Science - Key Stage 3 Level Descriptors

	Assessment Foci 1 -	AF2 -	AF3 -	AF4 -	AF5 -
Level 8	Describe or explain processes or phenomena, logically and in detail making use of abstract ideas and models from different areas of science. Select and justify an appropriate approach to evaluating the relative importance of a number of different factors in explanations or arguments. Analyse the development of scientific theories through the emergence of new, accepted ideas and evidence.	Describe ways in which the values of a society influence the nature of the science developed in that society or period of history. Evaluate the effects of scientific or technological developments on society as a whole. Explain the unintended consequences that may arise from scientific and technological developments. Make balanced judgements about particular scientific or technological developments by evaluating the economic, ethical/moral, social or cultural implications.	Critically evaluate information and evidence from various sources, explaining limitations, misrepresentations or lack of balance. Present robust and well structured explanations, arguments or counter arguments in a variety of ways. Suggest the specialisms and skills that would be needed to solve particular scientific problems or to generate particular new scientific or technological developments.	Justify their choice of strategies for investigating different kinds of scientific questions, using scientific knowledge and understanding. Choose and justify data collection methods that minimise error, and produce precise and reliable data. Adapt their approaches to practical work to control risk by consulting resources and expert advice	Propose scientific explanations for unexpected observations or measurements, making allowances for anomalies. Process data, including using multi-step calculations and compound measures, to identify complex relationships between variables. Critically interpret, evaluate and synthesise conflicting evidence. Suggest and justify improvements to experimental procedures using detailed scientific knowledge and understanding and suggest coherent strategies to take particular investigations further.
Level 7	Make explicit connections between abstract ideas and/or models in explaining processes or phenomena. Employ a systematic approach in deciding the relative importance of a number of scientific factors when explaining processes or phenomena. Explain how different pieces of evidence support accepted scientific ideas or contribute to questions that science cannot fully answer. Explain the processes by which ideas and evidence are accepted or rejected by the scientific community.	Suggest ways in which scientific and technological developments may be influenced. Explain how scientific discoveries can change worldviews. Suggest economic, ethical/moral, social or cultural arguments for and against scientific or technological developments.	Explain how information or evidence from various sources may have been manipulated in order to influence interpretation. Effectively represent abstract ideas using appropriate symbols, flow diagrams and different kinds of graphs in presenting explanations and arguments. Explain how scientists with different specialisms and skills have contributed to particular scientific or technological developments.	Formulate questions or ideas that can be investigated by synthesising information from a range of sources. Identify key variables in complex contexts, explaining why some cannot readily be controlled and planning appropriate approaches to investigations to take account of this. Explain how to take account of sources of error in order to collect reliable data. Recognise the need for risk assessments and consult, and act on, appropriate sources of information.	Explain how data can be interpreted in different ways and how unexpected outcomes could be significant. Identify quantitative relationships between variables, using them to inform conclusions and make further predictions. Assess the strength of evidence, deciding whether it is sufficient to support a conclusion. Explain ways of modifying working methods to improve reliability.
Level 6	Use abstract ideas or models or multiple factors when explaining processes or phenomena. Identify the strengths and weaknesses of particular models. Describe some scientific evidence that supports or refutes particular ideas or arguments, including those in development. Explain how new scientific evidence is discussed and interpreted by the scientific community and how this may lead to changes in scientific ideas.	Describe how different decisions on the uses of scientific and technological developments may be made in different economic, social or cultural contexts. Explain how societies are affected by particular scientific applications or ideas. Describe how particular scientific or technological developments have provided evidence to help scientists pose and answer further questions. Describe how aspects of science are applied in particular jobs or roles.	Identify lack of balance in the presentation of information or evidence. Choose forms to communicate qualitative or quantitative data appropriate to the data and the purpose of the communication. Distinguish between data and information from primary sources, secondary sources and simulations, and present them in the most appropriate form.	Apply scientific knowledge and understanding in the planning of investigations, identifying significant variables and recognising which are interdependent and which are dependent. Justify their choices of data collection method and proposed number of observations and measurements. Collect data choosing appropriate ranges, numbers and values for measurements and observations. Independently recognise a range of familiar risks and take action to control them.	Suggest reasons based on scientific knowledge and understanding for any limitations or inconsistencies in evidence collected. Select and manipulate data and information and use them to contribute to conclusions. Draw conclusions that are consistent with the evidence they have collected and explain them using scientific knowledge and understanding. Make valid comments on the quality of their data.
Level 5	Use abstract ideas or models or more than one step when describing processes or phenomena. Explain processes or phenomena, suggest solutions to problems or answer questions by drawing on abstract ideas or models. Recognise scientific questions that do not yet have definitive answers. Identify the use of evidence and creative thinking by scientists in the development of scientific ideas.	Describe different viewpoints a range of people may have about scientific or technological developments. Indicate how scientific or technological developments may affect different groups of people in different ways. Identify ethical or moral issues linked to scientific or technological developments. Link applications of science or technology to their underpinning scientific ideas.	Distinguish between opinion and scientific evidence in contexts related to science, and use evidence rather than opinion to support or challenge scientific arguments. Decide on the most appropriate formats to present sets of scientific data, such as using line graphs for continuous variables. Use appropriate scientific and mathematical conventions and terminology to communicate abstract ideas. Suggest how collaborative approaches to specific experiments or investigations may improve the evidence collected.	Recognise significant variables in investigations, selecting the most suitable to investigate. Explain why particular pieces of equipment or information sources are appropriate for the questions or areas under investigation. Repeat sets of observations or measurements where appropriate, selecting suitable ranges and intervals. Make, and act on, suggestions to control obvious risks to themselves and others.	Interpret data in a variety of formats, recognising obvious inconsistencies. Provide straightforward explanations for differences in repeated observations or measurements. Draw valid conclusions that utilise more than one piece of supporting evidence, including numerical data and line graphs. Evaluate the effectiveness of their working methods, making practical suggestions for improving them.
Level 4	Use scientific ideas then describing simple processes or phenomena. Use simple models to describe scientific ideas. Identify scientific evidence that is being used to support or refute ideas or arguments.	Describe some simple positive and negative consequences of scientific and technological developments. Recognise applications of specific scientific ideas. Identify aspects of science used within particular jobs or roles	Select appropriate ways of presenting scientific data. Use appropriate scientific forms of language to communicate scientific ideas, processes or phenomena. Use scientific and mathematical conventions when communicating information or ideas.	Decided when it is appropriate to carry out fair tests in investigations. Select appropriate equipment or information sources to address specific questions or ideas under investigation. Make sets of observations or measurements, identifying the ranges and intervals used. Identify possible risks to themselves and others.	Identify patterns in data presented in various formats, including line graphs. Draw straightforward conclusions from data presented in various formats. Identify scientific evidence they have used in drawing conclusions. Suggest improvements to their working methods, giving reasons.
Level 3	Identify differences, similarities or changes related to simple scientific ideas, processes or phenomena. Respond to ideas given to them to answer questions or suggest solutions to problems. Represent things in the real world using simple physical models. Use straightforward scientific evidence to answer questions, or to support their findings.	Explain the purposes of a variety of scientific or technological developments. Link applications to specific characteristics or properties. Identify aspects of our lives, or of the work that people do, which are based on scientific ideas.	Present simple scientific data in more than one way, including tables and bar charts. Use scientific forms of language when communicating simple scientific ideas, processes or phenomena. Identify simple advantages of working together on experiments or investigations.	Identify one or more control variables in investigations from those provided. Select equipment or information sources from those provided to address a question or idea under investigation. Make some accurate observations or whole number measurements relevant to questions or ideas under investigation. Recognise obvious risks when prompted.	Identify straightforward patterns in observations or in data presented in various formats including tables, pie and bar charts. Describe what they have found out in experiments or investigations, linking cause and effect Suggest improvements to their working methods.

Science - Key Stage 4 Grade Descriptors

	Assessment Foci 1 -
Grade A*	• undertake quantitative analysis of results • evaluate the reliability of their results, fully evaluating the procedure used. They often suggested improvements to the method, justifying these changes • apply their understanding confidently in both familiar and novel situations • show confidence in tackling a two or three stage calculation
Grade A	• show clarity of purpose when planning an investigation by using appropriate and relevant scientific knowledge and understanding to produce a clearly structured plan. They could give reasons to support their choice of method • evaluate the reliability of their results, but could not fully evaluate the procedure used. They often suggested improvements to the method but found it difficult to justify these changes • identify anomalies, and could sometimes account for them. • use scientific ideas and principles to explain more abstract concepts • demonstrate a broad knowledge and recall information from across the full range of the specification • apply their understanding confidently in familiar situations but often struggled to do so when faced with a novel situation. • use a wide scientific vocabulary with precision, handle numerical data confidently, using units consistently and accurately • develop a balanced argument drawing on a range of data and make a judgment supported by evidence, usually using scientific evidence rather than general knowledge.
Grade B	• use scientific knowledge and understanding to support predictions • demonstrate a good understanding of concrete concepts • use the correct scientific vocabulary for some ideas but struggled with more complex ideas, • recall the appropriate formula and rearrange it as necessary • make careful and reliable observations and record their results using significant figures consistently
Grade C	• plan an investigation in which they control the appropriate variables • use scientific knowledge and understanding to support predictions, though these were rarely quantitative • tabulate results, repeating and usually averaging, their results that usually included the correct units • plot suitable graphs with a best fit straight line, or smooth curve, attempted as appropriate. They could recognise anomalous results but were rarely able to explain them • make comments on procedure and sometimes suggested simple improvements to the method. • recall factual information well from across the syllabus, but had a limited ability to apply this knowledge. • recall simple formula, substitute numerical values and evaluate the expression correctly, though they found the manipulation of equations difficult • use the correct unit for common quantities • read information from a table or graph accurately
Grade D	• Link the fair test to the factors that could be investigated • Recognise relevant scientific knowledge • Plot a scatter graph with an attempt made at a line of best fit • Correct units used on results tables, but not necessarily correct significant figures • Write a complete report including an attempt at an evaluation • recall simple equations
Grade E	• Identify the key factors that could be investigated • With guidance recognize relevant scientific knowledge • Plot a graph appropriate to the results • Substitute numerical values into given formula correctly and evaluate an answer
Grade F	• plan a simple experiment and describe the method, including a diagram of the experimental apparatus to be used • show some awareness of the need for a fair test, though the plan was unlikely to be linked to valid or appropriate scientific knowledge and understanding • carry out a simple experiment and record and tabulate a set of results, though units were often omitted • make a simple comment on the trend of the results • write only an incomplete report, often confusing an evaluation with the conclusion. • recall some science terminology and could complete sentences, typically selecting the correct term from a list of alternatives • begin explanations, though they often relied on general knowledge rather than scientific principles in their answers.

Science - Key Stage 5 Grade Descriptors

	Assessment Foci 1 - Biology	AF2 - Chemistry	AF3 - Physics	AF4 – Forensic Science
Grade A*	Students at this level will consistently exhibit a secure depth of understanding, analysis and application across all the criteria as required to achieve a grade A			
Grade A	• Demonstrate knowledge and understanding of most principles, concepts and facts from across the specification • Select relevant information from the specification • Make links and connections between different areas within the specification • Explain ideas clearly and concisely with excellent use of scientific terminology which shows detailed knowledge • Apply principles and concepts in familiar and new contexts • Describe significant trends and patterns shown by data either in graphical or tabular form • Comment critically on statements, conclusions or data • Carry out calculations accurately (AS: linear magnification, Simpsons diversity index A2: Hardy – Weinberg principle, Chi-squared) • Translate data successfully from one form to another • Show safe and skillful practical techniques • Comment on ethical issues • Interpret, explain and **evaluate** the results of their own and others' experimental and investigative activities in appropriate contexts • Make observations and measurements with appropriate precision and accuracy and record them accurately and methodically • Evaluate and comment critically on the limitations of techniques and experimental design and refer to data	Students recall and use chemical knowledge from the whole AS and/or A2 course with few significant omissions and show good understanding of the principles and concepts they use. Students are thoroughly conversant with the construction of chemical equations and use them quantitatively in a range of contexts. They select chemical knowledge relevant to most situations and present their ideas clearly and logically, making use of appropriate chemical terminology. Students carry out calculations in a logical manner even when little guidance is given. They demonstrate good understanding of principles, applying them in familiar and new contexts, for example, in determining the order of reaction from empirical results, in predicting the conditions which might be used in an industrial process, in using knowledge of the periodic table to predict reactions of unfamiliar elements or compounds or in predicting the reactions of organic compounds containing specific functional groups. They bring together and use knowledge and understanding from more than one area of the specification, for example, in suggesting a method for synthesising a particular compound or in interpreting evidence relating to the structure of a molecule or ion. In experimental activities, Students independently formulate a clear and accurate plan. They use a range of manipulative techniques safely and skilfully, making and recording observations with appropriate precision. They interpret, explain and evaluate results, using appropriate chemical knowledge and terminology	• show a good recall of facts and theory, and could sustain this across the examination paper • demonstrate a wide understanding of physical concepts, including abstract ideas • select the correct formula and apply it correctly to numerical problems • perform calculations correctly, including those involving exponential or logarithmic forms • show a knowledge of a range of practical techniques and could apply them to a variety of experimental situations • They could use more complex graphical forms, such as inverse-square and exponential relationships • use microscopic models to explain macroscopic behaviour, for example they could explain electrical conduction in metals by discussion of the motion of electrons, or gas pressure by using the kinetic theory • explain abstract concepts well. Their explanations were usually succinct and well structured.	Distinction-grade learners will work with greater autonomy, using the teacher as a resource when necessary. The distinction grade learners will use a wide range of resources and analyse the information gained from these to produce fluent explanations and discussions, using the correct scientific language and units. The distinction grade learners' practical work will be planned, carried out and evaluated with a minimum of support. Errors will be identified and conclusions drawn. The examples given by the distinction grade learners will be detailed and comprehensive. The distinction grade learners will present reasoned discussions of issues, showing consideration of conflicting viewpoints.
Grade B		Displays very broad knowledge of factual information in the syllabus and a thorough understanding of concepts and principles. Selects and applies relevant information, concepts and principles in most contexts. Analyses and evaluates quantitative and/or qualitative data with a high level of competence. Constructs explanations of complex phenomena and makes appropriate predictions. Solves new or difficult quantitative and/or qualitative problems. Communicates effectively using appropriate terminology and Demonstrates personal skills, perseverance and responsibility in a wide variety of investigative activities in a very consistent manner. Works well within a team. Displays competence in a wide range of investigative techniques, paying due attention to safety, and is generally capable of working independently. Shows some insight or originality.	• Show a solid understanding of physical concepts • Practical work was often very competently carried out. Students took accurate measurements and recorded them clearly. Experimental results were processed appropriately and the analysis was accurate. • Abstract concepts beginning to be developed • show a good grasp of mechanics	
Grade C	• Demonstrate knowledge and understanding of most principles, concepts and facts from across the specification but with **some** inconsistency • Select **mostly** relevant information from the specification • Make **few** links and connections between different areas within the specification • Explain ideas which are **mostly** correct with **good** use of scientific terminology • Apply principles and concepts in familiar and **some** new contexts	Displays broad knowledge of factual information in the syllabus. Shows sound understanding of most concepts and principles and applies them in some contexts. Analyses and evaluates quantitative and/or qualitative data competently. Constructs explanations of simple phenomena. Solves most basic or familiar problems and some new or difficult quantitative and/or qualitative problems. Communicates clearly with little or no irrelevant material. Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities in a fairly consistent manner. Generally works well within a team. Displays competence in a range of investigative techniques, paying	• Show inconsistent recall of facts and theory • could begin more complex calculations but often had difficulties in algebraic manipulation. • Able to derive units • Abstract concepts attempted • use scientific vocabulary in an appropriate fashion. • Interpret graphical information accurately and manipulate formulae so as to apply the equation of a straight line.	Merit-grade learners will work with more independence. The learners will carry out research with little guidance and will be able to plan and carry out practical work to solve more complex problems, or use a range of practical techniques. The merit grade learners will be able to make accurate observations and give reasons for any inaccuracies. The merit grade learners will be able to link ideas from different areas and discuss the impact of a variety of factors on an issue.

	• Describe **most** trends and patterns shown by data either in graphical or tabular form • Make **some** critical comments on statements, conclusions or data • Carry out **most** steps in calculations accurately (AS: linear magnification, Simpsons diversity index A2: Hardy – Weinberg principle, Chi-squared) • Translate **most** data from one form to another • Show safe and **sometimes** skillful practical techniques • Comment on ethical issues • Interpret, explain and **communicate with some evaluation** the results of their own and others' experimental and investigative activities in appropriate contexts • Make observations and measurements and record them in a consistent way but not always accurately • Comment critically on the limitations of some techniques and sometimes refer to data	attention to safety, and is capable of working independently. In experimental activities, Students formulate a plan, which may need some modification. They use a range of techniques safely, making and recording observations and measurements, which are adequate for the task. They interpret and explain experimental results, relating these to chemical knowledge and understanding and, with help, evaluate how good their results are. Students recall chemical knowledge from many parts of the specification and show good understanding of some fundamental principles and concepts. They routinely represent most reactions, *for example, those for inorganic redox processes*, by chemical equations and use them quantitatively. They frequently select chemical knowledge relevant to a particular situation or context and present their ideas clearly and logically, making use of chemical terminology. Students carry out a range of calculations, making progress in some where little guidance is given. They show knowledge of fundamental principles in applying these in some new contexts, *for example, in using information about reactions to distinguish between compounds containing different functional groups*. They bring together information from more than one area of the specification in interpreting information, *for example, in explaining trends in K*a *for a range of organic acids*.		
Grade D		Displays reasonable knowledge of factual information in the syllabus, though possibly with some gaps. Shows adequate comprehension of most basic concepts and principles but with limited ability to apply them. Demonstrates some analysis or evaluation of quantitative or qualitative data. Solves some basic or routine problems but shows limited ability to deal with new or difficult situations. Communicates adequately although responses may lack clarity and include some repetitive or irrelevant material. Demonstrates personal skills, perseverance and responsibility in a variety of investigative activities, although displays some inconsistency. Works competently within a team. Displays competence in a range of investigative techniques, paying some attention to safety, although requiring some close supervision.	• carry out some calculations well • use information from text, graphs, tables and diagrams in the solution of problems. • demonstrate understanding in some areas, but were not consistent across the examination paper. Areas of weakness were often in specific areas of the syllabus, often in the more abstract ideas • recall specific applications from the syllabus but found it difficult to apply their physics knowledge to novel applications. • begin to make simple estimates of error, but were unlikely to have carried out any analysis of uncertainty.	
Grade E	Demonstrate knowledge and understanding of **some** principles, concepts and facts from across the specification Select **some** relevant information from the specification Present information using **basic** terminology Apply a given principle to material presented in a **familiar** context Describe **some** trends and patterns shown by data either in graphical or tabular form Identify, when directed, inconsistencies in conclusions or data Carry out **some** steps in calculations (AS: linear magnification, Simpsons diversity index A2: Hardy – Weinberg principle, Chi-squared) Translate data successfully from one form to another, in **some** contexts Show safe practical techniques Comment on ethical issues Interpret, explain and communicate **some** aspects of the results of their own and others' experimental and investigative activities in appropriate contexts Make observations and measurements and record them Identify **some** limitations of techniques but not data	Displays limited knowledge of factual information in the syllabus. Shows a partial comprehension of basic concepts and principles and weak ability to apply them. Shows some ability to manipulate data and solve basic or routine problems. Communicates with a possible lack of clarity and some repetitive or irrelevant material. Demonstrates personal skills, perseverance and responsibility in some investigative activities in an inconsistent manner. Students recall chemical knowledge from some parts of the specification and demonstrate some understanding of fundamental principles and concepts, *for example, in relating the properties of some compounds to the bonding found in them*. They write chemical equations for straightforward, frequently-encountered chemical reactions and use simple equations quantitatively. They select discrete items of knowledge in response to structured questions and use basic chemical terminology. Students carry out straightforward calculations where guidance is given. They apply knowledge and chemical principles contained within the specification to material presented in a familiar or closely related context, *for example, in using information about reactions to identify the functional groups in some organic compounds.* They use some fundamental chemical skills in contexts, which bring together different areas of the subject. In experimental activities, students formulate some elements of a practical approach when provided with guidance. They carry out frequently encountered practical procedures in a reasonably skilful manner, recognising the risks in familiar procedures and obtain some appropriate results. They interpret and explain some experimental results but need assistance to relate these to chemical knowledge and understanding.	recall some definitions, but were unlikely to be able to discuss any of the assumptions underlying the theory use base units well, but were likely to make mistakes with derived units or in conversions construct graphs from experimental data and could often calculate the gradient, though they often found it difficult to make inferences from this information construct diagrams to represent physical situations, though errors were often made carry out practical work and collect appropriate results, but were unlikely to be able to evaluate their work begin to explain physical phenomena, but would often omit important points so that the explanation was incomplete show some understanding of the relevant theories, but would often be unable to organise their written answer coherently explain some phenomena, especially in highly structured questions. However they were less likely to be successful in explanations relating to abstract concepts, or where the answer required extended prose.	Pass-grade learners will be able to follow scientific procedures and will be able to use scientific symbols, relevant terminology and identify errors. Their learning will contain both theory work which will be used to underpin their investigations, and work towards the scenario. Students will have completed work which may have required regular assistance from the teacher.