EDEXCEL GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C3 FOUNDATION TIER 5CH3F PAPERS

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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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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.

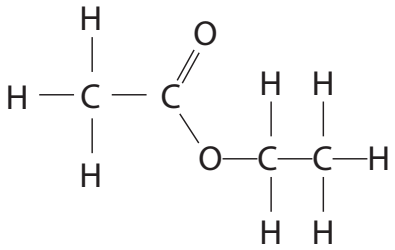
Write the word equation for this reaction.

(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.

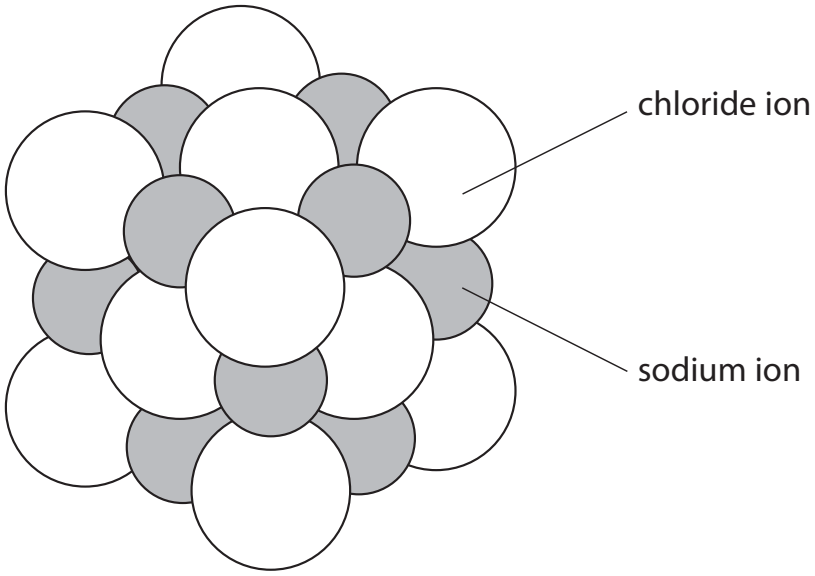
(2)

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.

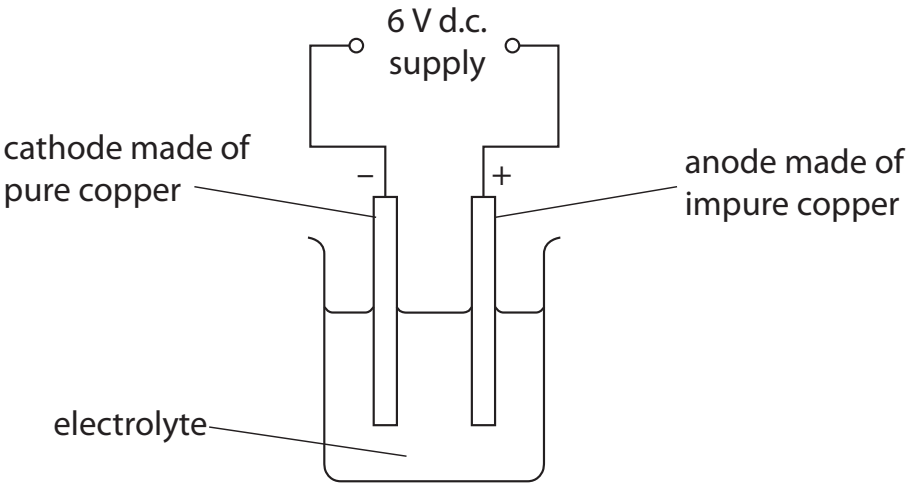
(2)

.....

.....

.....

(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)

.....

.....

.....

.....

(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)

.....

.....

.....

.....

(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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Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE
In Chemistry (5CH3F) Paper 01

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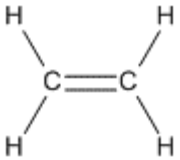
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark
1(a)	**D** propane **The only correct answer is D** **A** is not correct because butane contains four carbon atoms **B** is not correct because ethane contains two carbon atoms **C** is not correct because methane contains one carbon atoms	**(1)**

Question Number	Answer	Mark
1(b)	**D** C_5H_{12} **The only correct answer is D** **A** is not correct because the formula of a molecule of pentane is not C_5H_5 **B** is not correct because the formula of a molecule of pentane is not C_5H_7 **C** is not correct because the formula of a molecule of pentane is not C_5H_{10}	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	• the more carbon atoms (in a molecule) the higher the boiling point OWTTE	the fewer carbon atoms (in a molecule) the lower the boiling point	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	 • two carbon atoms joined by double bond **(1)** • rest of molecule correct **(1)**	Ignore bond angles second mark dependent of first mark	**(2)**

Question Number	Answer	Mark
1(e)(i)	**C** yeast **The only correct answer is C** **A** is not correct because when added to glucose solution, hydrochloric acid would not form ethanol by fermentation **B** is not correct because when added to glucose solution, sodium hydroxide would not form ethanol by fermentation **D** is not correct because when added to glucose solution, vinegar would not form ethanol by fermentation	**(1)**

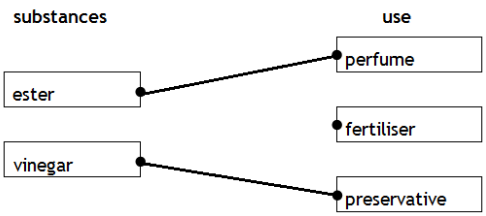
Question Number	Answer	Acceptable answers	Mark
1(e)(ii)	Any two from • named medical issues • social problems • driving and work-related issues	Ignore drunk unqualified Allow two from any category	**(2)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Mark
2(a)	**C** oxidation **The only correct answer is C** **A** is not correct because when ethanol reacts to from ethanoic acid the type of reaction taking place is called oxidation not distillation **B** is not correct because when ethanol reacts to from ethanoic acid the type of reaction taking place is called oxidation not neutralisation **D** is not correct because when ethanol reacts to from ethanoic acid the type of reaction taking place is called oxidation not thermal decomposition	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	ethanoic acid + magnesium → magnesium ethanoate + hydrogen • LHS **(1)** • RHS **(1)**	Correct chemical equation scores 2 marks $Mg + 2CH_3COOH \rightarrow (CH_3COO)_2Mg + H_2$ Allow $Mg(CH_3COO)_2$ Partially correct chemical equation scores 0 If both word and chemical equation given mark the word equation	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	carbon, hydrogen and oxygen	All 3 needed, in any order Ignore symbols	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)	 • ester linked to perfume **(1)** • vinegar linked to preservative **(1)** Do not award the mark if there are two or more lines starting from one of the substances		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(e)	reagent sodium hydroxide / potassium hydroxide (1) condition boil / heat / high temperature / concentrated (alkali) (1)	Allow alkali Accept formulae If correct name given ignore any formula Allow (very) hot Allow temperature range 70-100 ºC Ignore warm Ignore references to (high) pressure /catalysts	**(2)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	A description including any two from • determine mass of an empty evaporating basin **(1)** • pour (25 cm^3 of) water into the basin **(1)** • heat until all the water has evaporated **(1)** • determine mass of the basin and solid **(1)** and • subtract the mass of the empty basin from the mass of basin and solid **(1)**	Allow weigh Allow any suitable container Allow any form of heating or just allow water to evaporate Allow boil off/evaporate all the water Allow weigh If container NOT used allow max 2 marks for • heat until all the water has evaporated / boil off/evaporate all the water **(1)** • determine mass of/weigh the solid (left afterwards) (**1**)	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	$\frac{0.6 \times 1000}{25}$ (= 24 g dm^{-3}) OR $\frac{0.6}{0.025}$ (= 24 g dm^{-3})	Correct answer with no working **(1)** Correct working with {no/incorrect} answer **(1)**	**(1)**

Question Number	Answer	Mark
3(a)(iii)	**B** magnesium, Mg^{2+} **The only correct answer is B** **A** is not correct because potassium ions do not cause hardness in water **C** is not correct because sodium ions do not cause hardness in water **D** is not correct because ammonium ions do not cause hardness in water	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	An explanation linking • (water sample) C **(1)** • because there was no lather produced / all soap has been used up **(1)**	Allow least lather/smallest height of lather Allow height of lather = 0 Ignore references to scum Second mark dep on first mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	scum / precipitate / cloudy (mixture)	Ignore reference to no bubbles/lather	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)	(calcium hydrogen carbonate (aq)) → calcium carbonate (**s**) + carbon dioxide (**g**) + water (**l**) All 3 correct scores **(2)** 1 or 2 correct scores **(1)**	Allow upper case letters Do not allow solid / so(l) for s Do not allow gas for g Do not allow liquid for l	**(2)**

(Total for Question 3 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	ions are in fixed positions/cannot move/not mobile		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	An explanation linking • electron(s) **(1)** • gain(ed) **(1)**	accept reduction (1) second mark dep on first mark if state incorrect number of electrons gained by each sodium ion allow 1 mark $Na^+ + e^{(-)} \rightarrow Na$ scores 2 marks $Na^+ + 2e^{(-)} \rightarrow Na$ scores 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	An explanation linking • chlorine (gas) (1) AND • (is) toxic/poisonous **(1)**	Allow • hydrogen (gas) (1) AND • (is) flammable (1) Allow explosive For both pairs: Ignore dangerous/harmful Second mark dep on first mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation linking • electron(s) **(1)** • (have been) lost **(1)**	Second mark is dependent on first mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	copper sulfate (solution)	Allow sulphate Allow copper nitrate /copper chloride Allow $CuSO_4$ / $Cu(NO_3)_2$ / $CuCl_2$	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	A description including two from • cathode becomes larger **(1)** • anode becomes smaller **(1)** • solid drops to bottom **(1)**	 Allow copper coating (forms) on cathode Allow orange/brown solid coats cathode Ignore copper added to cathode Ignore cathode gains mass Ignore cathode gains copper Ignore copper moves/attracted to the cathode Ignore copper transferred to the cathode Ignore anode loses copper Ignore anode loses mass sludge formed Reject (impure) copper drops to bottom Ignore references to bubbles/fizzing/gas produced	**(2)**

(Total for Question 4 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	An explanation linking • filter **(1)** • to remove solid / zinc carbonate **(1)**	Allow to collect the {filtrate/zinc chloride solution} in a suitable container eg conical flask Allow what is left is zinc chloride (solution) Allow solid/zinc carbonate left on (filter) paper	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + H_2O + CO_2$ • CO_2 **(1)** • 2(HCl) **(1)**	Allow multiples of complete equation eg $2ZnCO_3 + 4HCl \rightarrow 2ZnCl_2 + 2H_2O + 2CO_2$	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	• any acid-base indicator **(1)** • colour change for named indicator **(1)** Examples: litmus – red to blue/ purple methyl orange – pink to orange / yellow phenolphthalein – colourless to pink/ red	do not allow universal indicator / pH paper second mark dependent on first mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **Advantages** • promotes plant growth (allow faster growth) • provides nitrogen/nutrients • contains a high percentage of nitrogen • increases crop yields / more food for people • easy to spread on soil (as a solid) or easy to spray unto crops (as a solution) • easily absorbed by plants (as it is soluble) • known amount of fertiliser provided **Disadvantages** • (can wash out from fields and) go into lakes/ rivers • increases plant/algae growth in lakes/ rivers • (which) blocks sunlight • as plants {die/decay} oxygen is used up • reduces oxygen available for other organisms/wildlife may die • eutrophication • too much in water supply can damage health of babies • some people may not wish to buy/eat produce grown using artificial fertilisers /some may prefer produce grown without artificial fertilisers) • cost of artificial fertilisers used has to be added to selling price of crops	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. one advantage or one disadvantage • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. two advantages, two disadvantages or one advantage and one disadvantage • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. at least four points including at least one advantage **and** at least one disadvantage • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 5 = 12 marks)

Question Number	Answer	Mark
6(a)	**C** iron(II), Fe^{2+} **The only correct answer is C** **A** is not correct because if a green precipitate is formed when sodium hydroxide is added to a solution it shows the solution contains iron(II) ions not sodium ions **B** is not correct because because if a green precipitate is formed when sodium hydroxide is added to a solution it shows the solution contains iron(II) ions not potassium ions **D** is not correct because because if a green precipitate is formed when sodium hydroxide is added to a solution it shows the solution contains iron(II) ions not iron(III) ions	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	aluminium (ions) could also give a white precipitate /excess (sodium hydroxide solution) has not been added	Allow both (aluminium and calcium ions) give a white precipitate Allow (white) precipitate may disappear in excess (sodium hydroxide) Allow only a few drops (of sodium hydroxide) have been added	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(c)	• copper **(1)** • sulfate **(1)**	Allow Cu Allow sulphate Allow SO_4	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(d)	$NaOH + NH_4Cl \rightarrow NaCl + NH_3 + H_2O$ • correct formulae on LHS **(1)** • correct formulae on RHS **(1)**	If all formulae correct but equation is incorrectly balanced award 1 mark	**(2)**

Question Number		Indicative Content	Mark
6 (e) QWC	*	A description to include some of the following points Flame test • carry out a flame test • clean wire • in (concentrated) hydrochloric acid • put solid / sample on wire • hold wire in flame • lilac flame indicates potassium ions / potassium chloride or potassium iodide • yellow flame indicates sodium ions / sodium iodide Test for anion • add solid to water / dissolve solid • add dilute nitric acid • add silver nitrate solution • if white precipitate forms • then chloride ion / potassium chloride present • if yellow precipitate forms • then iodide ion / sodium iodide or potassium iodide present	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• A limited description of one test e.g. carry out a flame test, potassium gives lilac colour • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• A simple description of a test for the cations or the anions **or** a limited description of both e.g. add silver nitrate, nitric acid and chloride gives white ppt • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• A detailed description containing tests for both cations **and** anions e.g. do flame test with solid on wire and put into flame and lilac colour means potassium ion present, yellow means sodium and test using silver nitrate solution to find the other ion including at least two correct results • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

(Total for Question 6 = 12 marks)

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | Candidate Number

Chemistry

Unit C3: Chemistry in Action

Foundation Tier

Wednesday 22 June 2016 – 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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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.

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Questions begin on next page.

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 ☒.

Water

1 Water from reservoirs is treated and tested before it is supplied to our homes.

(a) Give a reason why water is tested before it is supplied to our homes.

(1)

.....

.....

.....

(b) Water taken from reservoirs can be hard or soft.

You are given samples of hard water and soft water.

(i) Explain how you could show which sample was hard water and which sample was soft water.

Use the words from the box in your answer.

lather	scum	soap

(3)

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(ii) Which of these ions causes hardness in water?

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

(1)

☒ **A** potassium ions

☒ **B** magnesium ions

☒ **C** chloride ions

☒ **D** hydroxide ions

(iii) Hardness in water can be either temporary or permanent.

Describe a test to show whether the hardness in a sample of water is temporary or permanent.

(2)

.....

.....

.....

.....

.....

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

(1)

1000 cm^3 of a solution contained 1.0 g of dissolved solid.
The concentration of the solid in g dm^{-3} is

☒ **A** 0.1

☒ **B** 1.0

☒ **C** 2.0

☒ **D** 10.0

(Total for Question 1 = 8 marks)

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Solutions and tests for ions

2 (a) (i) Describe how you would make a solution of sodium chloride from sodium chloride crystals and distilled water.

(2)

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(ii) A test for chloride ions is carried out on the sodium chloride solution.

P, **Q**, **R** and **S** are involved in tests for ions.

P add silver nitrate solution to the solution

Q a white precipitate forms

R add sodium hydroxide solution to the solution

S add dilute nitric acid to the solution

Only three of these form part of the test for chloride ions.

Identify the three and place them in the order they occur in the test.

(2)

1 .....

2 .....

3 .....

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(b) The test for ammonium ions is

- add sodium hydroxide solution to a solution of the salt
- warm the mixture
- test the ammonia gas given off with damp red litmus paper.

(i) Choose the formula of sodium hydroxide.

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

(1)

☒ **A** KOH

☒ **B** NaO

☒ **C** NaOH

☒ **D** SOH

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

(1)

When the ammonia gas is tested with damp red litmus paper, the litmus paper turns blue.

This shows that the ammonia gas is

☒ **A** acidic

☒ **B** alkaline

☒ **C** neutral

☒ **D** an indicator

(c) Two tests are carried out on a solid.

- In a flame test, a yellow flame is seen.
- When some dilute hydrochloric acid is added to the solid, a gas is evolved. The gas turns limewater milky.

Give the name of the solid.

(2)

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(Total for Question 2 = 8 marks)

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Electrolysis and metal ions

3 (a) Some metals are extracted by the electrolysis of a molten compound.

(i) Complete the sentences about the electrolysis of a molten compound using words from the box.

decomposed	electricity	electrons	ions	molecules	purified

Each word may be used once, more than once or not at all.

(2)

The compound has to be molten so that the ..... can move.

When a molten compound is electrolysed its elements are formed. During electrolysis the compound is ..... .

(ii) Which of the following statements about electrolysis is correct?

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

(1)

☒ **A** an anion is positively charged

☒ **B** an anode is negatively charged

☒ **C** a cation is positively charged

☒ **D** a cathode is positively charged

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(b) (i) When molten zinc chloride is electrolysed, a solid forms at one electrode and a pale green gas forms at the other electrode.

Use this information to complete the word equation for the reaction that takes place when molten zinc chloride is electrolysed.

(2)

zinc chloride → ..... + ...

(ii) In this electrolysis, chloride ions lose electrons to form the pale green gas.

State the type of reaction that occurs when electrons are lost.

(1)

.....

(c) Copper chloride dissolves in water.

Describe what you **see** when sodium hydroxide solution is added to a solution containing copper ions, Cu^{2+}.

(2)

.....

.....

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(d) Sodium is manufactured by the electrolysis of molten sodium chloride.

Explain a large-scale use of sodium.

(2)

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(Total for Question 3 = 10 marks)

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Nitrogen, hydrogen and ammonia

4 (a) In industry, ammonia gas, NH_3, is manufactured from nitrogen gas, N_2 and hydrogen gas, H_2.

(i) Give the name of the industrial process used to manufacture ammonia.

(1)

.....

(ii) State the main source of the nitrogen and of the hydrogen used in this process.

(2)

source of nitrogen .....

source of hydrogen .....

(iii) Write the balanced equation for the reaction between nitrogen and hydrogen to produce ammonia.

(2)

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(iv) State why the following hazard symbol is seen on a bottle of concentrated ammonia solution.

(1)



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(b) The formula of a molecule of ammonia is NH_3.

Use the formula to describe the atoms combined in one molecule of ammonia.

(2)

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(c) Explain why ammonium compounds are important in agriculture.

(2)

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(Total for Question 4 = 10 marks)

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Ethanoic acid

5 (a) A few drops of phenolphthalein indicator are added to dilute ethanoic acid.

Choose the colour of this mixture.

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

(1)

☒ **A** colourless

☒ **B** orange

☒ **C** pink

☒ **D** yellow

(b) Sodium ethanoate can be made by reacting ethanoic acid solution with a solution of the alkali sodium hydroxide.
Water is also formed.

(i) Give the name of the type of reaction that occurs when ethanoic acid reacts with sodium hydroxide.

(1)

.....

(ii) Write the word equation for this reaction.

(2)

.....

.....

(c) Ethanoic acid is present in vinegar.

(i) State why vinegar is sprinkled on some foods.

(1)

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(ii) State why other foods are stored in vinegar.

(1)

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*(d) Magnesium ethanoate is a salt which is soluble in water.
It can be made by reacting magnesium carbonate powder with dilute ethanoic acid.
Magnesium carbonate is insoluble in water.

The equation for the reaction is

$$\underset{\text{acid}}{\text{ethanoic}}\,(aq) + \underset{\text{carbonate}}{\text{magnesium}}\,(s) \rightarrow \underset{\text{ethanoate}}{\text{magnesium}}\,(aq) + \underset{\text{dioxide}}{\text{carbon}}\,(g) + \text{water}\,(l)$$

You are given some dilute ethanoic acid and magnesium carbonate powder.

Describe how you would prepare a pure solution of magnesium ethanoate and how you would obtain pure, dry magnesium ethanoate crystals from that solution.

(6)

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Organic compounds

6 (a) The formula of a molecule of ethanol is C_2H_5OH.

(i) State how you know, from its formula, that ethanol is **not** a hydrocarbon.

(1)

.....

.....

(ii) A dilute solution of ethanol can be produced by the fermentation of a carbohydrate.

Starting from sugar (a carbohydrate), describe how a dilute solution of ethanol can be produced.

(3)

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

(1)

When ethanol reacts with ethanoic acid, ethyl ethanoate is formed.

Ethyl ethanoate is

☒ **A** an alkali

☒ **B** an acid

☒ **C** an ester

☒ **D** an enzyme

(iv) When one molecule of ethanol reacts with one molecule of ethanoic acid, one molecule of ethyl ethanoate and one molecule of another substance are formed.

Complete the equation.

(1)

$$\underset{\text{ethanol}}{C_2H_6O} + \underset{\text{ethanoic acid}}{C_2H_4O_2} \rightarrow \underset{\text{ethyl ethanoate}}{C_4H_8O_2} + \text{.....}$$

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*(b) The alkanes and the alkenes are two examples of homologous series.

Name and draw the structures of some alkanes and of some alkenes and use them to show how members of a homologous series are similar in their general formula, names and structures of their molecules.

(6)

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TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Chemistry (5CH3F) Paper 01
Unit C3: Chemistry in Action

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Summer 2016
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question number	Answer	Notes	Marks
1 (a)	to check purity / no bacteria / does not cause illness / is safe to drink	 **accept** to check if it contains any harmful/dangerous/ toxic substances /chemicals **ignore** to test quality **ignore** to ensure it is clean	1
(b) (i)	An explanation linking (use/mix/shake with) soap (1) hard water forms a scum / no lather (1) soft water forms a lather / no scum (1)	 **accept** react with/add soap **accept** needs more soap to lather/harder to lather **reject** (only) forms a little scum all marks indep	3
(ii)	**B** magnesium ions		1
(iii)	A description including boil/heat samples (1) and **EITHER** one from temporary hard water would then (need less soap to) lather (after boiling than before boiling) (1) permanently hard water would need same amount of soap to lather (before and after boiling) (1) **OR** one from temporary hard water forms precipitate / forms limescale / goes cloudy (1) permanent hard water remains clear (1)	 no reference to boil/heat then answer scores 0 answers involving evaporating score 0 **allow** would (still) not lather / would (still) form scum **ignore** scum in this part as no soap used **allow** (see) no change	2

1 (c)	**B 1.0**		1

Question number	Answer	Notes	Marks
2 (a) (i)	A description including add sodium chloride/crystals to water or vice versa (1) and **either** use of suitable container: test tube / boiling tube / beaker / flask (1) **or** shake / stir (1)	 **accept** dissolve **ignore** heat **ignore** any further steps eg attempts at crystallisation	2
(ii)	1/2: SP / PS (1) 3: Q (1)		2
(b) (i)	**C** NaOH		1
(ii)	**B** alkaline		1
2 (c)	sodium (1) carbonate / hydrogencarbonate (1)	**accept** Na_2CO_3 (2) **accept** correct formulae of ion Na^+ **accept** bicarbonate **accept** correct formulae of ion CO_3^{2-} / HCO_3^-	2

Question number	Answer	Notes	Marks
3 (a) (i)	ions (1) decomposed (1)		2
(ii)	**C** a cation is positively charged		1
(b) (i)	**accept** in either order zinc (1) chlorine (1)	 **accept** Zn **accept** Cl_2 **ignore** Cl	2
(ii)	oxidation	**accept** oxidised **allow** oxidated	1
(c)	A description including (pale) blue (1) precipitate /solid (1)	 **reject** other colours with green eg blue-green or blue/green **allow** ppt(e) **ignore** references to other observations indep marks	2

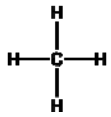
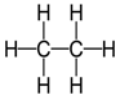
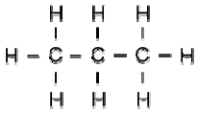
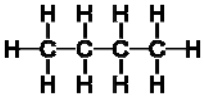
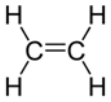
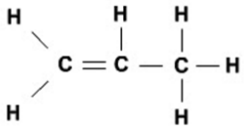
Question number	Answer	Notes	Marks
3 (d)	An explanation linking street {lamps/lights} (1) yellow (light is produced from sodium vapour) (1) **OR** nuclear reactors (1) good conductor of heat / coolant (1)	**ignore** uses of salt /sodium ions **allow** orange	2

Question number	Answer	Notes	Marks
4 (a) (i)	Haber		1
(ii)	the air/atmosphere (1) natural gas/methane/CH_4 (1)	 **accept** North Sea gas **ignore** references to electrolysis	2
(iii)	$N_2 + 3H_2 \rightarrow 2NH_3$ formulae on correct side (1) balancing of <u>correct</u> formulae (1)	**accept** reversible arrows **reject** incorrect subscripts eg N^2 **reject** incorrect cases eg Nh	2
(iv)	corrosive (1)	**allow** damage to/burns (skin) **ignore** irritant / harmful / etc	1
(b)	A description including identifies nitrogen and hydrogen (atoms) (1) one (nitrogen atom) and three (hydrogen atoms) (1)	 answers involving molecules/ions/ionic bonding scores max 1 for the question one nitrogen atom and three hydrogen atoms scores two marks **allow** 1 N and 3 H for 1 mark	2
4 (c)	An explanation linking (ammonium compounds used as) fertiliser (1) (promotes) plant growth/increases crop yields (1)	 **ignore** neutralisation/reference to pesticides etc	2

Question number	Answer	Notes	Marks
5 (a)	A colourless		1
(b) (i)	neutralisation (1)	**accept** exothermic	1
(ii)	ethanoic acid + sodium hydroxide → sodium ethanoate + water LHS (1) RHS (1)	**ignore** symbols but **allow** correct balanced equation for 2 marks	2
(c) (i)	flavouring / (improve) taste / OWTTE (1)		1
(ii)	preservative / pickling/ prevents deterioration / kills bacteria / OWTTE (1)	**ignore** keep food fresh **ignore** prevent food losing taste	1

Question Number		Indicative Content	Mark
QWC	**5(d)***	A explanation to include some of the following points MIXING • put ethanoic acid in suitable piece of apparatus eg beaker • add magnesium carbonate • small amount at a time • stir • using glass/plastic rod ENSURING COMPLETE REACTION • repeat adding of magnesium carbonate • until solid at bottom of beaker • until no more effervescence/fizzing/bubbles • or until no more 'dissolves'/reacts • magnesium carbonate in excess FILTRATION • filter • using filter funnel and paper • magnesium carbonate/solid residue MAKING CRYSTALS • heat/evaporate magnesium ethanoate solution • in evaporating basin • until crystals start to form • allow to cool • wash solid/crystals • dry solid/crystals with absorbent paper	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of one of the stages. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of at least two stages. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description to include aspects of at least three of the four stages. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question number	Answer	Notes	Marks
6 (a) (i)	(also) contains oxygen (atoms) / hydrocarbons only contain carbon and hydrogen (atoms)	**allow** O **ignore** reference to hydroxide	1
(ii)	A description linking • dissolve (sugar in) water (1) • add yeast (1) and one of • leave in a warm place / warm (1) • air lock / anaerobic / cotton wool plug (1)	**accept** carbohydrate for sugar **accept** add sugar to water/use sugar solution **ignore** heat **allow** in absence of air **ignore** closed container	3
(iii)	C an ester (1)		1
(iv)	H_2O	**allow** OH_2	1

Question Number		Indicative Content	Mark
QWC	**6(b)***	ALKANES methane CH_4  ethane C_2H_6  propane C_3H_8  butane C_4H_{10}  alkanes have general formula C_nH_{2n+2} alkanes are saturated / single bonds only successive members of homologous series differ (in molecular formulae) by CH_2 ALKENES ethene C_2H_4  propene C_3H_6  A explanation to include some of the following points alkenes have general formula C_nH_{2n} alkenes are unsaturated / have C=C bond successive members of homologous series differ (in molecular formula) by CH_2	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description e.g. names and gives formula/structure/relevant comment for at least one alkane / alkene • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple description e.g. names and gives formulae/structures for some alkanes and alkenes with relevant comments. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed description e.g. names and gives formulae/structures for several alkanes and alkenes with relevant comments. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for paper = 60 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit C3: Chemistry in Action

Foundation Tier

Wednesday 17 June 2015 – 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.
- Keep an eye on the time.
- 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
							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.

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Questions begin on next page.

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 ☒.

Organic substances

1 Vinegar contains ethanoic acid.

(a) Which of these is a use of vinegar?

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

(1)

- ☐ **A** fuel
- ☐ **B** perfume
- ☐ **C** preservative
- ☐ **D** soap

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator .....

colour in acid .....

(c) Use the gases from the box to complete the sentences.

Each gas may be used once, more than once or not at all.

carbon dioxide	hydrogen	nitrogen	oxygen

(3)

(i) If a bottle of wine is left open, ethanoic acid is formed when ethanol in the wine is oxidised by ..... .

(ii) Ethanoic acid reacts with magnesium to give a gas. When the gas is mixed with air and ignited with a lighted splint, it gives a squeaky pop.

This gas is ..... .

(iii) When solid sodium carbonate is added to dilute ethanoic acid, effervescence occurs. The effervescence is bubbles of ..... .

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(d) Ethanoic acid is reacted with ethanol to produce an ester, ethyl ethanoate, and water.

Write the word equation for this reaction.

(2)

.....

.....

(Total for Question 1 = 8 marks)

Identifying ions

2 Tests are used to identify ions in three salts **X**, **Y** and **Z**.

(a) (i) In a flame test salt **X** gives a yellow flame.

What is the metal ion in salt **X**?

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

(1)

☒ **A** calcium, Ca^{2+}

☒ **B** lithium, Li^{+}

☒ **C** potassium, K^{+}

☒ **D** sodium, Na^{+}

(ii) Describe how a flame test is carried out on a solid.

(3)

.....

.....

.....

.....

.....

.....

(b) Salt **Y** is a sulfate.
Salt **Y** is dissolved in water.
Dilute hydrochloric acid is added to the solution.
Barium chloride solution is then added to the mixture.

Describe what you would **see** when the barium chloride solution is added.

(2)

.....

(c) Salt **Z** contains iron(III) ions, Fe^{3+}.

Describe what is **seen** when sodium hydroxide solution is added to a solution of **Z**.

(2)

.....

(Total for Question 2 = 8 marks)

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Water

3 (a) An acid can be reacted with a base in a titration experiment.

(i) State the name of the type of reaction when an acid reacts with a base.

(1)

.....

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

The general equation for the reaction of an acid with a base is

(1)

☒ **A** acid + base → alkali + water

☒ **B** acid + base → salt + carbon dioxide

☒ **C** acid + base → salt + water + hydrogen

☒ **D** acid + base → salt + water

(b) A solution of sodium hydroxide is prepared.

The mass of a container with solid sodium hydroxide is determined.
The sodium hydroxide is transferred to a flask.
The mass of the empty container is determined.
The sodium hydroxide is dissolved in water and the volume made up to 2 dm^3.

The results are
mass of container + solid sodium hydroxide = 17.12 g
mass of empty container = 7.02 g

The results are used to calculate the concentration of the sodium hydroxide solution.

(i) Calculate the mass of solid sodium hydroxide transferred to the flask.

(1)

.....

mass of solid sodium hydroxide = ... g

(ii) Calculate the concentration of the sodium hydroxide solution in g dm^{-3}.

(1)

.....

.....

concentration of sodium hydroxide solution = ... g dm^{-3}

(c) Some tap water is hard.
The hardness is caused by metal ions dissolved in the water.

(i) Give the name of a metal ion that causes tap water to be hard.

(1)

.....

(ii) Describe problems that can be caused by the use of hard water in the home.

(2)

.....

.....

.....

.....

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(iii) The hardness in a water sample can be measured by finding the volume of soap solution needed to form a permanent lather with a known volume of the water.

The hardness in three types of water, **A**, **B** and **C**, was measured.
Fresh samples of **A**, **B** and **C** were boiled and allowed to cool.
The hardness in the boiled samples was then measured.

The table shows the results.

type of water	volume of soap solution needed / cm^3	
	original sample	boiled sample
A	2	2
B	18	18
C	14	2

Hard water can be temporary hard water or permanent hard water.

Water **A** is soft water.

Explain, using the results in the table, the type of hardness in water **B** and in water **C**.

(3)

(Total for Question 3 = 10 marks)

Ethanol and homologous series

4 (a) Ethanol is produced by the fermentation of glucose solution.

(i) Give the name of the substance added to the glucose solution to provide the enzymes needed for fermentation.

(1)

.....

(ii) Fermentation produces a dilute solution of ethanol.

Which process is used to obtain a concentrated solution of ethanol from this dilute solution?

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

(1)

☒ **A** cracking

☒ **B** crystallisation

☒ **C** filtration

☒ **D** fractional distillation

(iii) Alcoholic drinks contain ethanol.
State the effect of drinking alcohol on a person's reaction times.

(1)

.....

.....

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(b) Propane, C_3H_8, and butane, C_4H_{10}, are members of the same homologous series, called the alkanes.

(i) Explain why both propane and butane are alkanes.

(2)

.....

.....

.....

(ii) Draw the structure of a molecule of butane, C_4H_{10}, showing all covalent bonds.

(2)

(c) Write the balanced equation for the combustion of methane, CH_4, in oxygen to form carbon dioxide and water.

(3)

.....

(Total for Question 4 = 10 marks)

Fertilisers

5 (a) Nitrogen reacts with hydrogen to form ammonia.

(i) Which of these is the balanced equation for this reaction?

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

(1)

☐ **A** $N + 3H \rightleftharpoons NH_3$

☐ **B** $N_2 + H_2 \rightleftharpoons NH_3$

☐ **C** $N_2 + 3H_2 \rightleftharpoons 2\,NH_3$

☐ **D** $N + H_3 \rightleftharpoons NH_3$

(ii) State the meaning of the symbol $\rightleftharpoons$ in an equation.

(1)

.....

.....

(b) Ammonia is used in the manufacture of some fertilisers.

(i) The table shows information about three fertilisers manufactured from ammonia.

substance	% by mass of nitrogen	% by mass of oxygen
ammonium nitrate	35	60
ammonium sulfate	21	48
urea	47	27

Use the information in the table to explain why urea might be the best fertiliser.

(2)

.....

.....

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(ii) When rivers flow through areas where fertilisers have been spread on the land, plants and animals that live in the rivers can be affected.

Explain how this happens.

(2)

*(c) A student is told to prepare pure, dry crystals of ammonium sulfate.

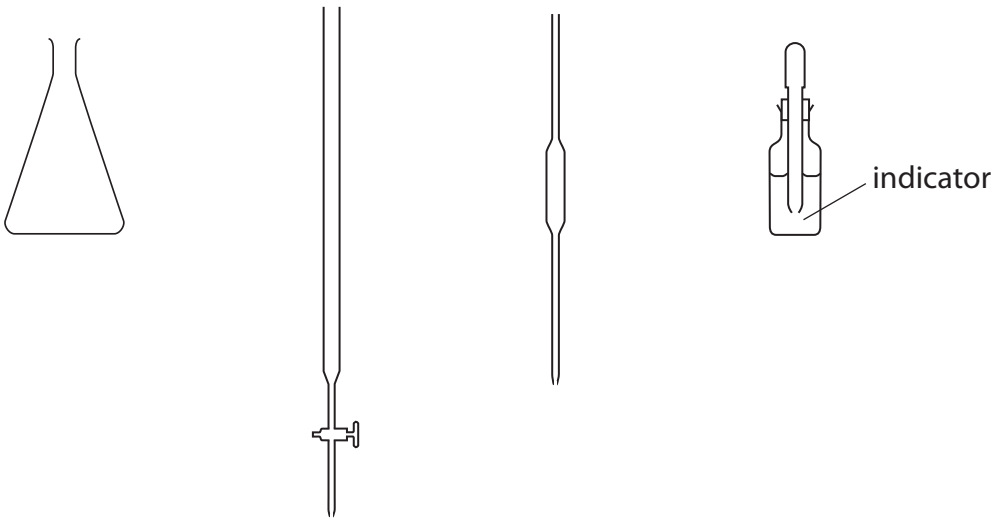
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



(Total for Question 5 = 12 marks)

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Electrolysis

6 A solution of sodium chloride contains the four ions shown in the box.

Na^+	Cl^-	OH^-	H^+

(a) The sodium chloride solution is electrolysed.

Give the formulae of the **two** ions that will be attracted to the positively charged electrode.

(1)

.....

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

When molten lead bromide is electrolysed the products are

(1)

☒ **A** lead and hydrogen

☒ **B** hydrogen and bromine

☒ **C** hydrogen and oxygen

☒ **D** lead and bromine

(c) During electrolysis, oxidation takes place at the anode and reduction takes place at the cathode.

Explain, in terms of electrons, what is meant by **oxidation** and **reduction**.

(2)

.....

.....

.....

.....

.....

(d) Explain why some metal objects are electroplated.

(2)

.....

.....

.....

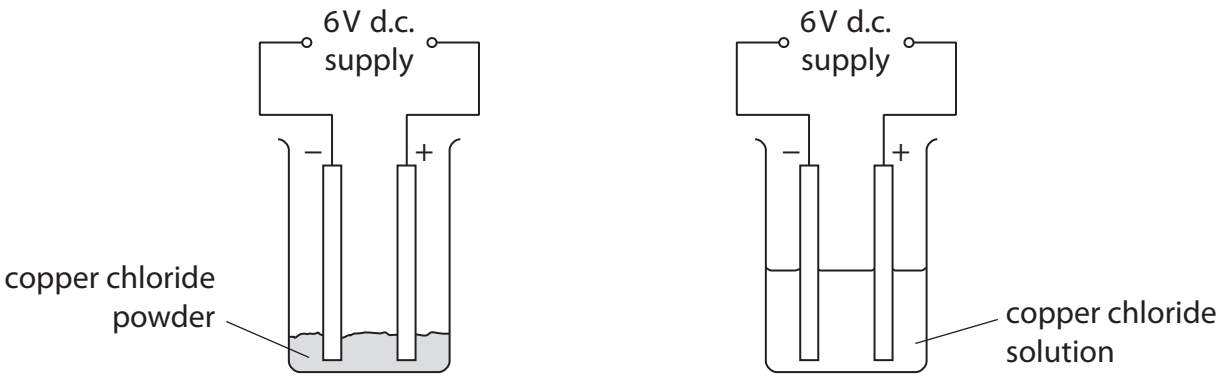
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*(e) Carbon electrodes were placed in copper chloride powder.

Some more copper chloride was dissolved in water to make a solution and carbon electrodes were placed in this solution.

In both cases the electrodes were connected to a direct current supply.



The following results were obtained.

substance tested	observation at the cathode (–)	observation at the anode (+)
copper chloride powder	no change	no change
copper chloride solution	red-brown solid formed	bubbles of a yellow-green gas

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Explain the results shown in the table for copper chloride powder and the copper chloride solution.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Chemistry (5CH3F) Paper 01 Unit C3: Chemistry in Action

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	**C** preservative		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	M1 named indicator (1) M2 correct colour (1) M2 dependent on M1	universal Indicator – yellow/orange/red methyl orange – red phenolphthalein – colourless (red/blue) litmus - red	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	oxygen (1)	O_2 reject O	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	hydrogen (1)	H_2 reject H	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(iii)	carbon dioxide (1)	CO_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	ethanoic acid + ethanol → ethyl ethanoate + water (2) left hand side (1) right hand side (1)	allow recognisable misspellings allow reactants and products in either order allow = for → allow correct formulae if formulae are used do not allow incorrect use of the subscripts / upper / lower case	**(2)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	**D** sodium, Na^+		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	A description including M1 CLEAN • (clean/dip) wire/test loop in (hydrochloric) acid (1) M2 SAMPLE • put solid / sample on (wire/test loop) (1) M3 TEST • hold (wire/test loop) in/at edge of (Bunsen) flame (1)	 ignore: water, but reject: other incorrect reagent do not allow use of tongs / spatula etc for M1, but can score M2 and M3 allow damp(en)/moisten splint allow dissolved solid / sample / solution on (wire/test loop) allow solid on to splint hold (splint) in/at edge of (Bunsen) flame allow solid held/put in flame ignore: hold <u>over</u> flame	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)	white (1) precipitate/solid (1)	ignore fizzing/bubbling/ effervescence ppt	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	(red-)brown (1) precipitate / solid (1)	ignore orange ppt	**(2)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	neutralisation (1)	accept recognisable spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	**D** acid + base → salt + water		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	17.12 – 7.02 (1) (=10.10/10.1) (g)	10.10/10.1 (g)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	$\frac{17.12 - 7.02}{2}$ (1) (=5.05) (g dm^{-3})	5.05 (g dm^{-3}) allow error carried forward from bi	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	calcium/magnesium (1)	Ca^{2+} / Mg^{2+} reject $CaCO_3$	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	A description linking any two from • (with soap forms) scum (1) • wastes soap/more soap needed (1) • (forms) scale / limescale (1) • (scale) blocks pipes (1) • (scale) wastes energy (1)	ignore references to cost alone	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	An explanation linking three of • B is permanent hard water (1) • (permanent) because same volume of soap solution /boiling has no effect (1) • C is temporary hard water (1) • (temporary) because smaller volume of soap solution required after boiling (1)	allow amount for volume different volumes	**(3)**

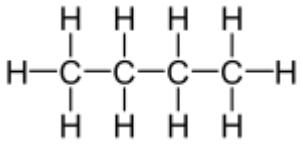
Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	Yeast		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	**D** – fractional distillation		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	increases	slower reactions ignore slows down/slower reaction time	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	An explanation including any two of the following • same general formula (1) • have similar/same chemical reactions/properties (1) • both saturated/(both only) have single bonds / (both) have no double bonds (1)	C_nH_{2n+2} = 2 marks allow both hydrocarbons / both contain hydrogen and carbon (only) allow both end in -ane allow (molecular) formulae differ by CH_2	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	fully correct (displayed) formula of butane (2)  M1 four carbon atoms joined by single bonds (1) M2 rest of molecule correct (1)	M2 dependent on M1 If methylpropane drawn fully correctly 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (3) LHS (1) RHS (1) balancing of correct formulae (1)	allow correct multiples allow reactants on LHS and products on RHS in either order ignore state symbols allow = for →	**(3)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**C** $N_2 + 3H_2 \rightleftharpoons 2\ NH_3$		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	reaction is reversible / goes both ways (1)	reaches equilibrium (1)	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	A description linking urea contains the highest percentage of nitrogen (1) (this is important because) nitrogen enables plants to grow (1)	 ignore references to oxygen	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	An explanation linking any **two** of the following points (excess) fertiliser is washed into rivers (by rainfall) (1) plants/algae (in the river) grow bigger / more quickly (1) oxygen is used up (by bacteria) when the plants decay/die (1) (this leads to) fish/animals die (due to lack of oxygen) (1)	 allow grow better / increases growth must indicate idea of an increase in growth/faster growth	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **Stage 1** • identifies pipette • pipette / measuring cylinder to measure out the ammonia solution (25 cm^3) • into a suitable container, e.g. conical flask **Stage 2** • add few drops of indicator / suitable named indicator • put flask on a white tile • identifies burette • fill burette with sulfuric acid solution • clamp burette / burette holder/stand • read level of burette • add acid from the burette • swirl flask (gently) • add drop-wise near end-point • until {indicator just changes colour / correct colour change for chosen indicator} • read level on burette • repeat experiment until concordant results owtte **Stage 3** • mix the same volumes of sulfuric acid and ammonia solution (determined from the titration experiment) • but leaving out the indicator **Stage 4** • pour into an evaporating dish • {heat the solution / leave to evaporate} to dryness, until pure salt crystals formed • to point of crystallisation/ concentrate solution • leave to cool • filter off crystals • wash with water • leave to dry	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description e.g. limited description of one stage / add one solution to the other • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description e.g. one stage in detail / attempt to describe more than one stage • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description e.g. add sulphuric acid to ammonia using indicator appropriately, good detail of equipment and of titration technique and some mention of producing crystals / detail description of producing crystals with some mention of titration • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	Cl^- and OH^-	Reject if any other ions given Allow names / chloride and hydroxide	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	**D** lead and bromine		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A explanation to include: oxidation is the loss of electrons (1) reduction is the gain of electrons (1)	 oxidation is the gain of electrons **AND** reduction is the loss of electrons (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(d)	A explanation to include any two from: to put a layer of one metal onto another metal (1) change / improve the appearance (of metal objects) (1) improve the resistance to corrosion (of metal objects) (1) qualified reference to cost eg thin layer of expensive metal on cheaper metal (1)	 allow to give shiny appearance / look nicer allow prevents corrosion ignore rusting unless linked to iron/steel	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(e)**	An explanation including some of the following points **copper chloride powder** • does not conduct • solid ionic compounds do not conduct • ions not free to move **copper chloride solution** • conducts • (ionic) solutions conduct • ions are free to move • red-brown solid is copper/copper produced at cathode • yellow green gas is chlorine/chlorine produced at anode **explanation in terms of ions for copper chloride solution** • negatively charged ions/chloride ions attracted to the anode • positively charged ions/copper ions attracted to the cathode More detailed explanation of electrode reactions/half equations not required but must be credited	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. products are identified • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation e.g. identifies the products and limited explanation of either powder or solution • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. a detailed explanation of copper chloride solution identifying the products • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number	Candidate Number

Chemistry

Unit C3: Chemistry in Action

Foundation Tier

Thursday 19 June 2014 – Afternoon
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.
- Keep an eye on the time.
- 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
							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.

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Questions begin on next page.

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 ☒.

Fertilisers and ammonia

1 (a) State why farmers spread fertilisers on their fields.

(1)

.....

.....

.....

(b) Using too much fertiliser can harm the environment.

Describe how the spreading of too much fertiliser on fields can harm the environment.

(2)

.....

.....

.....

.....

(c) Ammonium nitrate is a fertiliser.

Ammonium nitrate is formed when nitric acid reacts with ammonia.

(i) Write the word equation for this reaction.

(2)

..... + ... → .....

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(ii) This hazard symbol appears on a bottle of nitric acid.



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

This hazard symbol shows that the nitric acid is

(1)

☒ **A** corrosive

☒ **B** explosive

☒ **C** flammable

☒ **D** toxic

(d) In the Haber process, nitrogen and hydrogen react to form ammonia.

$$\text{nitrogen} + \text{hydrogen} \rightleftharpoons \text{ammonia}$$

(i) The $\rightleftharpoons$ symbol in the word equation shows that the reaction goes forwards and backwards at the same time.

Give the name of this type of reaction.

(1)

.....

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

The formula for a molecule of ammonia is

(1)

☒ **A** Am_3

☒ **B** HN

☒ **C** NH_3

☒ **D** N_3O

(Total for Question 1 = 8 marks)

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Ethanol

2 Ethanol can be made by fermentation.

(a) (i) In a fermentation reaction, yeast is added to sugar solution.

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

The yeast is added to the sugar solution because it

(1)

- ☐ **A** slows down the reaction
- ☐ **B** heats up the reaction
- ☐ **C** is an alcohol
- ☐ **D** provides enzymes

(ii) A teacher demonstrated the effect of temperature on fermentation.

She made a mixture of water, sugar and yeast.
Half of the mixture was kept in a flask at 40 °C and the other half was kept in a flask at 75 °C.

Ethanol was formed by fermentation at 40 °C.

Explain how the contents of the flask at 75 °C would be different from the contents of the flask at 40 °C.

(2)

.....

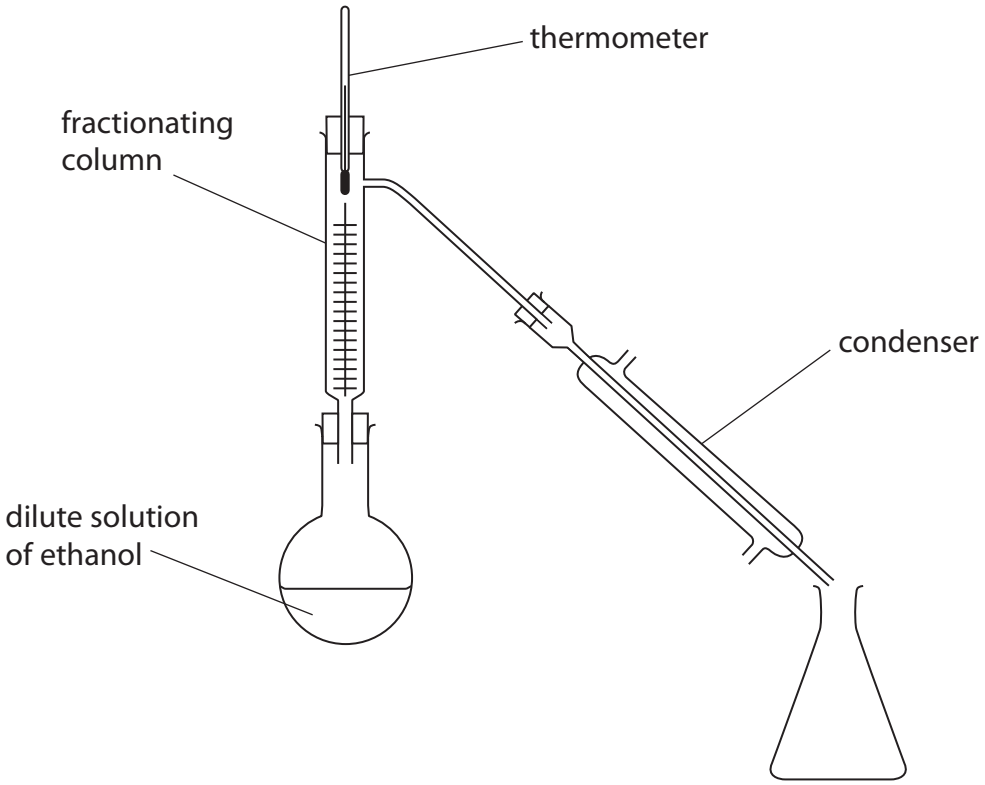
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.....

.....

.....

(b) A dilute solution of ethanol is concentrated by fractional distillation.



Describe how this apparatus is used to obtain a more concentrated solution of ethanol.

(2)

(c) Alcoholic drinks contain ethanol.

Explain why people should not drink alcoholic drinks before driving.

(2)

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(d) Ethanol is a member of an homologous series.
The members of this homologous series are called alcohols.
Methane and ethane are members of another homologous series.

Give the name of this other homologous series.

(1)

.....

(Total for Question 2 = 8 marks)

Tests for ions

3 (a) A flame test is used to identify some metal ions in salts.
A flame test was carried out on a salt.

The flame colour was orange-red.

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

The metal ion in the salt was

(1)

- ☒ **A** copper
- ☒ **B** sodium
- ☒ **C** potassium
- ☒ **D** calcium

(b) Some metal ions react with sodium hydroxide solution to produce coloured precipitates.

Draw one straight line from each metal ion to the colour of the precipitate formed when it reacts with sodium hydroxide solution.

(2)

metal ion	**colour of precipitate**
aluminium ions, Al^{3+}	blue
copper ions, Cu^{2+}	green
iron(III) ions, Fe^{3+}	red-brown
	white

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(c) Bromide ions in solution are detected by adding dilute nitric acid followed by silver nitrate solution.
A precipitate of silver bromide forms.

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

If bromide ions are present, the colour of the precipitate will be

(1)

- ☐ **A** white
- ☐ **B** cream
- ☐ **C** red
- ☐ **D** brown

(d) A salt contains carbonate ions.

Describe a test using dilute acid that shows the presence of carbonate ions.

(2)

(e) Water companies carry out tests on drinking water.

Explain why they need to test the water.

(2)

(f) A flame test is an example of qualitative analysis.

Explain the meaning of **qualitative** analysis and the meaning of **quantitative** analysis.

(2)

(Total for Question 3 = 10 marks)

Electrolysis

4 (a) When molten sodium chloride is electrolysed, the products are sodium and chlorine.

(i) Give the formula of sodium chloride.

(1)

.....

(ii) State why molten sodium is used in some nuclear reactors.

(1)

.....

.....

(b) Molten lead bromide is electrolysed.

(i) Complete the sentence describing the type of reaction.

(1)

During the electrolysis the lead ions gain electrons at the cathode.

The type of reactions in which metal ions gain electrons is called .....

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

Molten lead bromide, rather than solid lead bromide, has to be electrolysed because

(1)

☒ **A** ions can only move freely in molten lead bromide

☒ **B** electrolysis is too fast in solid lead bromide

☒ **C** molten lead bromide contains free electrons

☒ **D** lead bromide has a very low melting point

(iii) When molten lead bromide is electrolysed, a silver-coloured liquid is produced at the cathode and a red-brown gas is produced at the anode.

Complete the word equation by showing the products formed when molten lead bromide is electrolysed.

(2)

lead bromide → ..... + ...

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(c) Three colourless liquids, **A**, **B** and **C**, are tested.

Tests 1, 2 and 3 are carried out on each of these liquids.

Test 1: the liquid is tested to see if it conducts electricity.

Test 2: 20 cm^3 of the liquid is shaken vigorously with a few drops of soap solution.

Test 3: 20 cm^3 of the liquid is boiled and then test 2 is carried out on the boiled liquid.

The results are shown in the table.

liquid	observations		
	test 1	test 2	test 3
A	conducts	scum formed, no lather	scum formed, no lather
B	conducts	scum formed, no lather	lather formed
C	does not conduct	lather formed	lather formed

(i) State which of the liquids are electrolytes.

(1)

.....

(ii) Use the results of the tests to explain whether each of the liquids **A**, **B** and **C** is soft, shows permanent hardness, or shows temporary hardness.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

Salts

5 (a) A mass of magnesium sulfate was taken.

mass of watch glass + magnesium sulfate = 18.50 g

mass of watch glass = 18.20 g

The solid was dissolved in water to make 500 cm^3 solution.

Calculate the concentration of the magnesium sulfate solution in g dm^{-3}.

(1000 cm^3 = 1 dm^3)

(2)

.....

.....

.....

concentration = ... g dm^{-3}

(b) A titration is used to determine the exact volumes of sulfuric acid and sodium hydroxide solution that neutralise each other.

25.00 cm^3 of sodium hydroxide solution is put into a conical flask and a few drops of indicator solution are added.
The sulfuric acid is added slowly from a burette until the indicator changes colour when all the sodium hydroxide is just neutralised.

(i) State what is used to measure out 25.00 cm^3 of sodium hydroxide solution.

(1)

.....

(ii) State the name of an indicator that could be used and the colour change seen in this titration.

(3)

indicator .....

colour in sodium hydroxide solution .....

colour at end of titration .....

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*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

(Total for Question 5 = 12 marks)

Everyday substances

6 The chemical industry produces many useful products.

(a) Ethanol reacts with ethanoic acid to form ethyl ethanoate.

In general, alcohols react with carboxylic acids.

(i) Give the name of the type of organic substance formed when an alcohol reacts with a carboxylic acid.

(1)

.....

(ii) State why this type of organic substance is used in perfumes.

(1)

.....

.....

(b) Fleece jackets can be made from recycled polyesters.



Explain why polyesters are recycled to make fleece jackets.

(2)

.....

.....

.....

.....

(c) Describe how some soap could be made from an oil and concentrated sodium hydroxide solution.

(2)

*(d) Vinegar contains ethanoic acid.

Ethanoic acid is a typical acid.
All acids have some characteristic reactions in common.

Describe some characteristic reactions that show that ethanoic acid is a typical acid.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE
in Chemistry (5CH3F) Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	Increases {plant/ crop} growth/ yield/ size/ growth rate Adds minerals/ specified suitable element eg N, P, K/ nutrients	Allow synonyms for increase eg promote, helps, enhances etc Reject kills pests	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	A description linking two of the following • gets washed into water (1) • encourages growth of algae/ weed / algal bloom (1) • algae use up oxygen (1) • algae blocks sunlight (1) • **kills** aquatic life (1) • eutrophication (1) • contaminates drinking water (1)	Allow any sensible water eg river, lake etc but ignore sea Ignore damages, harms etc; allow any specified **water** life eg fish, **water** plants, animals **in water** Ignore effect of fertiliser on field eg on weeds.	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	ammonia + nitric acid → ammonium nitrate (2) Spelling must be correct but allow missing one 'm' from ammonia and/or ammonium	LHS (1) R ammonium RHS (1) R ammonia nitrate Allow fully correct balanced equation for 2 Ignore state symbols. If mixed words/symbols, any side with symbols scores 0.	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	**A** corrosive		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)(i)	(reaction is) **reversible** / (reaches dynamic) **equilibrium**	Allow equilibria R static equilibrium	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)(ii)	**C** NH_3		**(1)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	D provides enzymes		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking any two of • {no/little/less} ethanol formed • {no/little/less} fermentation/ reaction • enzyme denatured/damaged/ does not work/ works less well/ changes shape	ignore enzyme killed/died	**(2)**

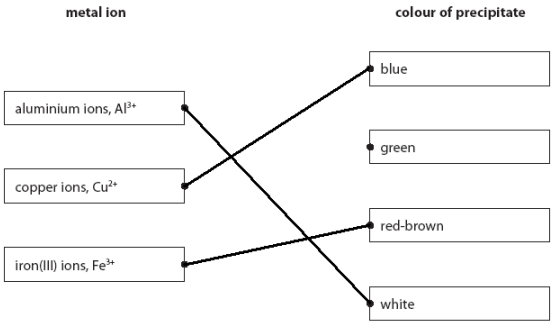
Question Number	Answer	Acceptable answers	Mark
2(b)	A description linking • heat /use of Bunsen with any one of • ethanol has low(er) boiling point/ boils at 78°C • ethanol distils/ boils/ evaporates (first) • condenser cools the vapour / ethanol condenses	Ignore references to less water in the resultant liquid or to any prior or subsequent separation techniques.	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking any two of • alcohol impairs thought processes/concentration/vision / judgment/coordination/ makes sleepy / dizzy • increases reaction times/thinking time/ affects motor skills/ makes more aggressive /slows your reactions • increases risk of accident/ driving would be more careless/ hazardous	Must be reasonably specific eg allow 'impairs thinking', do not allow 'affects the brain'	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	alk**a**ne(s) Exact spelling required	reject alk**e**ne(s)	**(1)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**D** calcium		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	three correct lines – 2 marks two correct lines – 1 mark  	If more than one line leaves a metal ion on the left, ignore them.	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	**B** cream		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)	A description linking any two from • (mix then) effervesces/ fizzes/ bubbles (1) • gas into limewater (1) • limewater goes cloudy/ milky/ white (1)	Ignore carbon dioxide	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(e)	A description including • check whether water is: pure/ contaminated (or not)/ safe (to drink)/ will not cause illness • to detect toxins / harmful substances / bacteria / named disease /chlorine/ hardness/ to find what substances are present in water / to meet UK standards	Ignore clean	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(f)	• qualitative – what is present (1) • quantitative – how much / what quantity (1) If definitions reversed or unspecified (eg 'one tells you what is there, one how much', allow 1	Do not allow 'quality'	**(2)**

(Total for Question 3 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	NaCl	Must be capital N, C; small a, l	**(1)**

Question Number	Answer	acceptable answers	Mark
4(a)(ii)	as a coolant/ removes **heat** energy	(good) conductor of heat Ignore what would happen if no coolant eg 'meltdown' etc.	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	reduction Exact spelling required.		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	**A** ions can only move freely in molten lead bromide		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	(lead bromide →) lead (1) + brom**in**e (1)	reject bromide or any formulae ignore state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	**A** and **B** both required for mark.		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	• **A** permanent hardness because scum/ no lather (even after boiling) (1) • **B** temporary hardness because lather /no scum (only) after boiling (1) • **C** soft because lather / no scum (before boiling) / does not conduct /no ions (1)	If no or some/all incorrect explanations, then allow: 3 correctly classified with 2 correct explanations = 3 marks 3 correctly classified with 1 correct explanation = 2 marks 3 correctly classified with 0 correct explanations = 1 Allow statements such as 'only in test 3' to mean 'after boiling'	**(3)**

(Total for Question 4 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)	mass of magnesium sulfate = 18.50 – 18.20 (1) (= 0.30 (g)) conc = ans to subtraction /0.3 (1) 0.5 (= 0.6 g dm^{-3})	Allow mark if you see 0.3 Give 2 if answer is 0.6.	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	pipette allow any recognisable spelling.		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	named indicator (1) colour in alkali (1) colour at end point / in acid (1) for example: phenolphthalein (1) pink/ purple (1) colourless (1) methyl orange (1) yellow (1) orange/pink (1)	if no indicator named/ substance named is not an indicator then score 0 for whole part. Indicator spelling has to be recognisable. Litmus (paper/ solution) allowed if universal indicator (allow 'indicator paper') **and** correct colours (allow neutral or acid colour for colour at end) allow 1 mark only.	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **Salt formation** • measure sulfuric acid into a beaker / suitable vessel • stir • heat / warm beaker and sulfuric acid (over a Bunsen flame) • add copper oxide • until solid remains **Separation** • filter the mixture • to remove excess / unreacted copper oxide **Crystallisation** • collect filtrate / copper sulfate solution in an evaporating basin • heat until concentrated / half evaporated • allow to cool and crystallise • pour off remaining solution to leave crystals • dry crystals eg filter paper/ oven/warm place	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. add copper oxide to sulfuric acid in a beaker and mix/stir • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. add copper oxide to sulfuric acid in a beaker until no more reacts and filter off the unreacted copper oxide • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. add copper oxide to sulfuric acid, filter, allow filtrate to crystallise, dry crystals • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	ester allow any recognisable spelling.		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	{pleasant / sweet/ fruity} **smell**	allow nice smell / ester is soluble in alcohol / ester is non-toxic [must be specific for this mark]	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation to include any two from: • used to form fibres • cheaper clothing • stops landfill filling up/ polyesters non-biodegradable • reduces waste / polyester is not wasted • preserves **oil** supplies • less energy required to recycle	Ignore 'environmentally friendly' and other slogans Note: answer must be about why recycling occurs, not about properties of polyester as such	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A description to include any two from • mix oil and alkali <u>in suitable container</u> • heat / boil mixture • add sodium chloride / salt • scrape / filter off soap • suitable safety precaution: glasses / gloves		**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description including some of the following points neutralisation reactions attempts at balanced equations are creditworthy (eg even if incorrect, evidence of knowledge of products can be given) **reaction with metals** reacts with metals eg magnesium effervescence / gas/ bubbles/ hydrogen salt formed **reaction with bases** reacts with bases eg sodium hydroxide water formed salt formed **reaction with carbonates** reacts with carbonates effervescence / gas / bubbles carbon dioxide evolved salt formed **effect on indicators** changes colour of acid-base indicators named indicator colour change pH less than 7	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. a brief indication of one reaction • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. a brief indication of two characteristic reactions • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. two reactions with one well developed in its description • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 6 = 12 marks)

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number | Candidate Number

Chemistry

Unit C3: Chemistry in Action

Foundation Tier

Thursday 23 May 2013 – 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.
- Keep an eye on the time.
- 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
							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.

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Questions begin on next page.

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 ☒.

Ammonia and fertilisers

1 In the Haber process nitrogen and hydrogen are reacted together to form ammonia.

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

The nitrogen used in the Haber process is obtained from

(1)

- ☒ **A** air
- ☒ **B** coal
- ☒ **C** crude oil
- ☒ **D** sea water

(b) The balanced equation for the reaction forming ammonia is

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) All substances in this reaction are in the same physical state.

Give the name of this physical state.

(1)

.....

(ii) State the meaning of the symbol $\rightleftharpoons$ in the equation.

(1)

.....

.....

(c) Some ammonia is reacted with sulfuric acid to make ammonium sulfate.

Write the word equation for this reaction.

(2)

.....

(d) Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

.....

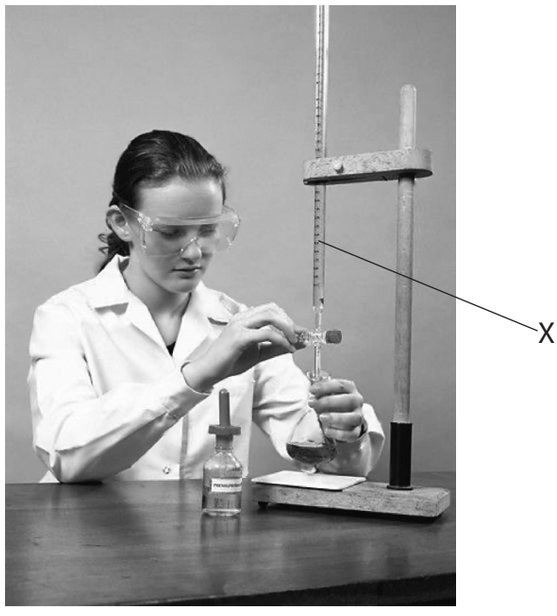
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(e) Titration can be used to determine the exact volume of ammonia solution that reacts with 25.0 cm^3 of sulfuric acid.

The photograph shows a student carrying out a titration.

(1)



(i) Give the name of the piece of apparatus labelled X.

.....

(ii) State what is added to the sulfuric acid to show when it has been neutralised by the ammonia solution.

(1)

.....

(Total for Question 1 = 8 marks)

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Testing substances

2 (a) A technician had two bottles, each containing a solid.
The labels had fallen off the bottles.
The two labels were:

sodium sulfate	**potassium chloride**

The technician carried out the following tests.

(i) A flame test was carried out on each solid.
One solid produced a yellow colour in the Bunsen flame.
Give the name of the ion that produces this yellow colour.

(1)

.....

(ii) Dilute hydrochloric acid was added to a solution of each solid.
Then barium chloride solution was added.
A white precipitate was seen in one of the mixtures.
Give the name of the ion that produces this white precipitate.

(1)

.....

(b) Describe how the technician should carry out a flame test on a solid.

(2)

.....

.....

.....

.....

(c) Describe what you would **see** when sodium hydroxide solution is added to a solution containing iron(III) ions, Fe^{3+}.

(2)

.....

.....

.....

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(d) When dilute hydrochloric acid is added to copper carbonate, a gas is produced.

Describe a test to show that this gas is carbon dioxide.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

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Organic chemistry

3 (a) Ethanol is produced by the fermentation of glucose solution.

(i) Describe how this fermentation is carried out.

(2)

.....

.....

.....

.....

(ii) Complete the word equation for the fermentation of glucose.

(2)

glucose → ..... + ...

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

Fermentation produces a dilute solution of ethanol.

A concentrated solution of ethanol is produced from a dilute solution by

(1)

☒ **A** cracking

☒ **B** dehydration

☒ **C** fractional distillation

☒ **D** polymerisation

(iv) State a possible harmful effect of consuming too many alcoholic drinks.

(1)

.....

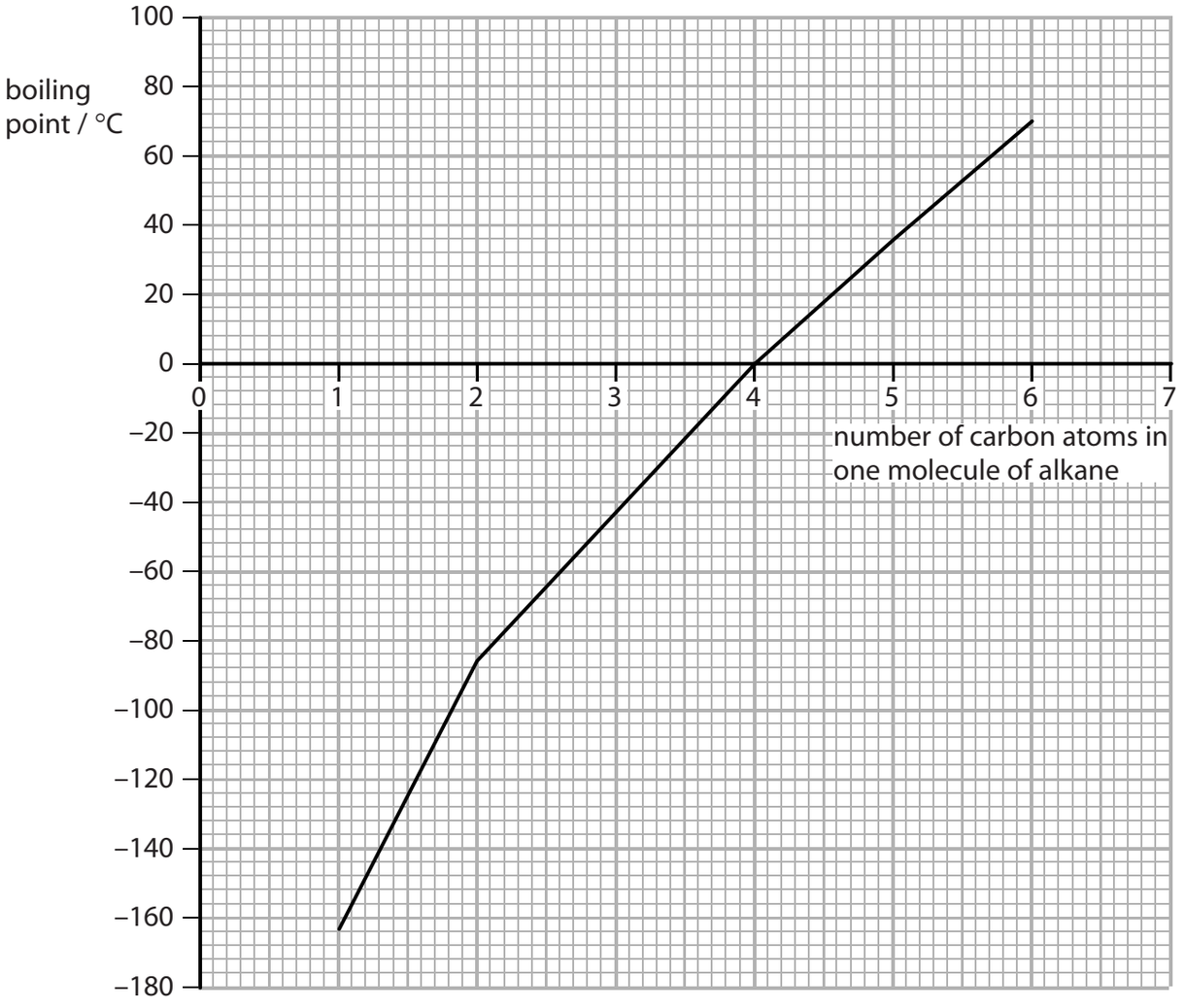
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(b) The graph shows the boiling points of some alkanes.

The boiling point of each alkane is plotted against the number of carbon atoms in one molecule of the alkane.



(i) A molecule of pentane contains five carbon atoms.
Use the graph to suggest the boiling point of pentane.

(1)

boiling point of pentane = ... °C

(ii) State how the boiling points of these alkanes change as the number of carbon atoms in one molecule of each alkane increases.

(1)

.....

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(c) (i) Which of the following is the formula for a molecule of ethane?

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

(1)

☒ **A** CH_4

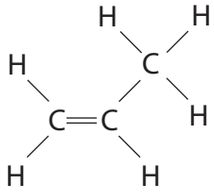
☒ **B** C_2H_4

☒ **C** C_2H_6

☒ **D** C_3H_8

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

The structure of a molecule of a substance is shown.



The substance is

(1)

☒ **A** ethene

☒ **B** propane

☒ **C** propene

☒ **D** butane

(Total for Question 3 = 10 marks)

Ethanoic acid

4 (a) A bottle of wine is opened and left exposed to the air for a few days.
The ethanol in the wine reacts with oxygen from the air to form ethanoic acid.

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

In this reaction the ethanol is

(1)

☒ **A** hydrated

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

(b) Vinegar is a dilute solution of ethanoic acid.

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

Vinegar is used as a

(1)

☒ **A** fibre

☒ **B** fuel

☒ **C** perfume

☒ **D** preservative

(c) State the colour of Universal indicator in a solution of ethanoic acid.

(1)

.....

(d) The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

(2)

CH_3COOH + ... → CH_3COONa + ...

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(e) When magnesium is added to dilute ethanoic acid, a colourless gas is formed. This gas gives a squeaky pop when mixed with air and ignited.

Give the name of the gas given off in this reaction.

(1)

.....

(f) Ethanoic acid reacts with ethanol to form ethyl ethanoate.

(i) Write the word equation for this reaction.

(2)

.....

(ii) Ethyl ethanoate is an ester.

Explain **one** use of esters.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

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Electrolysis

5 (a) A solution contains a mixture of ions with the formulae shown.

Na^+	Cl^-	Mg^{2+}	SO_4^{2-}

Give the formulae of **all** the ions that will be attracted to the negatively charged cathode during electrolysis.

(1)

.....

(b) During electrolysis, reduction takes place at the cathode.

Explain, in terms of electrons, what is meant by reduction.

(2)

.....

.....

.....

.....

(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

.....

.....

.....

.....

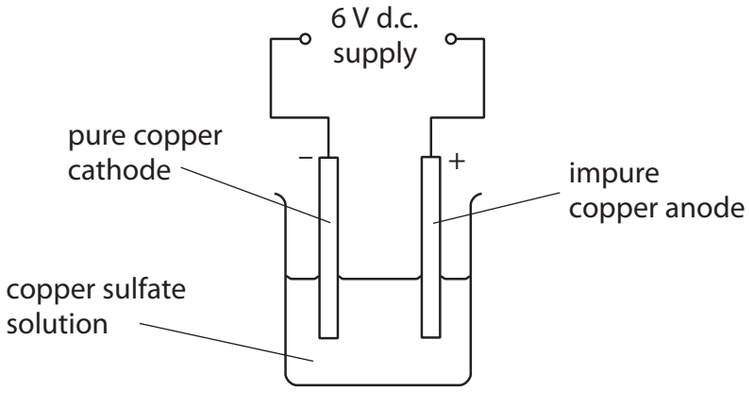
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*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

(Total for Question 5 = 12 marks)

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Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

.....

.....

.....

.....

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

.....

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(c) Samples of tap water from city A and city B were investigated.

Each sample of water was treated as follows.
The mass of an empty evaporating basin was determined.
500 cm^3 of tap water was added and evaporated to dryness.
The mass of the evaporating basin and remaining solid was determined.

Here are the results.

	city A	city B
mass of evaporating basin / g	261.500	258.450
mass of evaporating basin + solid / g	261.611	258.515
mass of solid / g	0.111	
concentration of dissolved solid in tap water / g dm^{-3}	0.222	

Calculate the concentration, in g dm^{-3}, of dissolved solid in the tap water from city B.

(2)

concentration of solid = ... g dm^{-3}

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*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Chemistry (5CH3F)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)	A – air		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	gas	ignore g alone	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	reaction is reversible / reaction goes both ways	reaction is in /reaches equilibrium	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	ammonia + sulfuric acid → ammonium sulfate (2) left hand side (1) right hand side (1)	Allow = for →	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	improve crop yields / promote plant growth	crops grow faster adds essential elements / OWTTE	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(e)(i)	burette		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(e)(ii)	indicator / any named acid-base indicator	ignore Universal indicator	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	sodium	Na^+ or Na	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	sulfate	SO_4^{2-} or SO_4	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	A description including two points from CLEAN • clean (flame test) wire with (hydrochloric) acid (1) SAMPLE • put (wire) into solid (1) TEST • hold (wire) in (Bunsen) flame (1)	• moisten splint • put splint into solid • hold splint in (Bunsen) flame ignore : hold <u>over</u> flame use of tongs / spatula etc for equipment, max 1 if yellow flame, max 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	A description including red-brown (1) precipitate / solid (1)	brown / red / orange or combinations of these (1) ppt (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	A description including (pass gas into) { limewater / calcium hydroxide solution} (1) which turns {milky / cloudy / white precipitate} (1)	2^{nd} mark dependent on 1^{st} MP ignore : puts out a flame	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	A description including 2 points from add yeast (to the glucose solution) (1) anaerobic conditions/in absence of air/attach airlock/insert plug of cotton wool (1) warm / less than 40^{o}C (1)	correctly named enzyme for fermentation eg zymase	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	ethanol (1) carbon dioxide (1)	C_2H_5OH CO_2	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	C – fractional distillation		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iv)	any harmful effect eg alcoholism / liver damage / slows reactions / anti-social behaviour / injuries / become drunk / depression / damage to (suitable named) organs / damage to foetus	danger to others / alcohol poisoning ignore affects reaction times alone	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	36 ±1 (^{o}C)		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	increases /OWTTE		**(1)** **grad**
Question Number	Answer	Acceptable answers	Mark
3(c)(i)	**C** C_2H_6		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	**C** propene		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)	**C** oxidised		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	**D** preservative		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	yellow / orange /red (1)	Combinations of yellow/orange/red pink	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)	(CH_3COOH +) NaOH (1) (→ CH_3COONa +) H_2O (1)	NaHO ignore attempts to balance	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	hydrogen	H_2 ignore H	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(f)(i)	ethanoic acid + ethanol → ethyl ethanoate + water (2)	correct spellings only left hand side (1) right hand side (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(f)(ii)	An explanation linking use (1) property (1) eg perfumes /cosmetics (1) pleasant smelling (1) other uses include flavourings / solvents	property dependent on use ignore 'sweet smelling' use – nail varnish remover property – acts as solvent for polyester: use – (polyester) to make clothing property – can be made into fibres	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	Na^+ **and** Mg^{2+}	reject if any other ions are given allow names	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking (reduction is) gain of electrons(2)	 if cathode gains electrons – 1 mark loss of oxygen – 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	An explanation linking three of the following {ions / particles} cannot move in solid (1) {ions / particles} move **in molten liquid** / lattice structure is **broken on melting** (1) {bromide (ions) / negatively charged (ions /bromine)} {move / attracted} to anode (1) bromide (ions) lose electrons / (bromide ions) are oxidised(1) to form bromine atoms (1) bromine molecules / Br_2 formed (1)	 Half equation, even unbalanced, showing bromide ions losing electrons (2)	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	A description / explanation including some of the following points anode • the anode decreases in mass / size • copper atoms form ions by losing electrons • copper ions pass into electrolyte • oxidation takes place at the anode • (anode) sludge forms as • impurities {are left behind / fall to the bottom} (under electrode) cathode • the cathode increases in mass / size • copper ions gain electrons to form copper • pure copper deposits on the cathode • reduction takes place at the cathode electrolyte • copper sulfate solution does not change in colour • no change in concentration of copper ions • copper ions in the electrolyte move toward the cathode	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. copper leaves the anode and deposits on the cathode. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. copper leaves the anode and deposits on the cathode and impurities fall to the bottom of the beaker. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description and explanation e.g. copper atoms from the anode lose electrons to form copper ions; copper ions are attracted to the cathode where they gain electrons to form pure copper. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	A description including excess magnesium oxide (1) filter (to remove excess solid / magnesium oxide) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$ (2) left hand side (1) right hand side (1)	max 1 if incorrect balancing	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A calculation involving mass of solid = 258.515 – 258.450 (1) (= 0.065 g) concentration = $0.065 \times \frac{1000}{500}$ (1) (= 0.130 (g dm^{-3}))	allow TE from mass of solid for second mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description including some of the following points • hardness caused by dissolved calcium and/or magnesium ions • boiling water • removes temporary hardness only / not permanent hardness • ions removed • by formation of limescale / calcium carbonate • ion exchange resin • run tap water through resin • calcium and / or magnesium ions are exchanged for other ions • which do not cause hardness allow full credit for use of other correct methods such as use of washing soda	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. temporary hardness by boiling water / permanent hardness (& temporary hardness) by ion exchange • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. use of ion exchange and boiling water removes ions causing hardness • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a simple description and explanation e.g. boiling water removes only temporary hardness, ion exchange resin removes both types of hardness, by removing calcium and/or magnesium ions from hard water • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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