| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4472/02

## ADDITIONAL SCIENCE/CHEMISTRY

# CHEMISTRY 2
## HIGHER TIER

A.M. THURSDAY, 15 May 2014

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **5** | |
| **2.** | **6** | |
| **3.** | **7** | |
| **4.** | **6** | |
| **5.** | **4** | |
| **6.** | **4** | |
| **7.** | **7** | |
| **8.** | **5** | |
| **9.** | **5** | |
| **10.** | **5** | |
| **11.** | **6** | |
| **Total** | **60** | |

4472
020001

### ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) used in your answers to questions **4** and **11**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Examiner only

*Answer* **all** *questions.*

**1.** *(a)* The following processes are used in the treatment of our water supply.

**sedimentation** **filtration** **chlorination**

State the purpose of each process. [3]

*Sedimentation*

.....

.....

*Filtration*

.....

.....

*Chlorination*

.....

.....

*(b)* Drinking water can be obtained by desalination.

State what is meant by *desalination* and name a process by which it can be carried out. [2]

.....

.....

5

Examiner only

**2.** Potassium reacts vigorously with water.

*(a)* (i) Describe what you would **observe** when potassium reacts with water. [3]

.....

.....

.....

.....

(ii) During a class demonstration the potassium exploded. Suggest what might have caused this to happen. [1]

.....

.....

*(b)* Complete and balance the symbol equation for the reaction between potassium and water. [2]

$2K + 2H_2O \longrightarrow$ ..... + .....

Examiner only

**3.** The table below shows the amount of soap solution required by different samples of water to form a permanent lather. In each case 25 $cm^3$ of the water samples were used and the soap solution was added 1 $cm^3$ at a time.

| | Volume of soap solution added ($cm^3$) | | | | |
|---|---|---|---|---|---|
| Sample | Test 1 | Test 2 | Test 3 | Test 4 | Mean |
| distilled water | 2 | 2 | 2 | 2 | 2 |
| **A** | 8 | 8 | 9 | 7 | 8 |
| **B** | 11 | 18 | 12 | 13 | |
| **C** | 15 | 14 | 14 | 13 | 14 |
| **A** after boiling | 8 | 7 | 9 | 8 | 8 |
| **B** after boiling | 6 | 5 | 6 | 7 | 6 |
| **C** after boiling | 2 | 2 | 2 | 2 | 2 |

*(a)* Two pupils, David and Haf, calculated the mean value for sample **B**. David calculated a value of 13.5 and Haf calculated a value of 12. Show how both values were obtained. State which is the better value to use and give a reason for your choice. [3]

.....

.....

.....

.....

*(b)* State which of water samples **A**, **B** and **C** is the **least** hard. [1]

*Water sample* .....

*(c)* State which of water samples **A**, **B** and **C** contains **both** temporary and permanent hardness. Give the reason for you answer. [2]

*Water sample* .....

*Reason* .....

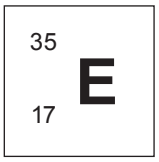
.....

*(d)* Name an ion which causes hardness in water. [1]

.....

Examiner only

**4.** An atom of element **E** is represented as follows.




State and explain what information this gives you about element **E**.

You may wish to refer to the key on the Periodic Table to help you answer this question. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Examiner only

**5.** *(a)* One of the main dangers in the coal mining industry is that coal dust can form an explosive mixture with air.

Explain why an explosion is more likely to occur with coal dust than with lumps of coal. [2]

.....

.....

.....

.....

*(b)* A chemical reaction goes twice as fast if the temperature is increased by 10 °C.

At 5 °C, milk undergoes a chemical reaction that makes it go sour in 8 days.

Calculate how long it will take milk to go sour at 35 °C. [2]

.....

.....

.....

4

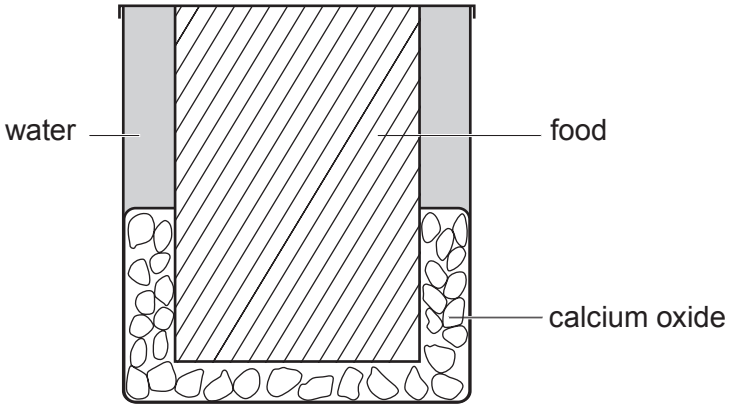
# BLANK PAGE

Examiner only

**6.** *(a)* 'Hot cans' are designed to heat the food inside them when it is to be eaten. The heat is generated by mixing calcium oxide with water.


*Source: Amazon*

The following diagram shows the cross-section of a 'hot can'.




During a trial reaction, the temperature reached 50 °C but a temperature of 70 °C is required to properly heat the food.

Suggest a change that could have been made and explain how this would lead to the can reaching the higher temperature. [2]

.....

.....

.....

.....

Examiner only

*(b)* When chemical reactions take place bonds are broken and new bonds are formed.

Explain, in terms of bond making and breaking, why some reactions are **exothermic**. [2]

.....

.....

.....

.....

Examiner only

**7.** *(a)* Sodium reacts with oxygen to give sodium oxide.

(i) Using the electronic structures below, draw dot and cross diagrams to show the transfer of electrons and the formation of ions that occur as sodium oxide is formed. [3]

sodium 2,8,1 oxygen 2,6

(ii) Give the **electronic structure** of the sodium and oxide **ions**. [1]

| | Electronic structure |
|---|---|
| sodium ion | |
| oxide ion | |

*(b)* Name the **type of structure** present in ammonia, $NH_3$, and explain why ammonia has a low melting point. [3]

.....

.....

.....

.....

.....

7

Examiner only

**8.** *(a)* When bromine is passed over heated iron wool it glows and forms iron(III) bromide.

Write a balanced **symbol** equation for the reaction. [3]

..... + ..... ⟶ .....

*(b)* Name the substance used to test for the presence of bromide ions in iron(III) bromide solution and give the expected result. [2]

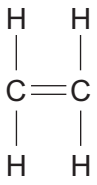
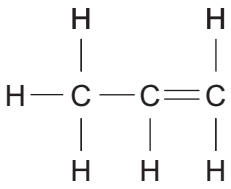
.....

.....

.....

Examiner only

**9.** *(a)* The table below shows the names, molecular formulae and the structural formulae of the first two members of the alkene series. Complete the table by giving the structural formula of butene, $C_4H_8$. [1]

| Name | Molecular formula | Structural formula |
|---|---|---|
| ethene | $C_2H_4$ |  |
| propene | $C_3H_6$ |  |
| butene | $C_4H_8$ | |

*(b)* Explain how polypropene is formed from propene. [4]

.....

.....

.....

.....

.....

.....

Examiner only

**10.** Many metal ores contain sulfides. Chalcocite is an important copper ore which contains copper(I) sulfide, $Cu_2S$.

Copper can be obtained from the ore by heating in air.

The equation for the reaction that takes place is as follows.

$$Cu_2S + O_2 \longrightarrow 2Cu + SO_2$$

*(a)* Use the above equation to calculate the mass of copper produced on reacting 20.5 tonnes of copper(I) sulfide with an excess of oxygen. [3]

$A_r$(Cu) = 64 $A_r$(S) = 32

*Mass of copper* = ..... tonnes

*(b)* When the extraction was carried out with 20.5 tonnes of chalcocite only 12.3 tonnes of copper was formed.

Calculate the percentage of **impurity** present in the ore. [2]

*Percentage of impurity* = ..... %

5





**Turn over.**

Examiner only

**11.** Describe how reactions involving chlorine, bromine and iodine can be used to show the trend in reactivity in Group 7 elements. [6 *QWC*]

You should include equations in your answer.

**END OF PAPER**

6

## FORMULAE FOR SOME COMMON IONS

| POSITIVE IONS | | NEGATIVE IONS | |
|---|---|---|---|
| **Name** | **Formula** | **Name** | **Formula** |
| Aluminium | $Al^{3+}$ | Bromide | $Br^{-}$ |
| Ammonium | $NH_4^{+}$ | Carbonate | $CO_3^{2-}$ |
| Barium | $Ba^{2+}$ | Chloride | $Cl^{-}$ |
| Calcium | $Ca^{2+}$ | Fluoride | $F^{-}$ |
| Copper(II) | $Cu^{2+}$ | Hydroxide | $OH^{-}$ |
| Hydrogen | $H^{+}$ | Iodide | $I^{-}$ |
| Iron(II) | $Fe^{2+}$ | Nitrate | $NO_3^{-}$ |
| Iron(III) | $Fe^{3+}$ | Oxide | $O^{2-}$ |
| Lithium | $Li^{+}$ | Sulfate | $SO_4^{2-}$ |
| Magnesium | $Mg^{2+}$ | | |
| Nickel | $Ni^{2+}$ | | |
| Potassium | $K^{+}$ | | |
| Silver | $Ag^{+}$ | | |
| Sodium | $Na^{+}$ | | |
| Zinc | $Zn^{2+}$ | | |




**Turn over.**

# PERIODIC TABLE OF ELEMENTS

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $^{1}_{1}$H Hydrogen | | | | | | | | | $^{4}_{2}$He Helium |
| $^{7}_{3}$Li Lithium | $^{9}_{4}$Be Beryllium | | | | | | | | | | | $^{11}_{5}$B Boron | $^{12}_{6}$C Carbon | $^{14}_{7}$N Nitrogen | $^{16}_{8}$O Oxygen | $^{19}_{9}$F Fluorine | $^{20}_{10}$Ne Neon |
| $^{23}_{11}$Na Sodium | $^{24}_{12}$Mg Magnesium | | | | | | | | | | | $^{27}_{13}$Al Aluminium | $^{28}_{14}$Si Silicon | $^{31}_{15}$P Phosphorus | $^{32}_{16}$S Sulfur | $^{35}_{17}$Cl Chlorine | $^{40}_{18}$Ar Argon |
| $^{39}_{19}$K Potassium | $^{40}_{20}$Ca Calcium | $^{45}_{21}$Sc Scandium | $^{48}_{22}$Ti Titanium | $^{51}_{23}$V Vanadium | $^{52}_{24}$Cr Chromium | $^{55}_{25}$Mn Manganese | $^{56}_{26}$Fe Iron | $^{59}_{27}$Co Cobalt | $^{59}_{28}$Ni Nickel | $^{64}_{29}$Cu Copper | $^{65}_{30}$Zn Zinc | $^{70}_{31}$Ga Gallium | $^{73}_{32}$Ge Germanium | $^{75}_{33}$As Arsenic | $^{79}_{34}$Se Selenium | $^{80}_{35}$Br Bromine | $^{84}_{36}$Kr Krypton |
| $^{86}_{37}$Rb Rubidium | $^{88}_{38}$Sr Strontium | $^{89}_{39}$Y Yttrium | $^{91}_{40}$Zr Zirconium | $^{93}_{41}$Nb Niobium | $^{96}_{42}$Mo Molybdenum | $^{99}_{43}$Tc Technetium | $^{101}_{44}$Ru Ruthenium | $^{103}_{45}$Rh Rhodium | $^{106}_{46}$Pd Palladium | $^{108}_{47}$Ag Silver | $^{112}_{48}$Cd Cadmium | $^{115}_{49}$In Indium | $^{119}_{50}$Sn Tin | $^{122}_{51}$Sb Antimony | $^{128}_{52}$Te Tellurium | $^{127}_{53}$I Iodine | $^{131}_{54}$Xe Xenon |
| $^{133}_{55}$Cs Caesium | $^{137}_{56}$Ba Barium | $^{139}_{57}$La Lanthanum | $^{179}_{72}$Hf Hafnium | $^{181}_{73}$Ta Tantalum | $^{184}_{74}$W Tungsten | $^{186}_{75}$Re Rhenium | $^{190}_{76}$Os Osmium | $^{192}_{77}$Ir Iridium | $^{195}_{78}$Pt Platinum | $^{197}_{79}$Au Gold | $^{201}_{80}$Hg Mercury | $^{204}_{81}$Tl Thallium | $^{207}_{82}$Pb Lead | $^{209}_{83}$Bi Bismuth | $^{210}_{84}$Po Polonium | $^{210}_{85}$At Astatine | $^{222}_{86}$Rn Radon |
| $^{223}_{87}$Fr Francium | $^{226}_{88}$Ra Radium | $^{227}_{89}$Ac Actinium | | | | | | | | | | | | | | | |

Key: