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| 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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PEARSON

The Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 Li lithium 3 | 9 Be beryllium 4 | 23 Na sodium 11 | 24 Mg magnesium 12 | 39 K potassium 19 | 40 Ca calcium 20 | 85 Rb rubidium 37 | 88 Sr strontium 38 | 133 Cs caesium 55 | 137 Ba barium 56 | [223] Fr francium 87 | [226] Ra radium 88 | 139 La* lanthanum 57 | [227] Ac* actinium 89 | 45 Sc scandium 21 | 48 Ti titanium 22 | 91 Zr zirconium 40 | 93 Nb niobium 41 | 181 Ta tantalum 73 | 178 Hf hafnium 72 | [261] Rf rutherfordium 104 | 55 Mn manganese 25 | 56 Fe iron 26 | 101 Ru ruthenium 44 | 103 Rh rhodium 45 | 192 Ir iridium 77 | 190 Os osmium 76 | [277] Hs hassium 108 | 59 Co cobalt 27 | 59 Ni nickel 28 | 106 Pd palladium 46 | 195 Pt platinum 78 | 197 Au gold 79 | [268] Mt meitnerium 109 | 63.5 Cu copper 29 | 65 Zn zinc 30 | 112 Cd cadmium 48 | 201 Hg mercury 80 | [272] Rg roentgenium 111 | 70 Ga gallium 31 | 73 Ge germanium 32 | 115 In indium 49 | 119 Sn tin 50 | 204 Tl thallium 81 | 111 Ag silver 47 | 108 Pd palladium 46 | 197 Pt platinum 78 | [271] Ds darmstadtium 110 | 115 Al aluminium 13 | 27 Si silicon 14 | 73 Ge germanium 32 | 119 Sn tin 50 | 207 Pb lead 82 | 112 Cd cadmium 48 | 201 Hg mercury 80 | [272] Rg roentgenium 111 | 14 N nitrogen 7 | 16 O oxygen 8 | 32 S sulfur 16 | 79 Se selenium 34 | 128 Te tellurium 52 | [209] Po polonium 84 | 19 F fluorine 9 | 35.5 Cl chlorine 17 | 79 Br bromine 35 | 127 I iodine 53 | [210] At astatine 85 | 4 He helium 2 | 20 Ne neon 10 | 40 Ar argon 18 | 84 Kr krypton 36 | 131 Xe xenon 54 | [222] Rn radon 86 |

| | | |
|---|----------|---|
| 1 | H | 1 |
| | hydrogen | |

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

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.



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)



(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?

| 1 | 2 | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
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Put a cross (☒) in the box next to your answer.

(1)

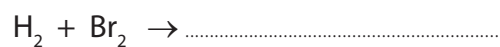
- A
- B
- C
- D



(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)



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

(1)

relative formula mass =

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

(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)

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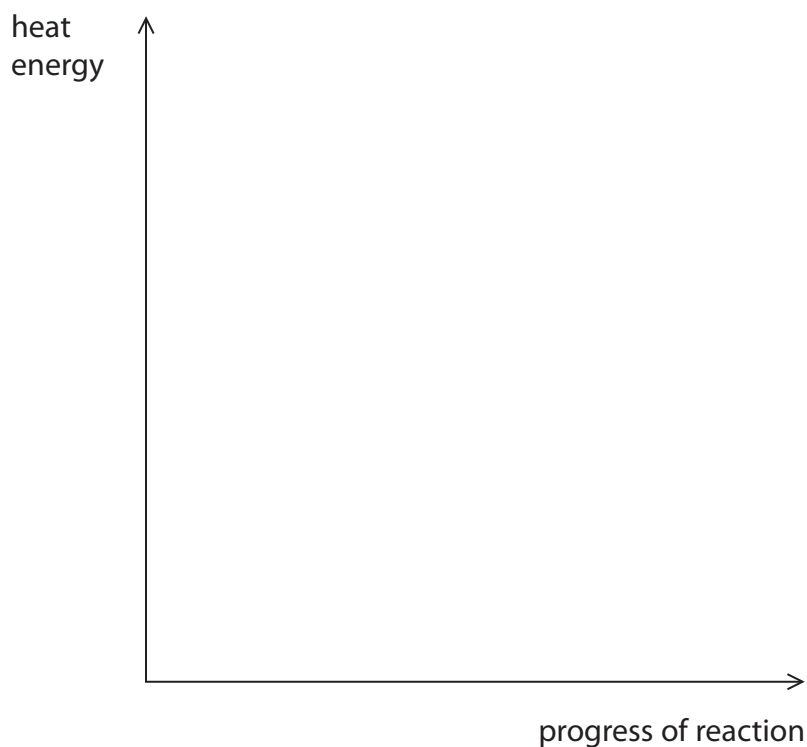
(ii) This reaction takes place in a catalytic converter



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)



(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)

A series of horizontal dotted lines for writing the answer.



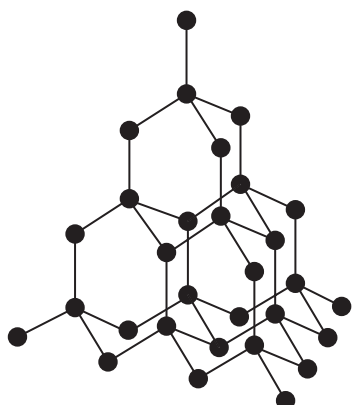
Handwriting practice area with 25 horizontal dotted lines.

(Total for Question 5 = 12 marks)

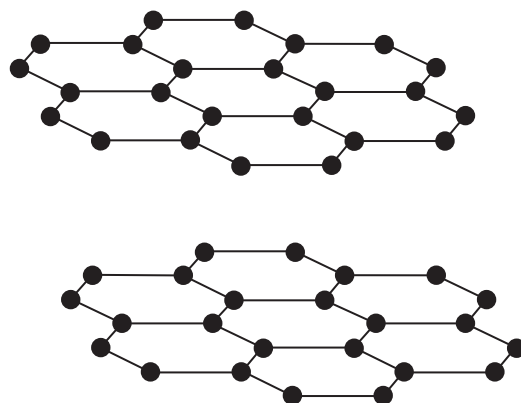


Bonding and properties

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)



Area with horizontal dotted lines for writing.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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