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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PEARSON

The Periodic Table of the Elements

Key

| relative atomic mass |
| **atomic symbol** |
| name |
| atomic (proton) number |

| 1 | hydrogen | 1 |

1	2												3	4	5	6	7	0
																		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

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.

Turn over ▶

P 4 1 9 4 0 A 0 3 2 0

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.

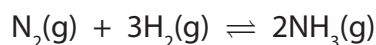(a) Complete the sentence by putting a cross (⊠) in the box next to your answer.

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)

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

(1)

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....

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

Write the word equation for this reaction.

(2)

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(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 cm³ of sulfuric acid.

The photograph shows a student carrying out a titration.

(1)
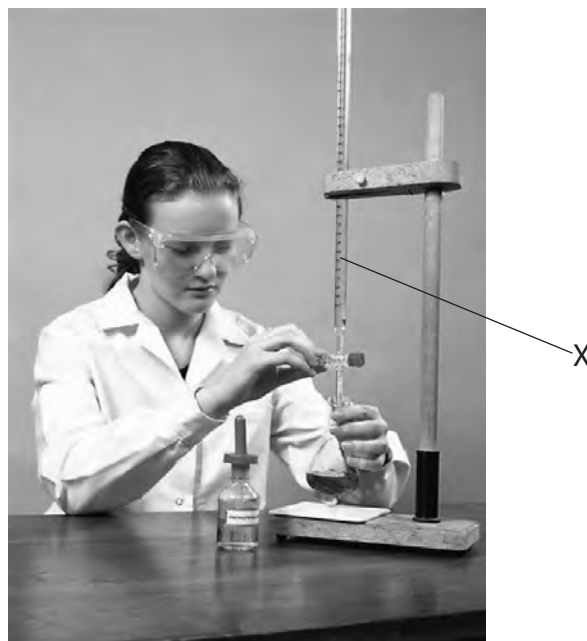
(i) Give the name of the piece of apparatus labelled X.

....

(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)

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)

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(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)

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(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)

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

(2)

glucose $\rightarrow$ .... + ...

(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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....

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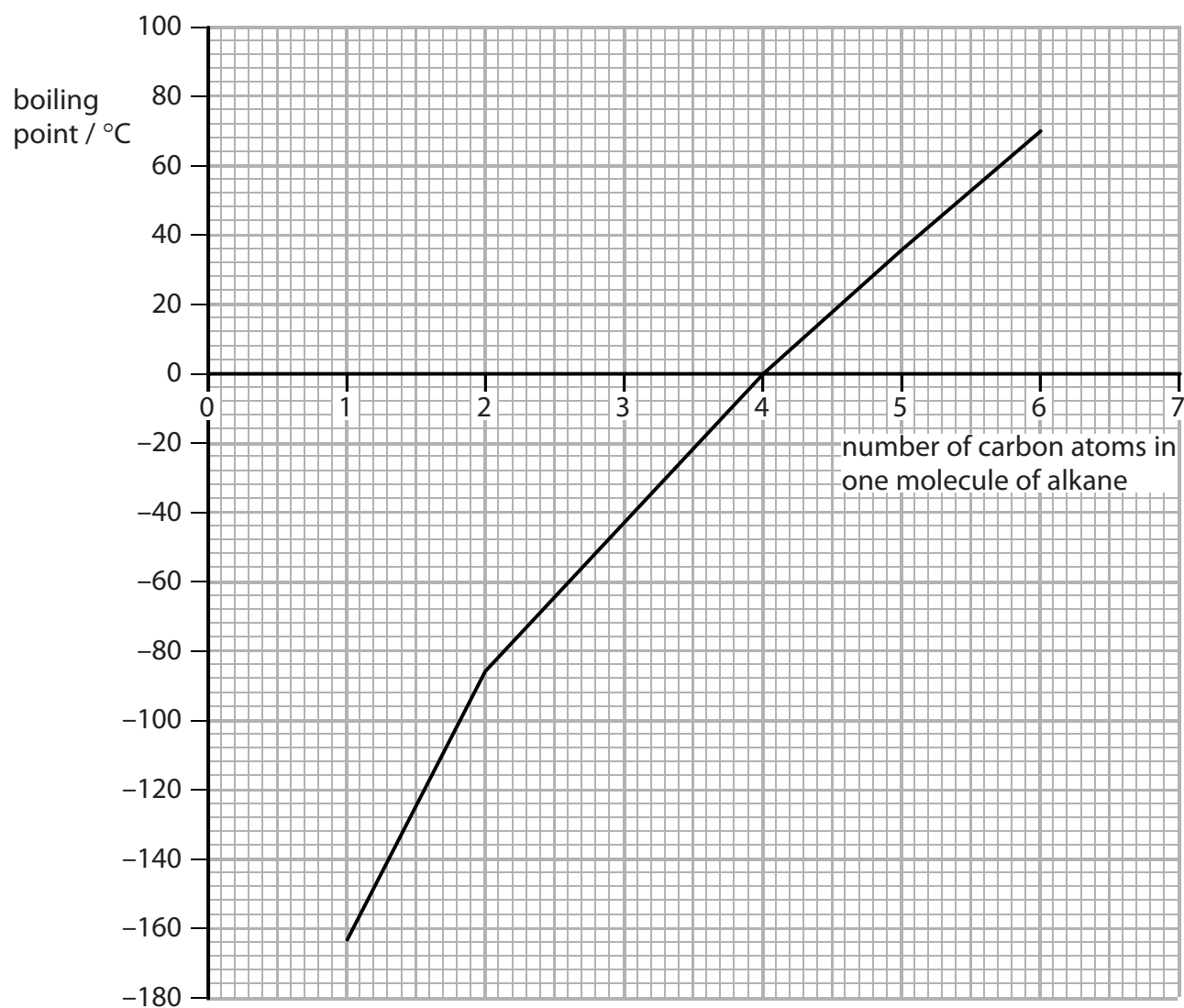
(i) A molecule of pentane contains five carbon atoms.
Use the graph to suggest the boiling point of pentane.

(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)

....

(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.

$$\begin{array}{c} H \qquad H \\ \diagdown \qquad \diagup \\ H \qquad\quad C \\ \diagdown \qquad\quad \diagdown \\ \quad C=C \qquad H \\ \diagup \qquad\quad \diagdown \\ H \qquad\quad H \end{array}$$
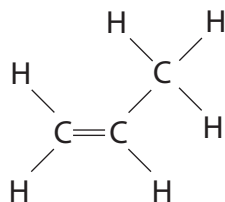
The substance is

(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)

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

| ethanoic acid | + | sodium hydroxide | → | sodium ethanoate | + | water |
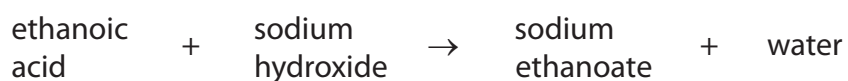
Complete the balanced equation for this reaction.

(2)

CH_3COOH + ... → CH_3COONa + ...
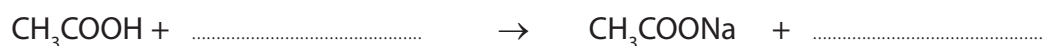
(e) When magnesium is added to dilute ethanoic acid, a colourless gas is formed. This gas gives a squeaky pop when mixed with air and ignited.

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)

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(Total for Question 4 = 10 marks)

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)

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

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

(2)

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(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)

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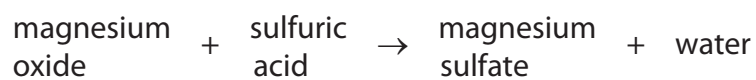
Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

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(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 cm³ 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)

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concentration of solid = ... g dm⁻³

*(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)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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