**ST MARY'S SCIENCE DEPARTMENT:**

**CHEMISTRY**

**H**

# GCSE CHEMISTRY **HOMEWORK BOOK**

# **TOPIC 2:** CHEMICAL REACTIONS

# STUDENT BOOK

**YOU MUST ANSWER ALL THREE SECTIONS IN EACH PART OF THE HOMEWORK TASKS**

| | |
|---|---|
| **NAME** | |
| **CLASS** | |
| **TEACHER** | |
| **FORM** | |

| TASK | MARK | GRADE |
|---|---|---|
| 1 | | |
| 2 | | |
| | | |
| OVERALL | | |

**GCSE CHEMISTRY**

**YEAR 11**

**TOPIC 1**

# HOMEWORK SCHEDULE

Please use the following table to ensure each homework task is completed and submitted on time.

Carrying out these homework tasks can only increase your ability to gain a high grade in the GCSE examinations.

Failure to hand in work on time will lead to sanctions to complete this work.

| Task | Submission Date | Completed? | On Time? |
|---|---|---|---|
| **Task 1**<br>Reversible Reactions | | | |
| **Task 2**<br>Le Chatelier | | | |

**SCIENCE DEPARTMENT MARKING CODE**

**ID =** Insufficient detail in answer
**W =** Wrong understanding of science
**IR =** Irrelevant information given.
**V =** This is too vague to get a mark.
**AQ =** Answer the question asked
**R =** Read the question/information
**M =** Maths mistake
**BOD =** Benefit of the doubt given.
**E =** Explain the answer further please.
**U =** Wrong units used.
**SF** = Wrong significant figures used.
**SP** = Wrong spelling of a technical term
**SR** = Same reason given more than once.
**A circle means this lost you marks**
**An underline means this gained you marks**

**PLEASE READ**

This homework booklet has made with custom selected examination questions and activities to assess your understanding in the concepts covered in class. This will increase your familiarity with the style of examination questions.

Carrying out these questions can only increase your ability to gain a high grade in the GCSE examination.

Thank you for your hard work in completing this book, and good luck.

Mr. Turnbull

## TASK 1: REVERSIBLE REACTIONS

## SPEC CHECK

| Content | Achieved? |
|---|---|
| In some chemical reactions, the products of the reaction can react to produce the original reactants. Such reactions are called reversible reactions and are represented:<br>$A + B \rightleftharpoons C + D$<br>The direction of reversible reactions can be changed by changing the conditions.<br>ammonium chloride $\underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}}$ ammonia + hydrogen chloride | |
| If a reversible reaction is exothermic in one direction, it is endothermic in the opposite direction. The same amount of energy is transferred in each case.<br>hydrated copper sulfate (blue) $\underset{\text{exothermic}}{\overset{\text{endothermic}}{\rightleftharpoons}}$ anhydrous copper sulfate (white) + water | |
| When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur at exactly the same rate. | |

**Target Setting**

In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

**What Topics Do I Know Well?**

**What Topics Do I Need to Revise?**

## SECTION A

**This is a revision question on a previous topic.**

You should aim to spend **10 minutes** answering this section.

**1.** A 1 kg mass is made from a platinum and iridium alloy.

**1.1** The platinum and iridium alloy is harder than pure platinum.

Explain why alloys are harder than the pure metal.

**[3 marks]**

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**1.2** The 1 kilogram mass consisted of 900 g platinum and 100 g iridium.

What was the ratio of platinum atoms to iridium atoms in the alloy?

Relative atomic masses ($A_r$): Pt = 195 Ir = 192

**[1 mark]**

Tick **one** box.

0.99 :1.00 ☐

8.86 :1.00 ☐

9.00 :1.00 ☐

9.14 :1.00 ☐

The Avogadro constant is the number of atoms in 1 mole of a substance.

**1.3** What is the value of the Avogadro constant?

**[1 mark]**

Tick **one** box.

$6.02 \times 10^{23}$ per mole ☐

$6.02 \times 10^{24}$ per mole ☐

$6.02 \times 10^{25}$ per mole ☐

$6.02 \times 10^{26}$ per mole ☐

**1.4** Scientists could use a sample of silicon to define the Avogadro constant.

Copper is an impurity in the silicon sample.

There are 70 nanograms of copper in 1 g of the sample.

Calculate the mass of copper in grams in 1 kg of the sample.

Give your answer in standard form.

1 nanogram = 10–9 g

**[2 marks]**

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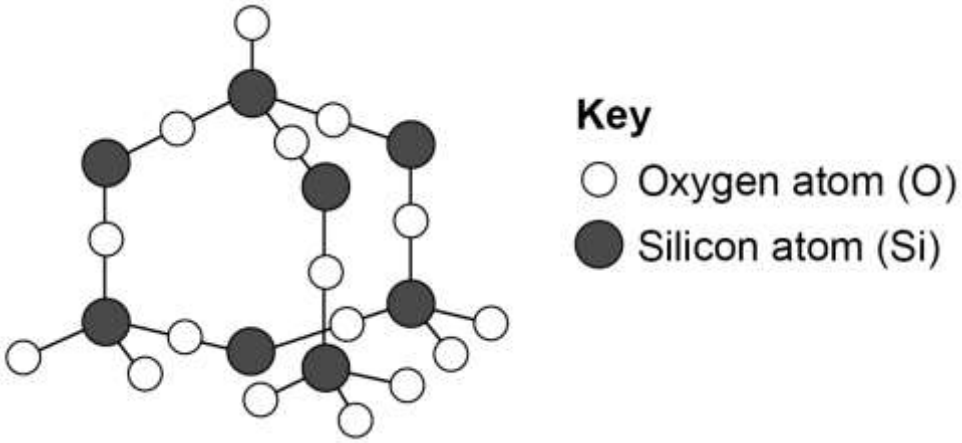
Mass of Copper =..... g

Silicon mainly occurs in the Earth's crust as silicon dioxide.

**Figure 8** represents part of the structure of silicon dioxide.

**Figure 8**




**1.5** Determine the empirical formula of silicon dioxide.

Use **Figure 8.**

**[1 mark]**

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Empirical Formula = .....

**1.6** Describe the structure and bonding in silicon dioxide.

**[3 marks]**

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## SECTION B

**This is a question to revise understanding carried out in lesson.**

You should aim to spend **10 minutes** answering this section.

**1.** Hydrated copper(II) sulfate is a blue solid. When it is heated, water is given off as steam and the crystals turn white. The reaction is reversible.

Describe an experiment to investigate this chemical change. You should outline the method you would use, name any apparatus required, and describe two pieces of evidence that the reaction is reversible.

**[6 marks]**

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## SECTION C

**This is a challenge question to extend your understanding.**

You should aim to spend **10 minutes** answering this section.

**1.** A company manufactures ethanol ($C_2H_5OH$).

The reaction for the process is:

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$ $\quad \Delta H = -45$ kJ per mole

The temperature and pressure can be changed to increase the yield of ethanol at equilibrium.

**1.1** Explain what is meant by equilibrium.

**[3 marks]**

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**1.2** How would increasing the temperature change the **yield** of ethanol at equilibrium?

Give a reason for your answer.

**[2 marks]**

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**1.3** How would increasing the pressure change the **yield** of ethanol at equilibrium?

Give a reason for your answer.

**[2 marks]**

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**1.4** A catalyst is added to increase the rate of the reaction.

Explain how adding a catalyst increases the rate of a chemical reaction.

**[2 marks]**

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**FEEDBACK SHEET**

| | | | |
|---|---|---|---|
| **Overall Mark:** | **/26** | **GRADE ACHIEVED:** | |
| **Section A: Mark** | /11 | **9** ☐ | **5** ☐ |
| **Section B: Mark** | /6 | **8** ☐ | **4** ☐ |
| **Section C: Mark** | /9 | **7** ☐ | **3** ☐ |
| | | **6** ☐ | **U** ☐ |

| **Knowledge and understanding shown** | Unsatisfactory | Satisfactory | Good | Outstanding |
|---|---|---|---|---|

| | | |
|---|---|---|
| **Strengths:** | ☐ Basic Knowledge of Concepts<br>☐ Quality of Written Communication<br>☐ Working Scientifically<br>☐ Answering Examination Questions<br>☐ Analytical Skills<br>**Others** (Topic Specific) | ☐ Applications of Concepts<br>☐ Mathematical Skills<br>☐ Experimental Technique<br>☐ Previous Topics<br>☐ Problem Solving |
| **Areas to Improve:** | ☐ Basic Knowledge of Concepts<br>☐ Quality of Written Communication<br>☐ Working Scientifically<br>☐ Answering Examination Questions<br>☐ Analytical Skills<br>**Others** (Topic Specific) | ☐ Applications of Concepts<br>☐ Mathematical Skills<br>☐ Experimental Technique<br>☐ Previous Topics<br>☐ Problem Solving |

| | | | | |
|---|---|---|---|---|
| **Progress:** | Unsatisfactory | Satisfactory | Good | Outstanding |
| **Working:** | Below | In line with | Above | **(your target)** |
| **Effort:** | Poor | Inconsistent | Good | Excellent |

**To improve further you need to:**

| | |
|---|---|
| ☐ Carry out **independent** revision. | ☐ Revise the equations. |
| ☐ Complete outstanding work. | ☐ Check the units on answers. |
| ☐ Make corrections as indicated by the teacher. | ☐ Check the correct amount of sig figs on answers. |
| ☐ Attend intervention for this topic | ☐ Check to convert values correctly. |
| ☐ Include more information in responses. | ☐ Show your full working out. |
| ☐ Include more key words in responses. | ☐ Check your calculations. |
| ☐ Attend departmental revision sessions. | ☐ Revise the science investigative skills. |
| ☐ Read the questions carefully. | ☐ Revise the key concepts of the topics. |
| ☐ Explain your answers in more detail. | ☐ Thoroughly check your work for mistakes. |
| ☐ Carry out revision on Seneca Learning. | Other: |

**Student response**

## TASK 2: LE CHATELIER

## SPEC CHECK

| Content | Achieved? |
|---|---|
| (HT Only)<br>The relative amounts of all the reactants and products at equilibrium depend on the conditions of the reaction.<br>If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change.<br>The effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle.<br>Students should be able to make qualitative predictions about the effect of changes on systems at equilibrium when given appropriate information. | |
| (HT Only)<br>If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again.<br>If the concentration of a reactant is increased, more products will be formed until equilibrium is reached again.<br>If the concentration of a product is decreased, more reactants will react until equilibrium is reached again.<br>Students should be able to interpret appropriate given data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium. | |
| (HT Only)<br>If the temperature of a system at equilibrium is increased:<br>• the relative amount of products at equilibrium increases for an endothermic reaction<br>• the relative amount of products at equilibrium decreases for an exothermic reaction.<br>If the temperature of a system at equilibrium is decreased:<br>• the relative amount of products at equilibrium decreases for an endothermic reaction<br>• the relative amount of products at equilibrium increases for an exothermic reaction.<br>Students should be able to interpret appropriate given data to predict the effect of a change in temperature on given reactions at equilibrium. | |
| (HT Only)<br>For gaseous reactions at equilibrium:<br>• an increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules as shown by the symbol equation for that reaction<br>• a decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules as shown by the symbol equation for that reaction.<br>Students should be able to interpret appropriate given data to predict the effect of pressure changes on given reactions at equilibrium. | |

**Target Setting**

In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

| What Topics Do I Know Well? | What Topics Do I Need to Revise? |
| --- | --- |
| | |

## SECTION A

**This is a revision question on a previous topic.**

You should aim to spend **10 minutes** answering this section.

**1.** A student planned to make copper sulfate crystals from excess copper oxide and dilute sulfuric acid.
The equation for the reaction is:

$$CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$$

**1.1** Why is it necessary to add excess copper oxide?

**[1 mark]**

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**1.2** This is the method used.

**1.** Add 25 $cm^3$ of dilute sulfuric acid to a conical flask.

**2.** Gently warm the dilute sulfuric acid.

**3.** Add excess copper oxide to the dilute sulfuric acid.

**4.** Stir the mixture.

**5.** Heat to evaporate all the water from the mixture.

Suggest **two** improvements to the method.

Explain why each improvement is needed.

**[4 marks]**

Improvement **1**

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Improvement **2**

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**1.3** The student used:

• 2 g of copper oxide (in excess)

• 25 $cm^3$ of a solution of dilute sulfuric acid with a concentration of 49 $g/dm^3$

Determine by how many moles the copper oxide (CuO) was in excess.

Relative atomic masses ($A_r$): Cu = 63.5 O = 16

Relative formula mass ($M_r$) of sulfuric acid = 98

**[5 marks]**

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Number of Moles in Excess = .....

## SECTION B

**This is a question to revise understanding carried out in lesson.**

You should aim to spend **10 minutes** answering this section.

**1.** The Contact process is an industrial method for making sulfuric acid from sulfur, oxygen, and water.

One important reaction in the Contact process is:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

sulfur dioxide | oxygen | sulfur trioxide

The reaction is exothermic in the forwards direction.

**1.1** State the meaning of the symbol ⇌.

**[1 mark]**

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**1.2** Describe **and** explain the effect of increasing pressure on the amount of sulfur trioxide at equilibrium.

**[2 marks]**

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The reaction is carried out at a temperature of 450 °C.

**1.3** Describe **and** explain the effect of raising the temperature above 450 °C on the amount of sulfur trioxide at equilibrium.

**[2 marks]**

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A vanadium pentoxide catalyst is used.

**1.4** Explain how the use of a catalyst increases the rate of the reaction.

**[2 marks]**

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## SECTION C

**This is a challenge question to extend your understanding.**

You should aim to spend **10 minutes** answering this section.

**1.** This question is about hydrocarbons

**1.1** Explain why the hydrocarbon $C_7H_{16}$ has a lower boiling point than $C_{10}H_{22}$

**[2 marks]**

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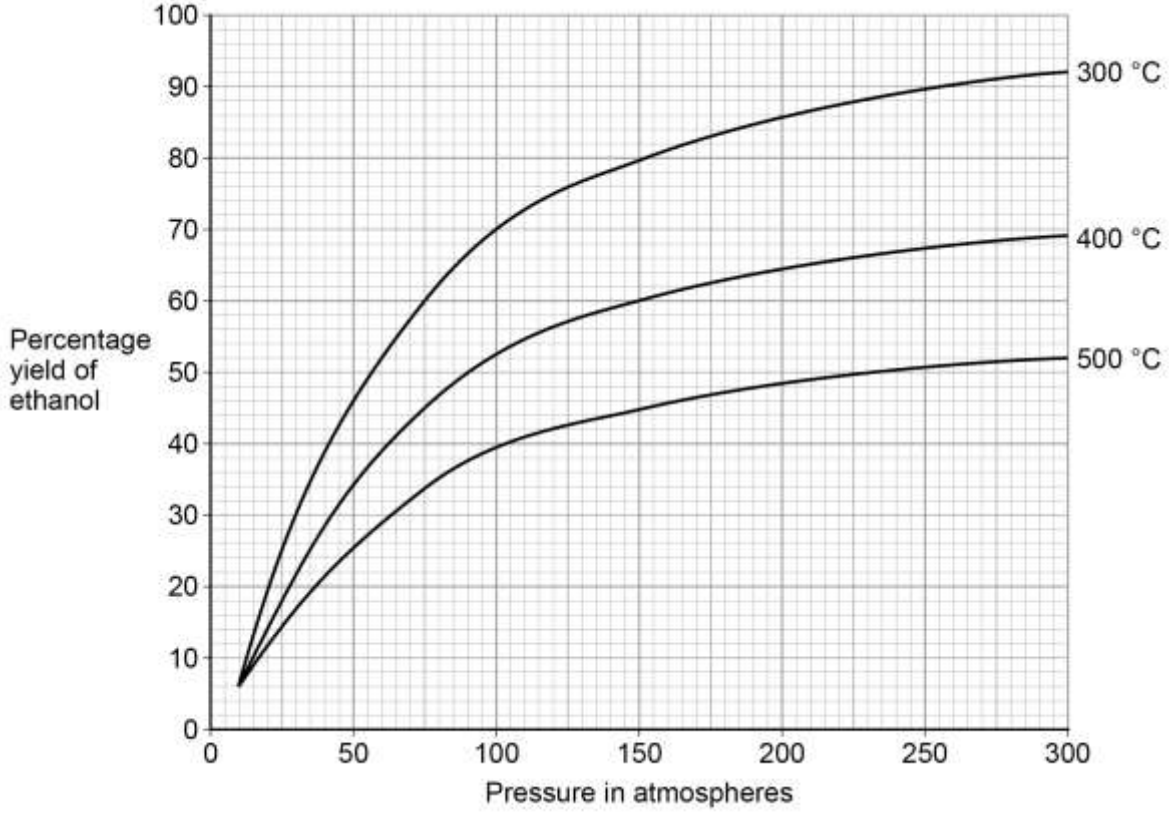
Ethanol is produced by reacting ethene with steam.

The equation for the reaction is:

$$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$$

**Figure 4** shows the percentage yield of ethanol using different reaction conditions.

**Figure 4**



**1.2** Explain why changing the pressure affects the percentage yield of ethanol.

**[3 marks]**

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The forward reaction is exothermic.

**1.3** How does **Figure 4** provide evidence for this?

**[1 mark]**

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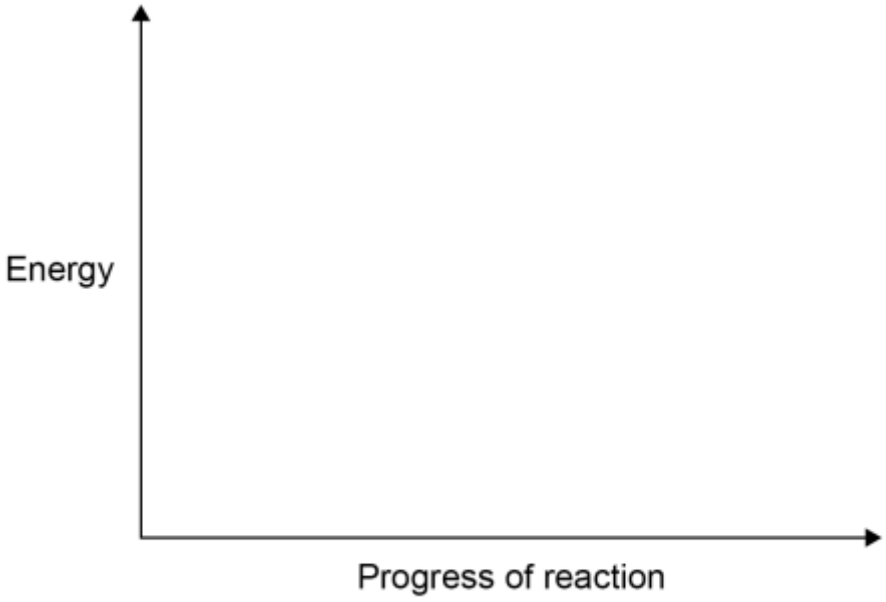
**1.4 Figure 5** shows part of a reaction profile diagram.

**Figure 5**




A catalyst is used in the reaction to produce ethanol.

Complete **Figure 5** to show how the catalyst increases the rate of this reaction.

You should label the reaction profile diagram.

**[4 marks]**

**1.5** Suggest why the catalyst does **not** affect the yield of ethanol at equilibrium.

**[2 marks]**

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**FEEDBACK SHEET**

| | | | |
|---|---|---|---|
| **Overall Mark:** | **/29** | **GRADE ACHIEVED:** | |
| **Section A: Mark** | /10 | **9** ☐ | **5** ☐ |
| **Section B: Mark** | /7 | **8** ☐ | **4** ☐ |
| **Section C: Mark** | /12 | **7** ☐ | **3** ☐ |
| | | **6** ☐ | **U** ☐ |

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|---|---|---|---|---|

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| ☐ Carry out revision on Seneca Learning. | Other: |

**Student response**

# The Periodic Table of 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 | [97] 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 | [267] Rf rutherfordium 104 | [270] Db dubnium 105 | [269] Sg seaborgium 106 | [270] Bh bohrium 107 | [270] Hs hassium 108 | [278] Mt meitnerium 109 | [281] Ds darmstadtium 110 | [281] Rg roentgenium 111 | [285] Cn copernicium 112 | [286] Nh nihonium 113 | [289] Fl flerovium 114 | [289] Mc moscovium 115 | [293] Lv livermorium 116 | [293] Ts tennessine 117 | [294] Og oganesson 118 |

Key: relative atomic mass, atomic symbol, name, atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

**Acknowledgements**

This document has been produced by Mr J Turnbull.

All relevant information has been credited in the document.

This document has been produced for educational purposes only.

This document has been produced for the AQA GCSE Science Specification.