



Simulation

Level 1

Typically, pupils should show evidence of being able to:

- View existing simple circuits and take part in a teacher-led discussion about choosing events to include in a simulation. Use simple simulation tools to investigate basic events. *This might include using a software application to simulate the effect of turning switches in a circuit on or off.* (Explore)
- Create a basic simulation with the teacher's help. *This might include simulating a simple circuit, using switches to illuminate LEDs.* (Express)
- Know that digital methods can be used to communicate. (Exchange)
- Talk about the simulation tools they used, led by the teacher. (Evaluate)
- Demonstrate their simple simulation with the teacher's help. (Exhibit)

Level 2

Typically, pupils should show evidence of being able to:

- Choose some simple events that can be simulated. Use basic controls to carry out simple actions in a simulation software application. *This might include simulating events, for example turning switches on or off to control an object on screen, such as a series of lights in a varied sequence.* (Explore)
- Create a simulation with the teacher's help. *This might include simulating switches to control the on-off sequence of different coloured displays.* (Express)
- Identify and talk about how to use different digital methods to communicate. (Exchange)
- Talk about how to improve their simulation, prompted by the teacher. (Evaluate)
- Save their simulation and/or demonstrate it to the class or group with help from the teacher. (Exhibit)

Level 3

Typically, pupils should show evidence of being able to:

- Research existing simulation examples that the teacher provides and search for and choose assets to edit and include in their own simulation. Edit properties of assets to solve simple problems using a simulation software application. *This might include using simulation software to create a working simulation involving a combination of assets and/or components, and editing component values to see how this affects the simulation, for example controlling switches to turn on a light or motor, or editing dimensions of 3D models to investigate the effect on volume.* (Explore)
- Create a simulation. *This might include combining a range of assets and controls to solve a given problem, for example producing a simulation of an electronic circuit to control components such as a light or a motor.* (Express)



- Use a contemporary digital method to communicate or contribute to a supervised online activity. *This might include sending an email or making a post to a wiki, blog or discussion thread. The email or post might be to a teacher.* (Exchange)
- Make some modifications to improve their working solution. *This might include altering the value of a component such as a resistor.* (Evaluate)
- Save their program with a filename and/or demonstrate it to the class or group. (Exhibit)

Level 4

Typically, pupils should show evidence of being able to:

- Research and select assets, including existing simulations, to use when creating their own simulation. Plan or edit an existing simulation to solve the problem set in the task brief. *Typically, pupils create a working simulation using a combination of assets and more complex commands, or create a fully functional simulation. They may also use a flowchart to simulate a sequence of programming instructions and monitor the corresponding outputs, for example simulating the control of a traffic light sequence using a particle-in-cell (PIC).* (Explore)
- Create a simulation that demonstrates an awareness of the audience and purpose defined in the task brief and combines a range of assets and/or controls. *This might include using a selection of components, commands and a flowchart to simulate a working circuit or a scientific law.* (Express)
- Use one or more contemporary digital methods to communicate, exchange and collaborate in supervised online activities *This might include emailing the completed simulation as an attachment or making several relevant posts to a wiki, blog or discussion forum.* (Exchange)
- Use appropriate ICT tools and features to improve their simulation. *This might include editing asset and/or component values or updating the design, making and documenting improvements where required.* (Evaluate)
- Save the program in a named folder, upload it to a class portfolio or publish it online. (Exhibit)

Level 5

Typically, pupils should show evidence of being able to:

- Research, select and evaluate a range of simulation software features and assets to edit and include in their simulation. Select appropriate simulation software and use a range of tools and features to solve the problem set in the task brief. *Typically, pupils draw up a specification or use a storyboard and/or flowchart to design their simulation and use a 'What if?' approach to explore the working of the simulation, including the monitoring and/or measurement of outputs, for example PIC registers or outputs.* (Explore)



- Create a simulation that combines a range of assets, controls, commands and/or flowcharts demonstrating a clear understanding of the audience and purpose defined in the task brief. *This might include using controls and timings, perhaps also using a flowchart, for example simulating the full sequence of lights and acoustic signals at a road traffic junction that incorporates a pedestrian crossing, or simulating a range of wash and rinse cycles used in a washing machine, or similar software simulation activity.* (Express)
- Use a range of contemporary digital methods to communicate, exchange and share their information and solutions, collaborating online with their peers. *This might include working online to collaborate in designing and creating a suitable simulation to solve the problem set in the task brief, or discussing online which processes to include in their design to improve efficiency.* (Exchange)
- Use the 'plan, do, review' cycle to improve their simulation for the audience and purpose defined in the task brief. *This might include designing, drafting and making adjustments to their simulation, creating a set of test criteria and using functions to explore the effects of changing component value, referencing their initial specification. They might also ask peers to test their simulation and give feedback to generate suggestions for improvements.* (Evaluate)
- Organise, store and maintain the simulation files to showcase learning digitally across the curriculum. (Exhibit)

Level 6

Typically, pupils should show evidence of being able to:

- Research, select and edit a range of possible solutions to the problem set in the task brief, identifying the required inputs, process and outputs to be simulated, referencing the sources and justifying how they will help create a solution to the problem. Explore the effects of using different tools in the simulation software to control inputs and monitor outputs. *This might, for example, include using graphs to monitor outputs.* (Explore)
- Create planning documents for a simulation targeted at a specific audience and purpose, including a wide range of software features to control and monitor inputs and outputs. *This might include time-dependent control of inputs and using simulated measurement tools such as multimeters, oscilloscopes or other instruments to monitor output, evidenced by annotated graphs. Pupils may use a flowchart, including subroutines to represent the operation of a program, for example when simulating a PIC microcontroller.* (Express)
- Use a range of contemporary digital methods to communicate, exchange and share their information and solutions, collaborating with peers, experts and end users. *This might include collaborating on the software simulation design and development with peers, for example using a discussion forum, where contributors submit and discuss alternative draft solutions and/or amendments.* (Exchange)



- Justify the solution they chose to complete the simulation task, the alternatives they considered and the process they carried out in producing the solution. Justify how their solution meets the requirements of the specified audience and purpose. *This might include describing and justifying the project management process, including using error checking, peer review, and test data for planned testing.* (Evaluate)
- Organise, store and maintain their work in a personalised area to showcase learning digitally across the curriculum. *This might include using version numbers to name files and assets.* (Exhibit)

Level 7

Typically, pupils should show evidence of being able to:

- Research, evaluate and adapt the most appropriate sources of information from a range of digital sources, referencing their sources and justifying how their choices help create a solution for the problem set in the task brief. Plan a sophisticated solution to the problem, and identify all inputs, outputs and the process to be simulated, selecting and exploring the use of software tools to control inputs and monitor outputs effectively. *This might include analysing a range of solutions for accuracy and/or efficiency and using appropriate development tools such as an error tracer to routinely test and correct their simulation parameters, justifying their decisions based on their original intentions and feedback from experts and end users.* (Explore)
- Create a requirements specification and formal plan for the proposed solution. Create a sophisticated simulation suitable for the audience and purpose, using the most appropriate design methods and validation techniques. *This might include using self-written subroutines to control inputs and process, with good use of commentary, or using a more sophisticated, annotated circuit design.* (Express)
- Exploit contemporary communication methods to exchange, share and collaborate on their developed ideas with peers, experts and end users, contributing to a collaborative global environment. *This might include creating and maintaining shared documents to collaborate on solutions to simulation problems.* (Exchange)
- Use features and planned testing to trace errors in logic or component variables, improve a design for efficiency, functionality or accuracy, and measure against agreed project objectives. Carry out these activities routinely, effectively and as an ongoing process. Review the project management process to evaluate the methods they used, including the testing process, and introduce changes to improve on these. (Evaluate)
- Manage and present a logically structured digital bank of work to showcase development, taking account of format, portability, size and versioning. *This might include publishing the simulation and a user guide in a format suitable for distribution.* (Exhibit)

Pupils should demonstrate, when and where appropriate, knowledge and understanding of e-safety, including acceptable online behaviour.