Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit C3: Chemistry in Action

Higher Tier

Wednesday 17 June 2015 – 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.
- 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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P 4 4 6 8 6 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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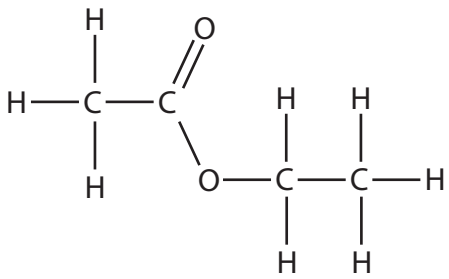
Questions begin on next page.

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 ☒.

Saturated and unsaturated organic compounds

1 The structure of a molecule of an ester, ethyl ethanoate, is shown.



(a) (i) Give the molecular formula of this compound.

(1)

.....

(ii) Write the word equation for the reaction of ethanol with another compound to form ethyl ethanoate and another product.

(2)

.....

(iii) A hazard from the ethyl ethanoate fact sheet is shown in the box.

Exposure to the vapour of ethyl ethanoate can cause you to feel dizzy or to faint

Suggest why, despite this hazard, it is still safe to use ethyl ethanoate in sweets.

(1)

.....

.....

.....

.....

(b) Vegetable oils and fats are esters.

One of these oils is boiled with concentrated sodium hydroxide solution.
The mixture is poured into concentrated sodium chloride solution.
A white solid is formed.

(i) What type of substance is the white solid?

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

(1)

☒ **A** alcohol

☒ **B** fat

☒ **C** polyester

☒ **D** soap

(ii) The white solid is formed in a mixture with a solution of other substances.

Describe how a pure sample of the white solid can be obtained from this mixture.

(2)

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

Liquid oils can be converted into solid fats by hydrogenation.

In this reaction

(1)

☒ **A** a salt and water are formed

☒ **B** the liquid oil is reacted with oxygen gas

☒ **C** unsaturated molecules in the liquid oil become saturated

☒ **D** C═C bonds are formed

(Total for Question 1 = 8 marks)

Identifying salts

2 (a) A technician had two bottles containing solid salts.
One bottle contained a potassium salt and the other contained a sodium salt.
Unfortunately the labels had fallen off the bottles.
The technician tested the salts to find the ions present.

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

Both salts contained the same anion.

A solution of one salt was made and some dilute nitric acid was added.
Drops of silver nitrate solution were added.
A yellow precipitate formed.

This test shows the anion in the salt is

(1)

☒ **A** bromide, Br^-

☒ **B** chloride, Cl^-

☒ **C** iodide, I^-

☒ **D** sulfate, SO_4^{2-}

(ii) The technician wanted to find out which bottle contained the sodium salt and which bottle contained the potassium salt.

Explain how the technician should do this.

(2)

.....

.....

.....

.....

(b) When sodium hydroxide solution is mixed with a solution containing copper ions, Cu^{2+}, copper hydroxide, $Cu(OH)_2$, is formed.

(i) Describe what you would **see** when these solutions are mixed.

(2)

.....

.....

(ii) Write the ionic equation for this reaction.

.....

(3)

(Total for Question 2 = 8 marks)

Ethanol

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

Yeast is needed for the fermentation reaction.

(i) State **two** other conditions for fermentation.

(2)

.....

.....

.....

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

A dilute solution of ethanol can be converted to a concentrated solution of ethanol by

(1)

☒ **A** filtration

☒ **B** fractional distillation

☒ **C** dehydration

☒ **D** cracking

(iii) Write the balanced equation for the fermentation of glucose, $C_6H_{12}O_6$.

(2)

.....

(b) In industry, ethene is converted to ethanol.

(i) State **two** conditions for this reaction.

(2)

(ii) A country has large reserves of crude oil.

It is a relatively wealthy country with a large population but it has only a small amount of fertile land.

Explain why the country would prefer to produce its ethanol from ethene rather than by fermentation.

(3)

(Total for Question 3 = 10 marks)

Gases

4 (a) Propene is a gaseous hydrocarbon.

Draw the structure of a molecule of propene, showing all bonds.

(2)

(b) Nitrogen reacts with hydrogen to form ammonia.

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

(i) Calculate the minimum volume of nitrogen, in dm^3, required to react completely with 1000 dm^3 of hydrogen.

All volumes are measured at the same temperature and pressure.

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

(1)

☒ **A** 333 dm^3

☒ **B** 1000 dm^3

☒ **C** 3000 dm^3

☒ **D** 4666 dm^3

(ii) The minimum volumes of nitrogen and hydrogen that must react completely to form 5000 dm^3 of ammonia are calculated.

These volumes are mixed and left, under appropriate conditions, until the reaction reaches equilibrium.

Explain which gas or gases will be present when equilibrium is reached.

(2)

.....

.....

.....

.....

(iii) The Haber process is carried out under a pressure of about 200 atm.

Explain the effect on the **equilibrium yield** of ammonia, if the process is carried out at a pressure higher than 200 atm.

(2)

(iv) Explain the effect on the **rate of attainment of equilibrium**, if the process is carried out at a pressure higher than 200 atm.

(3)

(Total for Question 4 = 10 marks)

Water

5 (a) A solution is made by dissolving calcium chloride in water.

11.1 g of calcium chloride are dissolved in water.

The volume of the solution is made up to 500 cm^3.

Calculate the concentration, in mol dm^{-3}, of calcium chloride, $CaCl_2$, in this solution.

(relative atomic masses: Cl = 35.5, Ca = 40.0)

(3)

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

(b) The concentration of a solution of an alkali can be determined by titration with an acid.

25.0 cm^3 portions of the solution of the alkali are transferred into a conical flask and titrated with the acid solution, using a suitable indicator.

(i) Describe how you would measure out and transfer 25.0 cm^3 of the solution of the alkali.

(2)

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

The burette readings of acid added were

	titration 1	titration 2	titration 3
final volume / cm^3	27.20	30.10	25.35
initial volume / cm^3	2.05	5.20	0.10
volume of acid added / cm^3	25.15	24.90	25.25

The volume of acid added that should be used in the calculation is

(1)

☒ **A** 24.90 cm^3

☒ **B** 25.00 cm^3

☒ **C** 25.10 cm^3

☒ **D** 25.20 cm^3

*(c) Some salts dissolved in water cause the water to be hard.

When mixed with a small volume of soap solution, hard water does not form a lather.

You are provided with three unlabelled samples of water.

- one is soft water
- one is permanent hard water
- one is temporary hard water

You are provided with soap solution and the usual laboratory apparatus.

Describe tests that you should carry out on each sample to identify the type of water in each sample.

(6)

(Total for Question 5 = 12 marks)

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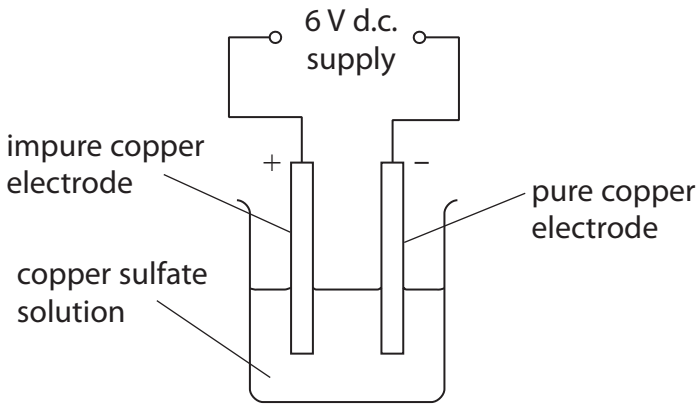
Electrolysis

6 (a) Impure copper is purified by electrolysis using the apparatus shown.



(i) Give the name of the electrode which is made of pure copper.

(1)

.....

(ii) Describe how each electrode will have changed at the end of the electrolysis process.

(2)

.....

.....

.....

.....

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

$$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$$

This half equation shows the process of

(1)

☒ **A** displacement

☒ **B** oxidation

☒ **C** redox

☒ **D** reduction

(iv) Copper sulfate solution is the electrolyte used in this electrolysis process.

Explain how copper sulfate solution conducts electricity.

(2)

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.....

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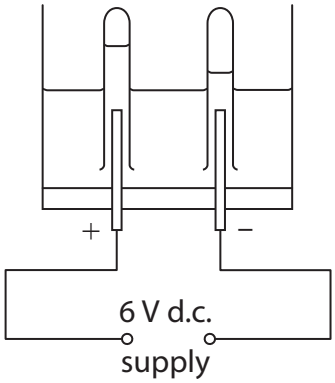
(b) Sodium sulfate solution is electrolysed in the apparatus shown.



Sodium sulfate solution contains sodium ions, Na^+, sulfate ions, SO_4^{2-}, hydrogen ions, H^+, and hydroxide ions, OH^-.

Hydrogen is produced at one electrode and oxygen is produced at the other electrode.

Explain how these products are formed from the ions in the electrolysis process, indicating how you would identify the products.

You may give ionic equations in your answer.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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