Curriculum Grid for Space Challenge

Computing programmes of study: Key Stage 3 and Key Stage 4 National Curriculum in England ● = 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.		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●		◐	◐	◐

Science programmes of study: Key Stage 3 National Curriculum in England

● = 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.		◐								◐											

Science programmes of study: Key Stage 3 and Key Stage 4 National Curriculum in England

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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.																						◐	◐	◐

Design and Technology programmes of study: Key Stage 3 National Curriculum in England

● = addresses standard
◐ = partially addresses standard

	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?
Subject content: Key Stage 3																						
Designing When designing, pupils should be taught to:																						
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		◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●				
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 When making, pupils should be taught to:																						
select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Evaluating																						
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].	◐	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●				

Mathematics programmes of study: Key Stage 3 National Curriculum in England

● = 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.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					

Mathematics programmes of study: Key Stage 3 National Curriculum in England ● = 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?
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.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			

Science programmes of study: Key Stage 4 National Curriculum in England

● = addresses standard
◐ = partially addresses standard

	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 MLS Robot	Launch The Satellite Into 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																							
The Development of Scientific Thinking																							
using a variety of concepts and models to develop scientific explanations and understanding		●	●	●	●	●	●	●	●	●	◐		◐	◐	◐	◐	◐	◐	◐				
appreciating the power and limitations of science and considering ethical issues which may arise													◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	
explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐									◐	◐	◐	
evaluating risks both in practical science and the wider societal context, including perception of risk		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐												
recognising the importance of peer review of results and of communication of results to a range of audiences.																				◐	◐	◐	
Experimental skills and Strategies																							
using scientific theories and explanations to develop hypotheses		◐			◐						◐												
planning experiments to make observations, test hypotheses or explore phenomena		●	●	●	●	●	●	●	●	●	●												
applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		●	●	●	●	●	●	●				
carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative							◐				●		◐	◐	◐	◐	◐	◐	◐				
making and recording observations and measurements using a range of apparatus and methods		◐		◐	◐			◐			◐												
evaluating methods and suggesting possible improvements and further investigations.		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
Analysis and evaluation																							
presenting observations and other data using appropriate methods		●	●	●	●	●	●	●	●	●	●												
translating data from one form to another																							
carrying out and representing mathematical and statistical analysis		◐		◐	◐			◐		◐	◐												
"interpreting observations and other data, including identifying patterns and trends,																							
making inferences and drawing conclusions"		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐												
being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐												
communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations.													◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	
Vocabulary, units, symbols and nomenclature																							
developing their use of scientific vocabulary and nomenclature		◐	◐	◐	◐	◐	◐	◐	◐	◐	◐									◐	◐	◐	
using an appropriate number of significant figures in calculations.			●	●	●								◐	◐	◐	◐	◐	◐	◐				

Science programmes of study: Key Stage 4 National Curriculum in England ● = addresses standard ◐ = partially addresses standard	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 MLS Robot	Launch The Satellite Into 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?
Subject Content: Physics																								
Energy																								
energy changes in a system involving heating, doing work using forces, or doing work using an electric current; calculating the stored energies and energy changes involved		◐																						
Space physics																								
the main features of the solar system.																					◐	◐	◐	

Mathematics programmes of study: Key Stage 4 National Curriculum in England

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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 MLS Robot	Launch The Satellite Into 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 3 and extend their understanding of the number system to include powers, roots {and fractional indices}	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
select and use appropriate calculation strategies to solve increasingly complex problems, including exact calculations involving multiples of ϖ {and surds}, use of standard form and application and interpretation of limits of accuracy	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions, {and expressions involving surds and algebraic fractions}			◐																				
use mathematical language and properties precisely.	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
Reason mathematically																							
extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically	◐																						
extend their ability to identify variables and express relations between variables algebraically and graphically	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐					
assess the validity of an argument and the accuracy of a given way of presenting information.	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
Solve problems																							
develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●					
develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts	◐	◐	◐	◐					◐	◐		◐	◐	◐	◐	◐	◐	◐					
make and use connections between different parts of mathematics to solve problems																							
model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐													
select appropriate concepts, methods and techniques to apply to unfamiliar and non- routine problems; interpret their solution in the context of the given problem.												●	●	●	●	●	●	●					

Mathematics programmes of study: Key Stage 4 National Curriculum in England

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Subject content	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 MLS Robot	Launch The Satellite Into 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?
Number																								
In addition to consolidating subject content from key stage 3, pupils should be taught to:																								
calculate exactly with fractions, {surds} and multiples of ϖ; {simplify surd expressions involving squares [for example 12 = 4 ×3 = 4 ×3 2= 3] and rationalise denominators}					◐																			
Algebra																								
In addition to consolidating subject content from key stage 3, pupils should be taught to:																								
recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point}					◐																			
Geometry and measures																								
In addition to consolidating subject content from key stage 3, pupils should be taught to:																								
identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment				◐	◐						◐			◐	◐	◐	◐	◐	◐	◐				
{apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results}		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐	◐				
construct and interpret plans and elevations of 3D shapes		◐		◐	◐	◐	◐	◐	◐	◐	◐	◐												