Write your name here

Surname	Other names

Pearson
Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Higher Tier

Tuesday 10 June 2014 – 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 3 4 3 0 R A 0 1 2 0

PEARSON

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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.

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 ☒.

Particles and formulae

1 (a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	relative charge	position in atom
proton		+1	
neutron	1		in nucleus
electron			

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

An atom of an element **always** contains

(1)

☒ **A** more protons than neutrons

☒ **B** equal numbers of protons and neutrons

☒ **C** more electrons than protons

☒ **D** equal numbers of protons and electrons

(c) The symbols for some atoms are given in the box

Ca	Cl	K	N	Ne	O

From the box, choose the symbol of

(i) an atom in group 2 of the periodic table

(1)

.....

(ii) an atom that readily forms an ion with a charge of 2–

(1)

.....

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

.....

(ii) What is the most likely formula of aluminium nitride?

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

(1)

☒ **A** $Al(NO_3)_2$

☒ **B** $AlNO_3$

☒ **C** $AlNO_2$

☒ **D** AlN

(Total for Question 1 = 8 marks)

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Rates of reactions and energy changes

2 (a) Marble chips react with hydrochloric acid to produce carbon dioxide.

The equation for the reaction is

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

Which one of these changes would **decrease** the rate of this reaction?

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

(1)

☒ **A** use hydrochloric acid which is more dilute

☒ **B** use smaller sized marble chips

☒ **C** use marble chips which have a larger surface area

☒ **D** use a larger volume of the hydrochloric acid

(b) Explain why increasing the temperature of a reaction increases the rate of the reaction.

(2)

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.....

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.....

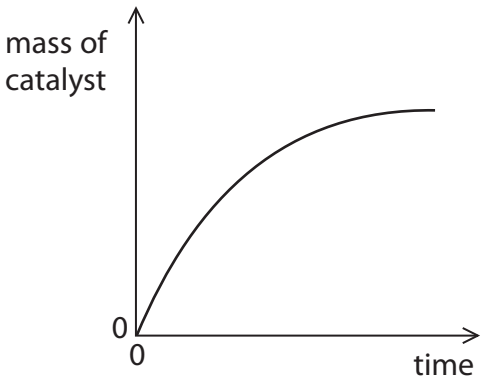
(c) (i) The rate of decomposition of hydrogen peroxide can be increased by adding a catalyst.

Which of these graphs shows the mass of the catalyst during the reaction?

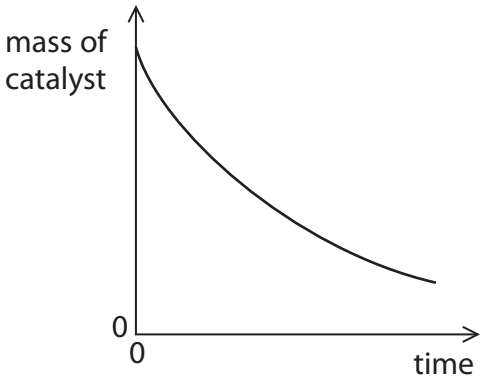
Put a cross (☒) in the box next to your answer.

(1)

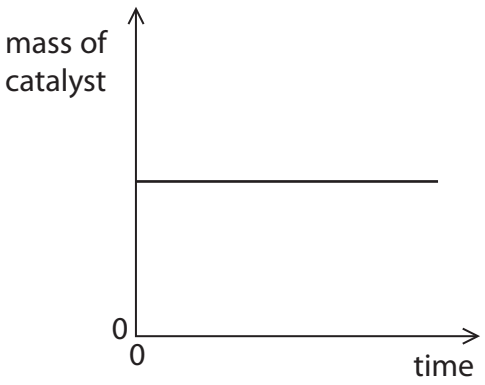
☒ **A**



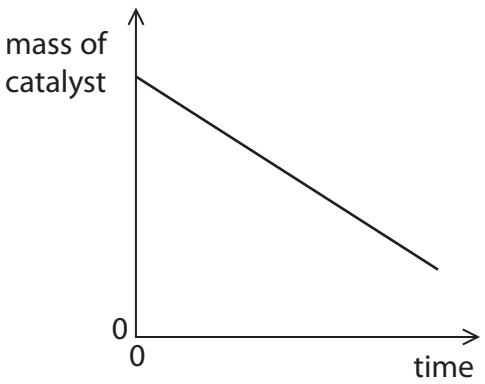
☒ **B**



☒ **C**



☒ **D**



(ii) The decomposition of hydrogen peroxide, H_2O_2, produces oxygen and water.

Give the balanced equation for this reaction.

(2)

.....

(d) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why some reactions are exothermic.

(2)

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(Total for Question 2 = 8 marks)

Metals

3 There are many metallic elements in the periodic table.

(a) Which row of the table correctly shows two metals that are in group 1 and two metals that are transition metals?

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

(1)

	group 1	transition metals
☒ **A**	lithium and zinc	calcium and copper
☒ **B**	potassium and caesium	copper and iron
☒ **C**	sodium and potassium	copper and magnesium
☒ **D**	sodium and magnesium	manganese and nickel

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

.....

.....

.....

(ii) Explain how metals conduct electricity.

(2)

.....

.....

.....

(c) (i) Describe what you would **see** when a small piece of sodium is added to water.

(2)

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.....

.....

.....

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

.....

(Total for Question 3 = 10 marks)

Salts and analysis

4 (a) Which of the following pairs of substances contains one substance that is soluble in water and one that is insoluble in water?

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

(1)

☒ **A** aluminium nitrate and lead sulfate

☒ **B** ammonium chloride and copper sulfate

☒ **C** copper hydroxide and lead sulfate

☒ **D** sodium hydroxide and potassium nitrate

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

.....

.....

.....

.....

(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

.....

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ .....

(d) Compound **X** is a metal carbonate.

(i) A flame test was carried out on compound **X**.
A lilac flame was seen.

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

(1)

The formula of the metal ion in compound **X** is

☒ **A** Ca^{2+}

☒ **B** Cu^{2+}

☒ **C** K^{+}

☒ **D** Na^{+}

(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

Chlorine and carbon

5 (a) Chlorine has an atomic number of 17.
Chlorine-35 and chlorine-37 are two isotopes of chlorine.

(i) Complete the table to show the numbers of protons, neutrons and electrons in each of the isotopes.

(2)

	chlorine-35	**chlorine-37**
number of protons		
number of neutrons		
number of electrons		

(ii) A normal sample of chlorine contains only chlorine-35 and chlorine-37 atoms.

Explain why the relative atomic mass of chlorine is 35.5

(2)

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(b) Tetrachloromethane is a simple molecular, covalent compound.
The formula of its molecule is CCl_4.

There are four electrons in the outer shell of a carbon atom.
There are seven electrons in the outer shell of a chlorine atom.

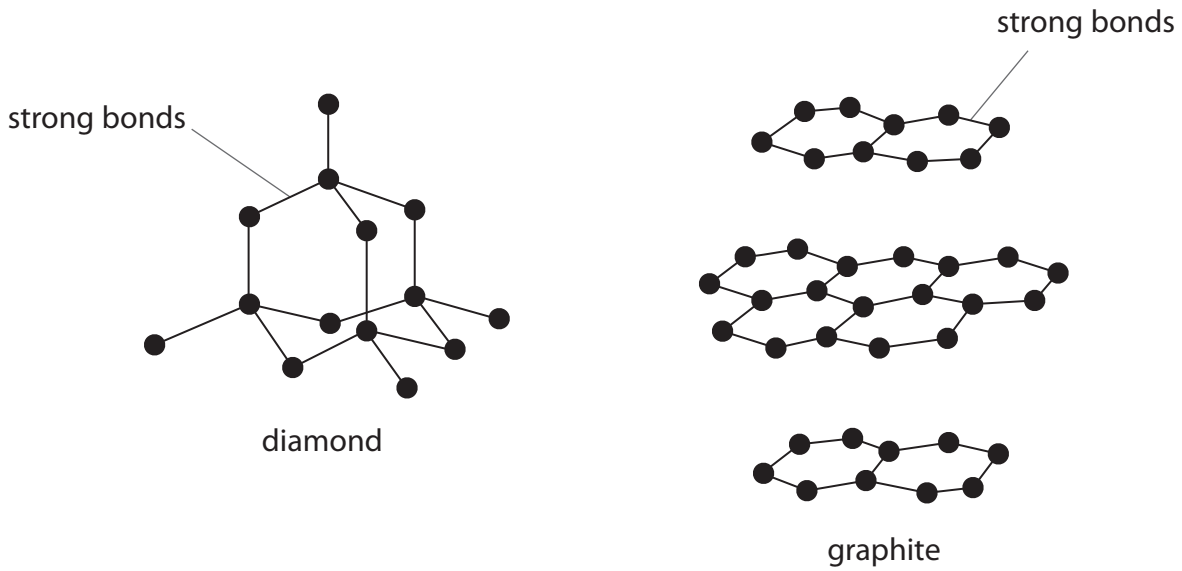
Draw a dot and cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

Show outer shell electrons only.

(2)

*(c) The diagrams show the arrangements of carbon atoms in diamond and in graphite.

● = carbon atom



diamond

graphite

Compare a use of diamond with a use of graphite, explaining each use in terms of the bonding and structure. In your answer you should use information from the diagrams.

(6)

(Total for Question 5 = 12 marks)

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Group 7 elements

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

empirical formula .....

(b) Sodium reacts with chlorine to form sodium chloride.

$$2Na + Cl_2 \rightarrow 2NaCl$$

Calculate the maximum mass of sodium chloride that could be formed by reacting 9.20 g of sodium with excess chlorine.
(relative atomic masses: Na = 23.0, Cl = 35.5)

(3)

mass of sodium chloride ..... g

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

potassium bromide solution
potassium chloride solution
potassium iodide solution
bromine solution
chlorine solution
iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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