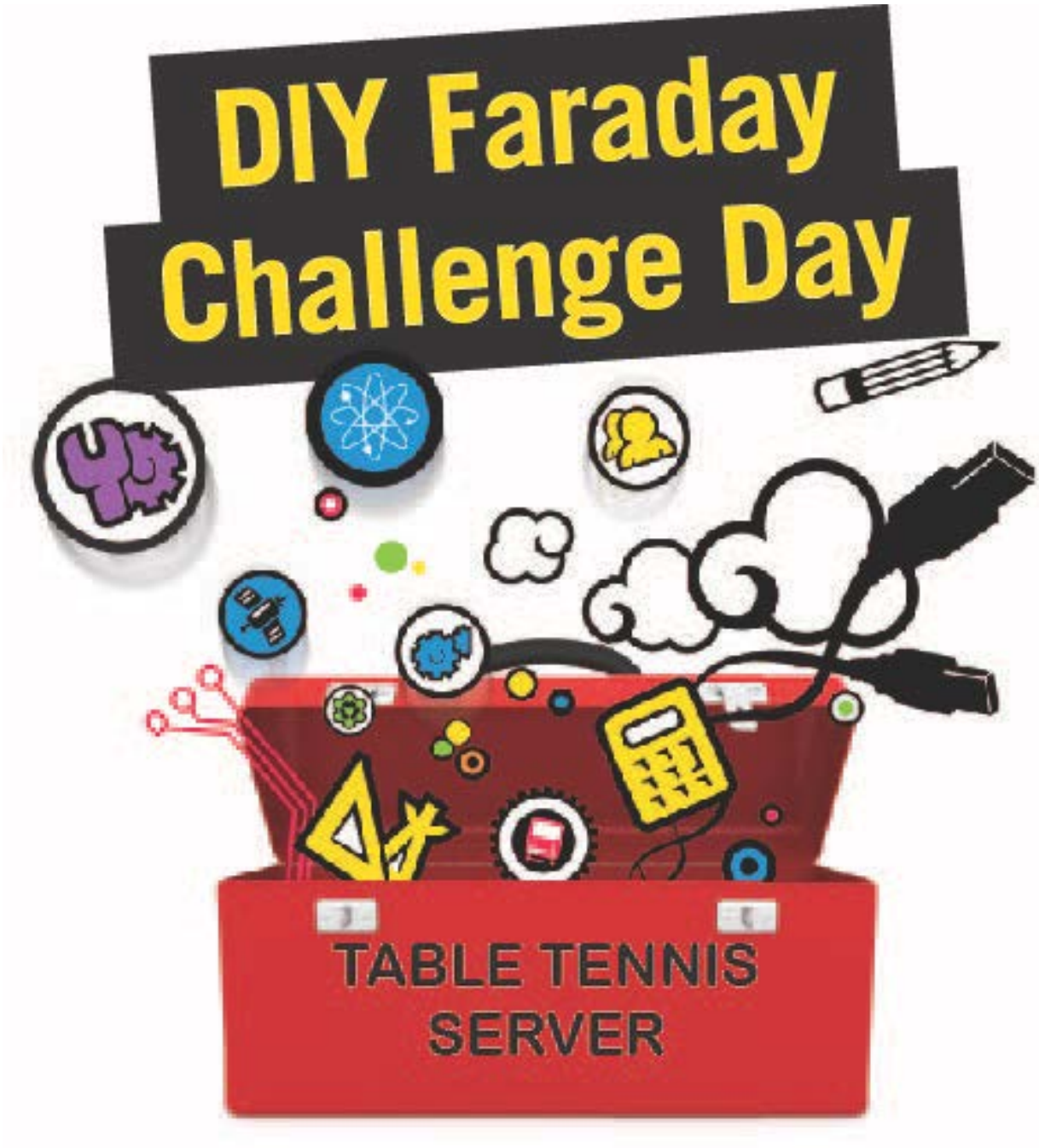
Education
The Institution of Engineering and Technology
Faraday



Student booklet

‘Practice makes perfect’

Faraday STEM Challenge Day

'Table tennis server'

CONTEXT

Table tennis is a growing sport in the UK.

Practice, as with most things, is the key to improving at the sport. The problem is, it is hard to practice table tennis on your own.

In this sport, being able to return service is often what provides the edge in terms of winning and losing.

BRIEF

Design and make a prototype table tennis server.

The server must:

- Be operated remotely
- Have adjustability in both horizontal and vertical directions/axis
- Must be able to serve 4 balls consistently

Assessment Information and criteria

Key Area	Marks
Initial ideas sheets (x3)	15
Developed ideas - sketches and notes	40
Accountant's balance sheet	10
Quality of final product	20
Function of device – consistent delivery	50
Team work	20
Video (STEM responses)	20
Total	**175**

1. INITIAL DESIGN SHEETS - (session one)
These are the first sheets you need to hand in. It involves every member of your team (in your subject pairs) drawing their initial thoughts and ideas after being given the context and brief. Three sheets need to be handed in. They need to include sketches, notes, diagrams and annotations. It is really important that you let the judges know what you are talking about in your discussions otherwise they will not understand these sheets and you will not get high marks.

2. DEVELOPMENT OF IDEAS - (session two)
This section is an important section and involves sketches and notes explaining the development of your ideas. You need to record your teams' agreed solution and then note down any changes or modifications you make, with reasons why you have changed the design. You need to think about materials, sizes, manufacture, including construction methods and ease of use (ergonomics).

You can use as many sheets as you want but it must be laid out so you can see the changes and why they were made.

3. ACCOUNTANTS BALANCE SHEET – (session three)
This is a record of all the costs the team has incurred. It should inform us how you have spent your money, giving us a total of how much you have left. You will gain more marks if you can spend less money. The materials you buy and the equipment you hire will be checked against the technician's record sheet.

4. **LEARNING VIDEO - (final challenge)**
   Your 2-minute video will be awarded a maximum of 30 marks. You will have to work as a team to provide the information needed for this video. The video production manager will be responsible for designing and producing your clip to the highest standard. There is a help sheet in your booklets relating to this assessment area. Not only the contents, but also the quality of presentation and production will be assessed.

5. **TEAMWORK - (throughout the day)**
   This will be assessed throughout the day and marks will be awarded if you work effectively as a team.
   Team working skills – does everyone have a clear role and are they working together effectively? Is your team communicating well? This is a really crucial area, as it is the team that works the best together that generally wins.

6. **THE CHALLENGE - (final challenge)**
   This will be tested during the 'Final Engineering Challenge.' Can it perform the given task to a high standard – consistently and accurately? Is it well made, to a high standard? If it doesn't deliver the ball consistently, can you explain why?

   You will still be given marks for understanding why your device hasn't worked and also for coming up with recommendations on how to improve it.

Materials resource sheet

AVAILABLE TO BUY:

Material	Unit Cost
MDF 6.0mm 150mm x 150mm	10 Faradays
Clear acrylic tube 150mm x 1	20 Faradays
19mm paper fasteners x 5	2 Faradays
Styrofoam sheet 25mm 100 x 100mm	20 Faradays
6mm Dowelling 300mm	10 Faradays
Elastic x 150mm	15 Faradays
Pan head machine screws and wing nuts M3 x 20mm x 5	10 Faradays
Jubilee clips x 1	10 Faradays
Cardboard tube 150mm x 1	10 Faradays
Technician to cut materials	10 Faradays

AVAILABLE TO USE:

Service	Unit Cost
Junior hacksaw	10 Faradays
Low melt glue gun	10 Faradays
Screwdriver	5 Faradays
Styrofoam cutter	15 Faradays

Timings for the day

(Please note these timings are only approximate and may be changed to fit with your school day)

09.15 **Teams arrive and take their seats**

09.30 **Session one**
- Deliver introduction with film, and directions for the day
- Teams to embark on initial ideas stage (each subject pair to work on specific details)
- Teams continue with development of ideas stage (bring together the 3 pairs with their subject expertise)
- Team to decide on which idea to develop
- Video production manager briefing

11.00 **Break (shop opens)**

11.10 **Session two**
- Introduce use of shop and technician – money, resources, equipment
- Teams to develop chosen idea into viable solution (application of scientific research into creative engineering solution)
- Teams start manufacturing

12.30 **Lunch**

13.00 **Session three**
- Hand in all learning logs at the beginning of the session
- Produce final engineering solution
- Teams put their engineering solution to the test!

13.30 **Shop shuts**

14.00 **Faraday STEM Challenge commences**
- Learning logs are presented
- Teams present their engineering solution

14.45 **Results announced**

Accounting balance sheet

Team ……..

Materials/services purchased	Quantity	Cost	Faradays remaining (start with F120)
Total Faradays remaining			

Learning log help sheet

Your team learning log is a short presentation about what you have learnt throughout the day. It should last about 2 to 3 minutes, in total. Your team needs to demonstrate to the judges what you know about each of the three subject areas and how you have used this to help you design and manufacture your prototype device.

These prompts might help you:

GENERAL CONTENT

- Are you capturing real learning (and not just *doing*?)
- Are the science, mathematics and design and technology specialists in your team talking clearly about the application of this knowledge and understanding?
- Is it interesting to listen to?
- Is it original in its content?

SCIENCE

There is a lot of science in this task, and you will need to identify the key areas and discuss them in relation to your device. Think about…

- What forces are being applied?
- How can you ensure consistency (height and length of delivery) every time you use the device?

MATHEMATICS

It is important that you and your team can identify the mathematical aspects of the problem you have been asked to solve. Sit down with your team and brainstorm all the different aspects of mathematics you can see that would ensure a lot of marks. Think about…

- Can you simplify your device and represent it mathematically? (i.e. a diagram, or using variables?)
- Can you explain which angle of trajectory is most efficient and why?

DESIGN AND TECHNOLOGY

The two key features you need to really think about and design effectively are the ‘stand’ and release mechanism. Both these features need a lot of thought in terms of ergonomics and function. Can you discuss the following...

- How you have designed the stand to achieve the movement you need?
- How are you going to ensure the degree of accuracy you need to be successful?
- Why have you used the materials chosen?
- What construction methods have you chosen and why?

Video help sheet 1

The film is fundamentally a 'learning log' of the day. It should last about 2 minutes, in total.

You will be assessed on two key areas:

1. Your technical abilities in terms of producing the film
   - You will be judged on the quality of the audio (can you hear what everyone is saying?
   - Are you using the zoom feature?
   - Do the clips 'stitch' together well?
   - Is it creatively produced?

2. The contents
   - Are you capturing real learning (and not just doing?)
   - Are the science, mathematics and design and technology specialists talking clearly about the application of this knowledge and understanding?
   - Is it interesting to listen to?
   - Is it original in its content?

Format for the video:

Scene	Focus for scene	Suggested length of video
1	Introduce your team, school and team members' roles and responsibilities	20 seconds
2	Talk through the decisions surrounding why you have chosen your specific idea to develop. • How it is going to work? • What are the problems and how are you going to solve them?	30 seconds
3	Interview the **Science specialists** • Make sure you capture the science in the design of your prototype	30 seconds
4	Interview the **Maths specialists** • Make sure you capture the maths in the design of your prototype	30 seconds
5	Interview the **Design and Technology specialists** • Think about the practical application of your design, how will you make all of the bits fit together?	30 seconds
6	Interview each member of the team and capture their key learning throughout the day	20 seconds

If you have time, include a 'good bye' from your team!

Top tips for using a digital camera

1. Love the light

Keep the light behind the camera as much as possible, so that it shines on what you're filming.

2. Hold the ice cream

Press record and hold the camera at arm's length, pointing towards your face. Now, if you hold the camera in your hand like you are holding an ice cream, you can tell us what you're thinking, walk about, even spin around and it all looks fantastic!

3. Up to your neck in treacle

Don't move the camera too quickly: make every moment slow and steady. Remember, it's not live, so there's no need to catch everything as it happens. If you don't get it the first time, go back and try again.

4. When it's over, count to five

When you think the subject you're filming has finished, keep the camera running and count to five before you stop recording. It's easier to edit – and you'd be surprised what happens when you're not expecting it.

5. Listen up

To make sure the camera can pick up someone's voice, you should be no more than your arm's length away from them.

6. Have fun!

Mess around with it – you can always delete what you don't like.

The IET DIY Faraday Challenge Day ***'Table Tennis Server'*** is based on the Faraday Challenge Day of the same name, a STEM activity day written and delivered by the Attainment Partnership on behalf of the Institution of Engineering and Technology (IET).

The IET Faraday 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.
www.ietfaraday.org

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