Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Higher Tier

Tuesday 9 June 2015 – Afternoon
Time: 1 hour

Paper Reference
5CH2H/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 4 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 ☒.

Salts

1 Tests can be carried out on salts to identify the ions present in the salts.

(a) (i) A flame test on a salt produces an orange-red colour.

Which ion is responsible for the orange-red colour?

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

(1)

☒ **A** calcium ion, Ca^{2+}

☒ **B** copper ion, Cu^{2+}

☒ **C** potassium ion, K^{+}

☒ **D** sodium ion, Na^{+}

(ii) A solution of a chloride salt is acidified with dilute nitric acid.
Silver nitrate solution is added to the mixture.

Describe what is **seen** when the silver nitrate solution is added.

(2)

.....

(b) Which of these salts is insoluble in water?

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

(1)

☒ **A** sodium carbonate

☒ **B** lead chloride

☒ **C** magnesium nitrate

☒ **D** potassium sulfate

(c) Sodium sulfate solution and barium chloride solution are mixed.
A precipitate of barium sulfate is formed.
Another product is formed in solution.

(i) Complete the word equation for the reaction.

Include state symbols.

(2)

sodium sulfate (aq) + barium chloride (aq) ⟶ ..... (.....) + ... (.....)

(ii) Barium salts are toxic.
Before some X-rays, patients have to swallow a suspension of barium sulfate, known as a 'barium meal'.

Explain why it is safe for these patients to swallow the barium sulfate.

(2)

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(Total for Question 1 = 8 marks)

Halogens

2 (a) Chlorine reacts with potassium bromide in solution to form bromine and potassium chloride.

(i) What type of reaction is taking place?

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

(1)

☒ **A** displacement

☒ **B** distillation

☒ **C** neutralisation

☒ **D** precipitation

(ii) State the colour of the mixture at the end of the reaction.

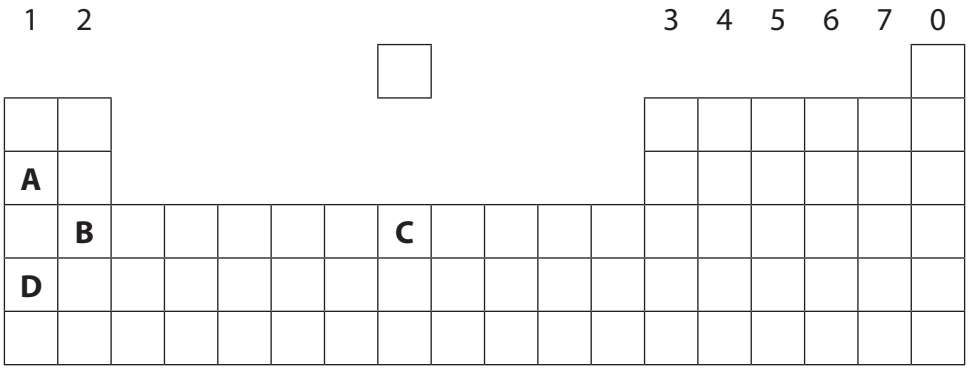
(1)

.....

(b) Chlorine reacts with an element X to form a solid chloride.

The solid chloride is dark red.

Which is the most likely position of the element X in the periodic table?



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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(c) The halogens react with hydrogen to form hydrogen halides.

Complete the balanced equation for the reaction between hydrogen and bromine forming hydrogen bromide.

(2)

$H_2 + Br_2 \rightarrow$ .....

(d) Calculate the relative formula mass of magnesium chloride, $MgCl_2$.
(relative atomic masses: Mg = 24.0; Cl = 35.5)

(1)

.....

relative formula mass = ...

(e) Calculate the percentage by mass of fluorine in sodium fluoride, NaF.
(relative atomic masses: F = 19; Na = 23)

(2)

.....

.....

.....

.....

percentage by mass of fluorine = ... %

(Total for Question 2 = 8 marks)

Chemical reactions

3 (a) Catalytic converters in the exhaust systems of cars contain catalysts.

(i) Explain what is meant by the term **catalyst**.

(2)

.....

.....

.....

.....

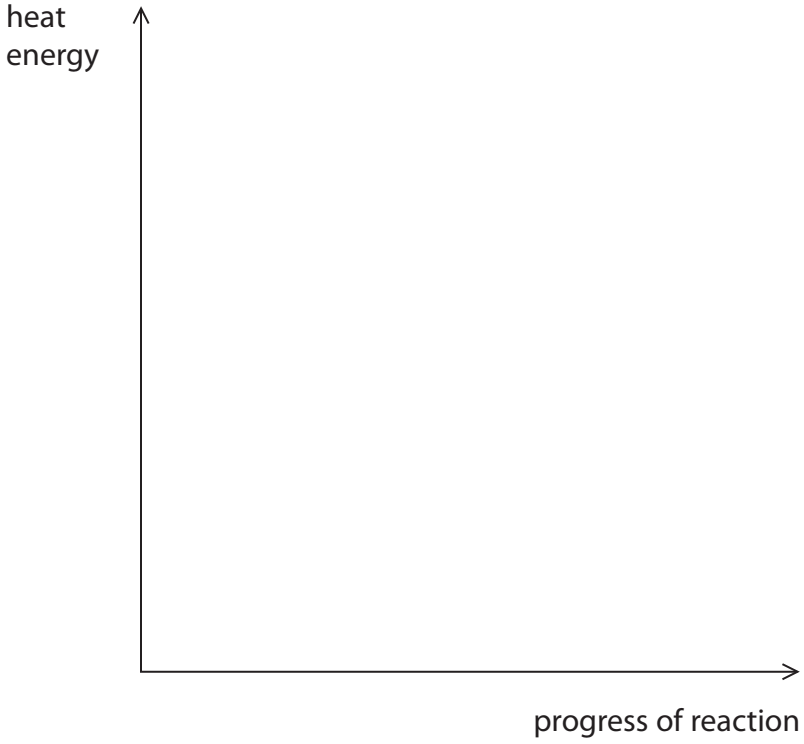
(ii) This reaction takes place in a catalytic converter

carbon monoxide + oxygen → carbon dioxide

This reaction is exothermic.

On the axes below, draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



(iii) Another reaction in a catalytic converter is the reaction of hydrocarbons with excess oxygen to form carbon dioxide and water.

Write the balanced equation for the reaction of the hydrocarbon heptane, C_7H_{16}, with excess oxygen.

(3)

(b) When reactions take place in a solution, the rate of reaction is affected by the concentration in the solution.

Explain, in terms of particles and collisions, why the rate of a reaction increases when the concentration of one of the reactants is increased.

(2)

(Total for Question 3 = 9 marks)

Atoms and isotopes

4 (a) An atom of copper has an atomic number of 29 and a mass number of 63.

(i) Complete the table to show the numbers of protons, neutrons and electrons in this atom of copper.

(2)

particle	number
proton	
neutron	
electron	

(ii) Copper is in period 4 of the periodic table.

State what information this gives about the number of shells that contain electrons, in a copper atom.

(1)

.....

(iii) Copper exists as isotopes.

Explain what is meant by the term **isotopes**.

(2)

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.....

(iv) A sample of copper contains

70% of copper-63 atoms and

30% of copper-65 atoms.

Use this information to calculate the relative atomic mass of copper in this sample.

(3)

relative atomic mass of copper = ...

(b) Copper nitrate contains copper ions, Cu^{2+}, and nitrate ions, NO_3^-.

(i) Describe, in terms of electrons, how a copper atom, Cu, becomes a copper ion, Cu^{2+}.

(2)

(ii) Write the formula for copper nitrate.

(1)

(Total for Question 4 = 11 marks)

Elements

5 (a) Argon is an element in Group 0 of the periodic table.
It is used as the gas in filament lamps.

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

Argon is used in filament lamps because it

(1)

☒ **A** has a low density

☒ **B** is a good conductor of electricity

☒ **C** is flammable

☒ **D** is inert

(b) Metals are malleable.

Explain, in terms of their structures, why metals are malleable.

(2)

.....

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.....

(c) In an experiment, 3.1 g of phosphorus reacted with 24 g of bromine to form phosphorus bromide.

Calculate the empirical formula of the phosphorus bromide.

You must show your working.

(relative atomic masses: P = 31, Br = 80)

(3)

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.....

empirical formula .....

*(d) Group 1 of the periodic table contains the alkali metals lithium, sodium and potassium.
The alkali metals show a pattern in their reactivity with water.
This pattern is shown when small pieces of lithium, sodium and potassium are added separately to water.

Describe the reactions and what would be seen and explain the pattern in reactivity.

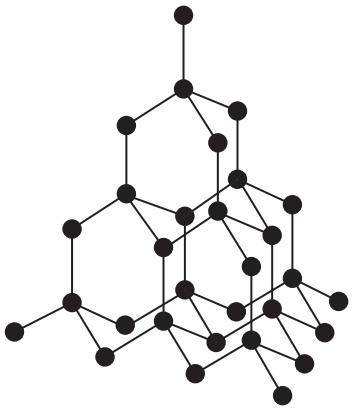
You may include equations as part of your answer.

(6)

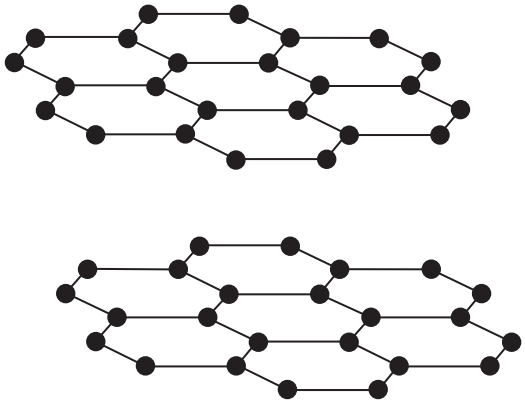
(Total for Question 5 = 12 marks)

Bonding and properties

6 (a) The structures of diamond and graphite are shown.



diamond



graphite

(i) State the maximum number of covalent bonds formed by a carbon atom in a diamond crystal.

(1)

.....

(ii) Which of the following statements about diamond and graphite is true?

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

(1)

☒ **A** they are both good conductors of electricity

☒ **B** they are both soluble in water

☒ **C** they both cut glass

☒ **D** they both have high melting points

(iii) Explain, in terms of its structure, why graphite is able to be used as a lubricant.

(2)

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.....

(b) The atomic number of carbon is 6.

The atomic number of hydrogen is 1.

Draw a dot and cross diagram of a molecule of methane, CH_4.

Show the outer shell electrons only.

(2)

*(c) Sodium chloride and water have very different properties.

Sodium chloride is an ionic substance.
It is a crystalline solid at room temperature.
It has a high melting point.
It conducts electricity when molten or in aqueous solution.

Water is a covalent substance.
It is a liquid at room temperature.
It is a very poor conductor of electricity.

Explain these properties of sodium chloride and water in terms of the particles present and the forces between them.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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