Curriculum Grid

National Curriculum Computing ● = Fully Met ◐ = Partially Met	BASICS OF GEARS	Basics of Gears	LEARNING MISSIONS	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor	SPACE CHALLENGE	Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch	RESEARCH PROJECTS	How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
Key Stage 3																								
Design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems.														◐	◐	◐	◐	◐	◐	◐				
Understand several key algorithms that reflect computational thinking [for example, ones for sorting and searching]; use logical reasoning to compare the utility of alternative algorithms for the same problem.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Use two or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures [for example, lists, tables or arrays]; design and develop modular programs that use procedures or functions.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Understand simple Boolean logic [for example, AND, OR and NOT] and some of its uses in circuits and programming; understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers [for example, binary addition, and conversion between binary and decimal].														◐	◐	◐	◐	◐	◐	◐				
Understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits.						◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●		◐	◐	◐
Key Stage 4																								
Develop their capability, creativity and knowledge in computer science, digital media and information technology.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●		◐	◐	◐
Develop and apply their analytic, problem-solving, design, and computational thinking skills.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●		◐	◐	◐

National Curriculum Mathematics Key Stage 3

● = Fully Met
◐ = Partially Met

	BASICS OF GEARS	LEARNING MISSIONS										SPACE CHALLENGE							RESEARCH PROJECTS			
	Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch	How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
Working mathematically Through the mathematics content, pupils should be taught to:																						
Develop fluency																						
Consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Select and use appropriate calculation strategies to solve increasingly complex problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
Substitute values in expressions, rearrange and simplify expressions, and solve equations.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs].	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Develop algebraic and graphical fluency, including understanding linear and simple quadratic functions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Reason mathematically																						
Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Identify variables and express relations between variables algebraically and graphically.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Make and test conjectures about patterns and relationships; look for proofs or counter-examples.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Begin to reason deductively in geometry, number and algebra, including using geometrical constructions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Solve problems																						
Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Begin to model situations mathematically and express the results using a range of formal mathematical representations.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			

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Subject content																						
Number Pupils should be taught to:																						
Understand and use place value for decimals, measures and integers of any size.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
Recognise and use relationships between operations including inverse operations.	●	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 and 3/8).	◐	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●			
Define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Interpret fractions and percentages as operators.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use standard units of mass, length, time, money and other measures, including with decimal quantities.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures].	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a<x\leq b$.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use a calculator and other technologies to calculate results accurately and then interpret them appropriately.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Appreciate the infinite nature of the sets of integers, real and rational numbers.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			

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Algebra Pupils should be taught to:																							
Understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Understand and use standard mathematical formulae; rearrange formulae to change the subject.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Model situations or procedures by translating them into algebraic expressions or formulae and by using graphs.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement).	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Work with coordinates in all four quadrants.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Interpret mathematical relationships both algebraically and graphically.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Reduce a given linear equation in two variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Generate terms of a sequence from either a term-to-term or a position-to-term rule.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Recognise arithmetic sequences and find the *n*th term.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Recognise geometric sequences and appreciate other sequences that arise.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Ratio, proportion and rates of change Pupils should be taught to:																							
Use scale factors, scale diagrams and maps.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Use ratio notation, including reduction to simplest form.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Divide a given quantity into two parts in a given part:part or part: whole ratio; express the division of a quantity into two parts as a ratio.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Use compound units such as speed, unit pricing and density to solve problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					

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Geometry and measures Pupils should be taught to:																						
Derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders).		●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●			
Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes.	●	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●			
Derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies.												◐	◐	◐	◐	◐	◐	◐			
Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures.		●	●	●	●	●	●	●	●			●	●	●	●	●	●	●			
Identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids.		●	●	●	●	●	●	●	●			●	●	●	●	●	●	●			
Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles.		●	●	●	●	●	●	●	●			●	●	●	●	●	●	●			
Understand and use the relationship between parallel lines and alternate and corresponding angles.		●	●	●	●	●	●	●	●			●	●	●	●	●	●	●			
Derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons.		◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	◐	◐	◐	◐	◐			
Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs.												◐	◐	◐	◐	◐	◐	◐			
Use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles.									◐			◐	◐	◐	◐	◐	◐	◐			
Use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D.	◐	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●			
Interpret mathematical relationships both algebraically and geometrically.		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Probability Pupils should be taught to:																						
Record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			

National Curriculum Mathematics Key Stage 4

A formal consultation on the National Curriculum for Key Stage 4 Mathematics will follow in line with the timetable for the reform of GCSEs. This document will then be updated to reflect this process.

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1 Key Concepts																								
1.1 Competence																								
a	Applying suitable mathematics accurately within the classroom and beyond.	●	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●					
b	Communicating mathematics effectively.	●	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●					
c	Selecting appropriate mathematical tools and methods, including ICT.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
1.2 Creativity																								
a	Combining understanding, experiences, imagination and reasoning to construct new knowledge.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	Using existing mathematical knowledge to create solutions to unfamiliar problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
c	Posing questions and developing convincing arguments.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
1.3 Application and implications of mathematics																								
a	Knowing that mathematics is a rigorous, coherent discipline.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		◐	◐	◐	
b	Understanding that mathematics is used as a tool in a wide range of contexts.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	
d	Engaging in mathematics as an interesting and worthwhile activity.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	
1.4 Critical understanding																								
a	Knowing that mathematics is essentially abstract and can be used to model, interpret or represent situations.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	Recognising the limitations and scope of a model or representation.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
2 Key Processes																								
2.1 Representing																								
Pupils should be able to:																								
a	identify the mathematical aspects of a situation or problem.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	compare and evaluate representations of a situation before making a choice.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
c	simplify the situation or problem in order to represent it mathematically, using appropriate variables, symbols, diagrams and models.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
d	select mathematical information, methods and tools to use.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					

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2.2 Analysing																						
Use mathematical reasoning Pupils should be able to:																						
a	make connections within mathematics.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
b	use knowledge of related problems.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
e	make and begin to justify conjectures and generalisations, considering special cases and counter-examples.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
f	explore the effects of varying values and look for invariance and covariance.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
g	take account of feedback and learn from mistakes.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
h	work logically towards results and solutions, recognising the impact of constraints and assumptions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
i	identify a range of techniques that could be used to tackle a problem, appreciating that more than one approach may be necessary.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
j	reason inductively, deduce and prove.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
Use appropriate mathematical procedures Pupils should be able to:																						
k	make accurate mathematical diagrams, graphs and constructions on paper and on screen.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
l	calculate accurately, using mental methods or calculating devices as appropriate.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
m	manipulate numbers, algebraic expressions and equations and apply routine algorithms.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
n	use accurate notation, including correct syntax when using ICT.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐			
o	record methods, solutions and conclusions.	●		●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
p	estimate, approximate and check working.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
2.3 Interpreting and evaluating																						
Pupils should be able to:																						
a	form convincing arguments based on findings and make general statements.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
b	consider the assumptions made and the appropriateness and accuracy of results and conclusions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
c	appreciate the strength of empirical evidence and distinguish between evidence and proof.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
d	look at data to find patterns and exceptions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
e	relate their findings to the original question or conjecture, and indicate reliability.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
f	make sense of someone else's findings and judge their value in the light of the evidence they present.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
g	critically examine strategies adopted.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			

National Curriculum Mathematics Key Stage 4

A formal consultation on the National Curriculum for Key Stage 4 Mathematics will follow in line with the timetable for the reform of GCSEs. This document will then be updated to reflect this process.

● = Fully Met
◐ = Partially Met

		BASICS OF GEARS	LEARNING MISSIONS										SPACE CHALLENGE								RESEARCH PROJECTS			
		Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch		How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
2.4 Communicating and Reflecting																								
Pupils should be able to:																								
a	use a range of forms to communicate findings to different audiences.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	engage in mathematical discussion of results.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
c	consider the elegance and efficiency of alternative solutions.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
d	look for equivalence in relation to both the different approaches to the problem and different problems with similar structures.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
e	give examples of similar contexts they have previously encountered and identify how these contexts differed from or were similar to the current situation and how and why the same, or different, strategies were used.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
3 Range and content																								
3.1 Number and algebra																								
a	real numbers, their properties and their different representations.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	rules of arithmetic applied to calculations and manipulations with real numbers, including standard index form and surds.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
3.2 Geometry and measures																								
a	properties of 2D and 3D shapes.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	circle theorems.	◐	◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	◐	◐	◐	◐	◐					
c	trigonometric relationships.		◐	◐	◐																			
d	properties and combinations of transformations.		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
e	3D coordinate systems.		◐	◐	◐					◐			◐	◐	◐	◐	◐	◐	◐					
f	vectors in two dimensions.	◐	◐	◐	◐					◐			◐	◐	◐	◐	◐	◐	◐					
g	conversions between measures and compound measures.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
3.3 Statistics																								
c	measures of central tendency and spread.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
4 Curriculum opportunities																								
a	develop confidence in an increasing range of methods and techniques.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
b	work on sequences of tasks that involve using the same mathematics in increasingly difficult or unfamiliar contexts, or increasingly demanding mathematics in similar contexts.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
c	work on open and closed tasks in a variety of real and abstract contexts that allow them to select the mathematics to use.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
d	work on problems that arise in other subjects and in contexts beyond the school.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
e	work on tasks that bring together different aspects of concepts, processes and mathematical content.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
f	work collaboratively as well as independently in a range of contexts.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
g	become familiar with a range of resources, including ICT, so that they can select appropriately.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					

National Curriculum Science Key Stage 3

● = Fully Met
◐ = Partially Met

	BASICS OF GEARS	LEARNING MISSIONS										SPACE CHALLENGE								RESEARCH PROJECTS			
	Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch		How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
Working scientifically Through the content across all three disciplines, pupils should be taught to:																							
Scientific attitudes																							
Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review.	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Evaluate risks.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●					
Experimental skills and investigations																							
Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●					
Make predictions using scientific knowledge and understanding.	●	●	●	●	●	●	●	●	●	◐		●	●	●	●	●	●	●					
Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.	◐	◐	◐	◐	◐	◐	●	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.	◐	◐	◐	◐	◐	◐	●	◐	◐	◐		●	●	●	●	●	●	●					
Apply sampling techniques.						◐				●		◐	◐	◐	◐	◐	◐	◐					
Analysis and evaluation																							
Apply mathematical concepts and calculate results.	●			●			●	●	●	●		●	●	●	●	●	●	●					
Present observations and data using appropriate methods, including tables and graphs.			◐	◐	◐	◐	◐			◐		◐	◐	◐	◐	◐	◐	◐					
Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions.		◐	◐			◐	◐					◐	◐	◐	◐	◐	◐	◐					
Present reasoned explanations, including explaining data in relation to predictions and hypotheses.					◐	◐	◐																
Evaluate data, showing awareness of potential sources of random and systematic error.					◐		◐					◐	◐	◐	◐	◐	◐	◐					
Identify further questions arising from their results.					◐							◐	◐	◐	◐	◐	◐	◐					
Measurement																							
Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature.		◐	◐																				
Use and derive simple equations and carry out appropriate calculations.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Undertake basic data analysis including simple statistical techniques.		◐								◐													

National Curriculum Science Key Stage 3

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	Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch		How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
Subject content – Physics Pupils should be taught about:																							
ENERGY **Calculation of fuel uses and costs in the domestic context**																							
Comparing amounts of energy transferred (J, kJ, kW hour).	◐																						
Fuels and energy resources.																				●	●	●	
Energy changes and transfers																							
Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged.	●	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Changes in systems																							
Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change.		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions.		●	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes.		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
MOTION AND FORCES **Describing motion**																							
Speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time).		●					●																
The representation of a journey on a distance-time graph.		●				◐	●					◐	◐	◐	◐	◐	◐	●					
Relative motion: trains and cars passing one another.		◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	◐	◐	◐	◐	◐					
Forces																							
Forces as pushes or pulls, arising from the interaction between two objects.	◐	◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	●	●	◐	●	●					
Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces.																							
Moment as the turning effect of a force.	●	◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	◐	◐	◐	◐	◐					
Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water.	●	◐	◐	◐	◐	◐	◐	◐	◐			◐	◐	●	●	◐	◐	◐					
Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity.																				◐	◐	◐	
Forces and motion																							
Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only).	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●					
Change depending on direction of force and its size.	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●					

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WAVES **Sound waves**																								
Frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound.						◐		◐		◐	◐			◐	◐	◐	◐	◐	◐	◐				
Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal.						●		●		●	●			◐	◐	◐	◐	◐	◐	◐				
Auditory range of humans and animals.						●		●		●	●			●	●	●	●	●	●	●				
Energy and waves																								
Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone.						●		●		●	●			●	●	●	●	●	●	●				
Light waves																								
Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras.							●		●			●			●		●							
Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.							●		●			●		◐	●	◐	●	◐	◐	◐				
MATTER **Energy in matter**																								
Internal energy stored in materials.																						◐	◐	◐
SPACE PHYSICS																								
Gravity force, weight = mass x gravitational field strength (g), on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only).																						◐	◐	
Our Sun as a star, other stars in our galaxy, other galaxies.																						◐	◐	◐
The light year as a unit of astronomical distance.																						◐	◐	◐

National Curriculum Science Key Stage 4

A formal consultation on the National Curriculum for Key Stage 4 Science will follow in line with the timetable for the reform of GCSEs. This document will then be updated to reflect this process.

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		BASICS OF GEARS	LEARNING MISSIONS										SPACE CHALLENGE								RESEARCH PROJECTS			
		Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch		How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
1. Data evidence, theories and explanations																								
Pupils should be taught:																								
a	how scientific data can be collected and analysed.		●		●					◐	◐													
b	how interpretation of data, using creative thought, provides evidence to test ideas and develop theories.	◐	●		●	●				◐	◐													
c	how explanations of many phenomena can be developed using scientific theories, models and ideas.	◐			●						◐													
2. Practical and enquiry skills																								
Pupils should be taught to:																								
a	plan to test a scientific idea, answer a scientific question, or solve a scientific problem.	●	●	◐	●	●	●			●	◐		◐	◐	◐	◐	◐	◐	◐					
b	collect data from primary or secondary sources, including using ICT sources and tools.		●		●	●	◐			●	●													
c	work accurately and safely, individually and with others, when collecting first-hand data.		●	◐	●	●	◐			●	◐													
d	evaluate methods of collection of data and consider their validity and reliability as evidence.		●		◐	●		◐	◐	●	●													
3. Communication skills																								
Pupils should be taught to:																								
a	recall, analyse, interpret, apply and question scientific information or ideas.		◐		●	●				◐	◐		◐	◐	◐	◐	◐	◐	◐					
b	use both qualitative and quantitative approaches.		●		◐	●					◐			◐	◐	◐	◐	◐	◐					
c	present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools.		●		●	●				◐				◐	◐	◐	◐	◐	◐					
4. Applications and implications of science																								
Pupils should be taught:																								
a	about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.	◐	●	◐	●	●	◐	◐			◐			◐	◐	◐	◐	◐	◐					
b	to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions.				◐									◐	◐	◐	◐	◐	◐					
7. Energy, electricity and radiations																								
In their study of science, the following should be covered:																								
a	energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use.	◐																						
b	evaluate scientific evidence and working methods.		◐		◐	◐				◐	◐			◐	◐	◐	◐	◐	◐					
d	radiations in the form of waves can be used for communication.		◐	◐	◐	◐	◐	◐	◐		◐													

National Curriculum Design and Technology Key Stage 3

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◐ = Partially Met

	BASICS OF GEARS	LEARNING MISSIONS										SPACE CHALLENGE							RESEARCH PROJECTS			
	Basics of Gears	Controlled Movements	Precise Turns	Turn Using Sensor	Detect a Colour	Detect an Object	Follow a Line	Detect and React	Intelligent Movements	Calibrate Colour Sensor		Activate Communication	Assemble Your Crew	Free the MSL Robot	Launch the Satellite in to Orbit	Return the Rock Samples	Secure Your Power Supply	Initiate Launch	How Can Humans Survive in Space?	How Do We Generate Energy for Human Outposts?	How Can Robots Help Humans Explore?
When designing and making, pupils should be taught to:																						
Design																						
Use research and exploration, such as the study of different cultures, to identify and understand user needs.																			◐	◐	◐	
Identify and solve their own design problems and understand how to reformulate problems given to them.												◐	◐	◐	◐	◐	◐	◐				
Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations.												◐	◐	◐	◐	◐	◐	◐				
Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses.																			◐	◐	◐	
Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐				
Make																						
Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Evaluate																						
Analyse the work of past and present professionals and others to develop and broaden their understanding.																			◐	◐	◐	
Investigate new and emerging technologies.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists.																			●	●	●	
Technical knowledge																						
Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Understand how more advanced mechanical systems used in their products enable changes in movement and force.		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs].				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers].		◐		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				