SCIENCE – CURRICULUM INTENT

ASPIRE – CHALLENGE – ACHIEVE

Bourne Academy's Science Department aims to produce confident, enthusiastic scientists who are numerate, literate and able to think clearly and apply their understanding to new situations. We believe that an understanding of all fields of science is essential for students to appreciate their effect on the world around them and the fragility of the natural world.

Biology introduces varied and complex new concepts and vocabulary which enables students to understand the pressing environmental and social problems associated with a growing and ageing population. Students will be provided with all the information required to make informed decisions regarding diet and lifestyle choices.

Chemistry underpins all areas of scientific study and students develop an understanding of the principles of atomic structure and bonding which form the basis of all reactions, both in living organisms and in industry. Students are encouraged to make links between their learning in the classroom to current events, such as global warming, dwindling natural resources and consider the implications of climate change.

Physics is known as the fundamental science. By studying energy and matter in space and time, and how they are related to each other, students develop critical thinking and quantitative reasoning skills that they can apply to scientific problems and experiments. Research in this area has led to the development of many technologies that have transformed modern-day society.

Through a structured programme of practical investigations, we empower students to apply their understanding of key concepts to real life practical situations, formulating hypotheses that they test using methods of their own design. At both KS3 & KS4 all formal assessment activities include the acquisition and application of key terminology and opportunities for extended writing, laying the foundations for success at KS5. Independent learning is encouraged at all key stages through the provision of research tasks, computer based self-evaluation activities and extended report writing.

All students are placed on aspirational flightpaths and curriculum intervention opportunities are embedded throughout all courses of study, which enables students to fulfil their potential. Revision activities and revision sessions are provided throughout the year, for all abilities.

SCIENCE: WIDER CURRICULUM *(Covid dependent)*

KS3	KS4	KS5
Big Bang Science Show IOP Super Physics Day Project X Science week	CERN -Switzerland STEM / Uni Events	CERN -Switzerland STEM / Uni Events
Discussion of current scientific advances/news articles Lunch & after school intervention / Easter & May holiday revision sessions *See separate Curriculum Intervention & SMSC Audits for contributions from Science too detailed to list here*		

SCIENCE – CURRICULUM MAP

Key = Matching colours denote links between topics either in content or skills across Key Stages

	Biology		Chemistry
	Physics		Revision
	Exams		Practical Skills (Enrichment)

Key Stage 3

7	STARTING SCIENCE	ENERGY	FORCES	ORGANISMS	MATTER	WAVES	REACTIONS	ELECTRICITY	GENES	EARTH
8	ECOSYSTEMS	FORCES	MATTER	ORGANISMS	MAGNETISM	REACTIONS	ENERGY AND WORK	CLIMATE AND RESOURCES	GENES	WAVES	INTRODUCTION TO REQUIRED PRACTICALS
9	CELL BIOLOGY	INFECTION AND RESPONSE	BIOENERGETICS	ATOMIC STRUCTURE AND THE PERIODIC TABLE	BONDING, STRUCTURE AND PROPERTIES	ENERGY CHANGES	PARTICLE MODEL OF MATTER	ELECTRICITY	ENERGY

The focus in key stage 3 is to develop a deeper understanding of a range of scientific ideas in the biology, chemistry and physics. Pupils should begin to see the connections between these areas and become aware of the big ideas underpinning scientific knowledge such as the links between structure and function in living organisms, the particulate model, interactions of matter in all its forms and the resources and means of transfer of energy. Students are encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations. Pupils should understand that science is about working objectively and scientifically using the correct vocabulary mathematical units and representations. Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be considered when collecting, recording and processing data. They should evaluate their results and identify further questions arising from them.

Key Stage 4

10	ORGANISATION	HOMEOSTASIS AND RESPONSE	ECOLOGY	QUANTITATIVE CHEMISTRY	CHEMICAL CHANGES	RATE AND EXTENT OF CHEMICAL CHANGE	ORGANIC CHEMISTRY	ATOMIC STRUCTURE	FORCES
11	INHERITANCE, VARIATION AND EVOLUTION	CHEMICAL ANALYSIS	CHEMISTRY OF THE ATMOSPHERE	USING RESOURCES	WAVES	MAGNETISM AND ELECTROMAGNETS	SPACE *(SEPARATE SCIENCE ONLY)*	*REVISION*	*GCSE EXAMS*

By the end of Key Stage 4 students will have developed scientific knowledge and understanding through the disciplines of biology, chemistry and physics. Students will have obtained understanding of the nature, process and methods of science, through different scientific enquiries, that will help them to answer questions about the world around them. Moreover, students will have developed and learnt how to apply observation, practical, modelling, enquiry and problem-solving skills, in the laboratory, the field and in other learning environments. Students will also have furthered their ability to evaluate claims based on science through critical analysis of methodology, evidence and conclusions, both quantitatively and qualitatively. Above all, students will have developed curiosity, insight and appreciation of science and its relevance in their everyday life.

Key Stage 5

12 & 13	**BIOLOGY AS** BIOLOGICAL MOLECULES	CELLS	ORGANISMS EXCHANGE SUBSTANCES WITH THEIR ENVIRONMENT	GENETIC INFORMATION, VARIATION AND RELATIONSHIPS BETWEEN ORGANISMS	PRACTICAL SKILLS	*REVISION*	*AS EXAMS*
	BIOLOGY A2 ENERGY TRANSFER IN AND BETWEEN ORGANISMS	ORGANISMS RESPOND TO CHANGES IN THEIR ENVIRONMENT	GENETICS, POPULATIONS, EVOLUTION, AND ECOSYSTEMS	THE CONTROL OF GENE EXPRESSION	PRACTICAL SKILLS	*REVISION*	*A2 EXAMS*
	CHEMISTRY AS ORGANIC CHEMISTRY AND ANALYSIS	PHYSICAL CHEMISTRY - PARTICULATE PHENOMENA IN CHEMICAL SYSTEMS	INORGANIC CHEMISTRY – PERIODICITY, GROUP2 AND GROUP 7	PRACTICAL SKILLS	*REVISION*	*EXAMS*	
	CHEMISTRY A2 ORGANIC CHEMISTRY SYNTHESYS STRUCTURE AND ANALYSIS	PHYSICAL CHEMISTRY – THERMODYNAMICS, KINETICS, EQUILIBRIA AND pH	INORGANIC CHEMISTRY – PERIODICITY, TRANSITION METALS AND AQUEOUS SOLUTIONS	PRACTICAL SKILLS	*REVISION*	*A2 EXAMS*	

PHYSICS AS MEASUREMENTS AND ERRORS	MECHANICS	MATERIALS	WAVES	ELECTRICITY	PARTICLES AND RADIATION	PRACTIC AL SKILLS	*REVISION*	AS EXAM
PHYSICS A2 FURTHER MECHANICS	THERMAL PHYSICS	FIELDS	NUCLEAR PHYSICS	MEDICAL PHYSICS	PRACTICAL SKILLS	*REVISION*		*A2 EXAMS*

BTEC APPLIED YR 12 PERIODICITY AND PROPERTIES OF ELEMENTS	STRUCTURE AND FUNCTIONS OF CELLS AND TISSUES	WAVES IN COMMUNICATION	UNIT 1 EXAM	TITRATION AND COLORIMETRY	CALORIMETRY	CHROMATOGRAPHY TECHNIQUES	REVIEW PERSONAL SCIENTIFIC SKILLS

BTEC APPLIED YR13 DIFFUSION OF MOLECULES	ENZYMES IN ACTION	PLANTS	ENERGY CONTENT OF FUELS	ELECTRICAL CIRCUITS	UNIT 3 EXAM	CARDIOVASCULAR AND RESPIRATORY SYSTEMS	HOMEOSTATIC MECHANISMS USED BY THE HUMAN BODY	HORMONES AND THE REPRODUCTIVE SYSTEM.

By the end of Key Stage 5 students will be able to solve problems and apply scientific knowledge to practical contexts. Students will also be able to use and apply scientific methods and practices such as being able to comment on experimental design and evaluate scientific methods. They will apply mathematical concepts in a practical context by plotting and interpreting graphs, processing and analysing data whilst considering margins and sources of error. Students will know and understand how to use a wide range of experimental and practical instruments, equipment and techniques appropriate to the knowledge and understanding included in the Level 3 courses.

SCIENCE: SKILLS / KNOWLEDGE PROGRESSION BY THEMES

	Development of scientific thinking	Experimental skills	Mathematical skills & Data Presentation	Analysis and Conclusions	Scientific Vocabulary
Year 7	Identify variables from information about an investigation. Write an observation enquiry question. Understand the importance of repeating readings in primary data. Know laboratory rules and safety.	Draw basic scientific equipment. Introduce the use of basic scientific equipment e.g. using a measuring cylinder, Bunsen burner, a microscope. Gather data. Follow a set of simple instructions to carry out an experiment.	Calculate a mean from a set of data. Record results in a pre-prepared table. Draw simple bar charts and line graphs with axes provided. Use given formulas E.g. Speed = distance/time.	Calculate a mean from a set of data. Write a simple conclusion using data collected or data provided in a table.	Variables Safety Mean Results Bar charts and line graphs Conclusion Word equations
Year 8	Identify the independent, dependent, and control variables in a scientific investigation. Write a fair test enquiry question. Gather sufficient data and suggest reasons for differences in repeat readings. Identify hazards & suggest the likelihood / risk of it happening. Use a model to explain an experiment or idea.	Draw a range of scientific equipment and simple diagrams. Introduce the use of scientific equipment e.g. ammeters, voltmeters, multimeters. Gather a range of data, minimising errors. Follow a set of simple instructions to carry out a method carefully and consistently.	Find arithmetic means from a set of data. Prepare a results table with space to record all measurements. Decide the type of chart or graph to draw based on the type of data with axes provided. Use given formulas E.g. Speed = distance/time and include units for all answers.	Find arithmetic means from a set of data. Write a simple conclusion and identify a pattern in data from a results table or bar chart.	Independent, dependent and control variables. Continuous and Discontinuous Fair test Data Hazards and Risks Model Error Arithmetic mean Formula Symbol equations
Year 9	Choose a suitable range for the independent and dependent variables. Write a pattern seeking enquiry question. Gather sufficient data, give detailed reasons for repeats and identify anomalous results. Identify hazards and suggest the likelihood of it happening i.e. the risk. Use a model to solve a problem.	Draw a range of scientific equipment and diagrams. Use a range of scientific equipment to follow a prescribed method. Gather a range of data, minimising errors, and using selected measuring equipment. Follow a set of instructions to carry out a method carefully and consistently.	Remove outliers & find arithmetic means from a set of data. Prepare a results table to record all measurements including headings for the independent and dependent variables. Decide the type of chart or graph to draw based on the type of data and decide on the scale showing what each square of graph paper represents. Draw a straight line or a curve of best fit. Use given formulas E.g. speed = distance/time and include units for all answers. Rearrange formulas to change the subject of an equation.	Remove outliers and find arithmetic means from a set of data. Write a conclusion and identify a pattern in data from a results table or bar chart. Draw conclusions using examples of data from the experiment, table or graph. Explain correlation shown on graphs or results tables using scientific understanding. Include units to all numerical answers.	Range Pattern Anomalous results Outliers Lines of best fit. Correlation Direct proportionality

Years 10 & 11	Choose a suitable range for the independent and dependent variables and control the most important variable for fair testing. Write and test own hypotheses. Gather sufficient data, give detailed reasons for repeats, identify anomalous results and give reasons for anomalous results. Identify hazards and risks and suggest ways of reducing the hazard and risk. Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding.	Draw a range of detailed scientific equipment and diagrams. Confidently use a range of scientific equipment to follow a prescribed method. Gather a range of data, minimising errors, checking that the measuring equipment can measure the complete range of the independent variable. Devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. Be aware of the safe and ethical use of living organisms in practical activities. Write methods for required practical activities.	Identify anomalous results and remove to find arithmetic means from a set of data. Prepare a results table with space to record all measurements including headings for the independent and dependent variables and the mean. Construct frequency tables. Decide the type of chart or graph to draw based on the type of data and decide on the scale showing what each square of graph paper represents. Label the x-axis with the independent variable and the y-axis with the dependent variable. Draw a straight line or a curve of best fit accurately. Draw and use the slope of a tangent to a curve or the gradient of a straight-line graph. Use given formulas E.g. speed=distance/time and include units for all answers. Rearrange formulas to change the subject of an equation. Solve simple algebraic equations.	Identify anomalous results and remove to find arithmetic means from a set of data. Write a conclusion and identify a pattern in data from a results table or bar chart. Draw conclusions using examples of data from the experiment, table or graph. Judge whether a conclusion is supported by the data. Evaluate practical experiments, with reference to improving reliability or accuracy. Use terms correctly E.g. directly proportional, positive correlation. Include SI units to all numerical answers. Use prefixes and powers of ten for orders of magnitude.	Hypothesis Reliability Accuracy SI Units Quantitative Chemistry Prefixes and powers of ten Significant figures

Years 12 & 13	Identify all variables including all of those that must be controlled and use the most appropriate piece of equipment to measure those variables. Write and test own hypotheses and conclude if hypotheses are correct. Gather sufficient data, give detailed reasons for repeats, identify anomalous results, give reasons for anomalous results. Use statistical tests to determine measures of dispersion and determine uncertainty. Research and write own risk assessments for both given methods and own methods. Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and develop scientific explanations and understanding.	Draw a range of detailed scientific equipment and diagrams, including whole equipment set ups for experiments. Confidently select the appropriate equipment for a scientific method, justify your choice, and safely handle solids and liquids including corrosive, irritant, flammable and toxic substances. Gather an appropriate range of data, minimising errors, checking that the measuring equipment can measure the complete range of the independent variable to produce reliable, repeatable and accurate results. Devise procedures using research from a number of reliable sources to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. Be aware of the safe and ethical use of living organisms in practical activities. Write methods for required practical activities following CPAC for all practical activities.	Identify anomalous results & remove to find arithmetic means from data (mean, mode & median.) Prepare a results table to record all measurements including headings & units for the independent and dependent variables & the mean. Record data to an appropriate number of significant figures depending on the precision of measuring equipment. Construct frequency tables. Process & analyse data using appropriate mathematical skills. Decide the type of chart or graph to draw based on the type of data & decide on the scale. Label the x-axis with the independent variable & the y-axis with the dependent variable. Draw a straight line or a curve of best fit accurately. Determine the slope & intercept of a linear graph. Draw & use the slope of a tangent to a curve as a measure of rate of change. Understand the possible physical significance of the area between a curve and the x-axis & be able to calculate it or estimate it by graphical methods. Use IT programs to draw graphs. Include error bars on line graphs. Use logarithms in relation to quantities that range over several orders of magnitude & plot logarithmic functions.	Identify anomalous results and remove to find arithmetic means from a set of data. Understand the terms mean, mode and median. Write a conclusion and identify a pattern in data from a results table or bar chart. Draw conclusions using examples of data from the experiment, table or graph. Judge whether a conclusion is supported by the data. Evaluate practical experiments, with reference to improving reliability or accuracy. Use terms correctly e.g. directly proportional, positive correlation. Evaluate results and draw conclusions with reference to measurement uncertainties and errors. Include SI units to all numerical answers. Use prefixes and powers of ten for orders of magnitude and use logarithmic scales for quantities that range over several orders of magnitude. Explain possible reasons for anomalous results in practical data collected, either from a graph or results table. Application to exam questions in terms of evaluating methods for accuracy and reliability.	Percentage error Experimental error Systematic error Uncertainties Reliability Accuracy Risk Hazard Positive/negative correlation Logarithmic scales

			Use given formulas & learnt formulas & include units for all answers. Rearrange formulas to change the subject of an equation. Solve simple algebraic equations. Recognise & make use of appropriate units in calculations & convert if necessary. Recognise & use expressions in decimal & ordinary form including retention of sig figs. Use calculators to use power, exponential & log functions & handle sinx, cosx and tanx when x is expressed in degrees or radians. Select & use statistical tests.		