Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number	Candidate Number

Chemistry

Unit C3: Chemistry in Action

Foundation Tier

Wednesday 21 June 2017 – Morning **Time: 1 hour**	Paper Reference **5CH3F/01**

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.*

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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 8 5 8 3 A 0 1 2 0

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The Periodic Table of the Elements

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
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **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	178 **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	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **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	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

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.

Answer ALL questions

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 ☒.

Alkanes, alkenes and ethanol

1 The alkanes form an homologous series of compounds.
Molecules of alkanes contain carbon and hydrogen only.

(a) Which of these alkanes contains three carbon atoms?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** butane

☒ **B** ethane

☒ **C** methane

☒ **D** propane

(b) Pentane is an alkane.
A molecule of pentane contains five carbon atoms.
The general formula for an alkane is C_nH_{2n+2}.

What is the formula of a molecule of pentane?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** C_5H_5

☒ **B** C_5H_7

☒ **C** C_5H_{10}

☒ **D** C_5H_{12}

(c) The molecular formulae and boiling points of alkanes containing six to nine carbon atoms per molecule are given in the table.

alkane	molecular formula	boiling point /°C
hexane	C_6H_{14}	69
heptane	C_7H_{16}	98
octane	C_8H_{18}	126
nonane	C_9H_{20}	151

Use the information in the table to state the relationship between the number of carbon atoms in a molecule of an alkane and the boiling point of the alkane.

(1)

.....

.....

.....

(d) The alkenes form another homologous series of compounds.
Ethene is an alkene.

Draw the structure of a molecule of ethene, C_2H_4, showing all the bonds.

(2)

(e) Glucose is a carbohydrate.
Ethanol can be made by the fermentation of glucose solution.

(i) Which of these needs to be added to glucose solution to form ethanol by fermentation?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** hydrochloric acid

☒ **B** sodium hydroxide

☒ **C** yeast

☒ **D** vinegar

(ii) Ethanol is present in all alcoholic drinks.

State **two** problems that may be caused by drinking too much alcohol.

(2)

1 .....

.....

2 .....

.....

(Total for Question 1 = 8 marks)

Carboxylic acids and esters

2 (a) Ethanol can react to form ethanoic acid.

What type of reaction occurs when ethanol, C_2H_5OH, reacts to form ethanoic acid, CH_3COOH?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** distillation
- ☒ **B** neutralisation
- ☒ **C** oxidation
- ☒ **D** thermal decomposition

(b) Magnesium reacts with dilute ethanoic acid to form magnesium ethanoate and hydrogen.

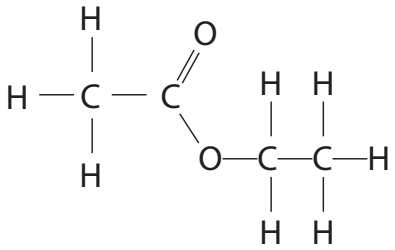
Write the word equation for this reaction.

(2)

.....

.....

(c) Ethyl ethanoate is an ester.
A molecule of ethyl ethanoate has the structure shown.



Give the names of the elements present in a molecule of ethyl ethanoate.

(1)

.....

(d) Esters and vinegar are useful substances.

Draw a straight line from each of the substances to one of its uses.

(2)

substances	**use**
ester	perfume
vinegar	fertiliser
	preservative

(e) A fat or oil can be reacted with a reagent to form a soap.

Give the name of the reagent and the conditions for the reaction.

(2)

reagent .....

conditions .....

(Total for Question 2 = 8 marks)

Hard water

3 Hard water contains dissolved solids.

(a) (i) Describe how to find the mass of dissolved solid in a 25 cm^3 sample of hard water.

(3)

(ii) A different 25 cm^3 sample of a hard water contained 0.6 g of dissolved solid **X**.

Calculate the concentration of **X** in the solution, in g dm^{-3}.

(1)

(iii) Which of these ions, dissolved in water, causes hardness in the water?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** potassium, K^+
- ☒ **B** magnesium, Mg^{2+}
- ☒ **C** sodium, Na^+
- ☒ **D** ammonium, NH_4^+

(b) **A**, **B** and **C** are samples of water from three different sources.
10 cm^3 of each water is placed in separate test tubes.
The same volume of a soap solution is added to each test tube and the mixture is shaken.
The height of the lather above the surface of the liquid in each test tube is measured.

The results are shown.

water sample	height of lather / cm
A	4
B	2
C	0

Explain, using the information from the table, which sample of water is the hardest.

(2)

.....

.....

.....

.....

(c) State what is **seen** in a sample of hard water after it has been shaken with the soap solution.

(1)

.....

(d) Temporary hardness in water can be caused by dissolved calcium hydrogencarbonate.

When temporary hard water is boiled, the calcium hydrogencarbonate decomposes to form carbon dioxide, water and a precipitate of calcium carbonate.

Add the state symbols for the products to the word equation for this reaction.

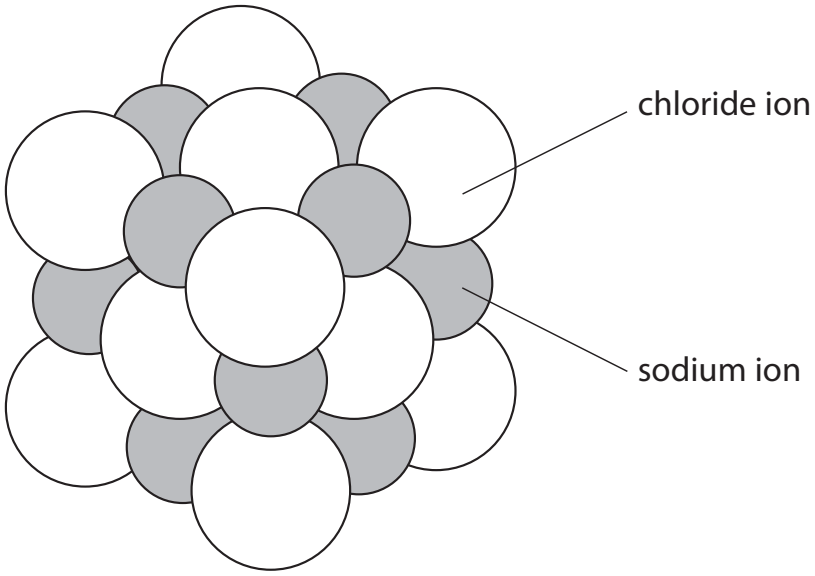
(2)

calcium hydrogencarbonate (aq) $\rightarrow$ calcium carbonate (.....) + carbon dioxide (.....) + water(.....)

(Total for Question 3 = 10 marks)

Electrolysis

4 (a) Sodium chloride is an ionic solid.
It contains sodium ions, Na^+, and chloride ions, Cl^-.
In solid sodium chloride, the ions are arranged as shown in the diagram.



(i) Solid sodium chloride does not conduct electricity.

Give a reason why solid sodium chloride does not conduct electricity, even though it contains ions.

(1)

.....

.....

(ii) Molten sodium chloride can be electrolysed.
When it is electrolysed, sodium is produced at one of the electrodes.

Explain how the sodium ions, Na^+, become sodium atoms, Na.

(2)

.....

.....

.....

.....

(b) The electrolysis of sodium chloride solution produces hydrogen, chlorine and sodium hydroxide solution.

(i) Explain why the electrolysis of sodium chloride solution should be carried out in a well-ventilated laboratory.

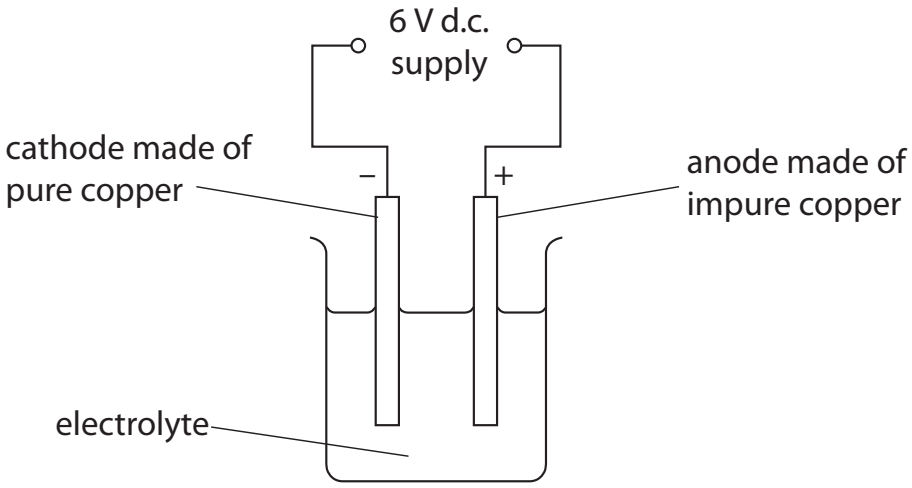
(2)

(ii) During the electrolysis, chloride ions, Cl^-, are oxidised to chlorine molecules, Cl_2.

Explain why this is an oxidation reaction.

(2)

(c) Electrolysis can also be used to purify a sample of impure copper using this apparatus.



(i) Suggest the name of a suitable solution to be used as the electrolyte.

(1)

.....

(ii) Describe what is **seen** during the electrolysis.

(2)

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.....

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(Total for Question 4 = 10 marks)

Salts

5 (a) Zinc carbonate powder is added to dilute hydrochloric acid in a beaker.
A gas is given off: the gas turns limewater milky.
Zinc carbonate is added until some is left as a solid at the bottom of the beaker.
At the end of the reaction, a mixture of zinc chloride solution and excess solid zinc carbonate is left in the beaker.

(i) Explain how pure zinc chloride solution is obtained from this mixture.

(2)

.....

.....

.....

.....

.....

.....

(ii) Complete the equation for this reaction by adding the formula of the gas given off and then balancing the equation.

(2)

$ZnCO_3$ + ... $HCl \rightarrow ZnCl_2 + H_2O$ + ...

(b) Dilute nitric acid is placed in a beaker.
A few drops of indicator are added.
Sodium hydroxide solution is added until the indicator changes colour.

Universal indicator is not a suitable indicator for this experiment.

Suggest the name of a suitable indicator and state the colour change.

(2)

name of indicator .....

colour change from ..... to .....

*(c) Ammonium salts are soluble in water and some are used in artificial fertilisers.

Describe the benefits and problems of using artificial fertilisers when growing crops.

(6)

(Total for Question 5 = 12 marks)

Testing for ions

6 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Sodium hydroxide solution is often used to test for ions in solution.

When sodium hydroxide solution is added to a solution, a green precipitate forms.

The green precipitate shows that the ions present in the original solution are

☒ **A** sodium, Na^+

☒ **B** potassium, K^+

☒ **C** iron(II), Fe^{2+}

☒ **D** iron(III), Fe^{3+}

(b) The table gives information about tests for aluminium and calcium ions in solutions.

ion in solution	effect of adding a few drops of sodium hydroxide solution	effect of adding excess sodium hydroxide solution
aluminium, Al^{3+}	white precipitate forms	white precipitate disappears
calcium, Ca^{2+}	white precipitate forms	white precipitate remains

A few drops of sodium hydroxide solution are added to a solution of one of these ions. A white precipitate forms.

Give a reason, using the information in the table, why it is **not** correct to say that the solution contains calcium ions.

(1)

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.....

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.....

(c) A salt was dissolved in water to form a solution.
Tests were carried out on this solution.

Sodium hydroxide solution was added to a sample of the solution.
A pale blue precipitate formed.

Dilute hydrochloric acid and barium chloride solution were added to another sample of the solution.
A white precipitate formed.

Give the name of the salt.

(2)

.....

(d) When sodium hydroxide solution, NaOH, is warmed with ammonium chloride, NH_4Cl, the products are sodium chloride, NaCl, ammonia, NH_3, and water.

Write the balanced equation for this reaction.

(2)

.....

*(e) Potassium chloride, potassium iodide and sodium iodide are all colourless crystals.
Unlabelled samples of the three substances are provided.

Describe the tests you would carry out to identify the potassium chloride, the potassium iodide and the sodium iodide.
Include the results you would expect for each test.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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