

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Edexcel GCSE**

**Chemistry/Additional Science**  
**Unit C2: Discovering Chemistry**

**Higher Tier**

Tuesday 5 March 2013 – Morning

**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 ►

P41965A

©2013 Pearson Education Ltd.

1/1/1/1/1/1/



**PEARSON**

# The Periodic Table of the Elements

|  | 1                                    | 2                                  | 3                                     | 4  | 5                                    | 6                                       | 7                                     | 0                                    |   |   |  |   |                                    |                                    |                                      |                                      |                                   |
|--|--------------------------------------|------------------------------------|---------------------------------------|--|--------------------------------------|---|---------------------------------------|--------------------------------------|---|---|--|---|------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|
|  | 7<br><b>Li</b><br>lithium<br>3       | 9<br><b>Be</b><br>beryllium<br>4   |                                       |  |                                      |   |                                       | 19<br><b>F</b><br>fluorine<br>9      | 20<br><b>Ne</b><br>neon<br>10           |   |  |   |                                    |                                    |                                      |                                      |                                   |
|  | 23<br><b>Na</b><br>sodium<br>11      | 24<br><b>Mg</b><br>magnesium<br>12 |                                       |  |                                      |   |                                       | 32<br><b>S</b><br>sulfur<br>16       | 40<br><b>Ar</b><br>argon<br>18          |   |  |   |                                    |                                    |                                      |                                      |                                   |
|  | 39<br><b>K</b><br>potassium<br>19    | 40<br><b>Ca</b><br>calcium<br>20   | 45<br><b>Sc</b><br>scandium<br>21     | 48<br><b>Ti</b><br>titanium<br>22          | 51<br><b>V</b><br>vanadium<br>23     | 52<br><b>Cr</b><br>chromium<br>24       | 55<br><b>Mn</b><br>manganese<br>25    | 56<br><b>Fe</b><br>iron<br>26        | 59<br><b>Ni</b><br>nickel<br>28         | 63.5<br><b>Cu</b><br>copper<br>29         | 65<br><b>Zn</b><br>zinc<br>30            | 70<br><b>Ga</b><br>gallium<br>31  | 73<br><b>Ge</b><br>germanium<br>32 | 75<br><b>As</b><br>arsenic<br>33   | 79<br><b>Se</b><br>selenium<br>34    | 80<br><b>Br</b><br>bromine<br>35     | 84<br><b>Kr</b><br>krypton<br>36  |
|  | 85<br><b>Rb</b><br>rubidium<br>37    | 88<br><b>Sr</b><br>strontium<br>38 | 89<br><b>Y</b><br>yttrium<br>39       | 91<br><b>Zr</b><br>zirconium<br>40         | 93<br><b>Nb</b><br>niobium<br>41     | 96<br><b>Mo</b><br>molybdenum<br>42     | [98]<br><b>Tc</b><br>technetium<br>43 | 101<br><b>Ru</b><br>ruthenium<br>44  | 106<br><b>Pd</b><br>palladium<br>46     | 108<br><b>Ag</b><br>silver<br>47          | 112<br><b>Cd</b><br>cadmium<br>48        | 115<br><b>In</b><br>indium<br>49  | 119<br><b>Sn</b><br>tin<br>50      | 122<br><b>Sb</b><br>antimony<br>51 | 128<br><b>Te</b><br>tellurium<br>52  | 127<br><b>I</b><br>iodine<br>53      | 131<br><b>Xe</b><br>xenon<br>54   |
|  | 133<br><b>Cs</b><br>caesium<br>55    | 137<br><b>Ba</b><br>barium<br>56   | 139<br><b>La*</b><br>lanthanum<br>57  | 178<br><b>Hf</b><br>hafnium<br>72          | 181<br><b>Ta</b><br>tantalum<br>73   | 184<br><b>W</b><br>tungsten<br>74       | 186<br><b>Re</b><br>rhenium<br>75     | 190<br><b>Os</b><br>osmium<br>76     | 192<br><b>Ir</b><br>iridium<br>77       | 195<br><b>Pt</b><br>platinum<br>78        | 197<br><b>Au</b><br>gold<br>79           | 204<br><b>Tl</b><br>thallium<br>81  | 207<br><b>Pb</b><br>lead<br>82     | 209<br><b>Bi</b><br>bismuth<br>83  | [209]<br><b>Po</b><br>polonium<br>84 | [210]<br><b>At</b><br>astatine<br>85 | [222]<br><b>Rn</b><br>radon<br>86 |
|  | [223]<br><b>Fr</b><br>francium<br>87 | [226]<br><b>Ra</b><br>radium<br>88 | [227]<br><b>Ac*</b><br>actinium<br>89 | [261]<br><b>Rf</b><br>rutherfordium<br>104 | [262]<br><b>Db</b><br>dubnium<br>105 | [266]<br><b>Sg</b><br>seaborgium<br>106 | [264]<br><b>Bh</b><br>bohrium<br>107  | [277]<br><b>Hs</b><br>hassium<br>108 | [268]<br><b>Mt</b><br>meitnerium<br>109 | [271]<br><b>Ds</b><br>darmstadtium<br>110 | [272]<br><b>Rg</b><br>roentgenium<br>111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated |                                    |                                    |                                      |                                      |                                   |

|   |          |          |   |
|---|----------|----------|---|
| 1 | <b>H</b> | hydrogen | 1 |
|---|----------|----------|---|

|                        |
|------------------------|
| 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.



**BLANK PAGE**

**Questions begin on next page.**



P 4 1 9 6 5 A 0 3 1 6

**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** Sodium carbonate and copper chloride are both ionic solids.

They are both soluble in water.

(a) Which row of the table shows the most likely melting points of these two salts?

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

(1)

|  | melting point / °C |                 |
|--|--------------------|-----------------|
|  | sodium carbonate   | copper chloride |
| <b>A</b> <input checked="" type="checkbox"/> | 17                 | 498             |
| <b>B</b> <input checked="" type="checkbox"/> | 851                | 9               |
| <b>C</b> <input checked="" type="checkbox"/> | 851                | 498             |
| <b>D</b> <input checked="" type="checkbox"/> | 9                  | 17              |

(b) Copper chloride contains copper ions,  $\text{Cu}^{2+}$ , and chloride ions,  $\text{Cl}^-$ .  
Give the formula of copper chloride.

(1)

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

If a flame test is carried out on copper chloride, the colour in the flame is

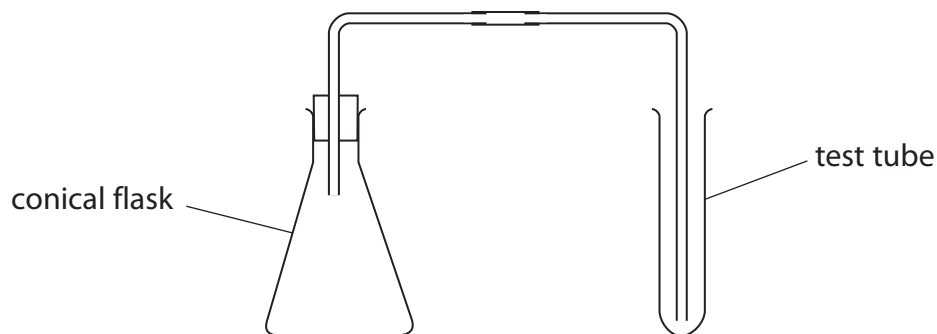
(1)

- A** red-brown
- B** yellow
- C** lilac
- D** green-blue



(d) Describe how this apparatus can be used to show that sodium carbonate reacts with dilute acid to form carbon dioxide.

(3)



.....

.....

.....

.....

.....

.....

(e) Copper carbonate is an insoluble salt.

Describe how you would use sodium carbonate and copper chloride to produce a pure, dry sample of copper carbonate.

(3)

.....

.....

.....

.....

.....

.....

**(Total for Question 1 = 9 marks)**

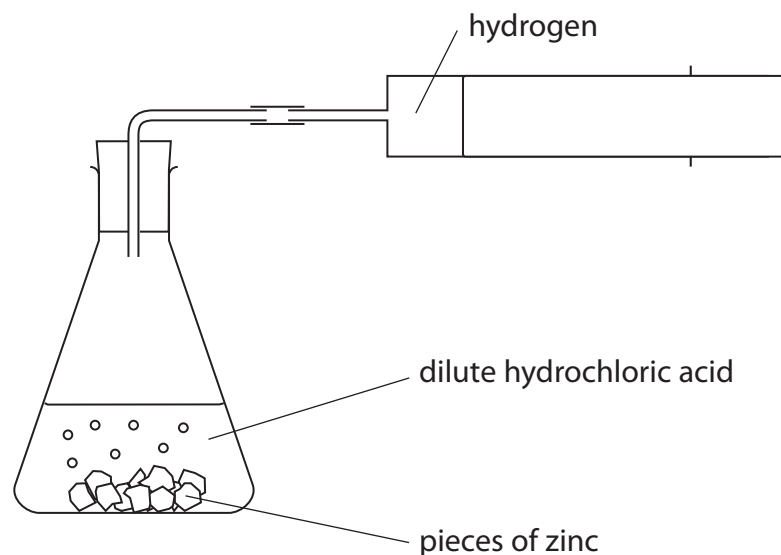


## Rates of reaction

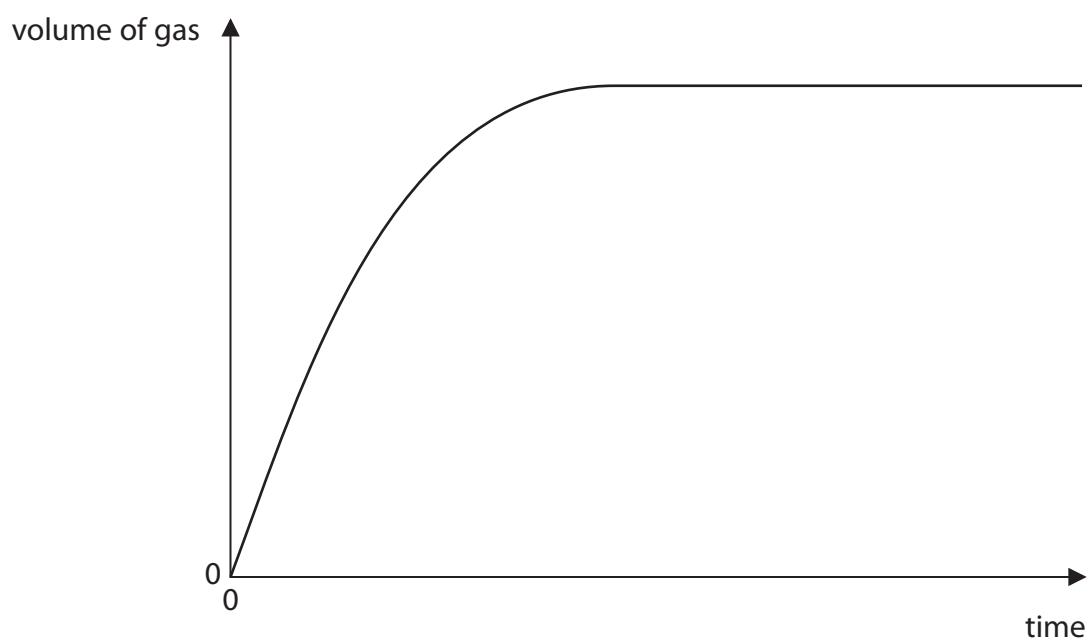
2 (a) Zinc is a metal.

Zinc reacts with dilute hydrochloric acid to produce zinc chloride and hydrogen.

Edward used this apparatus to investigate the speed of the reaction between zinc and dilute hydrochloric acid.



(i) Edward's results for 50 °C are shown on the graph.



Sketch a line on the graph to show the results that Edward should expect to obtain if he carried out the experiment to completion at 30 °C.

(2)



(ii) When zinc powder is used, instead of larger pieces of zinc, the reaction is faster.

Explain, using ideas about particles, why the reaction is faster when zinc powder is used.

(2)

.....

.....

.....

.....

(iii) Balance the equation for the reaction of zinc with dilute hydrochloric acid by putting a number in the space provided.



(1)

(iv) The reaction between zinc and dilute hydrochloric acid is exothermic.

Explain, in terms of breaking and forming bonds, why this reaction is exothermic.

(3)

.....

.....

.....

.....

.....

.....

(b) Catalysts are added to some reactions.

State the effect of catalysts on reactions.

(1)

.....

.....

**(Total for Question 2 = 9 marks)**



### Mixtures

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

A mixture of two immiscible liquids can be separated by using

(1)

- A fractional distillation
- B a separating funnel
- C evaporation
- D filtration

(b) Oxygen is a simple molecular, covalent substance.

(i) The electronic configuration of oxygen is 2.6.

Draw a dot and cross diagram for a molecule of oxygen, O<sub>2</sub>.

Show the outer electrons only.

(3)

(ii) The boiling point of oxygen is -183 °C.

Explain, in terms of the forces between the molecules, why oxygen has a very low boiling point.

(2)

.....

.....

.....

.....





(c) Describe how oxygen and nitrogen are obtained from liquid air by fractional distillation.

(3)

.....

.....

.....

.....

.....

.....

**(Total for Question 3 = 9 marks)**



**Calcium carbonate**

4 (a) Calcium oxide is manufactured by heating calcium carbonate.

The waste product of this process is carbon dioxide.

(i) Calculate the relative formula mass of carbon dioxide, CO<sub>2</sub>.  
(Relative atomic masses: C = 12, O = 16)

(1)

.....  
.....

relative formula mass = .....

(ii) The equation for the reaction is



Calculate the maximum mass of calcium oxide that can be obtained by heating 25 tonnes of calcium carbonate.

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

(3)

.....  
.....  
.....

mass calcium oxide = ..... tonnes

(b) (i) State what is meant by **theoretical yield**.

(1)

.....  
.....

(ii) Explain why the actual yield for a reaction is usually less than the theoretical yield for the reaction.

(2)

.....  
.....  
.....  
.....



(c) Many industrial processes produce waste products.

Suggest reasons why manufacturers try to find uses for these waste products.

(2)

.....

.....

.....

.....

**(Total for Question 4 = 9 marks)**



**Group 1**

**5** Lithium, sodium and potassium all react with cold water.

(a) Lithium, sodium and potassium are in group 1 of the periodic table.

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

These elements are

(1)

- A** halogens
- B** noble gases
- C** transition metals
- D** alkali metals

(b) When sodium is added to cold water, it forms a molten ball which floats on the surface of the water.

Explain why this happens.

(2)

.....

.....

.....

.....

(c) Write the balanced equation for the reaction of sodium with water.

(3)

.....



\***(d)** Sodium and potassium react with cold water to give similar products.

The electronic configuration of sodium is 2.8.1.

The electronic configuration of potassium is 2.8.8.1.

Explain the similarities and differences in the way sodium and potassium react with cold water by considering their reactions and their electronic configurations.

**(6)**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

---

**(Total for Question 5 = 12 marks)**

---

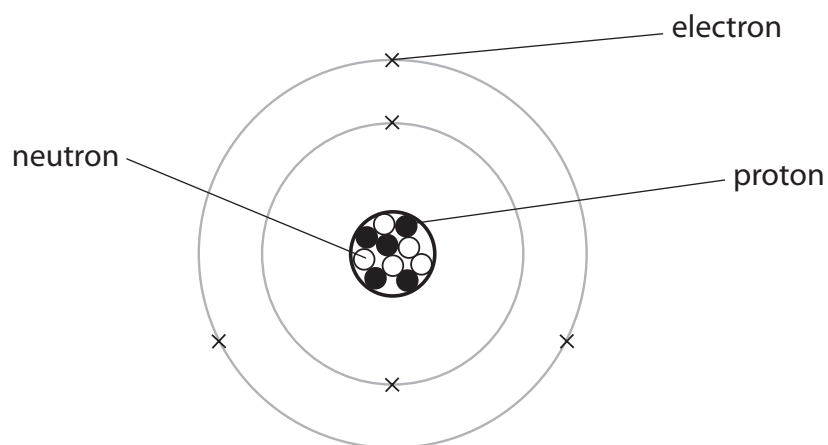


## Isotopes

6 Boron exists as two isotopes.

These are boron-10,  $^{10}_5\text{B}$ , and boron-11,  $^{11}_5\text{B}$ .

(a) The diagram shows an atom of the isotope, boron-10.



(i) State the electronic configuration of boron.

(1)

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

In the periodic table, boron is in period

(1)

- A 2
- B 3
- C 5
- D 10

(iii) The table shows the three particles present in atoms and their relative masses and charges.

Complete the table.

(2)

| particle | relative mass    | relative charge |
|----------|------------------|-----------------|
| electron | $\frac{1}{1837}$ |                 |
| neutron  |                  |                 |
| proton   |                  | +1              |



\* (b) A sample of boron contains 20% boron-10 and 80% boron-11.

In part (a) you were given the structure of a boron-10 atom.

Describe the structure of a boron-11 atom and explain why, in this sample, boron has a relative atomic mass of 10.8.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Mendeleev was a Russian chemist who produced the first version of the periodic table.

Give one similarity and one difference between his version of the periodic table and the periodic table shown on page 2.

(2)

**(Total for Question 6 = 12 marks)**

---

**TOTAL FOR PAPER = 60 MARKS**





**BLANK PAGE**

