

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International GCSE (9–1)

Centre Number

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Candidate Number

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Monday 20 January 2020

Afternoon (Time: 1 hour 15 minutes)

Paper Reference **4CH1/2CR**

Chemistry

Unit: 4CH1

Paper: 2CR

You must have:
Calculator, ruler

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 70.
- 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.
- 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 of the Elements

1	2	3	4	5	6	7	0																																																																																																																																																																																																
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 F fluorine 9	18 Ne neon 10																																																																																																																																																																																														
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27	30 Ni nickel 28	31 Cu copper 29	32 Zn zinc 30	33 Ga gallium 31	34 Ge germanium 32	35 As arsenic 33	36 Se selenium 34	37 Br bromine 35	38 Sr strontium 38	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																																																																																																																																																																						
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	58 Ce cerium 58	59 Pr praseodymium 59	60 Nd neodymium 60	61 Pm promethium 61	62 Sm samarium 62	63 Eu europium 63	64 Gd gadolinium 64	65 Tb terbium 65	66 Dy dysprosium 66	67 Ho holmium 67	68 Er erbium 68	69 Tm thulium 69	70 Yb ytterbium 70	71 Lu lutetium 71	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86																																																																																																																																																																								
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	112 Cd cadmium 112	113 In indium 113	114 Sn tin 114	115 Pb lead 115	116 Fl flerovium 116	117 Ts tennessine 117	118 Og oganesson 118	119 Uu unununium 119	120 Uub ununbium 120	121 Uut ununtrium 121	122 Uuq ununquadium 122	123 Uub ununhexium 123	124 Uuq ununseptium 124	125 Uub ununoctium 125	126 Uuq ununnonium 126	127 Uub unundecium 127	128 Uuq unundundium 128	129 Uub ununtridecium 129	130 Uuq ununquadecium 130	131 Uub ununpentadecium 131	132 Uuq ununhexadecium 132	133 Uub ununseptadecium 133	134 Uuq ununoctadecium 134	135 Uub ununnonadecium 135	136 Uuq ununtriacontium 136	137 Uub ununtriacontium 137	138 Uuq ununtriacontium 138	139 Uub ununtriacontium 139	140 Uuq ununtriacontium 140	141 Uub ununtriacontium 141	142 Uuq ununtriacontium 142	143 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1
H
hydrogen
1

Key
relative atomic mass
atomic symbol
name
atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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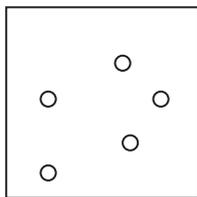
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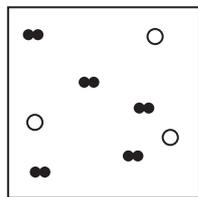
Answer ALL questions.

1 Substances can be classified as elements, mixtures or compounds.

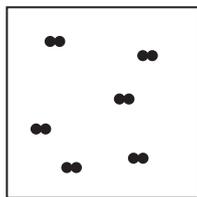
(a) Each box represents an element, a mixture or a compound.



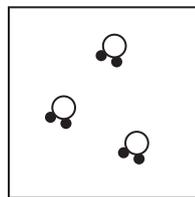
Box 1



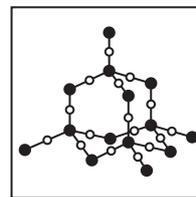
Box 2



Box 3



Box 4



Box 5

(i) Which box represents a mixture?

(1)

- A 1
- B 2
- C 3
- D 4

(ii) Which two boxes represent elements?

(1)

- A 1 and 2
- B 2 and 3
- C 1 and 3
- D 3 and 4

(iii) Explain why Box 5 represents a compound.

(2)

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(b) The Periodic Table contains all the known elements.

(i) How are the elements arranged in the Periodic Table?

(1)

- A increasing mass number
- B increasing number of neutrons
- C increasing number of protons
- D increasing reactivity

(ii) Elements in the same group have the same number of

(1)

- A electrons in the outer shell
- B electron shells
- C neutrons
- D protons

(Total for Question 1 = 6 marks)



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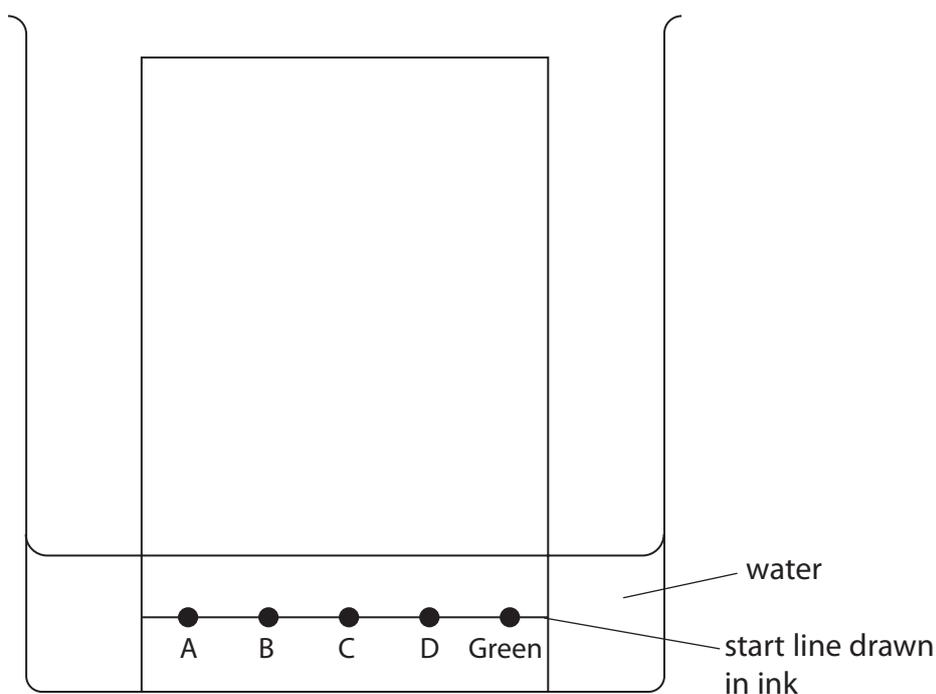
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2 Chromatography is used to analyse mixtures.

A student does a chromatography experiment to analyse the composition of green food colouring in sweets.

She places four known dyes, A, B, C and D, and the green food colouring on chromatography paper.

The diagram shows the student's apparatus at the start of her experiment.



(a) The diagram shows that the student makes two mistakes when setting up her apparatus. State the two changes that the student should make so that her experiment works. (2)

1.....

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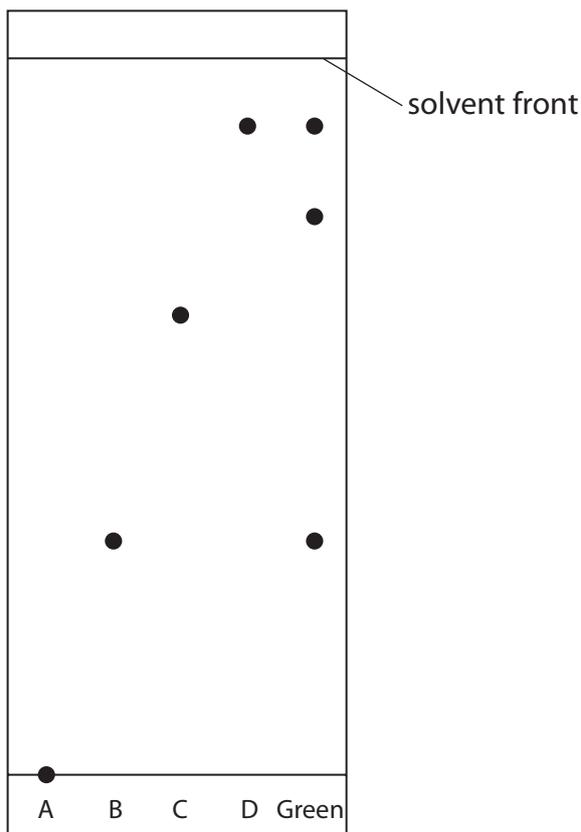
2.....

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(b) Another student does the chromatography experiment correctly.

The diagram shows her chromatogram at the end of the experiment.



(i) Explain what the chromatogram shows about the composition of the green food colouring.

(3)

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(ii) The distance between the start line and the spot for dye C is 6.2 cm.

Calculate the R_f value of dye C.

(3)

R_f value =

(iii) Suggest why dye A does not move.

(1)

(Total for Question 2 = 9 marks)

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3 Solutions of silver nitrate and potassium chloride react together to make the insoluble salt, silver chloride.

A student uses this method to prepare a sample of silver chloride.

Step 1 add 25 cm^3 of silver nitrate solution to a conical flask

Step 2 add potassium chloride solution to the flask

Step 3 filter off the silver chloride

(a) What term is used for this reaction?

(1)

- A neutralisation
- B precipitation
- C redox
- D thermal decomposition

(b) Give two more steps that will produce a pure, dry sample of silver chloride.

(2)

Step 4.....

Step 5.....

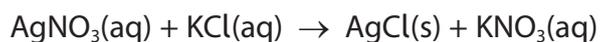
(c) Acidified silver nitrate solution is used to test for chloride ions.

Give a reason why hydrochloric acid is not used to acidify silver nitrate solution.

(1)



- (d) The chemical equation for the reaction between solutions of silver nitrate and potassium chloride is



A student adds an excess of potassium chloride solution to 25.0 cm^3 of 0.100 mol/dm^3 silver nitrate solution.

Calculate the maximum mass of silver chloride, in grams, that can be produced.

[M_r of $\text{AgCl} = 143.5$]

(2)

mass = g

(Total for Question 3 = 6 marks)

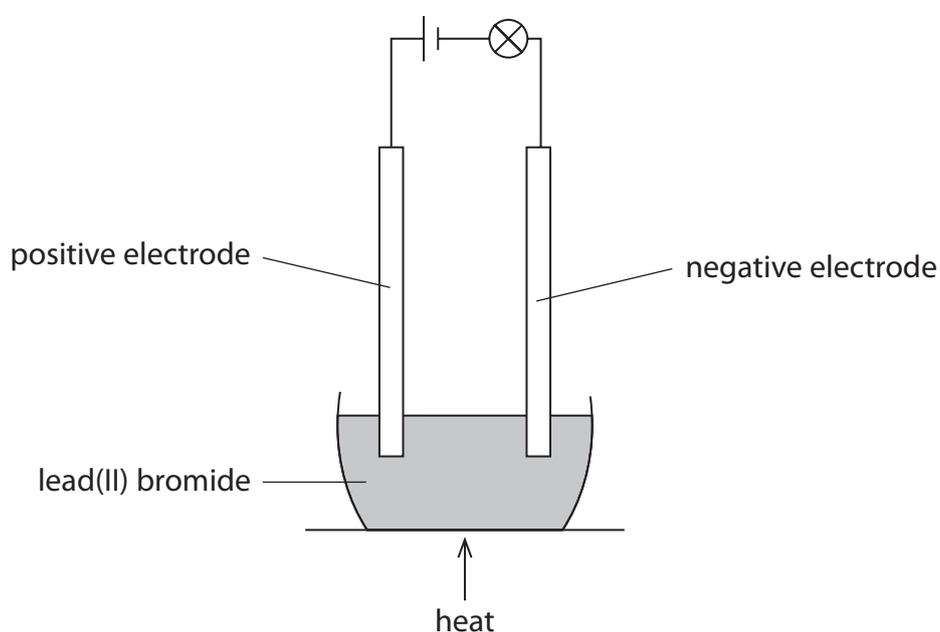


4 This question is about the metal, lead.

(a) Explain why metals, such as lead, are malleable.

(2)

(b) A teacher uses this apparatus in a fume cupboard to demonstrate the electrolysis of lead(II) bromide.



The lead(II) bromide is heated until it melts.

When the lead(II) bromide melts, the lamp lights.

One of the products of this electrolysis is lead.

(i) State why solid lead(II) bromide does not conduct electricity.

(1)



(ii) Bromine is formed by the oxidation of bromide ions at the positive electrode.

Complete the ionic half-equation for the oxidation of bromide ions.

(1)



(iii) Explain why lead metal forms at the negative electrode.

(2)

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(iv) The teacher stops heating the mixture and allows it to solidify.

Suggest why the lamp stays alight.

(1)

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(Total for Question 4 = 7 marks)

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5 This question is about Group 1 metals and their reactions.

(a) When lithium is added to water, bubbles of hydrogen gas are observed.

(i) Give two other observations that could be made.

(2)

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2.....
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(ii) Give the test for hydrogen gas.

(1)

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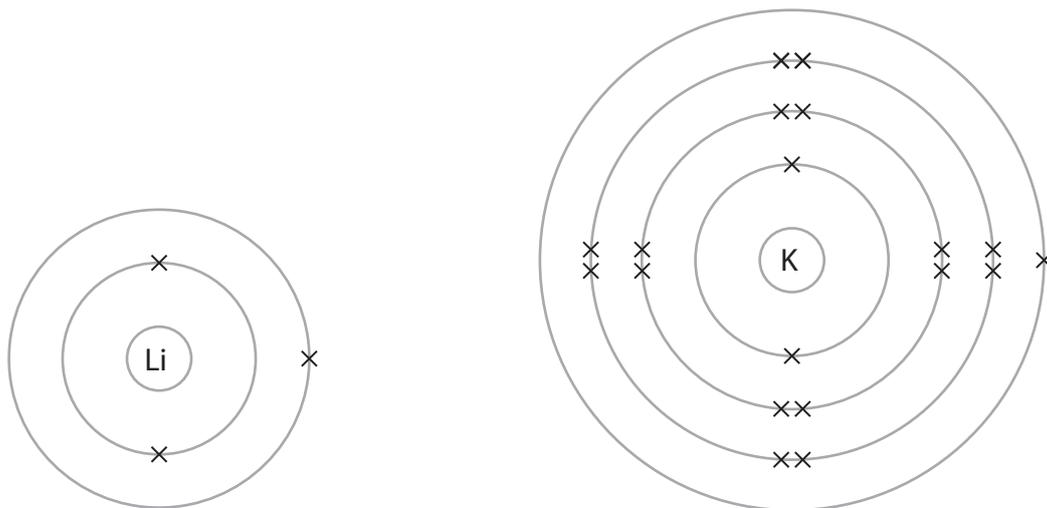
(b) (i) Give one observation that would be different if potassium is used instead of lithium.

(1)

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(ii) The diagram represents an atom of lithium and an atom of potassium.



Explain why potassium is more reactive than lithium.

(3)

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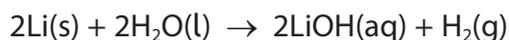
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(c) The equation for the reaction between lithium and water is



(i) A mass of 0.500 g of lithium reacts with an excess of water.

Calculate the volume, in cm^3 , of hydrogen gas produced at rtp.

[molar volume of a gas at rtp = $24\,000\text{ cm}^3$]

Give your answer to three significant figures.

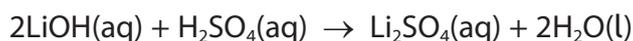
(3)

volume = cm^3

(ii) In a reaction between lithium and water, 150 cm^3 of lithium hydroxide solution is formed.

The lithium hydroxide solution is then completely neutralised by 24.85 cm^3 of 0.100 mol/dm^3 sulfuric acid.

The equation for the neutralisation is



Calculate the concentration, in mol/dm^3 , of the lithium hydroxide solution.

(3)

concentration = mol/dm^3

(Total for Question 5 = 13 marks)



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(ii) The rate of this reaction can also be increased by using a catalyst.

Explain how using a catalyst increases the rate of a reaction.

(2)

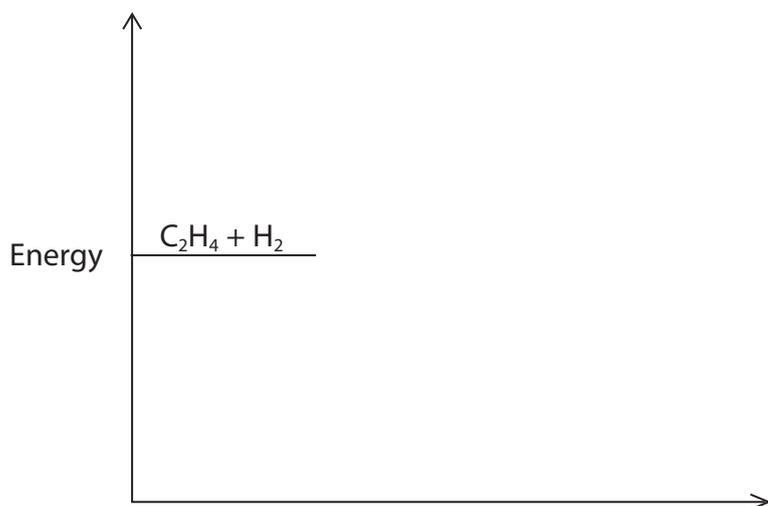
(iii) Give one other way that the rate of reaction between ethene gas and hydrogen gas can be increased.

(1)

(iv) The reaction between ethene and hydrogen is exothermic.

Complete the reaction profile diagram, including labels for the activation energy and the enthalpy change, ΔH .

(3)



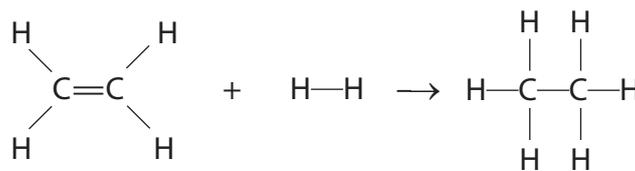
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(c) The reaction between ethene and hydrogen can be represented using displayed formulae.



Bond	Bond energy in kJ/mol
C=C	612
C—H	412
H—H	436
C—C	348

Use the bond energies in the table to calculate the enthalpy change, ΔH , in kJ/mol for this reaction.

(3)

$\Delta H = \dots\dots\dots$ kJ/mol

(Total for Question 6 = 15 marks)



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7 (a) Ethanol, C₂H₅OH, can be produced by the fermentation of glucose, C₆H₁₂O₆

(i) Complete the equation for the fermentation of glucose. (1)



(ii) State why it is necessary for fermentation to be done in the absence of air. (1)

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(iii) Explain why the temperature should not be higher than 40°C. (2)

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(iv) When 4 mol of glucose is fermented, a mass of 55.2 g of ethanol is produced.

Show that the percentage yield of ethanol is 15%.

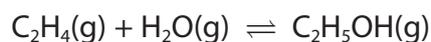
[M_r of C₂H₅OH = 46]

(2)



(b) Ethanol can also be produced by the reaction between ethene and steam.

The equation for the reaction is



(i) This reaction is in dynamic equilibrium.

Give two features of a reaction in dynamic equilibrium.

(2)

1

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(ii) When the equilibrium mixture is heated, the yield of ethanol decreases.

Explain whether the forward reaction is exothermic or endothermic.

(2)

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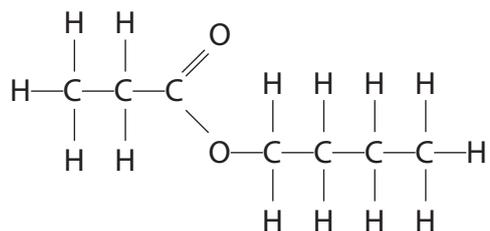
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(c) Carboxylic acids react with alcohols to form esters.

The displayed formula of an ester is



(i) Carboxylic acid A and alcohol B react to produce this ester.

Give the displayed formula of carboxylic acid A and of alcohol B.

(2)

Carboxylic acid A	Alcohol B

(ii) Indicators can be used to test for carboxylic acids.

Describe a different chemical test for a carboxylic acid.

(2)

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(Total for Question 7 = 14 marks)

TOTAL FOR PAPER = 70 MARKS

