**Functional Requirements**

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| ID | Requirement |
| 1 | Player can move around using the ‘WASD’ keys and look around using the mouse |
| 2 | Game objects (including player) cannot pass through one another |
| 3 | Player can pick up and carry relevant game objects |
| 4 | Game objects are correctly added and removed when building apparatus in correct order |
| 5 | Light gate records the time taken for the card to fall through |
| 6 | HUD outputs correct message when looking at a given game object |
| 7 | Notes page should open and record input |
| 8 | Table page should create a table with given row and column values and accept user input |
| 9 | HUD displays correct stage of the experiment |
| 10 | Graph allows users to plot points and draw a line of best fit |
| 11 | System should grade player on their performance |

**Non-Functional Requirements**

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| ID | Requirement |
| 1 | User interface is clear and easy to read |
| 2 | Game educates users on the scientific method and principles |
| 3 | Gameplay is smooth and without glitches |
| 4 | Game plays successfully on multiple screen sizes and operating systems |
| 5 | Game menu should allow for addition of new levels |

**Functional Requirement Tests:**

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| Test ID: | 1 |
| Requirement to Test: | Functional Requirement 1 |
| Test Case Description: | WASD moves player in game world and the mouse rotates the camera. |
| Test Steps: | 1. Hold W 2. Hold A 3. Hold S 4. Hold D 5. Move mouse around screen |
| Expected Outcome: | The player moves forward when holding ‘W’, left when holding ‘A’, backward when holding ‘S’ and left when holding ‘D’. When moving the mouse around the screen, the camera follows |
| Pass/Fail: | Pass |

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| Test ID: | 2 |
| Requirement to Test: | Functional Requirement 2 |
| Test Case Description: | Player attempts to move through objects to ensure they cannot pass through one another |
| Test Steps: | 1. Walk player into tables 2. Walk player into equipment 3. Walk player into walls |
| Expected Outcome: | The player stops moving when colliding with tables and walls and pushes the game objects when colliding with the equipment |
| Pass/Fail: | Pass |

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| Test ID: | 3 |
| Requirement to Test: | Functional Requirement 3 |
| Test Case Description: | Picking up and dropping each piece of equipment |
| Test Steps: | For each piece of equipment:   1. Look at object and hold the left mouse click 2. Release mouse click |
| Expected Outcome: | Whilst the mouse button is down, the object is held in front of the player. When the mouse is released, the object falls |
| Pass/Fail: | Pass |

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| Test ID: | 4 |
| Requirement to Test: | Functional Requirement 4 |
| Test Case Description: | The apparatus is built in the correct order |
| Test Steps: | 1. Player carries each object to the build area in the correct order and releases the object 2. Player carries each object to the build area in the incorrect order and releases the object |
| Expected Outcome: | The object being held, and current apparatus is deleted, with the next apparatus stage appearing. When the object is released in the wrong order, the apparatus doesn’t change, and the object falls |
| Pass/Fail: | Pass |

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| Test ID: | 5 |
| Requirement to Test: | Functional Requirement 5 |
| Test Case Description: | Timer outputs the time for the card to fall through the light gate |
| Test Steps: | 1. Drop the card at a height of 10cm 2. Drop the card at a height of 20cm 3. Drop the card at a height of 30cm 4. Drop the card at a height of 40cm 5. Drop the card at a height of 50cm |
| Expected Outcome: | The time output on the timer decreases as the height of each drop increases |
| Pass/Fail: | Pass |

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| Test ID: | 6 |
| Requirement to Test: | Functional Requirement 6 |
| Test Case Description: | The pickup text displays the correct value |
| Test Steps: | 1. Look at info page 2. Look at equation sheet 3. Look at final page 4. Look at table page 5. Look at graph page 6. Look at equipment 7. Look at build area whilst holding correct stage of equipment 8. Look at build area whilst holding the incorrect stage of equipment 9. Look at table 10. Look at completed apparatus whilst holding card |
| Expected Outcome: | 1. Pickup text displays ‘Open Info Page’ 2. Pickup text displays ‘Open Equation Page’ 3. Pickup text displays ‘Open Final Page’ 4. Pickup text displays ‘Open Table’ 5. Pickup text displays ‘Open Graph’ 6. Pickup text displays ‘Pick Up’ 7. Pickup text displays ‘Build’ 8. Pickup text does not appear 9. Pickup text does not appear 10. Pickup text displays ‘Drop’ |
| Pass/Fail: | Pass |

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| Test ID: | 7 |
| Requirement to Test: | Functional Requirement 7 |
| Test Case Description: | Tests functionality of notes page |
| Test Steps: | 1. Press tab button 2. Type letters and numbers 3. Press tab button |
| Expected Outcome: | 1. Notes page appears 2. Text appears on notes page 3. Notes page closes |
| Pass/Fail: | Pass |

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| Test ID: | 8 |
| Requirement to Test: | Functional Requirement 8 |
| Test Case Description: | Tests table can create rows and columns with input fields |
| Test Steps: | 1. Vary column slider 2. Vary row slider 3. Enter text in each input field |
| Expected Outcome: | The row and column amounts change to match the slider values, with input fields generating in each field. Each input field accepts user text. |
| Pass/Fail: | Pass |

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| Test ID: | 9 |
| Requirement to Test: | Functional Requirement 9 |
| Test Case Description: | Ensures each stage of the instructions matches relevant experiment stage |
| Test Steps: | 1. Start Game 2. Close info page 3. Close equation page 4. Add clamp stand 5. Add light gate 6. Add ruler 7. Add timer 8. Add wires 9. Close table page 10. Close graph page 11. Close final page |
| Expected Outcome: | 1. Shows info instructions 2. Shows equation instructions 3. Shows clamp stand instruction 4. Shows light gate instruction 5. Shows ruler instruction 6. Shows timer instruction 7. Shows wire instructions 8. Shows table instructions 9. Shows graph instructions 10. Shows final instructions 11. Shows card dropping instructions |
| Pass/Fail: | Pass |

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| Test ID: | 10 |
| Requirement to Test: | Functional Requirement 10 |
| Test Case Description: | Check graph points and line of best fit functionality |
| Test Steps: | 1. Drag points to the graph page and release 2. Click on point to move to a new position 3. Hold and drag a line of best fit onto screen |
| Expected Outcome: | 1. Points follow the mouse and stop where mouse is released 2. Points reposition when picked up again 3. Line of best fit draws following the mouse clicks |
| Pass/Fail: | Pass |

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| Test ID: | 11 |
| Requirement to Test: | Functional Requirement 11 |
| Test Case Description: | Grading system successfully grades player |
| Test Steps: | 1. Enter ‘height’ as independent variable 2. Enter ‘Velocity’ as dependent variable 3. Enter a change in y of 14 and a change in x of 2 4. Add a graph label above the graph with the text ‘Velocity and Distance’, add a graph label on the left of the graph with the text ‘(V)’ and add a graph label underneath the graph with no text 5. Add two grid line labels on the left of the graph with the text ‘5’ and ‘10’ in ascending order. Add three grid line labels underneath the graph with the text ‘10’, ‘20’, ‘30’ in ascending order 6. Create a table with three columns. In the first field in column one add the text ‘(s)’, in the first field of column two add the text ‘(s)’ and in the first field of column three add the text ‘(m/s)’ 7. Create a table with 4 rows and 4 columns. Enter a random string of text in every box |
| Expected Outcome: | 1. Gets 3/5 for independent variable 2. Gets 5/5 for dependent variable 3. Gets 3/5 for gravity value 4. Gets 4/6 for graph 5. Gets 3/6 for grid line labels 6. Gets 3/6 for table units 7. Gets 5/5 for no blanks in table   Player receives mark of E |
| Pass/Fail: | Pass |

**Non-Functional Requirement Tests:**

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| Test ID: | 12 |
| Requirement to Test: | Non-Functional Requirement 3 |
| Test Case Description: | Tests smoothness of game |
| Test Steps: | Player plays through game recording any issues in quality |
| Expected Outcome: | There are no issues in game quality |
| Pass/Fail: | Pass |

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| Test ID: | 13 |
| Requirement to Test: | Non-Functional Requirement 4 |
| Test Case Description: | Tests game functionality on multiple devices |
| Test Steps: | 1. Play through game on high processor device speed 2. Play through game on low processor device speed 3. Play through game on large screen 4. Play through game on medium screen 5. Play through game on small screen |
| Expected Outcome: | The game plays correctly and identically on all processor speeds and screen sizes |
| Pass/Fail: | Pass |