# GCSE Chemistry Paper 2 Personal Learning Checklist

## 6. The Rate and Extent of Chemical Change

| | Learning Objectives: | Confidence | | |
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| **Rates of Reaction (Chapter 8)** | Describe how the rate of reaction can be determined experimentally. | | | |
| | Calculate the mean rate of reaction. | | | |
| | Give units for the rate of a reaction. (HT including in terms of moles.) | | | |
| | Draw and interpret graphs showing the amount of product formed (or reactant used up) against time – describe how the rate of reaction changes with time and compare the rate of different reactions. | | | |
| | Draw tangents to curves on these graphs and use the slope to describe the rate of reaction. (HT – calculate the gradient of the tangent to give the rate of reaction at a specific time). | | | |
| | Explain what happens to particles in a reaction using the collision theory. | | | |
| | Predict what happens to the rate of reaction if the temperature, concentration, pressure or surface area are changed and explain why this happens using ideas about particles and collision theory. | | | |
| | Describe what catalysts and enzymes are. | | | |
| | Identify when a catalyst has been used in a reaction. | | | |
| | State and explain the effect of using a catalyst on the rate of reaction and explain why catalysts are important in industry. | | | |
| **Reversible Reactions and Equilibrium (Chapter 8)** | Recall the symbol used to represent a reversible reaction. | | | |
| | Describe how the direction of a reversible reaction can be changed by changing the conditions, e.g. the thermal decomposition of ammonium chloride. | | | |
| | Explain how equilibrium is reached with a reversible reaction in a closed system. | | | |
| | Use Le Chatelier's Principle to predict the effect of changing conditions (concentration, temperature or pressure) on a system at equilibrium (**HT only**). | | | |

# 7. Organic Chemistry

| | Learning Objectives: | Confidence | | |
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| Crude Oil and Alkanes (Chapter 9) | Describe what crude oil is. | | | |
| | Define the terms mixture and hydrocarbon. | | | |
| | State the properties of hydrocarbons and describe the trends in these properties. | | | |
| | Describe how crude oil is separated. | | | |
| | Explain why crude oil is separated and how the technique works. | | | |
| | Name some of the useful products obtained from crude oil. | | | |
| | Describe what an alkane is. | | | |
| | Identify an alkane from its name, molecular formula or displayed formula. | | | |
| Fuels and Combustion (Ch 9) | Name the elements that fuels contain. | | | |
| | List the products of combustion (complete and incomplete) and identify the problems associated with these products. | | | |
| | State what type of chemical reaction combustion is and explain why. | | | |
| | Write and balance symbol equations for combustion reactions. | | | |
| Cracking (Chapter 9) | Explain what cracking is and why it is carried out. | | | |
| | Describe how steam and catalytic cracking are carried out, name the products and identify some uses of these products. | | | |
| | Balance symbol equations for cracking. | | | |
| Alkenes (Chapter 10) | Describe what an alkene is. | | | |
| | Identify an alkene from its name, molecular formula or displayed formula. | | | |
| | Name and draw the structures of the first four alkenes. | | | |
| | State the general formula of an alkene. | | | |
| | State the functional group of an alkene and explain what a functional group is. | | | |
| | Describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes. | | | |
| | Explain what an addition reaction is. | | | |
| | Draw displayed formulae for the products of the reactions of hydrogen, water, chlorine, bromine and iodine with the first four alkenes. | | | |
| | Describe the test for an alkene and the result of this test. | | | |
| | Write balanced equations for the combustion of alkenes. | | | |

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| | Explain why alkenes tend to burn with a smoky flame. | | | |

| | **Learning Objectives:** | **Confidence** | | |
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| **Alcohols and Carboxylic Acids (Chapter 10)** | State what functional group alcohols have. | | | |
| | Name and draw structural and displayed formulae for the first four members of the alcohol homologous series. | | | |
| | Describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water or react with an oxidising agent. | | | |
| | Recall the main uses of alcohols. | | | |
| | Describe how ethanol can be made by fermentation, including conditions. | | | |
| | Write balanced equations for the combustion of alcohols. | | | |
| | State what functional group carboxylic acids have. | | | |
| | Name and draw structural and displayed formulae for the first four members of the carboxylic acid homologous series. | | | |
| | Describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water or react with alcohols. | | | |
| | Explain why carboxylic acids are weak acids in terms of ionisation and pH. (**HT only**) | | | |
| **Addition Polymerisation (Chapter 11)** | Define the terms monomer and polymer and classify them as saturated or unsaturated. | | | |
| | Describe the process of addition polymerisation. | | | |
| | Draw the structure of a polymer from a given monomer. | | | |
| | Draw the structure of a monomer from a given polymer. | | | |
| | Write equations for polymerisation reactions and give some uses of polymers. | | | |
| | Explain why polymers are solids in terms of their structure and bonding whereas the monomers they are made from tend to be liquids or gases. | | | |
| **Condensation Polymerisation (Chapter 11)** | Describe the process of condensation polymerisation. | | | |
| | State the type of molecules that are used as monomers in condensation polymerisation. | | | |
| | Recall the molecules that is lost during condensation polymerisation and explain why. | | | |
| | Recognise condensation polymers from diagrams of their structure. | | | |
| **Amino Acids (Chapter 11)** | Describe what an amino acid is. | | | |
| | Describe how amino acids react by condensation polymerisation to produce polypeptides. | | | |
| | Recall that different amino acids combined in the same chain produce proteins. | | | |
| **DNA (Chapter 11)** | State what DNA is. | | | |
| | Name some other naturally occurring polymers. | | | |

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| | Name the types of monomers that form these naturally occurring polymers. | | | |

# 8. Chemical Analysis

| | Learning Objectives: | Confidence | | |
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| Chemical Analysis (Chapter 12) | Describe what is meant by the term 'pure' in chemistry and in everyday language. | | | |
| | Use melting and boiling point data to distinguish between pure and impure substances. | | | |
| | Describe what a formulation is and identify formulations from given information. | | | |
| | Describe how to test for the following gases (and the results of the tests): hydrogen, oxygen, carbon dioxide and chlorine. | | | |
| Chromatography (Chapter 12) | Describe and explain how paper chromatography can be used to separate mixtures. | | | |
| | Explain how to identify pure and impure substances by chromatography. | | | |
| | Interpret chromatograms and calculate $R_f$ values from chromatograms. | | | |
| | **Required Practical –** Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Calculate $R_f$ values. | | | |
| Flame Tests (Chapter 12) | Describe how flame tests can be used to identify some metal ions (cations). | | | |
| | State the flame colours of lithium, sodium, potassium, calcium and copper compounds. | | | |
| | Identify the metal ions present in a compound from the results of a flame test. | | | |
| | Explain that if there are a mixture of ions, the flame colours can be masked (difficult to see). | | | |
| Testing for Ions (Chapter 12) | Describe how some metal ions (cations) can be identified using sodium hydroxide solution. | | | |
| | State what is formed when sodium hydroxide solution is added to solutions containing aluminium, calcium, magnesium, copper (II), iron (II) or iron (III) ions. | | | |
| | Write balanced equations for the reactions above. | | | |
| | Describe how to test for carbonates using dilute acids and limewater. | | | |
| | Describe how to test for halide ions using silver nitrate solution in nitric acid. | | | |
| | State the colours of silver chloride, silver bromide and silver iodide. | | | |
| | Describe how to test for sulfate ions using barium chloride solution in dilute hydrochloric acid. | | | |
| Instrumental Methods (Chapter 11) | State the advantages of using instrumental methods compared to chemical tests to identify elements and compounds. | | | |
| | Describe how flame emission spectroscopy can be used to analyse metal ions. | | | |

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| | Interpret flame emission spectra using data provided. | | | |

# 9. Chemistry of the Atmosphere

| | Learning Objectives: | Confidence | | |
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| Chemistry of the Atmosphere (Chapter 13) | Recall the proportions of the gases that currently make up the Earth's atmosphere. | | | |
| | Describe the main changes to the Earth's atmosphere over the past 4.6 billion years and some of the likely causes of these changes. | | | |
| | Explain why evidence for this is limited. | | | |
| | Interpret evidence that is provided to evaluate different theories about the Earth's early atmosphere. | | | |
| | Explain how oxygen increased in the atmosphere (including an equation). | | | |
| | Explain how carbon dioxide decreased. | | | |
| | Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. | | | |
| | Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. | | | |
| | Explain how the greenhouse effect enables the Earth to support life. | | | |
| | Name three greenhouse gases. | | | |
| | Recall two human activities that increase greenhouse gases in the atmosphere. | | | |
| | Evaluate the quality of evidence (from provided information) for global climate change. | | | |
| | Describe uncertainties in the evidence base. | | | |
| | Recognise the importance of peer review of results and of communicating results to a wide range of audiences. | | | |
| | Describe briefly four potential effects of global climate change. | | | |
| | Discuss the scale, risk and environmental implications of global climate change. | | | |
| | State what is meant by the term 'carbon footprint'. | | | |
| | Describe actions to reduce emissions of carbon dioxide and methane. | | | |

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| | Give reasons why actions may be limited. | | | |

# 10. Using Resources

| | **Learning Objectives:** | **Confidence** | | |
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| **Using Resources (Chapter 14)** | State examples of natural products that are supplemented or replaced by agricultural and synthetic products. | | | |
| | Distinguish between finite and renewable resources given appropriate information. | | | |
| | Extract and interpret information about resources from charts, graphs and tables. | | | |
| | Use orders of magnitude to evaluate the significance of data. | | | |
| | State what is meant by the term 'potable water'. | | | |
| | Distinguish between potable water and pure water. | | | |
| | Describe the differences in treatment of ground water and salty water. | | | |
| | Give reasons for the steps used to produce potable water. | | | |
| | **Required Practical –** Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. | | | |
| | Describe some of the processes involved in sewage and waste water treatment. | | | |
| | Comment on the relative ease of obtaining potable water from waste, ground and salt water. | | | |
| | Describe how metals can be obtained by phytomining and bioleaching (**HT only**). | | | |
| | Explain why alternative methods of extracting metals are necessary (**HT only**). | | | |
| | Evaluate alternative biological methods of metal extraction, given appropriate information (**HT only**). | | | |
| | Describe what a life cycle assessment (LCA) is and state the four stages that are considered. | | | |
| | Explain why an LCA is not purely objective. | | | |
| | Discuss how a LCA can be used to evaluate a product, but how it can also be misused, e.g. to support claims for advertising purposes. | | | |
| | Give three reasons why reducing the use of/reusing/recycling materials is important. | | | |
| | Give examples of materials that are produced from limited raw materials. | | | |

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| | Describe how glass can be reused or recycled. | | | |
| | Describe how metals can be recycled. | | | |
| | Evaluate ways of reducing the use of limited resources, given appropriate information. | | | |

| | **Learning Objectives:** | **Confidence** | | |
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| **Corrosion (Chapter 15)** | Describe what corrosion is. | | | |
| | Name the metal that rusts, state what rust is and give the conditions needed for rusting. | | | |
| | Describe experiments and interpret results to show that both air and water are necessary for rusting. | | | |
| | Describe how corrosion can be prevented by applying a coating barrier (grease, paint, electroplating). | | | |
| | Explain how aluminium is protected from further corrosion. | | | |
| | Explain how sacrificial protection works in terms of relative reactivity. | | | |
| **Alloys (Chapter 15)** | State what the alloys bronze, 'gold' in jewellery, low carbon steel, high carbon steel and stainless steel are made of. | | | |
| | Describe the properties of the alloys listed above and state a use of each one. | | | |
| | Interpret and evaluate the composition and uses of alloys from given information. | | | |
| **Ceramics, Polymers and Composites (Chapter 15)** | Explain how low density and high density poly(ethene) are produced from ethene. | | | |
| | Explain the difference between thermosetting and thermosoftening polymers in terms of their structures. | | | |
| | Describe the formation of glass, clay ceramics and composites. | | | |
| | Compare quantitatively the physical properties of glass, clay ceramics, polymers, composites and metals. | | | |
| | Explain how the properties of materials are related to their uses and select appropriate materials for a use. | | | |
| **The Haber Process and NPK Fertilisers (Chapter 15)** | Write an equation for and describe how ammonia in produced in the Haber process. | | | |
| | State the conditions used in the Haber process. | | | |
| | State the sources of nitrogen and hydrogen for the Haber process. | | | |
| | Describe how the ammonia is removed from the reactor and state what happens to the remaining nitrogen and hydrogen. | | | |
| | Recall that the Haber process is a reversible reaction. | | | |
| | Interpret graphs of reaction conditions versus rate. (**HT only**) | | | |
| | Apply the principles of dynamic equilibrium to the Haber process. | | | |
| | Explain the trade-off between rate of production and position of equilibrium. | | | |
| | Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate. | | | |
| | State what NPK fertilisers contain. | | | |
| | Recall that ammonia is used to manufacture ammonium salts and nitric acid. | | | |

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| | Recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid. | | | |
| | Compare the industrial production of fertilisers with laboratory preparations for the same compounds, using given information. | | | |

# Mathematical Skills (Paper 1+2)

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| **Arithmetic and Numerical Computation** | Express numbers in decimal form. | | | |
| | Express numbers in standard form. | | | |
| | Use ratios, fractions and percentages. | | | |
| | Make estimates of the results of simple calculations. | | | |
| **Handling Data** | Use an appropriate number of significant figures/ | | | |
| | Calculate the mean. | | | |
| | Understand the terms mean, mode and median. | | | |
| | Make order of magnitude calculations. | | | |
| **Algebra** | Understand and use the symbols: =, <, <<, >>, >, α, ~ | | | |
| | Change the subject of an equation. | | | |
| | Substitute numerical values into equations using appropriate units. | | | |
| **Graphs** | Understand that $y = mx+c$ represents a linear relationship. | | | |
| | Plot a line graph from experimental data, including drawing a line of best fit. | | | |
| | Determine the gradient and intercept of a linear graph. | | | |
| | Draw a tangent to a curve and calculate its gradient as a measure of the rate of change. | | | |
| **Geometry and Trigonometry** | Visualise and represent 2D and 3D forms. | | | |
| | Calculate areas of triangles and rectangles. | | | |
| | Calculate surface areas and volumes of cubes. | | | |