Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Wednesday 15 June 2016 – Afternoon
Time: 1 hour

Paper Reference
5CH2F/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.
- You should use a calculator in this examination.

Turn over ▶

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P 4 5 9 2 9 A 0 1 2 4

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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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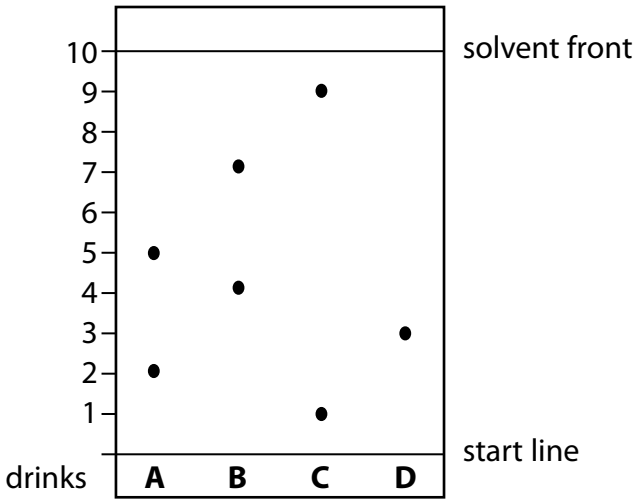
Questions begin on next page.

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 ☒.

Separation techniques

1 The diagram shows a chromatogram of the coloured substances in four different drinks, **A**, **B**, **C** and **D**.



(a) (i) State the letter of the drink that contains only one coloured substance.

(1)

.....

(ii) An illegal coloured substance has an R_f value of 0.71.

Which of the drinks, **A**, **B**, **C** or **D**, contains the illegal coloured substance?

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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(iii) Starting with a piece of chromatography paper and the four drinks, describe how an experiment would be set up to produce the chromatogram in the diagram.

(3)

(b) Liquid **X** and liquid **Y** are immiscible.
Liquid **X** is denser than liquid **Y**.

Describe how you could use a separating funnel to obtain a pure sample of liquid **X** and a pure sample of liquid **Y** from a mixture of the two liquids.

(2)

(c) Oxygen and nitrogen are two gases present in the air.

Give the name of the process used to obtain oxygen and nitrogen from liquid air.

(2)

(Total for Question 1 = 9 marks)

Atomic structure

2 (a) State the relative charge on a proton.

(1)

.....

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

(1)

An atom of sodium has an atomic number of 11 and a mass number of 23.

The number of protons in this atom of sodium is

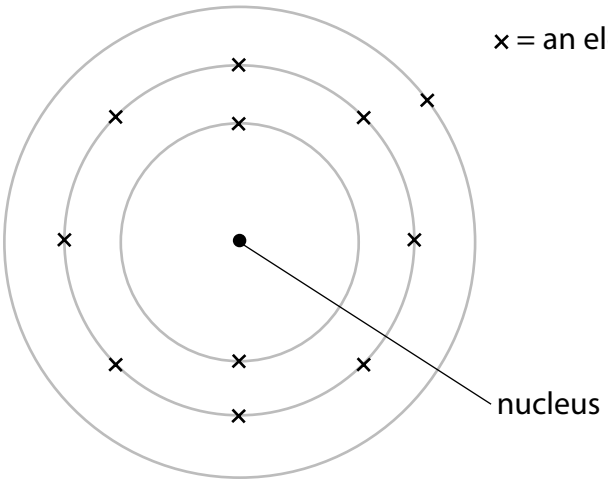
☒ **A** 11

☒ **B** 12

☒ **C** 23

☒ **D** 34

(c) The diagram shows the arrangement of electrons in a sodium atom.



(i) State the electronic configuration of sodium.

(1)

.....

(ii) Explain, in terms of its electronic configuration, why sodium is placed in group 1 of the periodic table.

(2)

.....

.....

.....

.....

(d) Elements can be classified as metals or non-metals.
Metals and non-metals appear in different sections of the periodic table.

Use the periodic table to answer the following questions.

(i) Which of the following is a non-metal?

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

(1)

☐ **A** iridium, Ir

☐ **B** ruthenium, Ru

☐ **C** selenium, Se

☐ **D** strontium, Sr

(ii) Elements are arranged in the periodic table in order of increasing atomic number.

In terms of electronic configurations, describe a similarity between elements in the same period.

(1)

.....

.....

.....

(Total for Question 2 = 7 marks)

Salts

3 (a) Insoluble salts are prepared by precipitation reactions.

Lead nitrate solution reacts with potassium iodide solution to form a lead iodide precipitate and potassium nitrate solution.

(i) What is the name of the insoluble salt?

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

(1)

☐ **A** lead nitrate

☐ **B** potassium iodide

☐ **C** lead iodide

☐ **D** potassium nitrate

(ii) Write the word equation for the reaction.

(2)

.....

.....

(iii) Two solid, soluble salts were used to make an insoluble salt in a precipitation reaction.

The statements below show the steps used in an experiment to make a pure, dry insoluble salt from the two solid, soluble salts.

They are not in the correct order.

A filter the mixture

B dissolve each of the soluble salts in water

C put in an oven to dry

D wash the solid with distilled water

E mix the solutions together

Write the letters in the boxes to put the steps in the correct order.

B is the first step.

(2)

B				

(b) Sodium and potassium salts produce colours in a flame test.

Draw a line from each salt to the colour that it produces in a flame test.

(2)

salt	**colour in flame test**
potassium salt	lilac
sodium salt	red
	blue / green
	yellow

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(c) Potassium chloride contains potassium ions, K^+, and chloride ions, Cl^-.

(i) State the formula of potassium chloride.

(1)

.....

(ii) Explain how a chlorine atom, Cl, forms a chloride ion, Cl^-.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

Quantitative chemistry

4 (a) Calculate the relative formula mass of calcium carbonate, $CaCO_3$.

(relative atomic masses: C = 12, O = 16, Ca = 40)

(1)

.....

relative formula mass = ...

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

(1)

Magnesium reacts with sulfur to form magnesium sulfide

magnesium + sulfur → magnesium sulfide

In magnesium sulfide 24 g of magnesium are combined with 32 g of sulfur.

The ratio of magnesium atoms to sulfur atoms in magnesium sulfide is

(relative atomic masses: Mg = 24, S = 32)

		ratio of magnesium atoms : sulfur atoms
☒	**A**	1 : 1
☒	**B**	1 : 2
☒	**C**	2 : 1
☒	**D**	3 : 4

(c) The simplest ratio of aluminium atoms to chlorine atoms in aluminium chloride is 1 : 3.

The empirical formula of aluminium chloride is $AlCl_3$.

The simplest ratio of aluminium atoms to oxygen atoms in aluminium oxide is 2 : 3.

Give the empirical formula of aluminium oxide.

(1)

.....

(d) The answers shown are the molecular formulae of four hydrocarbons.

What is the molecular formula of the hydrocarbon with the empirical formula CH_2?

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

(1)

☒ **A** CH_4

☒ **B** C_2H_6

☒ **C** C_2H_4

☒ **D** C_3H_8

(e) Zinc oxide is formed by decomposition of zinc carbonate

zinc carbonate $\rightarrow$ zinc oxide + carbon dioxide

(i) In an experiment to decompose some zinc carbonate, the actual yield of zinc oxide was 7.2 g.

The theoretical yield of zinc oxide for this experiment is 9.0 g.

Calculate the percentage yield of zinc oxide.

(2)

.....

.....

.....

.....

percentage yield = ... %

(ii) Explain why the actual yield of a product in an experiment is usually lower than the theoretical yield.

(2)

.....

.....

.....

.....

(iii) Calculate the percentage by mass of zinc in zinc oxide, ZnO.

(relative atomic masses: O = 16, Zn = 65
relative formula mass of ZnO = 81)

(2)

.....

.....

.....

.....

percentage by mass of zinc = ... %

(Total for Question 4 = 10 marks)

Periodic table

5 (a) (i) When lithium is placed in water it reacts to form lithium hydroxide and hydrogen gas.

Describe what you would **see** during this reaction.

(2)

.....

.....

.....

(ii) The following hazard symbol is attached to cylinders of hydrogen gas.

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

(1)

This symbol shows that hydrogen is

☒ **A** corrosive

☒ **B** flammable

☒ **C** oxidising

☒ **D** toxic

(b) Magnesium and iron are both metals.

(i) They both conduct electricity.

Explain, in terms of their structures, how metals conduct electricity.

(2)

.....

.....

.....

.....

(ii) Magnesium is in group 2 of the periodic table.

Iron is a transition metal.

Both magnesium and iron can form salts.

State a difference in the appearance of magnesium salts and iron salts.

(1)

.....

*(c) The three halogens chlorine, bromine and iodine are mixed with solutions of their potassium salts.

The table shows the results.

solution of	chlorine	bromine	iodine
potassium chloride		×	×
potassium bromide	✓		×
potassium iodide	✓	✓	

The three ticks in the table show where there are reactions.

Describe and explain what you would **see** in each of these three reactions and what it would tell you about the relative reactivity of the halogens, bromine, chlorine and iodine.

(6)

(Total for Question 5 = 12 marks)

Reactions

6 (a) This question is about three different reactions, **P**, **Q** and **R**.

As the reactions are carried out, the initial and final temperatures are recorded.

reaction	initial temperature / °C	final temperature / °C
P	16	12
Q	15	34
R	17	17

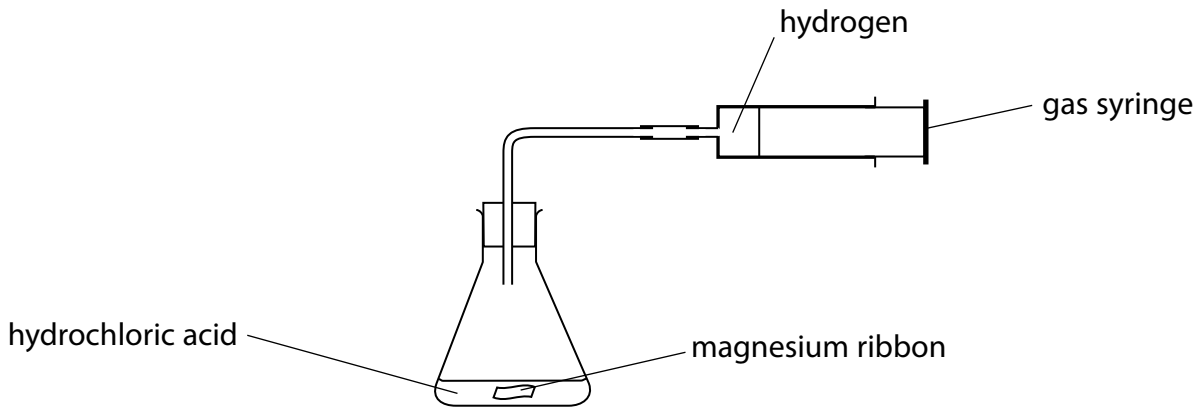
Explain which of these reactions, **P**, **Q** or **R**, is exothermic.

(2)

(b) Magnesium ribbon and hydrochloric acid are reacted in the apparatus shown in the diagram.

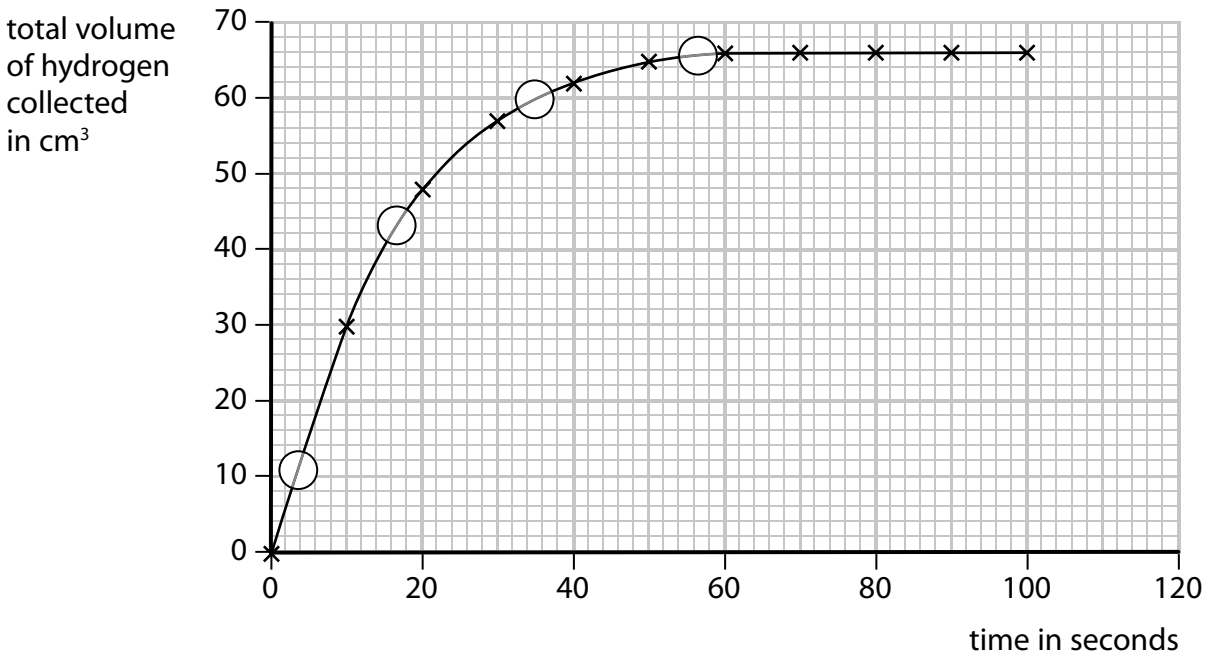
The equation for the reaction is

$$\text{magnesium} + \text{hydrochloric acid} \rightarrow \text{magnesium chloride} + \text{hydrogen}$$



(i) The volume of hydrogen in the gas syringe is recorded every 10 seconds for 100 seconds.

The results are plotted on the graph.



Place a cross in a circle on the graph to show where the reaction is at its fastest rate.

(1)

(ii) The experiment is repeated, keeping all conditions exactly the same, except that the hydrochloric acid is more dilute.

This change causes the reaction to take place more slowly.

On the graph, sketch a line to show the results you would expect in this experiment.

(1)

(c) Powdered coal is burnt in coal-fired power stations.

Explain why powdered coal burns in air at a faster rate than lumps of coal.

(2)

*(d) At room temperature, hydrogen peroxide decomposes slowly to form water and oxygen gas.
The equation for the reaction is

$$\text{hydrogen peroxide} \rightarrow \text{water} + \text{oxygen}$$

The progress of the reaction can be followed by measuring the volume of gas given off.

This reaction can be catalysed by the addition of solid manganese(IV) oxide.

Two properties of a catalyst are

- it increases the rate of a reaction
- its mass is unchanged at the end of the reaction.

Using hydrogen peroxide solution and manganese(IV) oxide, describe experiments to show that manganese(IV) oxide has these properties when used as a catalyst in this reaction.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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