

Curriculum Grid for Space Challenge

<p style="text-align: center;">Computing programmes of study: Key Stage 3 and Key Stage 4 National Curriculum in England</p> <p style="text-align: center;"> ● = Fully Met ◐ = Partially Met </p>	How Can Robots Help Humans Explore?	How Do We Generate Energy for Human Outposts?	How Can Humans Survive in Space?	RESEARCH PROJECTS				SPACE CHALLENGE											
	Initiate Launch	Secure Your Power Supply	Return the Rock Samples	Launch the Satellite in to Orbit	Free the MSL Robot	Assemble Your Crew	Activate Communication	Calibrate Colour Sensor	Intelligent Movements	Detect and React	Follow a Line	Detect an Object	Detect a Colour	Turn Using Sensor	Precise Turns	Controlled Movements	LEARNING MISSIONS	Basics of Gears	BASICS OF GEARS
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 and Key Stage 4 National
Curriculum in England**

◆ = Fully Met
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How Can Robots Help Humans Explore?
How Do We Generate Energy for Human Outposts?
How Can Humans Survive in Space?
RESEARCH PROJECTS
Initiate Launch
Secure Your Power Supply
Return the Rock Samples
Launch the Satellite in to Orbit
Free the MSL Robot
Assemble Your Crew
Activate Communication
SPACE CHALLENGE
Calibrate Colour Sensor
Intelligent Movements
Detect and React
Follow a Line
Detect an Object
Detect a Colour
Turn Using Sensor
Precise Turns
Controlled Movements
LEARNING MISSIONS
Basics of Gears
BASICS OF GEARS

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.	◆		◆	◆	◆	◆	◆	◆	◆	◆	◆	

<p style="text-align: center;">Mathematics programmes of study: Key Stage 3 National Curriculum in England</p> <p style="text-align: center;"> ● = Fully Met ◐ = Partially Met </p>	How Can Robots Help Humans Explore?	How Do We Generate Energy for Human Outposts?	How Can Humans Survive in Space?	RESEARCH PROJECTS				Initiate Launch	Secure Your Power Supply	Return the Rock Samples	Launch the Satellite in to Orbit	Free the MSL Robot	Assemble Your Crew	Activate Communication	SPACE CHALLENGE	Calibrate Colour Sensor	Intelligent Movements	Detect and React	Follow a Line	Detect an Object	Detect a Colour	Turn Using Sensor	Precise Turns	Controlled Movements	LEARNING MISSIONS	Basics of Gears	BASICS OF GEARS
	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.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	

<p style="text-align: center;">Science programmes of study: Key Stage 4 National Curriculum in England</p> <p style="text-align: center;">◆ = addresses standard ◐ = partially addresses standard</p>	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?		
	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.			◆	◆	◆								◆	◆	◆	◆	◆	◆	◆						

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	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.														◆	◆	◆	◆	◆	◆	◆	◆	◆	◆

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	Subject content																											
	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																												