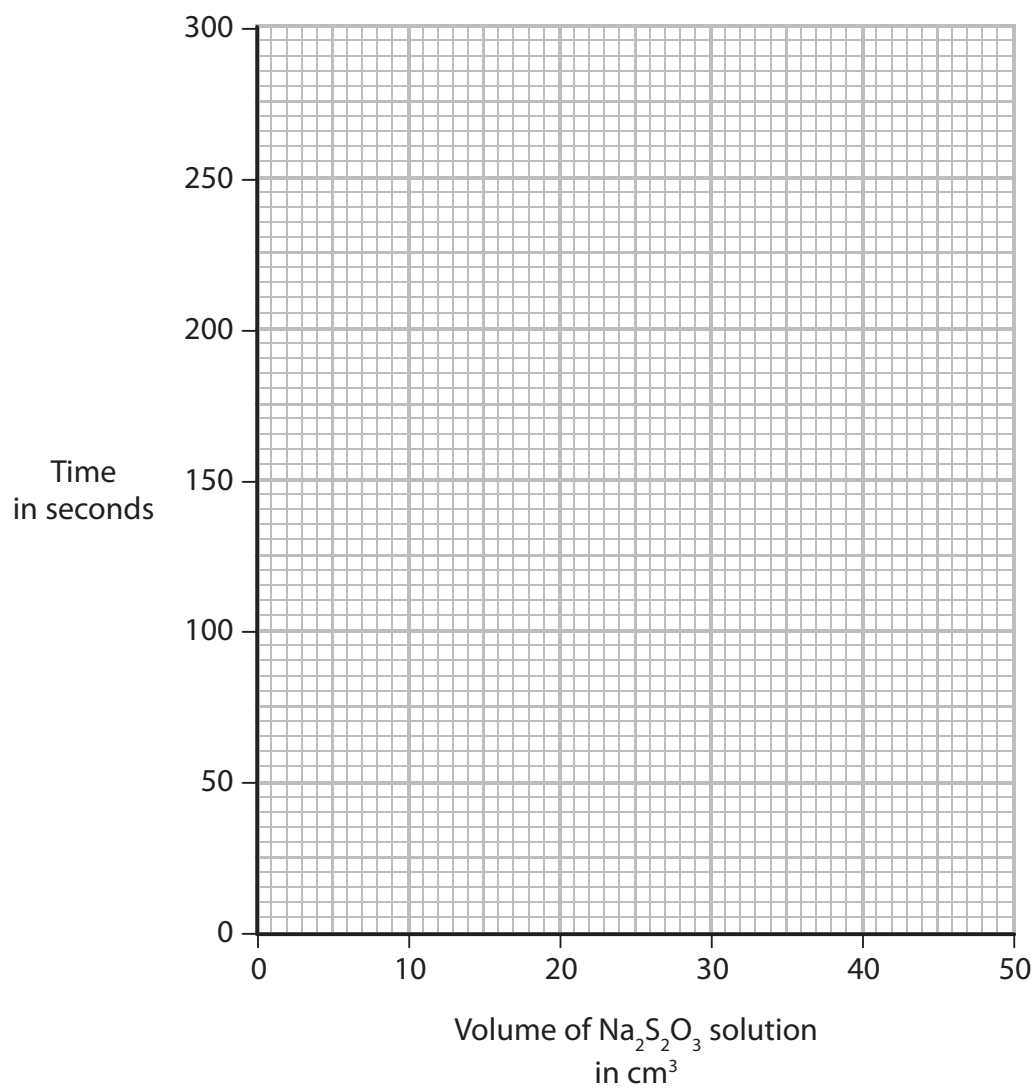
explanation.....

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(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 .

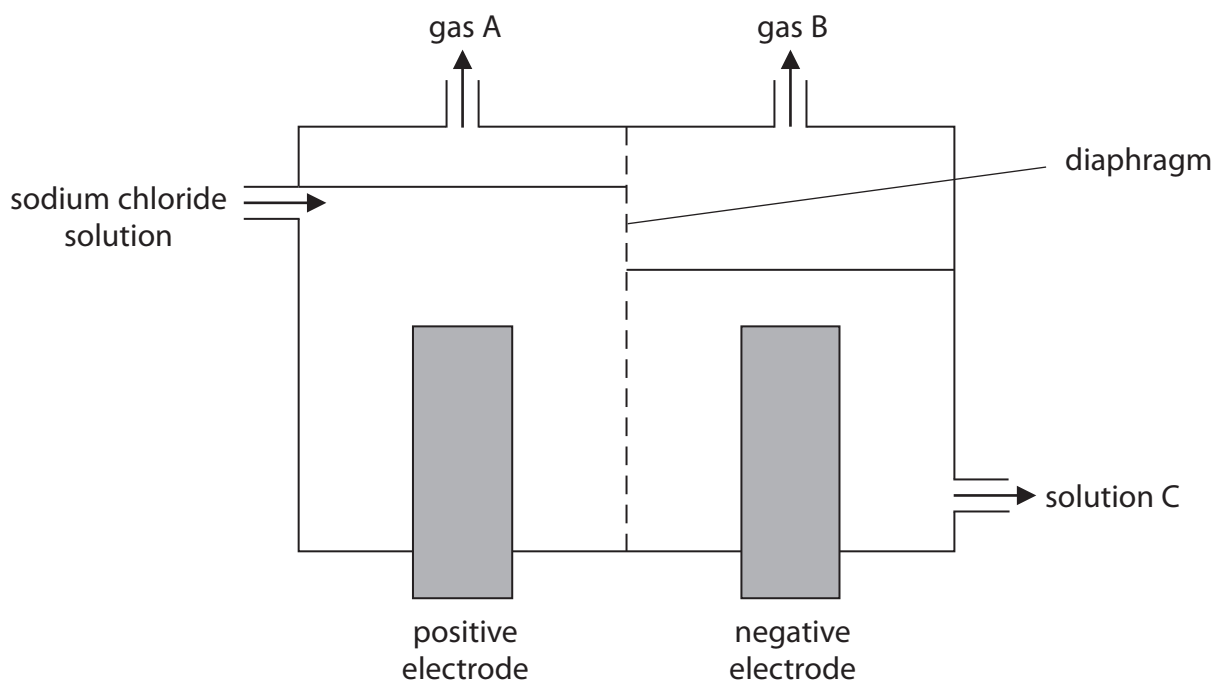
Assume all other factors remain constant.

(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.....

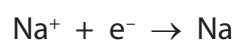


(c) Sodium is manufactured by the electrolysis of molten sodium chloride, NaCl(l).

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.

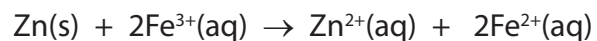
(1)

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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.....

.....

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(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)

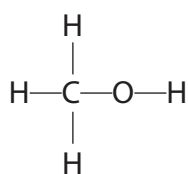
1.....

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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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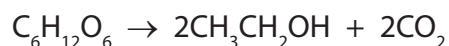
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(c) The equation for the fermentation of glucose is



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)



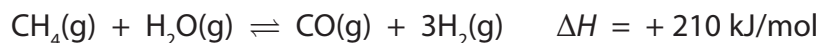
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- 8 The hydrogen needed for the manufacture of ammonia is made by a process called steam reforming.

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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