Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit C3: Chemistry in Action

Higher Tier

Wednesday 22 June 2016 – Morning
Time: 1 hour

Paper Reference
5CH3H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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P 4 5 9 3 2 A 0 1 2 0

PEARSON

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 ☒.

Hard and soft water

1 20 cm^3 samples of waters, **A**, **B**, **C** and **D**, are tested for hardness by adding soap solution and shaking the mixture.
The soap solution is added until a permanent lather is formed.

Each sample of water is tested before and after boiling.

The results are shown.

water sample	volume of soap solution needed to form permanent lather / cm^3	
	before boiling	after boiling
A	0.1	0.1
B	5.0	2.0
C	7.5	7.5
D	3.0	0.1

(a) (i) Which of the water samples is most likely to be pure water?

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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Which water sample is most likely to contain **only** temporary hardness?

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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) Without using soap solution, describe how you would show that a sample of hard water contains dissolved solid.

(2)

(c) Explain one method which removes both temporary **and** permanent hardness from water.

(2)

(d) Explain a disadvantage of having a domestic water supply that is hard.

(2)

(Total for Question 1 = 8 marks)

Ions

2 (a) The qualitative test for chloride ions in solution is

add dilute nitric acid
then add silver nitrate solution

(i) Describe what you **see** if this test is carried out on a solution containing chloride ions.

(2)

.....

(ii) What is the **ionic equation** for the reaction that occurs between silver nitrate solution and potassium chloride solution?

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

(1)

☒ **A** $AgNO_3 + Cl^- \rightarrow AgCl + NO_3^-$

☒ **B** $AgNO_3 + KCl \rightarrow AgCl + KNO_3$

☒ **C** $Ag^+ + KCl \rightarrow AgCl + K^+$

☒ **D** $Ag^+ + Cl^- \rightarrow AgCl$

(iii) Doctors often request blood tests. The tests they require to be carried out are quantitative tests.

Describe the difference between a **qualitative** and a **quantitative** test.

(2)

.....

.....

.....

.....

(b) Describe a test to show that aluminium iodide contains aluminium ions.

(3)

(Total for Question 2 = 8 marks)

Ammonia

3 (a) Ammonia gas, NH_3, is formed by reacting ammonium chloride, NH_4Cl, with sodium hydroxide, NaOH.

$$NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3$$

In an experiment 4.0 g of sodium hydroxide react completely with ammonium chloride.

Calculate the maximum volume, in dm^3, of ammonia gas formed at room temperature and pressure.
(relative atomic masses: H = 1.0, N = 14, O = 16, Na = 23, Cl = 35.5
one mole of any gas occupies 24 dm^3, measured at room temperature and pressure)

(3)

maximum volume of ammonia = ... dm^3

(b) Ammonia is manufactured using the Haber process.

The reaction of nitrogen with hydrogen to form ammonia is exothermic.
The process is carried out at 450 °C.
This reaction can reach a dynamic equilibrium.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

(i) Explain what is meant by **dynamic equilibrium**.

(2)

.....

.....

.....

.....

(ii) Explain why a temperature of 450 °C is used for this process even though a higher temperature would increase the rate of production of ammonia.

(2)

.....

.....

.....

.....

(c) When ammonia gas is dissolved in water, an alkaline solution is formed.
State the name and the formula of the ion which causes the solution to be alkaline.

(2)

name .....

formula .....

(Total for Question 3 = 9 marks)

Electrolysis

4 (a) Which of the following does **not** conduct electricity?

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

(1)

☒ **A** sodium chloride crystals

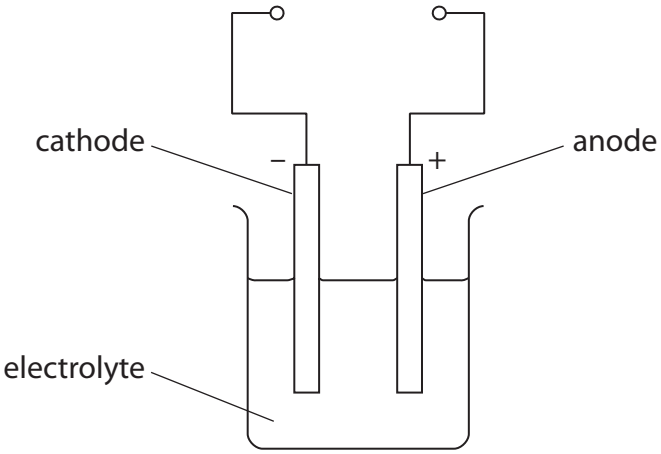
☒ **B** sodium chloride solution

☒ **C** molten sodium chloride

☒ **D** seawater

(b) Impure copper is purified by electrolysis.

A diagram of the apparatus that can be used is shown.



(i) Describe the use of this apparatus to purify a piece of impure copper.

(4)

(ii) During the electrolysis a deposit forms under the anode.

Explain how this deposit forms.

(2)

.....

.....

.....

(c) (i) In the electrolysis of molten lead bromide, $PbBr_2$, the half equation for the reaction occurring at the cathode is

$$Pb^{2+} + 2\ e \rightarrow Pb$$

Explain what **type** of reaction is shown in this equation.

(2)

.....

.....

(ii) Bromine, Br_2, is formed at the anode.
Write the half equation for the reaction occurring at the anode.

(2)

.....

(Total for Question 4 = 11 marks)

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Ethanoic acid

5 (a) (i) Ethanoic acid, CH_3COOH, reacts with ethanol to form ethyl ethanoate and water.

Complete the equation for the reaction by adding the formula of ethyl ethanoate.

(1)

(ii) Ethanoic acid is a typical acid.

State what you would **see** if solid calcium carbonate is added to some dilute ethanoic acid.

(1)

.....

.....

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

(1)

1.0 dm^3 of ethanoic acid solution, CH_3COOH, contains 6.0 g of ethanoic acid.
(relative molecular mass: $CH_3COOH = 60$)

The concentration of ethanoic acid, in mol dm^{-3}, is

☒ **A** 0.1

☒ **B** 0.6

☒ **C** 1.0

☒ **D** 10.0

*(c) Sodium ethanoate solution can be formed by neutralising sodium hydroxide solution with dilute ethanoic acid.

Pure crystals of sodium ethanoate can be obtained from this solution.

The volumes of sodium hydroxide solution and dilute ethanoic acid required to form the pure sodium ethanoate solution must be found by titration.

Describe how you would prepare a pure solution of sodium ethanoate from sodium hydroxide solution and dilute ethanoic acid, and how you would obtain pure, dry sodium ethanoate crystals from this solution.

(6)

(d) In an experiment 25.0 cm^3 of 0.0100 mol dm^{-3} ethanoic acid, CH_3COOH, was titrated with 0.0200 mol dm^{-3} sodium hydroxide solution, NaOH.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

Calculate the volume, in cm^3, of 0.0200 mol dm^{-3} sodium hydroxide solution needed to neutralise the ethanoic acid in this experiment.

(3)

volume of sodium hydroxide solution needed = ... cm^3

(Total for Question 5 = 12 marks)

Organic chemistry

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

(1)

Butane is an alkane.

The formula of a molecule of butane is

☒ **A** C_3H_6

☒ **B** C_4H_{10}

☒ **C** C_3H_8

☒ **D** C_4H_8

(b) Ethanol is an alcohol.

Ethanol is present in various alcoholic drinks, such as wine, beer and whisky.

(i) It is dangerous to drive after having an alcoholic drink.

Suggest why it is more dangerous to drive a car after drinking 25 cm^3 of whisky than it is after drinking 25 cm^3 of beer.

(2)

.....

.....

.....

.....

(ii) If a bottle of wine is left open to the air, some of the ethanol is converted into ethanoic acid.

Give the name of the homologous series in which ethanoic acid is found.

(1)

.....

(c) Propanol, C_3H_7OH, can be dehydrated to form propene.

Write the balanced equation for this reaction.

(2)

.....

*(d) The table gives information about four substances, **A**, **B**, **C** and **D**.

The substances, in no particular order, are ethane, ethanoic acid, ethanol and ethene.

	substance A	**substance B**	**substance C**	**substance D**
symbols of all atoms found in the formula	C H	C H O	C H O	C H
oxidises when left in the air	no	yes	no	no
observation when magnesium added	no reaction	no reaction	effervescence	no reaction
observation when added to sodium carbonate solution	no reaction	no reaction	effervescence	no reaction
observation when bromine water added	orange to colourless	stays orange	stays orange	stays orange
can be polymerised	yes	no	no	no

Identify substances **A**, **B**, **C** and **D**, explaining how you have used the information in the table to identify them.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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