Write your name here

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Pearson Edexcel GCSE

Centre Number | | | | | |

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Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Tuesday 10 June 2014 – 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.
- Keep an eye on the time.
- 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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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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PMT

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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 ☒.

Elements in the periodic table

1 (a) Copper is a metal.

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

In the periodic table copper is in

(1)

☐ **A** group 0

☐ **B** group 1

☐ **C** group 7

☐ **D** the transition metals

(ii) Which of these is a property of copper metal?

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

(1)

☐ **A** does not conduct an electric current

☐ **B** forms colourless compounds

☐ **C** has a low melting point

☐ **D** is malleable

(b) Helium and argon are noble gases.

(i) Choose the correct word from this box to complete the sentence below.

non- flammable	odourless	reactive

(1)

Argon can be used to put out fires because it is .....

(ii) Choose the correct phrase from this box to complete the sentence below.

has a high density	has a low density	is colourless

(1)

Helium is used in airships because it .....

(c) Chlorine, bromine and iodine are halogens.

(i) The table shows the appearance of bromine and iodine at room temperature.

Complete the table to show the appearance of chlorine at room temperature.

(2)

halogen	**appearance at room temperature**
chlorine	
bromine	dark red liquid
iodine	grey solid

(ii) Chlorine reacts with hydrogen to form hydrogen chloride.

Write the word equation for this reaction.

(2)

..... + ... → .....

(Total for Question 1 = 8 marks)

Elements and atoms

2 Beryllium, Be, has atomic number 4.

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

From its position in the periodic table (page 2), beryllium is most likely to be a

(1)

☒ **A** metal

☒ **B** halogen

☒ **C** compound

☒ **D** gas at room temperature

(ii) Give the symbol of an atom of another element in the same period of the periodic table as beryllium.

(1)

.....

(b) The atomic number of beryllium is 4.

The mass number of an atom of beryllium is 9.

(i) State the numbers of protons, electrons and neutrons in this atom of beryllium.

(3)

..... protons

..... electrons

..... neutrons

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

The relative charge on an electron is

(1)

☒ **A** +1

☒ **B** 0

☒ **C** –1

☒ **D** –2

(c) The electronic configuration of phosphorus is 2.8.5.

Explain, in terms of its electronic configuration, why phosphorus is in group 5 of the periodic table.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

Salts

3 (a) Solutions of soluble salts can react together to form an insoluble salt.

What name is given to this type of reaction?

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

(1)

☒ **A** combustion

☒ **B** neutralisation

☒ **C** precipitation

☒ **D** separation

(b) Information about the solubility of some salts is given below.

- all nitrates are soluble
- all common carbonates are insoluble except sodium carbonate, potassium carbonate and ammonium carbonate.

Copper carbonate can be made by reacting together solutions of sodium carbonate and copper nitrate.

Complete this equation by filling in the missing state symbols.

(2)

$$\text{sodium carbonate}(aq) + \text{copper nitrate}(aq) \rightarrow \text{copper carbonate}(\ldots\ldots) + \text{sodium nitrate}(\ldots\ldots)$$

(c) The symbol for a copper ion is Cu^{2+}.

The symbol for a carbonate ion is CO_3^{2-}.

Write the formula for copper carbonate.

(1)

.....

(d) In an experiment, solid lead iodide is produced in a mixture with a solution of a soluble salt.

Describe how a pure, dry sample of solid lead iodide can be obtained from this mixture.

(3)

.....

.....

.....

.....

.....

.....

.....

(e) Two tests were carried out to identify the ions in salt **X**.

(i) Test: flame test on solid salt **X**.

Result: lilac flame.

Identify the ion in salt **X** that gives the lilac flame.

(1)

ion in salt **X** .....

(ii) Test: addition of dilute nitric acid and silver nitrate solution to a solution of salt **X**.

Result: white solid formed.

Identify the ion in salt **X** that produces the white solid.

(1)

ion in salt **X** .....

(Total for Question 3 = 9 marks)

Compounds

4 (a) (i) Balance the equation for the reaction between sodium and chlorine to produce sodium chloride by putting numbers in the spaces provided.

(2)

..... Na + Cl_2 → ..... NaCl

(ii) In an experiment to make sodium chloride, the yield is 2.5 g.
The theoretical yield of sodium chloride for this experiment is 4.0 g.

Calculate the percentage yield of sodium chloride in this experiment.

(2)

.....

.....

.....

percentage yield = ... %

(iii) Sodium chloride has a high melting point.
Sodium chloride does not conduct electricity when solid but does conduct electricity when molten.

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

These properties show that the structure of sodium chloride is

(1)

☒ **A** ionic

☒ **B** giant molecular, covalent

☒ **C** simple molecular, covalent

☒ **D** metallic

(iv) Calculate the relative formula mass of sodium chloride, NaCl.
(relative atomic masses: Na = 23, Cl = 35.5)

(1)

.....

relative formula mass = ...

(b) Calculate the percentage by mass of magnesium in magnesium sulfate, $MgSO_4$.

(relative atomic masses: O = 16, Mg = 24, S = 32
relative formula mass: $MgSO_4$ = 120)

(2)

.....

.....

.....

percentage of magnesium = ... %

(c) The formula of a molecule of ethane is C_2H_6.

(i) Give the empirical formula of ethane.

(1)

.....

(ii) Ethane is a simple molecular, covalent compound.

Ethane has a low boiling point.

Explain, in terms of particles it contains, why ethane has a low boiling point.

(2)

.....

.....

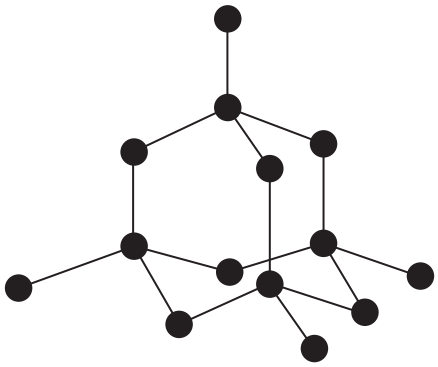
.....

.....

(Total for Question 4 = 11 marks)

Bonding and separation techniques

5 (a) The diagram shows the structure of diamond.



(i) Describe what each ● represents.

(2)

.....

.....

(ii) State the type of bonding in the diamond structure.

(1)

.....

(b) Give the name of the process used to obtain oxygen from liquid air.

(2)

.....

.....

(c) A colouring in some sweets was analysed using paper chromatography.

One of the dyes in the colouring moved 2 cm up the paper while the solvent moved 8 cm.

What is the R_f value of this dye?

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

(1)

☒ **A** 0.25

☒ **B** 2

☒ **C** 4

☒ **D** 6

*(d) Here is some information about magnesium, oxygen and magnesium oxide.

The electronic configuration of magnesium atoms is 2.8.2
The electronic configuration of oxygen atoms is 2.6
Magnesium oxide is an ionic compound.

When magnesium ribbon is heated, it reacts with oxygen from the air to form magnesium oxide, MgO.

Describe how the reaction can be carried out, including an explanation of what happens to the magnesium and oxygen atoms when they form magnesium oxide.

(6)

(Total for Question 5 = 12 marks)

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Energy changes and rates of reaction

6 (a) When zinc reacts with copper sulfate solution, zinc sulfate solution and copper are formed.

(i) An experiment was carried out to measure the temperature change when zinc powder reacts with copper sulfate solution.

initial temperature of copper sulfate solution = 20 °C
final temperature of mixture after the reaction = 46 °C

Explain what the temperature readings show about the type of heat change that occurs during this reaction.

(2)

.....

.....

.....

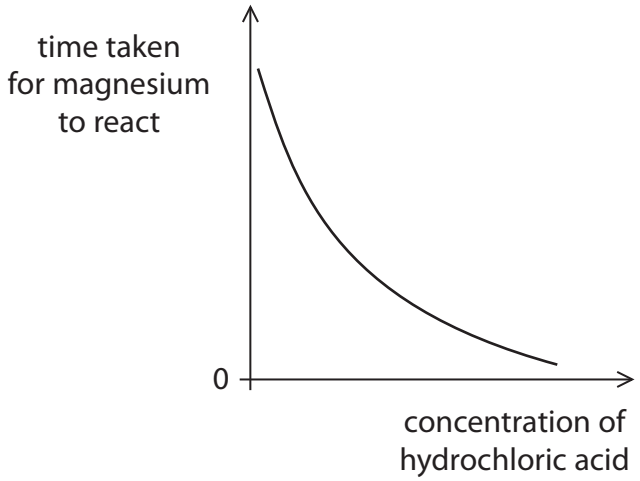
.....

(ii) Complete the equation for the reaction between zinc and copper sulfate by putting formulae in the spaces provided.

(2)

$Zn + CuSO_4 \rightarrow$ ..... + ...

(b) A length of magnesium ribbon was added to excess hydrochloric acid.
The time for all of the magnesium to react was recorded.
The experiment was repeated with the same lengths of magnesium ribbon but different concentrations of the acid.
The graph shows the time taken for the magnesium to react with different concentrations of this acid.



Use the graph to explain how the rate of this reaction changes as the concentration of hydrochloric acid increases.

(2)

.....

.....

.....

.....

*(c) Marble chips react with dilute hydrochloric acid to produce carbon dioxide gas.
The rate of this reaction can be changed by changing the size of the marble chips.

Describe experiments to investigate what effect using smaller marble chips has on the rate of this reaction.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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