**The IET**



**Thorpe Park**

**Teacher Handbook**

**Could you be our engineer….?**

The IET DIY Faraday Challenge Day ‘Thorpe Park’ is based on the Faraday Challenge Day of the same name, a STEM activity day written and delivered by the Institution of Engineering and Technology (IET).

The IET Education website hosts a wide range of teaching resources for science, design and technology and maths. These include classroom activities with film clips, online games, posters, careers resources and STEM activity days.

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**Stay safe**

Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:

* ensuring that any equipment used for this activity is in good working condition
* behaving sensibly and following any safety instructions so as not to hurt or injure

yourself or others

Please note in the absence of any negligence or other breach of duty by us, this activity is

carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠

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# The Context



With over 30 thrilling rides, attractions and live events, Thorpe Park Resort attracts visitors from all over the world and they are constantly looking for new ideas. Although many of their visitors come to experience some of the world-class rides such as The Swarm, Stealth and the movie themed coaster, SAW – The Ride, they know that there are some who find the stomach-churning speed and height of these popular rides a little challenging!

Thorpe Park are currently looking to redevelop a part of the park and want your help. Your brief is to design an attraction which could appeal to a wide range of visitors, not just those thrill seekers who currently enjoy our fast and furious rides.

Engineering all the aspects of an attraction takes a long time but you will need to demonstrate that you have the engineering skills Thorpe Park requires by designing a new attraction and constructing one small part of your design.



Remember attractions are more than just the rides. Thorpe Park has shows, exhibitions, a beach, refreshment and food outlets so think carefully about what you could design to complement what is already available and consider how your attraction could be accessible to all.

**Today is your chance to make a difference, could you be our engineer..........?**

# 2. The Brief

The Thorpe Park team wants you to:

* **Develop** a detailed drawing of your attraction and provide ideas for how you could address some of the considerations and restrictions Thorpe Park engineers need to accommodate.
* **Design and engineer ONE** aspect of your design to include an electronic circuit/component.
* **Complete** the planning and reflections sheet to show how you have solved problems and how you have worked as a team throughout the project.
* **Present** the design of your attraction and the element you have engineered to the IET Faraday Thorpe Park judge(s).

You will need to work effectively as a team. In order to do this your team will need some of you to take on a role in addition to being a Faraday Thorpe Park Engineer. These additional roles will give some of your team the responsibility for managing or marketing the project, budgeting and keeping to time.

**Considerations:**

* Think carefully about what might make your attraction unique both at Thorpe Park and across other theme parks. Remember theme parks are more than just thrill-seeking rides.
* Make sure your attraction complies with the restrictions Thorpe Park must work within.
* It takes years to design and build a ride so think about what you can realistically achieve in the limited time available today.
* Think about the following when deciding on which element to construct:
* Target audience
* Visitor experience
* Visitor accessibility
* Visitor comfort (including queuing)
* Safety (staff and visitor)
* Impact on the environment

**Restrictions:**

* Attractions and their queues can be no closer than 8 metres to the water’s edge.
* Attractions can be no higher than 30 metres.
* Attractions can be no higher than 100 decibels.

# Checklist

|  |  |
| --- | --- |
| **Student tables** | **Notes** |
| Team number sign (laminated) | 1 per table in plastic stand |
| Student team registration form | 1 per student table |
| Student booklet | 1 per table |
| Accounts sheet | 1 per table |
| A3 Planning and Reflections sheet | 1 per table |
| Team roles and responsibilities (laminated) | 1 per table on clipboard |
| Engineering Apprenticeship (laminated) | 2 per table on clipboard |
| A3 Thorpe Park map (laminated) | 1 per table |
| Name badge stickers | 6 role stickers per table |
| Faraday branded currency | **Each team** - 1 x 20F, 4 x 10F, 6 x 5F, 10 x 1F = F100.00 |
| Engineering apprenticeship pack | 1 per table – box contains 2AA battery pack with battery snap, 3 x crocodile leads, LED and LDR. |
| **Challenge Leader** | **Notes** |
| Presentation - hard and electronic copy | Best to bring on your own laptop and presentation and video on a memory stick |
| Clicker for PowerPoint presentation | Carry spare batteries |
| Assessment matrix | 1 per event |
| Clipboard | For hard copy of presentation, assessment matrix, etc. |
| A4 plain paper | Up to 3 sheets free per team for presentation notes |
| A3 plain paper | 1 sheet per team for drawing attraction |
| Certificates | 1 per student – give to teachers to write names in and present back at school (**NOTE:** JPF have their own certificates so ensure you have the correct ones) |
| Shop | Notes |
| Shop manager account sheet | 1 per event - Put on a clipboard |
| Shop manager resources list | Laminated sheets on clipboard |
| Shop keeper instructions | 2 x laminated sheet to give to shop keepers as briefing for role |
| Faraday branded currency | Shop change – 2 x 20; 10 x 10; 20 x 5; 20 x 1 |
| All shop items with price tags |  |
| Signage – shop |  |
| Signage – judges table |  |

# 4. Shop resources

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Electrical components** | | | | |
| **Item** | **Description** | | **Unit** | **Cost** |
| Crocodile leads |  | Lead with crocodile clips at each end | Each | 2 Faradays |
| Insulated wire – red or black |  | Can be used to create a circuit using terminal blocks or used for electro-magnets | Per 30 cms | 2 Faradays |
| Terminal blocks |  | Can be used to connect insulated wire | Each | 2 Faradays |
| Piezo buzzer | Kittronic buzzer | Connect in a circuit to give a sound output | Each | 6 Faradays |
| LED – various colours |  | Light Emitting Diode which lights up when connected in a circuit. Choose from red, orange, green or blue. | Each | 6 Faradays |
| 2.5V Bulb with bulb holder |  | Used as a light in a circuit. **NOTE:** Will not work with an LDR | Each | 6 Faradays |
| Motor |  | Connect in a circuit to create clockwise or anti-clockwise movement. | Each | 6 Faradays |
| Motor holder |  | Used to fix a motor or a syringe in position. NOTE: you will need the insert to connect a syringe. | Each | 4 Faradays |
| Gear attachment for motor |  | Used to connect a motor to a cog | Each | 2 Faradays |
| Pulley attachment for motor |  | Used to connect a motor to a pulley wheel – will need connector (e.g. elastic band) | Each | 2 Faradays |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Light Dependent Resistor | LDR 2 | Component that detects the light level and changes resistance in a circuit. | Each | 8 Faradays |
| Moisture sensor |  | Component which detects moisture in the surroundings. Can also be used to detect materials which conduct electricity. | Each | 8 Faradays |
| Potentiometer |  | Can be used to vary the resistance in a circuit | Each | 8 Faradays |
| 2AA cells in battery holder with battery snap |  | Used to provide power for your circuit | Each | 6 Faradays |
| Push button switch |  | Connects a circuit when pushed down and breaks the circuit when released. | Each | 6 Faradays |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Construction materials** | | | | |
| **Item** | **Description** | **Unit** | | **Cost** |
| Correx | Used to create structures | Piece | | 6 Faradays |
| Plastic syringes with tube | Used to develop pneumatic system | Pair of syringes with plastic tube | 8 Faradays | |
| Nail | Used to build an electro-magnet | Each | 2 Faradays | |
| Small cog | Used in gear systems with motors | Each | 2 Faradays | |
| Medium cog | Used in gear systems with motors | Each | 2 Faradays | |
| Large cog | Used in gear systems with motors | Each | 4 Faradays | |
| Dowel | Piece of solid cylindrical wooden rod used to create structures | Each | 4 Faradays | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Description** | **Unit** | **Cost** |
| Straws | Can be used in structures | Each | 2 Faradays |
| Pulley wheel 54cm | Used to connect to pulley attachments on motor | Each | 6 Faradays |
| Wooden wheel 54cm | Used with motors to drive something | Each | 4 Faradays |
| Plastic reel | Used in construction | Each | 4 Faradays |
| Polyfoam | A5 foam sheet – assorted colours | Each | 4 Faradays |
| Coloured card | A4 sheet of card – assorted colours | Each | 4 Faradays |
| Tin foil | A conductive material which can be used to make pressure pads or switches (**MUST NOT** be used in place of connecting wires) | 10cm strip | 6 Faradays |
| Masking tape | Can be used to secure light parts in your design. **NOTE:** excessive use of tape will result in an additional charge | Roll | 6 Faradays |
| Sponge | Can be used to make pressure switches or enhance your design. | Each | 6 Faradays |
| Paperclip | Used to create switches or in construction | Each | 1 Faraday |
| Paper fastener | Used to create switches or in construction | Each | 1 Faraday |
| Elastic bands | Used to hold or create working parts | Each | 1 Faraday |
| Cable ties | Can be used to hold your structures in place | Each | 2 Faradays |
| Green wire | Used to connect structures (**MUST NOT** be used in your electrical circuit) | 20 cm piece | 4 Faradays |
| String | Can be used as part of your product design | 30cm piece | 4 Faradays |
| Access card | Use this to collect various items from the shop – see next page | One per team | 6 Faradays |

**Available with your access card**

These items can be used with your access card. You will need to take it to the shop to get use of one of these items. You may only get one item at a time.

|  |  |
| --- | --- |
| Stapler | Used to staple soft materials only |
| Hole punch | Used to make small holes in soft materials |
| Rulers | Used to measure any part of your product or additional items |
| Scissors | Used for soft materials only |
| Screwdriver | Used to connect insulated wire in terminal blocks or to bulb holders. |
| Wire strippers | Used to cut or strip insulated wire. |

**Free to use**

The cutting station – craft knives and junior hacksaws may be used at any point **BUT** only 3 people will be allowed at this station at any one time. Please take care when using this equipment.

# 3. Suppliers

Products have come from a range of sources below:

* Kitronik: https://www.kitronik.co.uk (for Piezo buzzers, switches and LDRs)
* Piezo buzzers - <https://www.kitronik.co.uk/c3301-piezo-buzzer-with-drive.html>
* LDRs <https://www.kitronik.co.uk/c3515-standard-ldr.html>
* Push button switches - <https://www.kitronik.co.uk/c3401-miniature-push-to-make-switch-red.html>
* RS components: <http://uk.rs-online.com> (for LEDs)
* [Green diffused LED,L53SGD 25mA 5mm](javascript:showQuickView('quickViewModalPanel',%20%7burl:'/web/p/products/000000000002471678',viewMode:'quickView',%20qvPageState:'passive',pageSource:'Order%20History'%7d);), RS Stock No.247-1678
* [Orange diffused LED,L53ND 30mA 5mm](javascript:showQuickView('quickViewModalPanel',%20%7burl:'/web/p/products/000000000002285994',viewMode:'quickView',%20qvPageState:'passive',pageSource:'Order%20History'%7d);), RS Stock No.228-5994
* [Red diffused LED,L-53HD 25mA 5mm](javascript:showQuickView('quickViewModalPanel',%20%7burl:'/web/p/products/000000000002285988',viewMode:'quickView',%20qvPageState:'passive',pageSource:'Order%20History'%7d);), RS Stock No.228-5988
* [Blue LED Round 5mm](javascript:showQuickView('quickViewModalPanel',%20%7burl:'/web/p/products/000000000008614418',viewMode:'quickView',%20qvPageState:'passive',pageSource:'Order%20History'%7d);), RS Stock No.861-4418
* TTS: tts-group.co.uk: for building materials and electrical components
* Hobby craft: <http://www.hobbycraft.co.uk/> (for polyfoam, coloured card, etc.)
* Poundland: <http://www.poundland.co.uk/>

**6. Schedule of the day**

|  |  |
| --- | --- |
| **09:15** | Register your team |
| **09:30** | Welcome and introduction |
| **09:45** | **Project brief:** Introduction to the Faraday Challenge |
| **10:05** | **Planning:** Identifying the problems and generating initial ideas |
| **10:20** | **Team role selection:** team decides on which roles they need |
| **10:25** | **Engineering apprenticeship:** teams complete a short engineering task⚠ |
| **10:35** | **Development**   * Shop opens * Agree on final product designs |
| **11:00** | **Break** |
| **11:10** | **Development continues** ⚠   * Continue to design and modify where necessary |
| **12:10** | Project and/or marketing managers are briefed on the content of the presentation |
| **12:30** | **Lunch** – Tools down |
| **13:00** | **Development: Final preparations** ⚠   * Finalise product * Prepare presentation with notes |
| **13:30** | * Shop closes * Submit accounting sheet to the Shop keeper * Practise presentation |
| **14:00** | **Presentation** ⚠   * Teams present their designs to the judge(s) |
| **14:45** | Award ceremony with final feedback and evaluation of the day |

**7. Room/hall layout**

**Notes:**

* Each team table will need 6 chairs and be large enough for 6 students to work comfortably. The judges’ table and shop will each need 2 chairs. Table positions do not need to be exact and can be arranged to best accommodate the shape and size of the venue.
* The challenge leader will bring one cutting mat for the cutting station but you must provide more or cover this table with a mat. This table should be a minimum of 3 x 0.5 metres or equivalent area.

**BACK**

**Team 2**

**FRONT – Projection screen**

**Team 4**

**Team 5**

**Team 6**

**Shop**

**Judge’s table**

**Team 1**

**Team 3**

**Team 7 Teachers**

**Refreshments Table**

**Presentation table**

**Cutting station**

# 8. Assessment matrix

**Host name: ………………………………………………………. Date: …………………………….**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assessment Criteria | | Team  1 | Team  2 | Team  3 | Team  4 | Team  5 | Team  6 | Team  7 |
| Planning | 12 |  |  |  |  |  |  |  |
| Development of product | 27 |  |  |  |  |  |  |  |
| Use of budget | 10 |  |  |  |  |  |  |  |
| The product | 21 |  |  |  |  |  |  |  |
| The presentation | 15 |  |  |  |  |  |  |  |
| Teamwork | 15 |  |  |  |  |  |  |  |
| **Total score** | **100** |  |  |  |  |  |  |  |
| **Faradays spent** |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **Team** | **School/Team name** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |

# 

# 9. Assessment criteria

|  |  |
| --- | --- |
| Criteria | Marks |
| 1. Planning | 12 marks |
| 1. Development of product | 27 marks |
| 1. Use of budget | 10 marks |
| 1. The product | 21 marks |
| 1. The presentation | 15 marks |
| 1. Teamwork | 15 marks |
| **Total** | **100 marks** |

1. **Planning (12 marks)**

Using the planning and product design section of the Planning and Reflections sheet, marks will be awarded as follows:

* Were there three relevant ideas for the attraction? ***(6 marks)***
* Did they explain how their ideas might meet Thorpe Park’s considerations and restrictions? ***(6 marks)***

1. **Development of product (27 marks)**

Using the Project Design, observations of the team and Reflections 1 and 2 of the Planning and Reflections sheet, marks will be awarded as follows:

* Did they produce a detailed drawing of their product including the electric circuit?

***(3 marks)***

* *Did they explain how their product meets the Thorpe Park brief?* ***(4 marks)***
* Did they provide honest and accurate observations relating to teamwork? ***(5 marks)***
* Did they provide honest and accurate observations relating to problems? ***(5 marks)***
* Did they provide honest and accurate observations relating to solutions? ***(5 marks)***
* Was the team flexible in their approach to their developments? ***(5 marks)***

1. **Use of budget (10 marks)**

Using the accountancy sheet, marks will be awarded as follows:

* Was there an accurate record of spending? ***(4 marks)***
* Was the budget used effectively? ***(6 marks)***

**4. The product (21 marks)**

Using the presentation of your attraction, marks will be awarded for:

* Was the concept of their attraction relevant to the brief? ***(4 marks)***
* Did the product comply with Thorpe Park restrictions and considerations? ***(4 marks)***
* Did the product work? ***(9 marks)***
* Was the product completed as far as possible? ***(4 marks)***

**5. The presentation (15 marks)**

Using the presentation of your products, marks will be awarded as follows:

* Did the team explain the reasons for selecting their development idea? ***(3 marks)***
* Did the team effectively demonstrate their product? ***(3 marks)***
* Did the team explain how they used their engineering knowledge and skills during the project? ***(3 marks)***
* Did the team explain how they used their roles effectively? ***(3 marks)***
* Was the presentation well organised and rehearsed? ***(3 marks)***

1. **Teamwork (15 marks)**

Using the judges’ observations of your team throughout the day, marks will be awarded as follows:

* Did the team work well together with all members engaged in the project? ***(5 marks)***
* Did the team work tidily and safely? ***(5 marks)***
* Did the team use resilience and perseverance during the project? ***(5 marks)***

# 10. Risk Assessment

The following risk assessment is given as guidance. It is advised that the school refers to the CLEAPSS Model Risk Assessment Documents for D&T.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Assessment and Operating Procedure - IET** | | | |
|  | | | |
| **Activity: Faraday Challenge Days Thorpe Park** | | | |
| **Persons at risk** | Students taking part in the Faraday Challenge Day and adults in the location | | |
| **Maximum Group Size** | 36 students | Recommended Staffing/Student Ratio | 1:6 |
|  | | | |
| **Risk Assessment** | | | |
| **Hazards** | | **Control Measures** | |
| 1. **Use of electrical equipment – risk of electric shock** | | All electrical equipment is low voltage. | |
| 1. **Use of electrical equipment – short circuit causing heating** | | Warn students of the possibility of burns when connecting and disconnecting components. All pupils will receive a briefing about correct use of electrical components. | |
| 1. **Basic use of hand tools (craft knives, screwdrivers, scissors, hole punches, staplers) – risk of cutting or abrasion** | | Warn students of the risks and advise them of safe working practices. Identify member of staff to supervise area. Inform challenge leader if use of knives in school is restricted. | |
| 1. **Use of water with moisture sensors** | | Ensure students test their moisture sensor using the sponge in a box provided rather than directly in any drink or cup of water to avoid spillage on electrical components. | |
| **Location issues** (to be completed by Host School) | |  | |
| Further Action Required: 1. Ensure all persons staffing the Faraday Challenge Days are aware of and competent to comply with this risk assessment and the control measures. | | | |

# Risk Assessment (page 2)

|  |  |
| --- | --- |
| **Working Practice** | |
| **Group structure** | One Faraday Challenge Day Leader and one member of staff from the host school to be present during the whole day to oversee use of equipment and to keep order. Teachers bringing groups from other schools must remain in the room and be responsible for their own students. |
| **Restrictions** | Unknown premises. |
| **Emergency**  **Procedure** | Follow the lead from the Host School.  Faraday Challenge Day Leader to be fully briefed on risk assessment procedure prior to the day or on arrival. |
| **Safeguarding** | The Challenge Leader will carry their DBS and provide it where requested. They will comply with the safeguarding regulations within the school. A representative from the school **MUST** be present in the rooms at all times when students are present. |
| **Safety Equipment** | First aid kit and fire extinguisher (electrical fires) to be provided by Host School. |
| **Name and role of IET Faraday Challenge representative** | Keira Sewell  Challenge Day Leader. |
| **Name and role of school representative** |  |
| **Signature of the school representative** |  |
| **Date of this Review** | September 2017 |